

SERVICE MANUAL

**FOR
HYSTER
DIRECT DRIVE
AND
POWER CONTROLLED
WINCHES**

D7J

(Also For Model D7K)

OPERATOR RULES

Safety is a necessary part of winch operation. Every operator must know the operating procedures and restrictions. The following list is a guide and not a complete list of rules for winch operation. Only trained and authorized operators can use the winch.

1. Do not operate a winch unless the vehicle is equipped with a rear screen for operator protection against a broken cable.
2. Make sure you are in the operator's seat when you operate the vehicle or the winch.
3. Do not use a winch that has damage.
4. Do not use a winch that has controls, oil pressure, or operation that is not normal.
5. Do not use the control levers for hand holds when moving to the operator position.
6. Do not use the control levers for hangers for clothes, water bags, grease guns, lunch pails, or other objects.
7. Do not permit personnel around the vehicle when using the winch.
8. Do not permit personnel to go near a cable under tension.
9. Do not permit personnel to stand in a loop of cable.
10. The operator must stay in the operator position when the winch cable is under tension.
11. Make sure the winch cable is in good condition.
12. Do not connect a double or two-part cable to the winch.
13. Do not permit personnel to ride on a load.
14. Do not permit extra personnel on the vehicle.
15. Do not pull the hook over the drum and through the throat of the winch. This action can damage the winch.
16. Always leave the winch in BRAKE ON position when not operating the winch.
17. Do not clean, service, or adjust a machine during operation.
18. Be careful when removing the cable and ferrule from the drum. When the ferrule is loosened, the cable can move like a compressed spring.

Winch Serial Number _____

Date put in service _____

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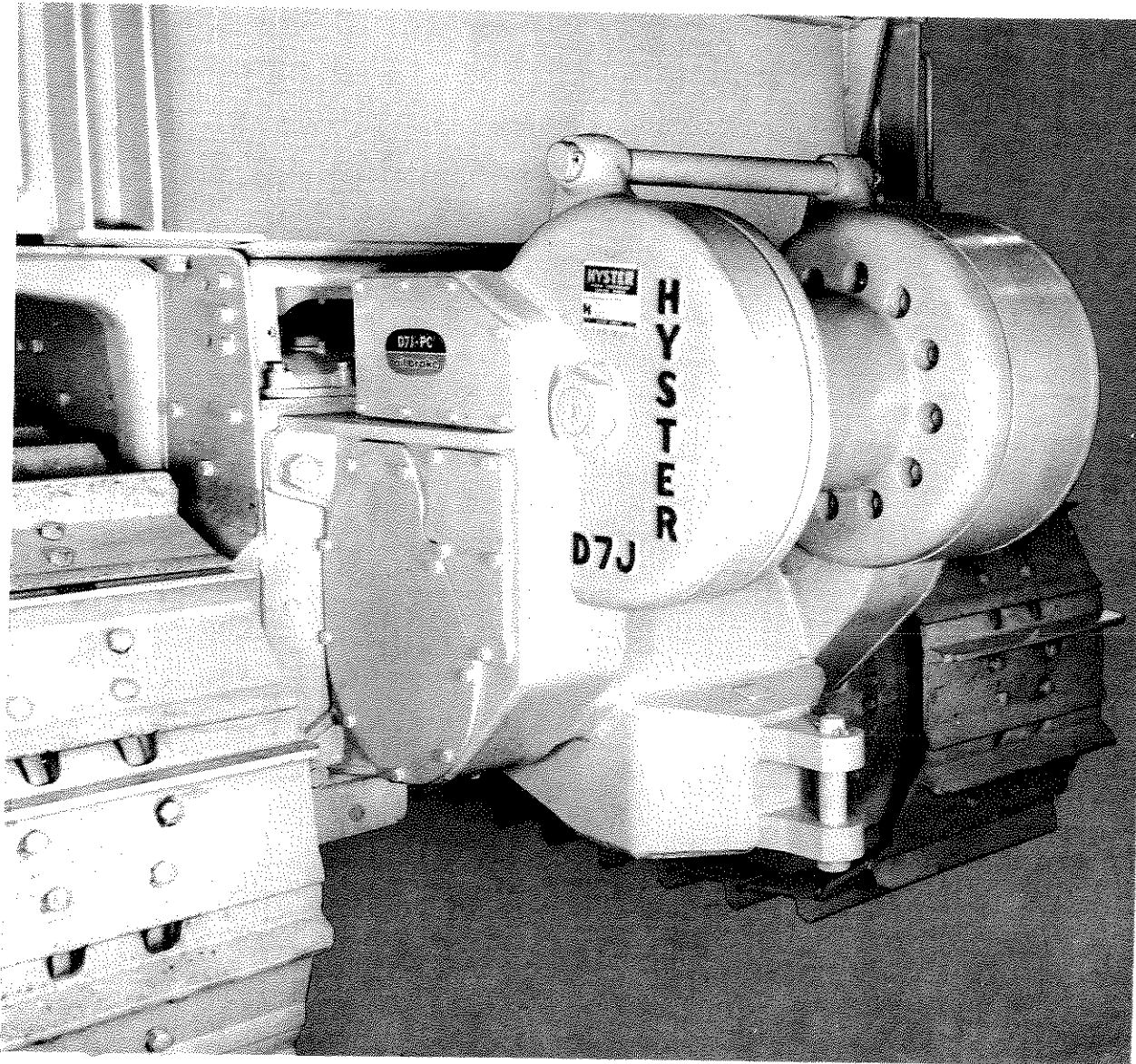
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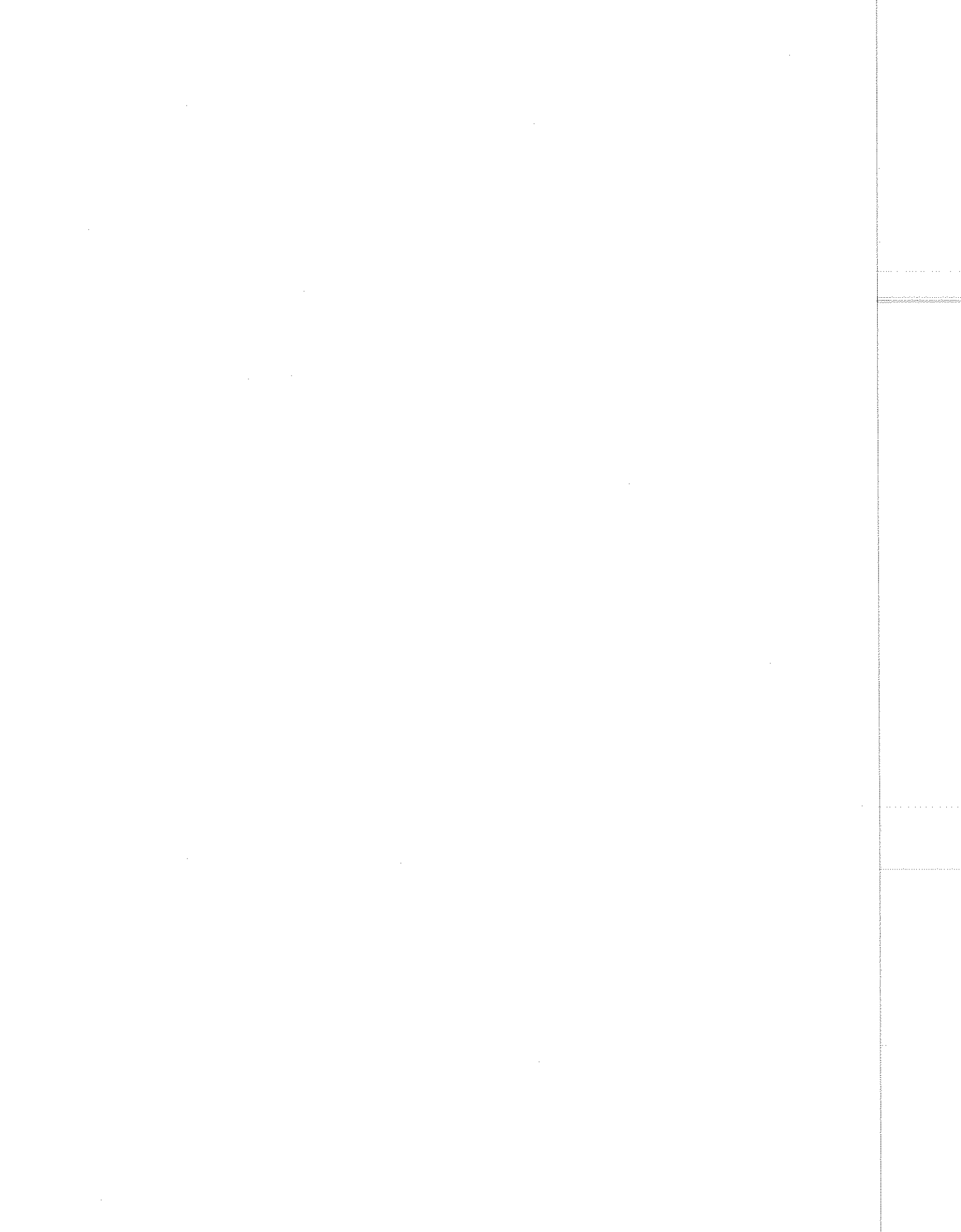


INTRODUCTION

This service manual contains operation, maintenance and repair instructions for the D7J Direct Drive and Power Controlled towing winches. Instructions are also included for the removal and installation of the winch on the tractor. Specification tables are pro-

vided which contain winch design data. Complete physical and functional descriptions of the winch are given to aid the repairman in understanding the operation of winch components.







SPECIFICATIONS & DESCRIPTIONS

1-1. GENERAL.

1-2. This section contains a list of specifications for the Direct Drive and Power Controlled towing winches. Complete physical and functional descriptions of the winch and its subassemblies are also given. These descriptions will aid the repairman in understanding the construction and operation of the

winch and its subassemblies. (See figures 1-1 through 1-24.)

1-3. LIST OF SPECIFICATIONS.

1-4. A complete list of specifications is given in Table 1-1 through 1-5.

Table 1-1. Component Specifications (Sheet 1 of 4)

ITEM	DESIGN DATA			REFERENCE FIGURE
	Lo-Speed	Slo-Speed	Std. Speed	
Gear Ratios				
Forward	71.6 to 1	49.8 to 1	40.6 to 1	
Reverse	30.9 to 1	21.5 to 1	17.53 to 1	
Number of Gear Teeth				
PTO Shaft Bevel Gear	16	23	23	5-3 , Step 3
Bevel Gear Shaft				
Bevel Gear	45	45	45	
2nd Reduction Pinion - Forward	22	22	22	5-7 , Step 9
2nd Reduction Pinion - Reverse	19	19	22	5-7 , Step 6
Brake Shaft				
2nd Reduction Driven Gear	51	51	51	5-9 , Step 3
Intermediate Pinion	19	22	22	5-9 , Step 4
Intermediate Shaft				
Intermediate Driven Gear	54	54	51	5-10 , Step 3
Drum Pinion	15	15	15	5-10 , Step 4
Drum Gear	58	58	58	5-11 , Step 7
Drum				
Barrel Diameter	8	12	12	5-11 , Step 9
Barrel Length	10-5/8	12-3/8	12-3/8	5-11 , Step 9
Flange Diameter	22-1/2	22-1/2	22-1/2	5-11 , Step 9
Cable Capacity (per SAE J115B) (Allow for loose or unevenly spooled cable)				
3/4-inch Cable	503 ft.	480 ft.	480 ft.	
7/8-inch Cable	362 ft.	345 ft.	345 ft.	
One inch Cable	280 ft.	268 ft.	268 ft.	
1-1/8-inch Cable	229 ft.	215 ft.	215 ft.	
Ferrule Size (Cable size)	L-6 (3/4") J-7 (7/8") J-8 (1") J-9 (1-1/8") J-10 (1-1/4")			
Seal Bore Diameter		6.002-6.003		5-11 , Step 9
Bearing Bore Diameter		6.002-6.003		5-11 , Step 11
Drive Flange Counterbore Diameter		15.997-16.006		5-11 , Step 8
Drive Flange Outside Diameter		15.995-15.998		5-11 , Step 8

Table 1-1. Component Specifications (Sheet 2 of 4)

ITEM	DESIGN DATA		REFERENCE FIGURE
Drum Shaft and Outer Retainer			
Shaft			
Bearing Journal Diameter	3.999-4.000		5-11 , Step 6
Retainer Journal Diameter	3.493-3.495		5-11 , Step 6
Gear			
Bearing Bore Diameter	6.377-6.379		5-11 , Step 7
Pilot Diameter	7.842-7.844		5-11 , Step 7
Outer Retainer			
Bore Diameter	3.498-3.500		5-11 , Step 3
Pilot Diameter	11.120-11.123		5-11 , Step 3
PTO Shaft and Carrier			
Shaft			
Bearing Journal Diameter	1.9681-1.9688		5-3 , Step 3
Seal Journal (Spacer) Diameter	2.370-2.380		5-3 , Step 3
Carrier			
Bearing Bore Diameter	4.3306-4.3318		5-3 , Step 3
Seal Bore Diameter	3.498-3.502		5-3 , Step 3
Pilot Diameter	5.185-5.187		5-3 , Step 3
	DIRECT DRIVE	POWER CONTROLLED	
BEVEL GEAR SHAFT ASSEMBLY			
Bearing Retainers (LH and RH)			
Seal Ring Bore Diameter	None	1.500-1.505	5-7 , Steps 1, 2
Bearing Cup Bore Diameter	3.6708-3.6718	3.6708-3.6718	5-7 , Steps 1, 2
Pilot Diameter	4.997-4.999	4.997-4.999	5-7 , Steps 1, 2
Bevel Gear Backlash	0.006-0.014	0.006-0.014	
Seal Ring Width	None	0.0925-0.0935	5-7 , Step 3
Shaft			
Bearing Journal Diameter	1.8744-1.8749	1.8744-1.8749	5-7 , Step 13
Seal Ring Groove Width	None	0.125-0.133	5-7 , Step 3
End Play	0.006-0.009	None	5-20 , Step 20
Preload	None	0.000-0.004	5-20 , Step 20
Spacers			
Ball Bearing Carrier			
Surface Diameter	3.1491-3.1500	3.1491-3.1500	5-20 , Step 3
Width	1.630-1.635	1.630-1.635	5-20 , Step 3
Both Ends Parallel Within	0.0013	0.0013	5-20 , Step 3
Long Spacer			
Length	4.250-4.255	4.250-4.255	5-7 , Step 10
Both Ends Parallel Within	0.0035	0.0035	5-7 , Step 10
Medium Spacer			
Length	3.500-3.505	None	5-6
Both Ends Parallel Within	0.003		5-6
Short Spacer			
Length	2.187-2.192	3.500-3.505	5-7 , Step 10
Both Ends Parallel Within	0.0018	0.003	5-7 , Step 10
Thrust Washer			
Width	None	0.190-0.195	5-7 , Step 5

Table 1-1. Component Specifications (Sheet 3 of 4)

ITEM	DESIGN DATA		REFERENCE FIGURE
	DIRECT DRIVE	POWER CONTROLLED	
BRAKE SHAFT ASSEMBLY			
Bearing Retainers			
Left-Hand Retainer			
Bearing Cup Bore Diameter	4.452-4.455	4.452-4.455	5-9 , Step 1
Seal Bore Diameter	3.496-3.498	None	
Right-Hand Retainer			
Bearing Cup Bore Diameter	3.6708-3.6718	3.6708-3.6718	5-9 , Step 2
Shaft			
Left-Hand Bearing Journal Diameter	2.500-2.501	2.500-2.501	5-9 , Step 1
Right-Hand Bearing Journal Diameter	2.375-2.376	2.375-2.376	5-9 , Step 4
Preload	0.006-0.009	0.000-0.004	5-19 , Step 6
Brake Drum Diameter	12	None	5-5 , Step 2
BRAKE ASSEMBLY, OIL	None		
Brake Apply Spring			
Dish		0.337-0.347	5-4 , Step 3
Pressure at 11/32-inch Deflection		11,000-11,900 lbs.	5-4 , Step 3
Piston			
Outside Diameter		10.496-10.498	5-4 , Step 12
Inside Diameter		3.499-3.502	5-4 , Step 12
Piston Housing			
Piston Cavity			
Large Diameter		10.503-10.506	5-4 , Step 12
Small Diameter		3.493-3.496	5-4 , Step 12
Push Rod			
Diameter		0.373-0.375	5-4 , Step 5
Length		3.222-3.225	5-4 , Step 5
Friction Disc			
Overall Width		0.122-0.128	5-4 , Step 4
Friction Material Thickness		0.0275-0.0365	5-4 , Step 4
Separator Plate			
Width		0.080-0.084	5-4 , Step 4
Dish		0.012-0.022	5-4 , Step 4
CLUTCH ASSEMBLY			
2nd Reduction Gear Bore	3.0000-3.0012	None	5-6
Dental Clutch Groove	0.510-0.515	None	5-6
Bearing Carrier Diameter	2.2494-2.2500	None	5-6
Piston	None		
Outside Diameter		8.496-8.498	5-8 , Step 7
Inside Diameter		5.750-5.752	5-8 , Step 7
Piston Housing	None		
Piston Cavity			
Large Diameter		8.506-8.508	5-8 , Step 7
Small Diameter		5.740-5.742	5-8 , Step 7
Inside Diameter		3.376-3.378	5-8 , Step 7

Table 1-1. Component Specifications (Sheet 4 of 4)

ITEM	DESIGN DATA		REFERENCE FIGURE
	DIRECT DRIVE	POWER CONTROLLED	
CLUTCH ASSEMBLY (Cont'd)			
Hub - Small Diameter	None	3.373-3.375	5-8 , Step 5
Friction Disc	None		
Overall Width		0.122-0.128	5-8 , Step 4
Friction Material			
Thickness		0.0275-0.0365	5-8 , Step 4
Separator Plate	None		
Width		0.080-0.084	5-8 , Step 4
Dish		0.012-0.022	5-8 , Step 4
Cooling Valve Spring	None		
Free Length		2-11/16	5-8 , Step 6
Pressure At Two Inches		11.0 oz.	5-8 , Step 6
Cooling Valve Installed	None		
Height		1.875-1.906	5-16 , Step 2
Release Springs	None		
Free Length		2-31/32	5-8 , Step 4
Pressure at Two Inches		45 pounds	5-8 , Step 4
Plate (cover) To Friction			
Disc Clearance		0.065-0.125	5-8 , Step 1
INTERMEDIATE SHAFT ASSEMBLY			
Bearing Journal Diameter	2.5000-2.5005		5-10 , Step 2
Endplay	0.004-0.007		5-18 , Step 4
SIDE FRAME (RH Side)			
Bore Diameters			
Bevel Gear Shaft Bearing Retainer	5.000-5.002		5-7 , Step 2
Drum Shaft Outer Retainer	11.125-11.128		5-11 , Step 3
Intermediate Shaft Bearing Retainer	5.376-5.377		5-10 , Step 1
Brake Shaft Bearing Retainer	6.250-6.252		5-9 , Step 2
Drum Seal	10.998-11.002		5-11 , Step 10
TRANSMISSION HOUSING (LH Side)			
Bore Diameters			
PTO Shaft Carrier	5.188-5.190		5-3 , Step 2
Bevel Gear Shaft Bearing Retainer	5.000-5.002		5-7 , Step 1
Ball Bearing	4.9211-4.9225		5-20 , Step 3
Brake Shaft Bearing Retainer	4.2515-4.2525		5-9 , Step 1
NOTE: All dimensions given in inches unless otherwise specified.			

Table 1-2. Hydraulic Specifications

ITEM	DESIGN DATA		REFERENCE FIGURE
	DIRECT DRIVE	POWER CONTROLLED	
CONTROL VALVE	None		
High Pressure Relief		225±10 PSI	4-11
Cooling Oil Pressure		3-10 PSI	4-11
PUMP OUTPUT	None		
NOTE: Pump output is given at engine RPM			
On D7 Tractor			
At 500 RPM		7 GPM	5-14
At 1200 RPM		18 GPM	5-14
On 977H Traxcavator	None		
At 600 RPM		4.9 GPM	5-14
At 1950 RPM		13.8 GPM	5-14
FILTER			
Pressure		25-Micron Cartridge	5-23 , Step 3
Suction		50-Mesh Screen	
OIL	18 Gal. SAE 90 EP MIL-L-2105B		
Capacity		20 Gal.	4-1
Type		SAE 10	4-1
		MIL-L-2104B	
		NOTE: Series 3 oil may be substituted for MIL-L-2104B.	

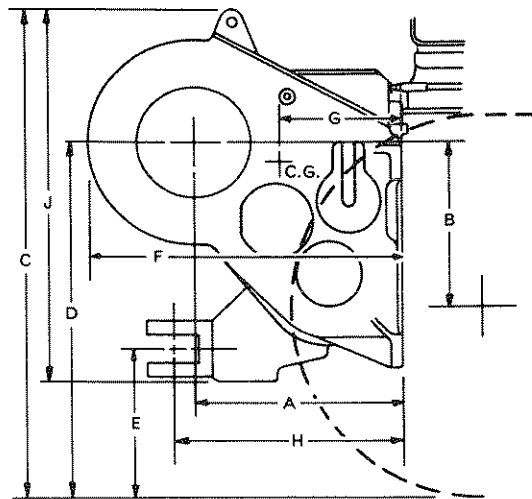
Table 1-3 Torque Specifications (Sheet 1 of 2)

TORQUE VALUES			
NOTE: All torques are given in ft.-lb. and with threads lubricated.			
Bevel Gear Shaft Assembly			
Bearing Retainer Bolts			
LH Side	75	75	5-20 , Step 16
RH Side	75	75	5-20 , Step 18
Bearing Locknut	None	200	5-20 , Step 17
Control Valve Mounting Bolts	None	40	5-13

Table 1-3 Torque Specifications (Sheet 2 of 2)

ITEM	DESIGN DATA		REFERENCE FIGURE
	DIRECT DRIVE	POWER CONTROLLED	
TORQUE VALUES (Cont'd)			
Drum Shaft Assembly			
Bearing Retainer (RH Side)	75	75	5-17 , Steps 9, 12
Internal and External Drum To Adapter	200	200	5-17 , Step 14
Intermediate Shaft Assembly			
Bearing Retainer Bolts	75	75	5-18 , Step 4
Brake Assembly			
Oil Brake Cover Nuts	None	200	5-21 , Step 12
Brake Compartment Cover	75	75	1-1
PTO Shaft Assembly			
Retainer Bolts	75	75	5-3 , Step 1

Table 1-4 Dimension And Weight Specifications

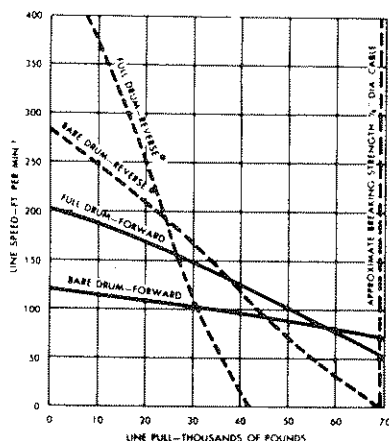


Model	Tractor Model	Winch Weight	A	B	C	D	E	F	G	H	J	Overall Width Winch
D7 DD & Lo Speed	D7E	2,420	23	26-3/8	62-1/8	47	22-7/8	34-1/4	11	26-7/8	43-1/8	44-3/4
D7 PC & Lo Speed	D7E	2,750	23	26-3/8	62-1/8	47	22-7/8	34-1/4	11	26-7/8	43-1/8	44-3/4

Dimensions to nearest 1/8 inch.

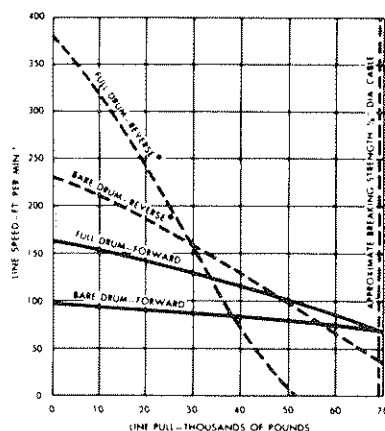
Table 1-5 Performance Specifications

D7J POWER CONTROLLED



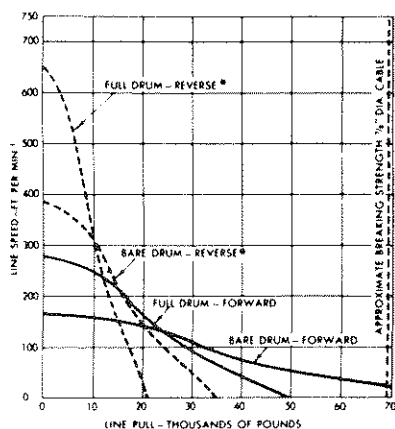
Winch performance on D7, Series E, Power Shift Tractor, and 572 Pipelayer, 180 HP (at flywheel) using 7/8 inch cable.

D7J POWER CONTROLLED LO-SPEED



Winch performance using slo-speed gears on D7, Series E, Power Shift Tractor, and 572 Pipelayer, 180 HP (at flywheel) using 7/8 inch cable.

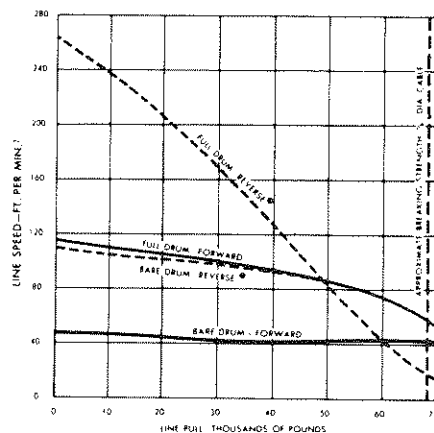
D7J POWER CONTROLLED



Winch performance on 977, Series H Traxcavator, 150 HP (at flywheel) using 7/8 inch cable. Tractor transmission in second-forward, neutral range.

+Lower line speeds can be obtained by decreasing throttle.

D7J POWER CONTROLLED SLO-SPEED



Winch performance on D7, Series E, Power Shift Tractor, and 572 Pipelayer, 180 HP (at flywheel) using 7/8 inch cable.

D7J POWER CONTROLLED

& D7J DIRECT DRIVE

Performance on D7, Series E, Direct Drive Tractor, 180 HP (at flywheel) at 1200 RPM using 7/8 inch cable.

Standard Gears

Slo-Speed Gears

Line Pulls, Lbs	Forward	Reverse*	Forward	Reverse*	Forward	Reverse*	Forward	Reverse*
Bare drum	59,200	25,700	69,200	29,600	69,200	30,000	69,200	30,000
Full drum	35,000	15,460	41,000	18,960	47,600	21,000	47,600	21,000
Line Speeds, F.P.M.								
Bare drum	73	169	60	127	30	70	29	66
Full drum	121	279	90	209	72	167	69	159

*All reverse values are based on cable in underwind position using reverse gear train.

NOTE: Winch will develop line pulls beyond breaking strength of any practical size cable. Cable size should conform to all safety regulations applicable to job.

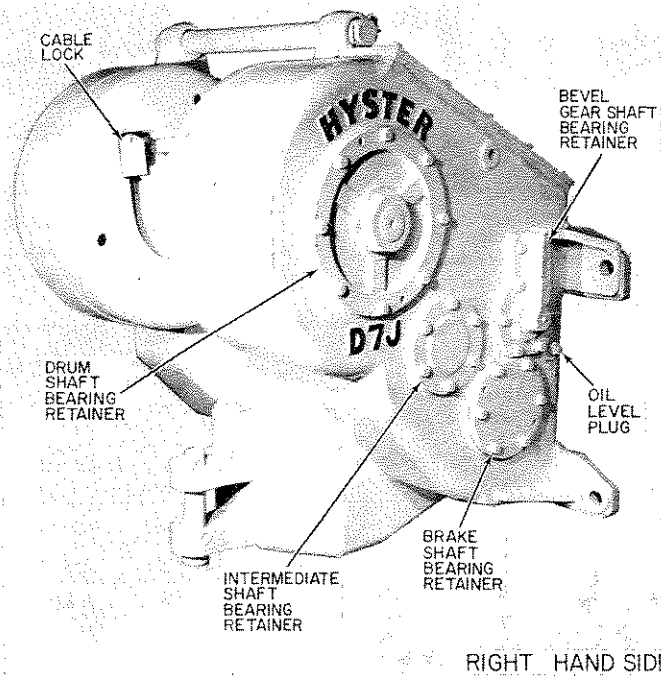
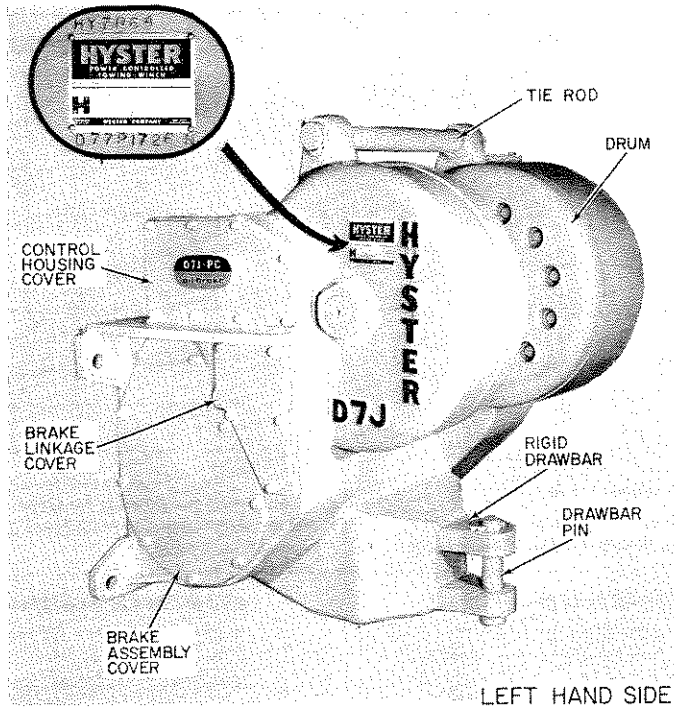


Figure 1-1. D7J Towing Winch

1-5. SERIAL NUMBER DATA (See Figure 1-1).

1-6. The name plate 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 just below the name plate. The Model Number is stamped just above the name plate. The Serial Number indicates the design series, manufacturing plant, serial number and year manufactured. A typical Serial Number designates the following:

Examples	D77	P	0000	M
	(1)	(2)	(3)	(4)

1. The first letter and number denote the design series and model of the unit. In the example D77 denotes the D7J series.
2. The second letter denotes the plant at which the unit was manufactured.

A. Scotland	G. Belgium	P. Portland
B. Tacoma	H. South Africa	R. Ipswich
C. Kewanee	J. Africa	S. Australia
D. Danville	L. Peoria	T. Canada
E. Nijmegen	N. New Zealand	Y. Brazil
F. France		

3. The number series indicates the serial number of the unit.
4. The final letter designates the year of manufacture starting with "A" in 1957. The Letters "I", "O" and "Q" are not used.

1-7. PHYSICAL DESCRIPTION.

1-8. TOWING WINCH. (See Figure 1-1.)

1-9. The D7J Towing Winch is manufactured as a Direct Drive or Power Controlled towing winch. The Direct Drive version employs dental clutches with related mechanical linkage to shift the winch gear train to forward, neutral, or reverse. A brake drum and band arrangement with related mechanical linkage provides braking on the Direct Drive winch. The Direct Drive winch is primarily designed for use on direct drive and torque converter tractors equipped with an interruptable power-take-off (PTO). The Power Controlled winch can be used on direct drive, torque converter and powershift tractors equipped with a constant-running PTO. The Power Controlled winch is basically the same as the Direct Drive winch except multiple disc clutch packs are hydraulically actuated to shift the winch to forward, neutral, or

reverse. Also, the Power Controlled winch uses a multiple disc oil brake assembly for braking. All major gear train and brake assembly components for the Direct Drive and Power Controlled winches are mounted inside of a fabricated weldment. The PTO shaft assembly, bevel gear shaft assembly and brake shaft assembly are mounted in the center and left-hand section of the weldment. The brake assembly and associated linkage are mounted in the left-hand section. The drum gear, intermediate shaft assembly and reverse clutch assembly are mounted in the right-hand section of the weldment. A control valve, cooling oil relief valve and related hydraulic hoses serve as the control mechanism on the Power Controlled winch. The control valve is mounted at the top, left-hand section of the weldment. Mechanical linkage is used to control the operation of the Direct Drive winch.

1-10. HANDLING GEAR.

1-11. DIRECT DRIVE WINCH. The handling gear (see figure 1-2) for the Direct Drive winch consists of a clutch handle lever, brake handle lever assembly and mounting bracket with an attached quadrant bar. This handling gear is mounted to the floor plate just to the front, left of the operator's seat. The clutch handle lever controls the dental clutches through a control cable. The brake handle lever has a panel and rod assembly which allows positive positioning along the quadrant bar. A release button on the end of the brake handle lever must be depressed before the handle lever will move forward to release the brake. The position of the brake handle lever determines to what extent the brake is released.

1-12. POWER CONTROLLED WINCH. There are two different handling gear designs used on the Power Controlled winch. These will be referred to as earlier production and current production. (Refer to paragraphs 1-13 and 1-14.)

1-13. EARLIER PRODUCTION. (See Figure 1-3.) This handling gear consists of a housing, control lever, selector lever, oil pressure gauge, and handle lever gate assembly. It is mounted on the right-hand side of the operator's seat and is connected to the control valve by two teflon-lined push-pull cables. The control lever is the short lever mounted in the front, right-hand corner of the housing and determines one of two shift patterns for the selector lever (refer to paragraph 2-14). The selector lever is mounted to the handle lever gate assembly and operates within one of the two shift patterns to control the winch brake and clutch operations. The oil pressure gauge is mounted directly behind the selector lever and indicates brake release pressure.

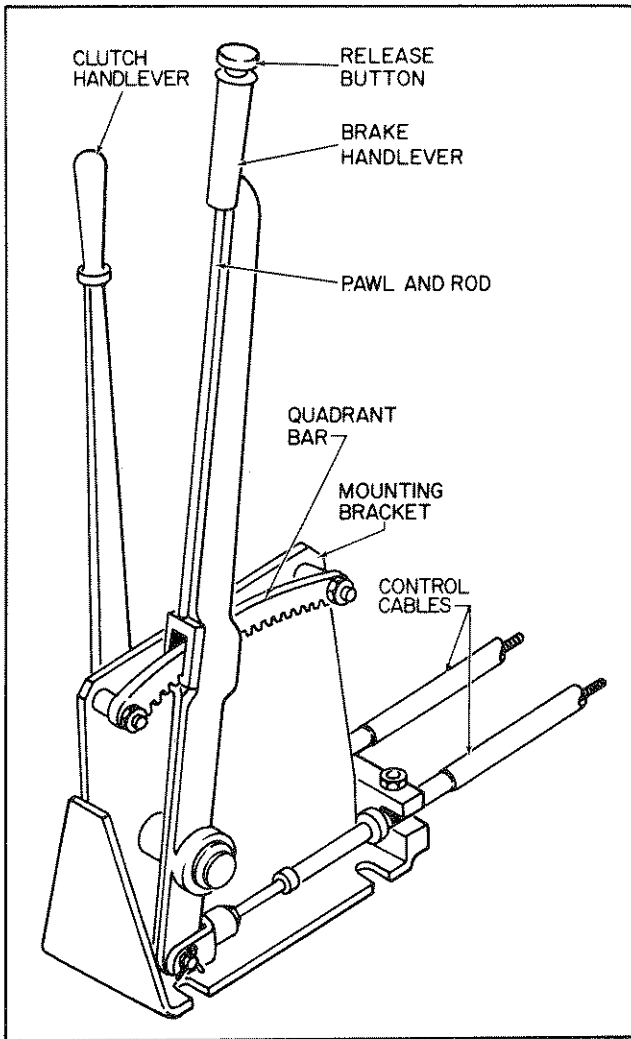


Figure 1-2. Direct Drive Handling Gear
1-14. CURRENT PRODUCTION. (See Figure 1-3.) This handling gear consists of a housing, inching lever, selector lever, oil pressure gauge and an inching stop latch. The major change from the earlier design is that the push-pull cables are no longer linked together through the handlever gate assembly. The selector and inching levers on the current production handling gear are positioned independently of each other. The inching lever, which is spring-loaded to the Brake-on position, has an inching stop latch to lock it in the Brake-off position. The selector lever is mounted parallel to the inching lever and controls winch clutch and brake operations. The control levers for the current production handling gear are manufactured in two different configurations, straight levers and curved levers. The curved lever group is used on a standard application. On the curved lever handling gear, the housing is mounted to the right side of the operator's seat. The straight lever group is used on the Traxcavator and is mounted to the left of the operator's seat.

1-12

1-15. DIRECT DRIVE GEAR TRAIN. (See Figure 1-4.)

1-16. The direct drive gear train consists primarily of five shaft assemblies; the PTO shaft assembly, bevel gear shaft assembly, brake shaft assembly, intermediate shaft assembly, and drum shaft assembly. The PTO shaft assembly is integral on the Lo-Speed winch. On the Standard and Slo-Speed winches the bevel pinion is splined and locked with a snap ring to the PTO shaft. The bevel gear shaft assembly contains two straight cut pinion gears, two dental clutches, four spacers, two single taper roller bearings at each end of the shaft, and one ball bearing for center support. The brake shaft assembly turns between two single taper roller bearings. This shaft serves to transfer torque to the intermediate gear when the unit is in forward and prevents the gear train from turning when the brake is applied. The intermediate shaft assembly contains a large intermediate spur gear and a drum pinion gear that are splined together on a shaft between two taper roller bearings. This assembly transfers the torque to the large drum gear. The drum shaft assembly is aligned between two matched double taper roller bearings. The drum shaft is secured to the winch frame and therefore, DOES NOT rotate. The drum gear is bolted and splined to an adapter plate which is bolted to the drum. This allows the drum, adapter plate, and drum gear to rotate around the shaft. All drive train gears are heat treated to provide maximum service life.

1-17. POWER CONTROLLED GEAR TRAIN. (See Figure 1-5.)

1-18. The Power Controlled gear train is essentially the same as the direct drive gear train except multiple disc clutch packs replace the dental clutches. Manufacturing differences between the Direct Drive and the Power Controlled frames are great enough that interchangeability of components should not be attempted. The Power Controlled bevel gear shaft is center drilled on each end and cross drilled at the clutch pack locations to allow oil under pressure to flow to the clutches. A cast iron seal ring on each end of the bevel gear shaft prevents this pressurized oil from escaping between the bearing retainers and the shaft ends. The clutch spider gears rotate on roller bearings independently of the bevel gear shaft. The Power Controlled bevel gear shaft assembly is preloaded between two taper roller bearings as opposed to an endplay condition with the Direct Drive bevel gear shaft assembly.

1-19. CONTROL VALVE ASSEMBLY. (See Figure 1-6.)

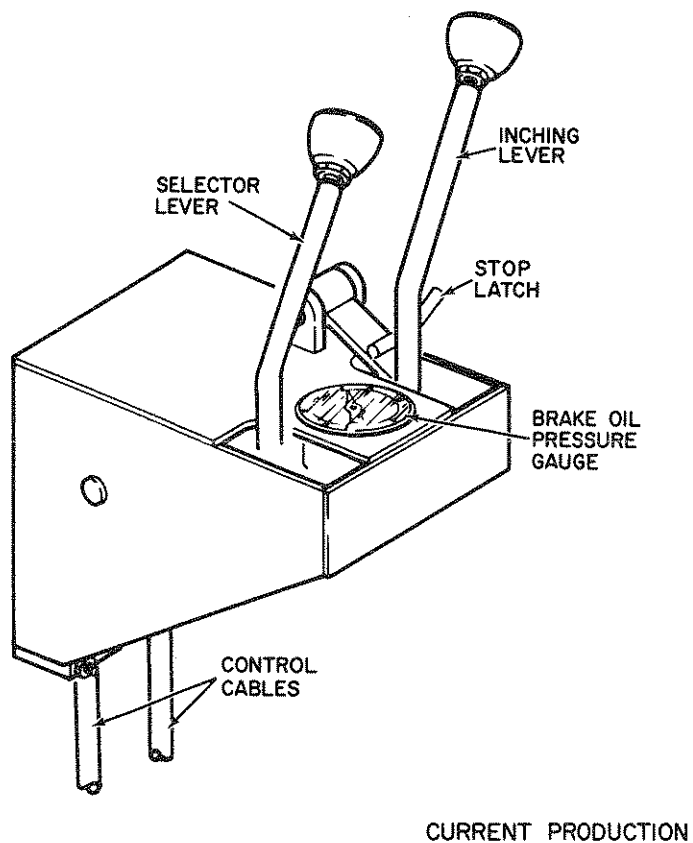
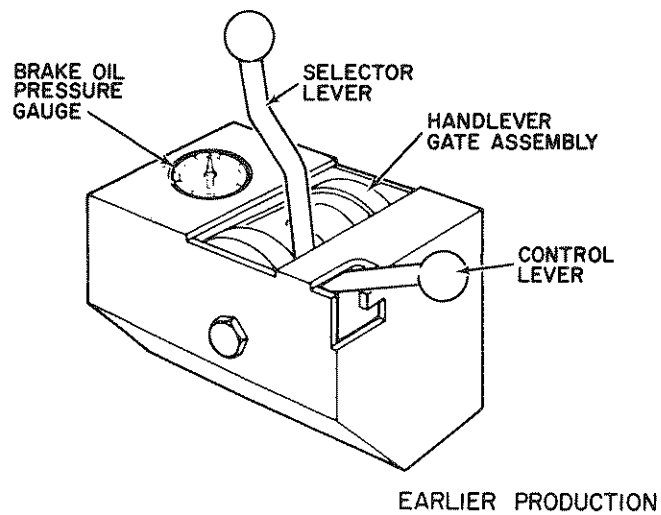


Figure 1-3. Power Controlled Winch Handling Gear

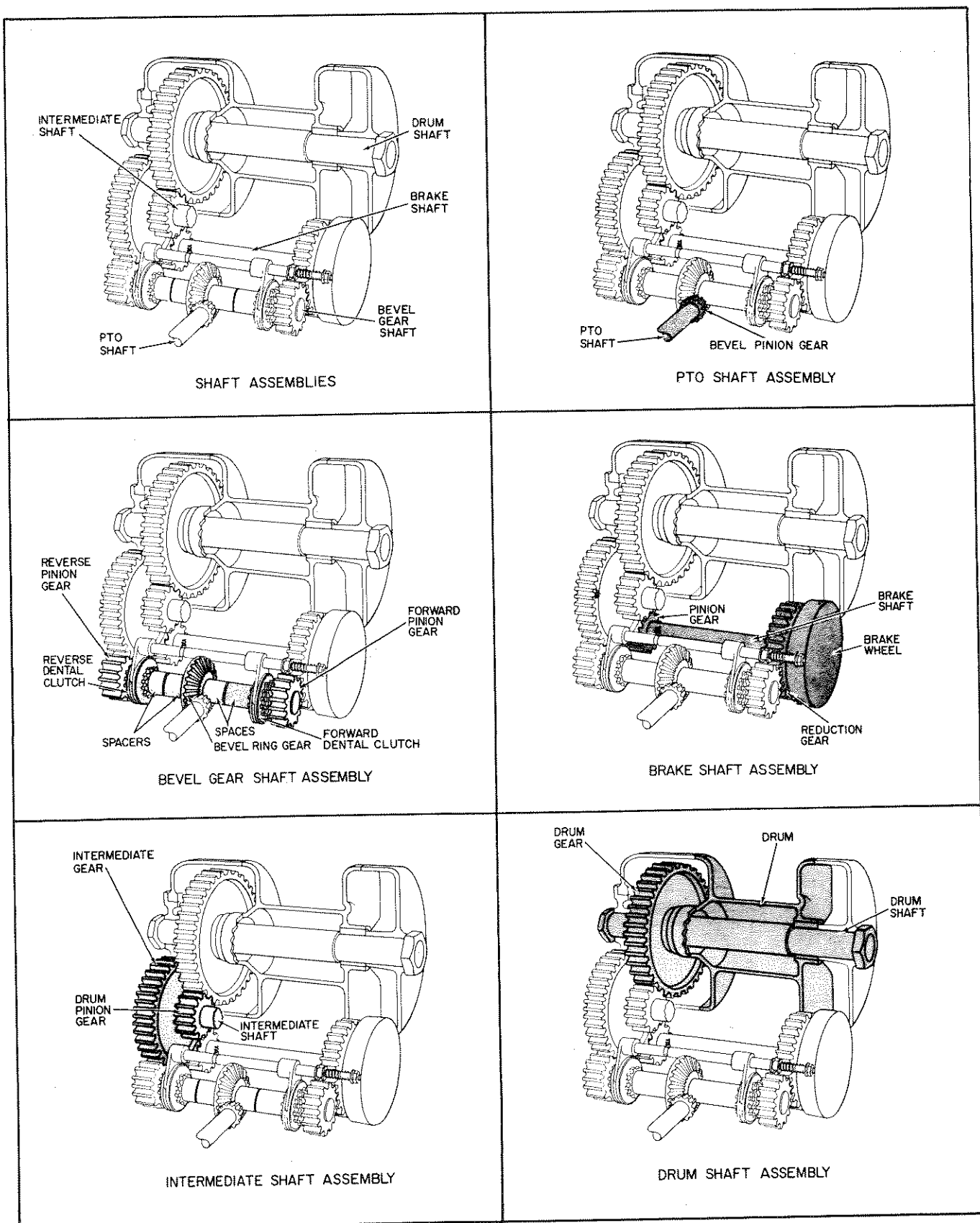
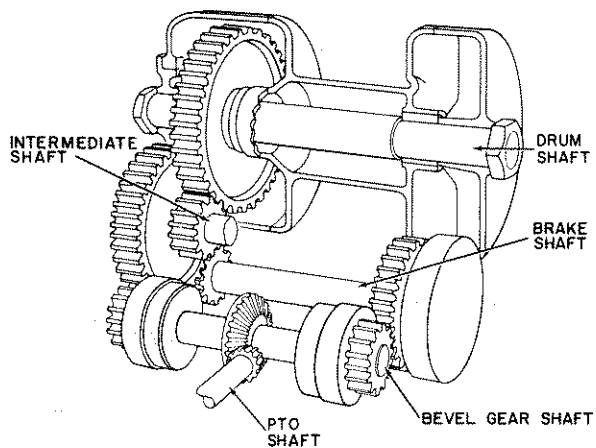
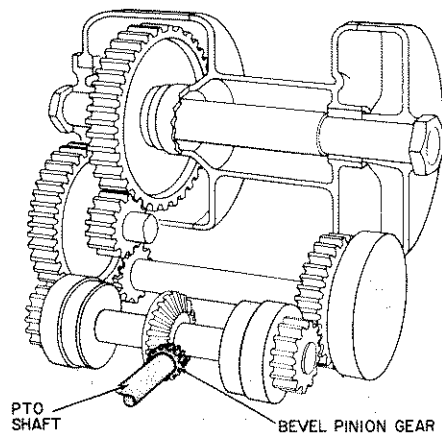


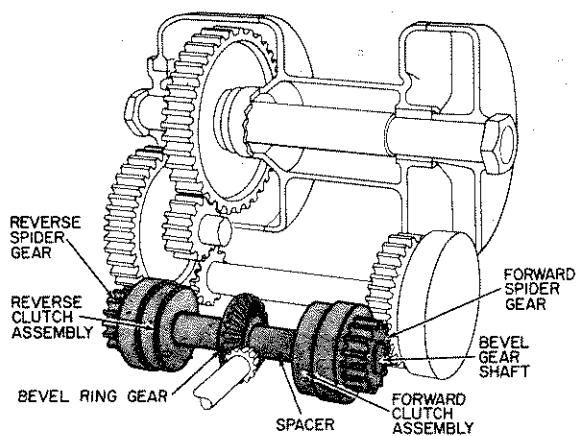
Figure 1-4. Direct Drive Gear Train



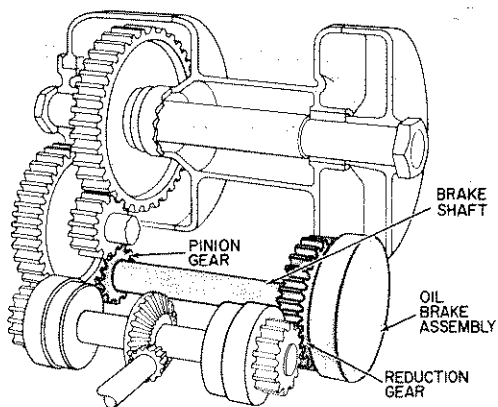
SHAFT ASSEMBLIES



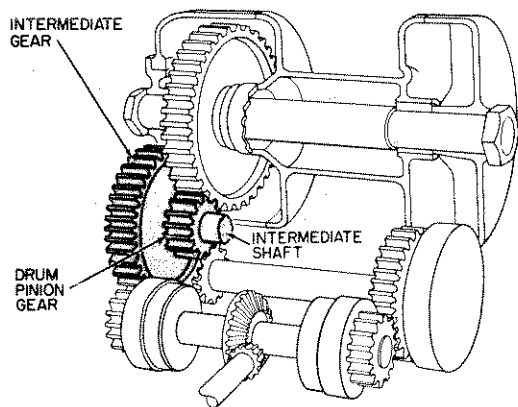
PTO SHAFT ASSEMBLY



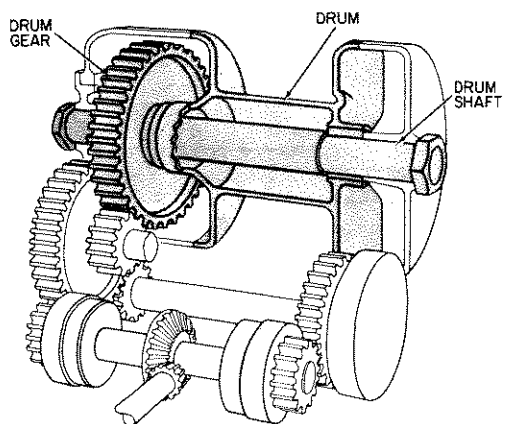
BEVEL GEAR SHAFT ASSEMBLY



BRAKE SHAFT ASSEMBLY



INTERMEDIATE SHAFT ASSEMBLY



DRUM SHAFT ASSEMBLY

Figure 1-5. Power Controlled Gear Train

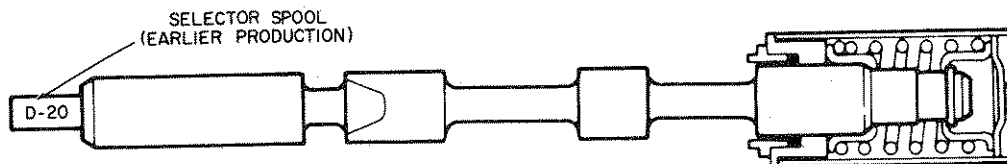
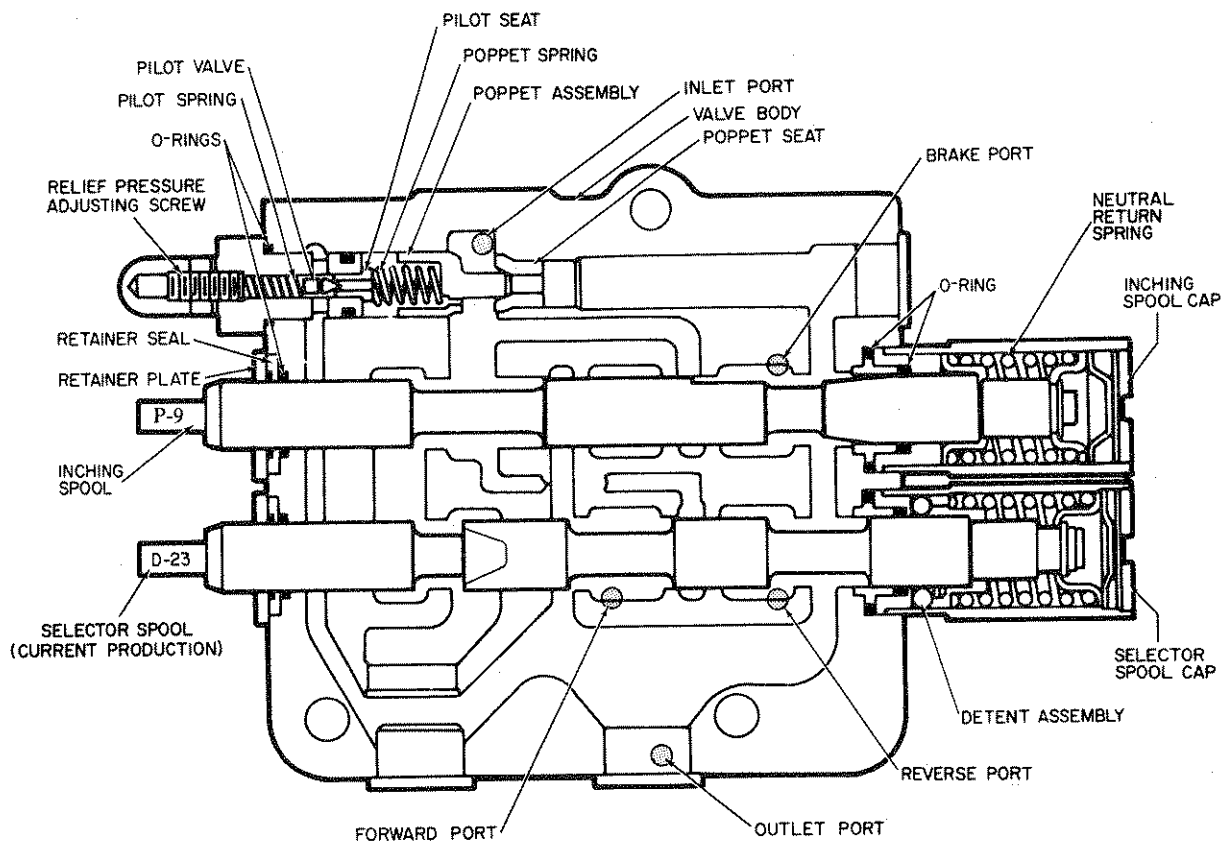


Figure 1-6. Control Valve Assembly

1-20. The control valve assembly consists primarily of a valve body, relief valve assembly, inching spool assembly, and selector spool assembly. The valve body is an open center design. Passages within the valve body connect the spool bores with inlet, forward, reverse, brake, and outlet ports. Actuating the spools connects these passages to obtain the desired hydraulic flow. (Refer to paragraph 1-38.) The relief valve assembly consists of a poppet assembly, poppet spring, poppet seat, pilot valve, pilot spring, and relief pressure adjusting screw. The relief pressure adjusting screw determines the spring tension applied to the pilot valve. The pilot valve regulates the hydraulic system's maximum pressure. This pilot-operated feature assures nearly constant pressure regulation over the full flow range of the pump. The inching spool assembly consists primarily of an inching spool (P-9), retainers, neutral return spring, locking screw, O-rings, and cap assembly. The selector spool assembly consists primarily of a selector spool (D-23), detent assembly, retainers, neutral return spring, snap ring, O-rings, and cap assembly. The spool caps ARE NOT interchangeable. The O-rings prevent the escape of oil and entry of contaminants between the spools and valve body. Each spool is connected by a separate push-pull cable to the handling gear.

NOTE: The spool stamped D-20 was used on earlier production units. The spool stamped D-23 is used on current production units. These spool assemblies ARE interchangeable.

1-21. COOLING OIL RELIEF VALVE ASSEMBLY. (See Figure 1-7.)

1-22. The cooling oil relief valve consists of a valve body, valve cap, O-ring, spring and poppet. The valve body end screws directly into the outlet port of the control valve assembly. This valve assembly is a simple poppet and spring type relief valve. It regulates the hydraulic system cooling oil pressure.

1-23. BRAKE ASSEMBLY.

1-24. DIRECT DRIVE BRAKE ASSEMBLY.

(See Figure 1-8.) The brake assembly contains a brake wheel, band assembly, lever assembly, crank assembly, and connecting linkage. The cast iron brake wheel is splined to the left-hand side of the brake shaft and is retained by a snap ring. A segmented lining is riveted to the brake band. The liner assembly has oilite bushings in the pin bores. When the control cable is pulled, the crank assembly rotates and forces the lever assembly to apply the brake. This brake assembly is a self-energizing design.

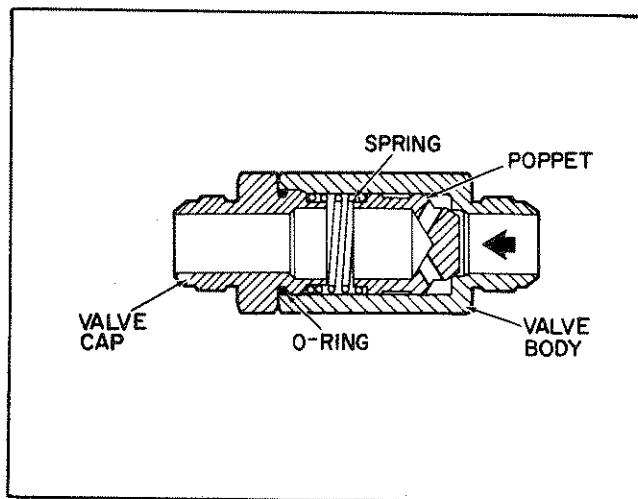


Figure 1-7. Cooling Oil Relief Valve Assembly

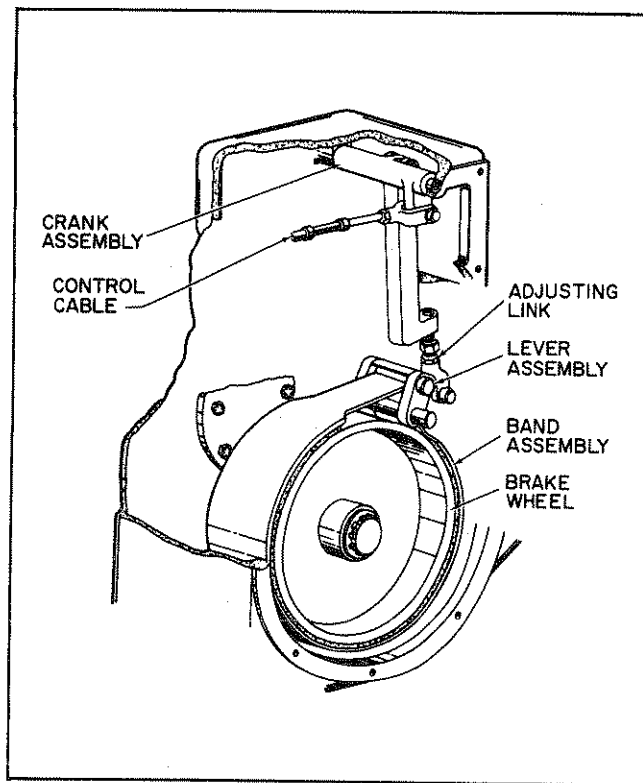


Figure 1-8. Direct Drive Brake Assembly

1-25. DIRECT DRIVE AUTOMATIC BRAKE ASSEMBLY (OPTIONAL). (See Figure 1-9.)

The automatic brake assembly consists primarily of a brake wheel, hub, pawl assembly, drag rings, oil seals, bearings, cover, and vent plug. The hub assembly is splined to the left-hand side of the brake shaft and is retained by a snap ring. The brake wheel is designed with an internal ratchet ring (integral) and rotates on two roller bearings. The pawl assembly retracts toward

the hub when the winch drum is turning. When the drum stops the pawl immediately engages into the brake wheel ratchet.

1-26. POWER CONTROLLED OIL BRAKE ASSEMBLY.

(See Figure 1-10.) The oil brake assembly consists primarily of a cover, belleville spring, thrust ring, multiple disc assembly, hub, cage, pressure plate, piston, and piston housing. The multiple disc assembly has ten separator plates and eleven friction discs placed alternately on the hub. The separator plates are dished and have internal lugs that are indexed with the external splines on the hub. The external lugs of the friction discs are indexed with the internal splines of the cage. The hub is splined to the left-hand side of the brake shaft and is retained by a snap ring. The cage is secured by eight studs between the brake cover and pressure plate. The belleville spring pushes against the thrust ring which compresses the multiple disc assembly. Since the friction discs are splined to the stationary cage and separator plates to the shaft through the hub, this will prevent the brake shaft from turning thus

applying the brake. The brake is released by directing pressurized oil into the cavity between the piston and piston housing. This oil forces the piston out pushing the push pin, thrust ring, and belleville spring away, releasing the multiple disc assembly.

1-27. DUMP VALVE ASSEMBLY. (See Figure 1-11.)

1-28. The dump valve assembly consists of a valve body, spring and spool assembly. The spool assembly consists of a counterbored sleeves, ball and roll pin. The ball is free to move in the counterbore and is prevented from falling out by the roll pin.

1-29. CLUTCH ASSEMBLY.

1-30. DIRECT DRIVE CLUTCH ASSEMBLY.

(See Figure 1-12) The Direct Drive clutch assembly consists primarily of a reverse dental clutch, forward dental clutch, two dental clutch hubs, right-hand shifter fork, left-hand shifter fork, shifter shaft, detent ball and detent spring. The shifter forks are secured to the shifter shaft with a lock screw and lockwire. The shifter shaft is connected through a shifter crank

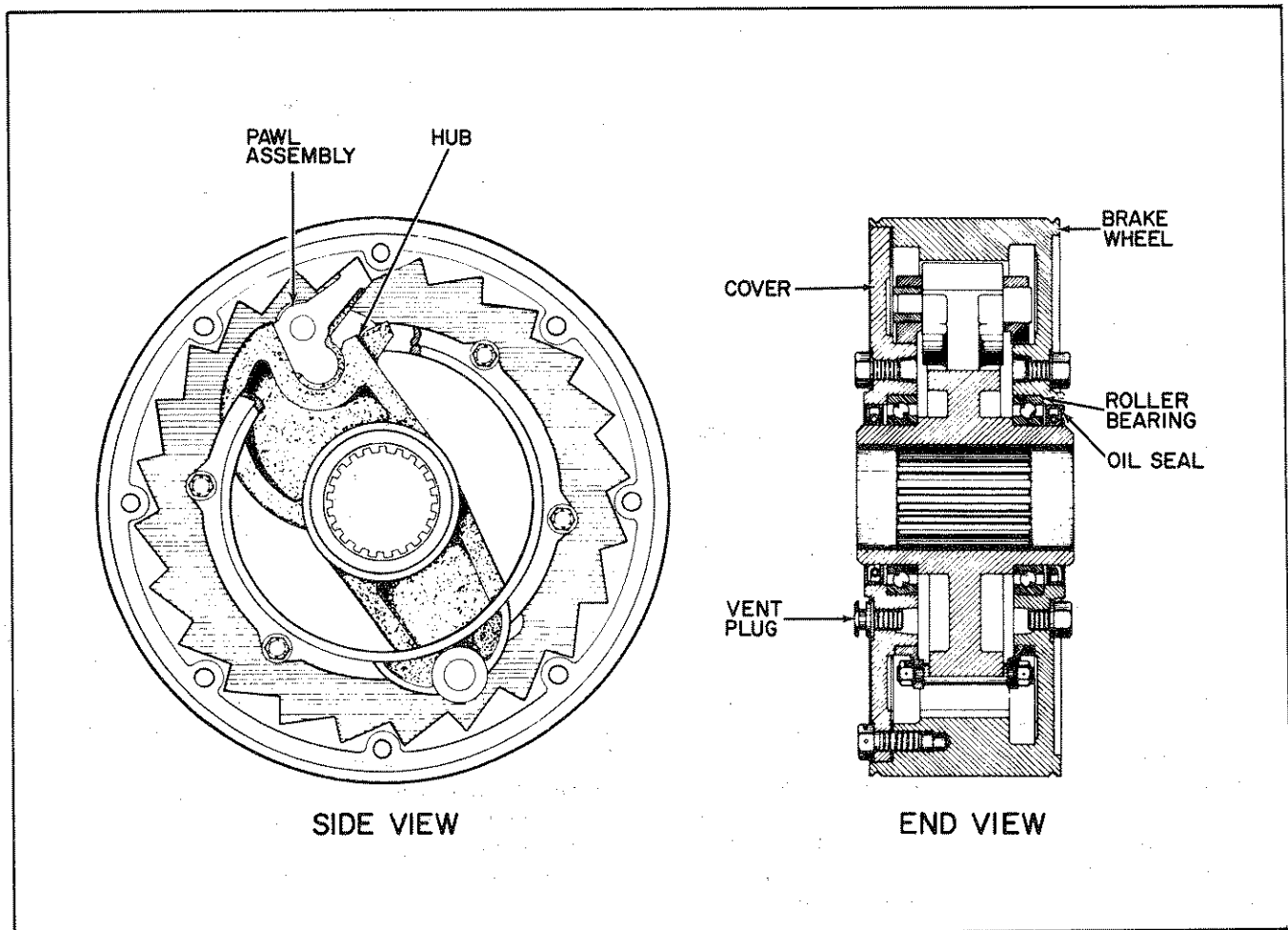


Figure 1-9. Direct Drive Automatic Brake Assembly (Optional)

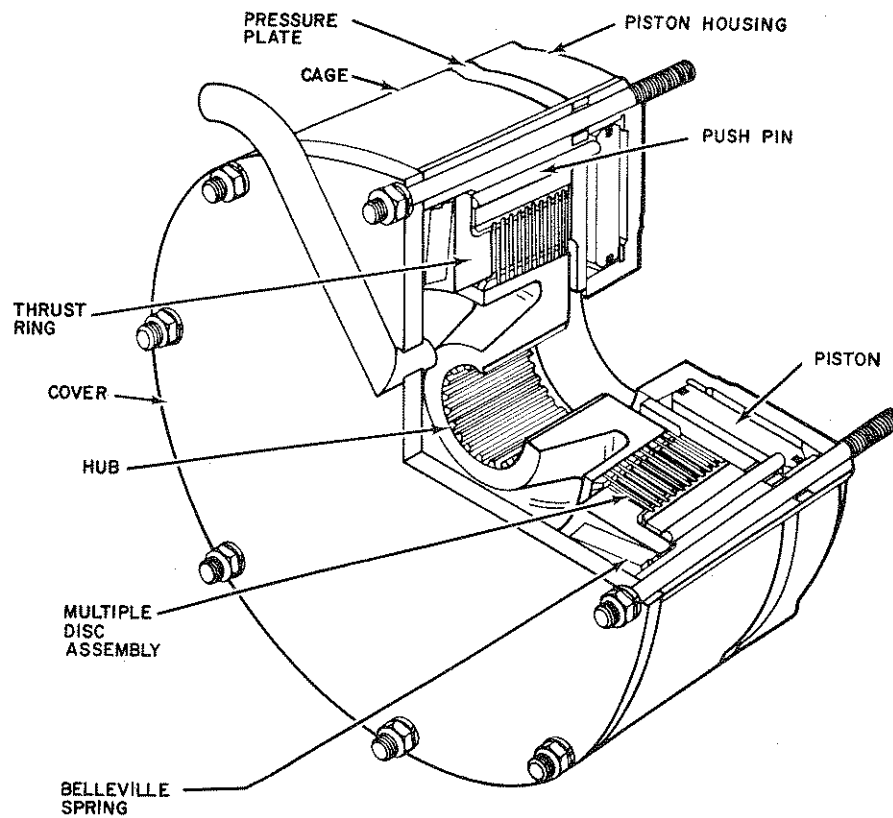


Figure 1-10. Power Controlled Oil Brake Assembly

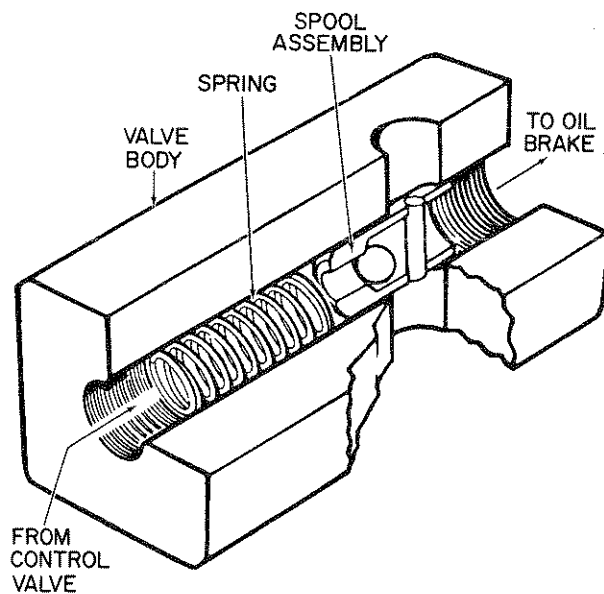


Figure 1-11. Dump Valve Assembly

assembly to the clutch control cable. The detent ball and spring hold the shifter forks in the Forward, Neutral, or Reverse position. The compression spring absorbs the shifting force until the external teeth of the dental clutch hub align with the external dental teeth of the pinion gear. Once the teeth are aligned the dental clutch will slide onto the dental teeth of the pinion gear. This completely engages the bevel gear shaft to the pinion gear.

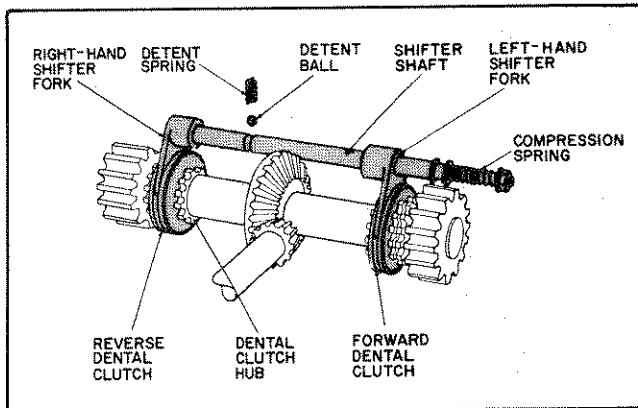


Figure 1-12. Direct Drive Clutch Assembly

1-31. POWER CONTROLLED CLUTCH ASSEMBLY.

(See Figure 1-13.) The clutch assembly consists primarily of a piston retainer, piston, release springs, spring retainer, cooling valve assembly, multiple disc assembly, hub, and cover plate. The hub is drilled to allow the release springs, cooling valve, and capscrews to pass through. The multiple disc assembly consists of eight separator plates and eight friction discs placed alternately on the hub starting with a separator plate next to the piston. The separator plates are dished and have internal lugs that are indexed with the external splines on the hub. The external lugs of the sintered bronze friction discs are indexed to the spider gear housing. The clutch assembly can be locked-up by directing pressurized oil into the cavity between the piston and the piston retainer. This oil forces the piston to compress the friction discs and separator plates together. Since the separator plates are splined to the bevel gear shaft through the hub and the friction discs are splined to the spider gear, torque will be transferred. A roller bearing between the spider gear and bevel gear shaft allows the spider gear to rotate independently around the shaft when the clutch pack is not locked-up. The cooling valve assembly allows an increased amount of cooling oil to pass through the clutch assembly when the clutch pack is released.

1-32. HYDRAULIC PUMP ASSEMBLY. (See Figure 1-14.)

1-33. The hydraulic pump assembly consists pri-

marily of a pump body, front cover, rear cover, drive gear, driven gear, bearings and seals. The pump body, front cover and rear cover are cast aluminum. The bearings are composed of a tin and aluminum alloy. The drive shaft and gear (integral), and the driven shaft and gear (integral) are a steel alloy. The pump assembly is gear driven by the tractor auxiliary PTO shaft in most applications, however, on Traxcavators the pump is engine driven through the fan belts. This positive displacement external gear pump provides hydraulic energy necessary to operate the Power Controlled Winch. The inlet port is connected by a hose assembly to the winch intake manifold assembly. The outlet port is connected by a hose assembly to the pressure filter assembly, then through another hose assembly to the Control Valve Assembly.

1-34. FUNCTIONAL DESCRIPTION.

1-35. DIRECT DRIVE GEAR TRAIN. (See Figure 1-15.)

The PTO shaft assembly rotates clockwise as viewed from the front of the tractor. Torque is transmitted from the PTO bevel pinion gear to the bevel gear shaft ring gear. This causes the bevel gear shaft to rotate clockwise as viewed from the left-hand side. In Neutral, the bevel gear shaft, the bevel ring gear, the spacers, and the clutches rotate, but the pinion gears do not. This is because neither clutch is engaged. In Forward, the left-hand dental clutch is moved toward the left-hand side to engage the forward pinion gear. This will cause torque to be transferred from the forward pinion gear to the brakeshaft reduction gear, forcing the brakeshaft assembly to rotate counterclockwise. The brakeshaft pinion gear will now turn the large intermediate gear causing the intermediate shaft assembly to rotate clockwise. The intermediate shaft drum pinion gear will now turn the large drum gear and drum counterclockwise. In Reverse, the right-hand dental clutch is moved toward the right-hand side to engage the reverse pinion gear. This will cause torque to be transferred from the reverse pinion gear to the large intermediate gear causing the intermediate shaft assembly to rotate counterclockwise. The intermediate shaft drum pinion gear will now turn the large drum gear and drum clockwise.

1-36. POWER CONTROLLED GEAR TRAIN. (See Figure 1-15.)

The PTO shaft assembly rotates clockwise as viewed from the front of the tractor. Torque is transmitted from the PTO bevel pinion gear to the bevel gear shaft ring gear. This causes the bevel gear shaft to rotate clockwise as viewed from the left-hand side. In Neutral, the bevel gear shaft, the bevel ring gear, the spacers, and the clutches rotate,

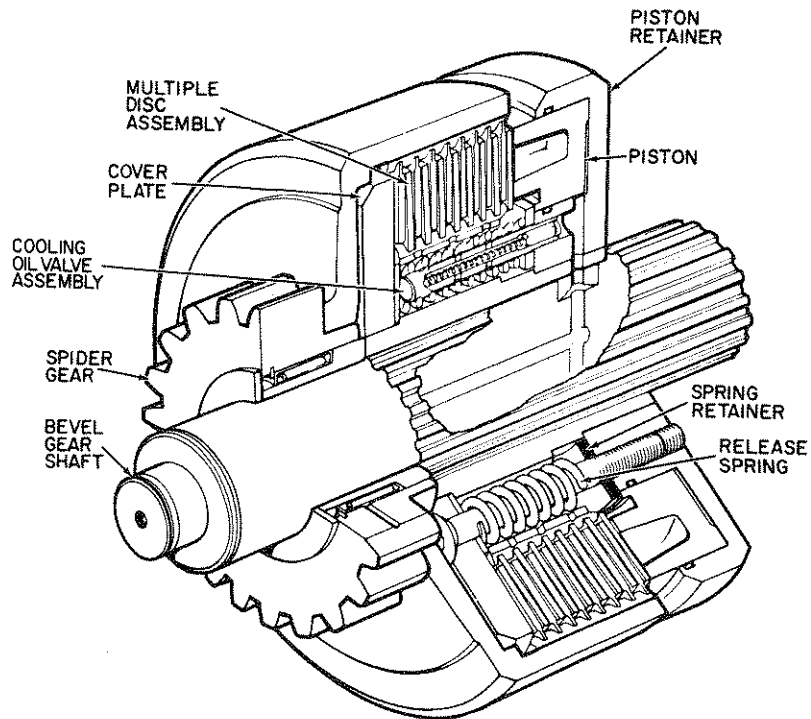


Figure 1-13. Power Controlled Clutch Assembly

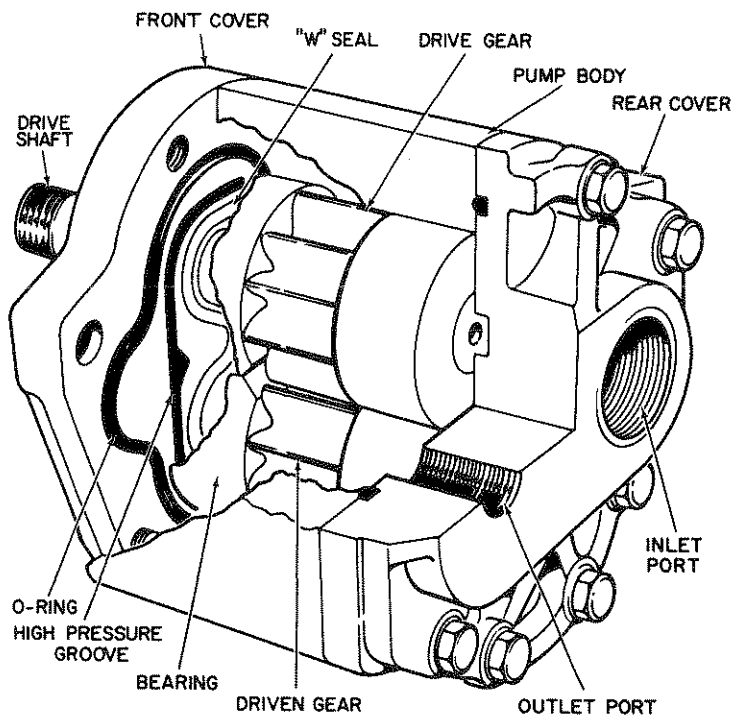
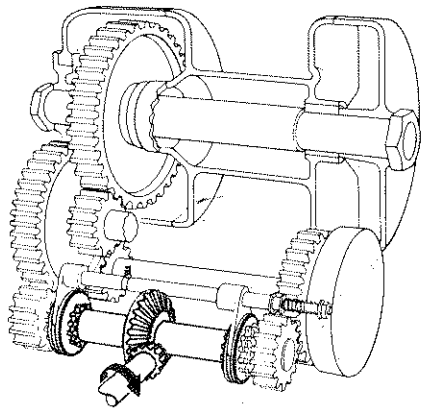
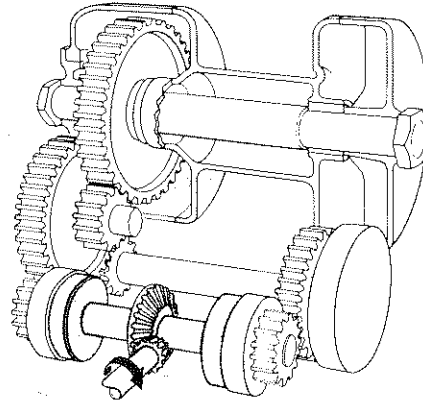


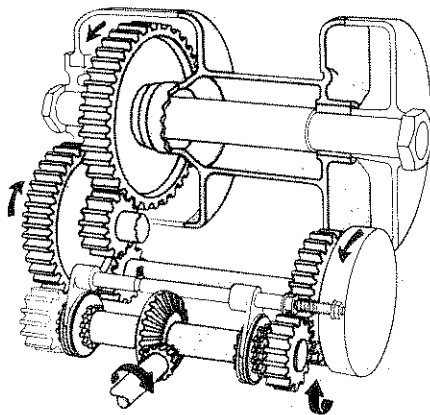
Figure 1-14. Hydraulic Pump Assembly



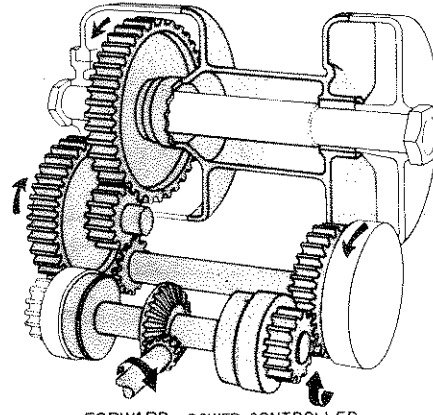
NEUTRAL, DIRECT DRIVE



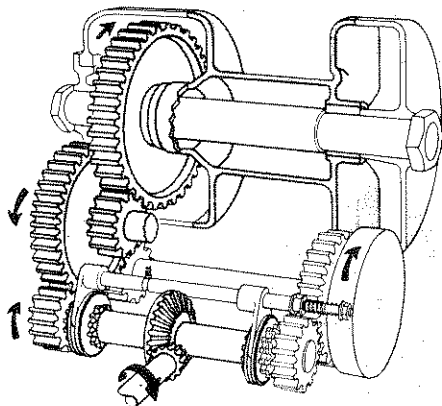
NEUTRAL, POWER CONTROLLED



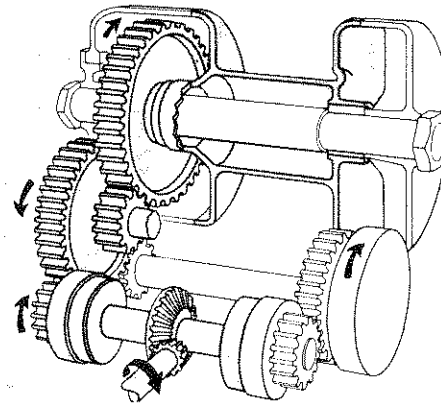
FORWARD, DIRECT DRIVE



FORWARD, POWER CONTROLLED



REVERSE, DIRECT DRIVE



REVERSE, POWER CONTROLLED

Figure 1-15. Torque Transfer

but the spider gears do not. This is because neither clutch is engaged. In Forward the left-hand forward clutch assembly is locked-up to the forward spider gear by hydraulic pressure. This will cause torque to be transferred from the forward spider gear to the brakeshaft reduction gear forcing the brakeshaft assembly to rotate counterclockwise. The brakeshaft pinion gear will now turn the large intermediate gear causing the intermediate shaft assembly to rotate clockwise. The intermediate shaft drum pinion gear will now turn the large drum gear and drum counterclockwise. In Reverse, the right-hand reverse clutch assembly is locked-up to the reverse spider gear by hydraulic pressure. This will cause torque to be transferred from the reverse spider gear to the large intermediate gear causing the intermediate shaft assembly to rotate counterclockwise. The intermediate shaft drum pinion gear will now turn the large drum gear and drum clockwise.

1-37. HYDRAULIC SYSTEM. (See Figure 1-16.) The hydraulic system consists primarily of a suction filter, pump, control valve, cooling oil relief valve, pressure gauge, forward clutch, reverse clutch, oil brake, dump valve and related lines. The hydraulic pump supplies the oil for the system. The control valve which is actuated by the handling gear distributes and regulates the oil. The filters remove contaminants from the oil. The cooling oil relief

valve maintains oil flow to the clutches and oil brake. The dump valve is placed in the hydraulic system to assure fast evacuation of brake release oil. This is necessary for rapid brake application. The pressure gauge which is located on the handling gear indicates winch brake release pressure.

1-38. There are basically eight different conditions under which the winch will operate. The operational conditions will be referred to as follows: (Refer to paragraphs 1-39 through 1-46.)

- a. NEUTRAL, Normal Operation
- b. FORWARD, Normal Operation
- c. GRADUAL BRAKE RELEASE, Normal Operation
- d. REVERSE, Normal Operation
- e. FORWARD, Inching Operation (Brake Applied)
- f. FORWARD, Inching Operation (Brake Slipping)
- g. REVERSE, Inching Operation (Brake Applied)
- h. REVERSE, Inching Operation (Brake Slipping)

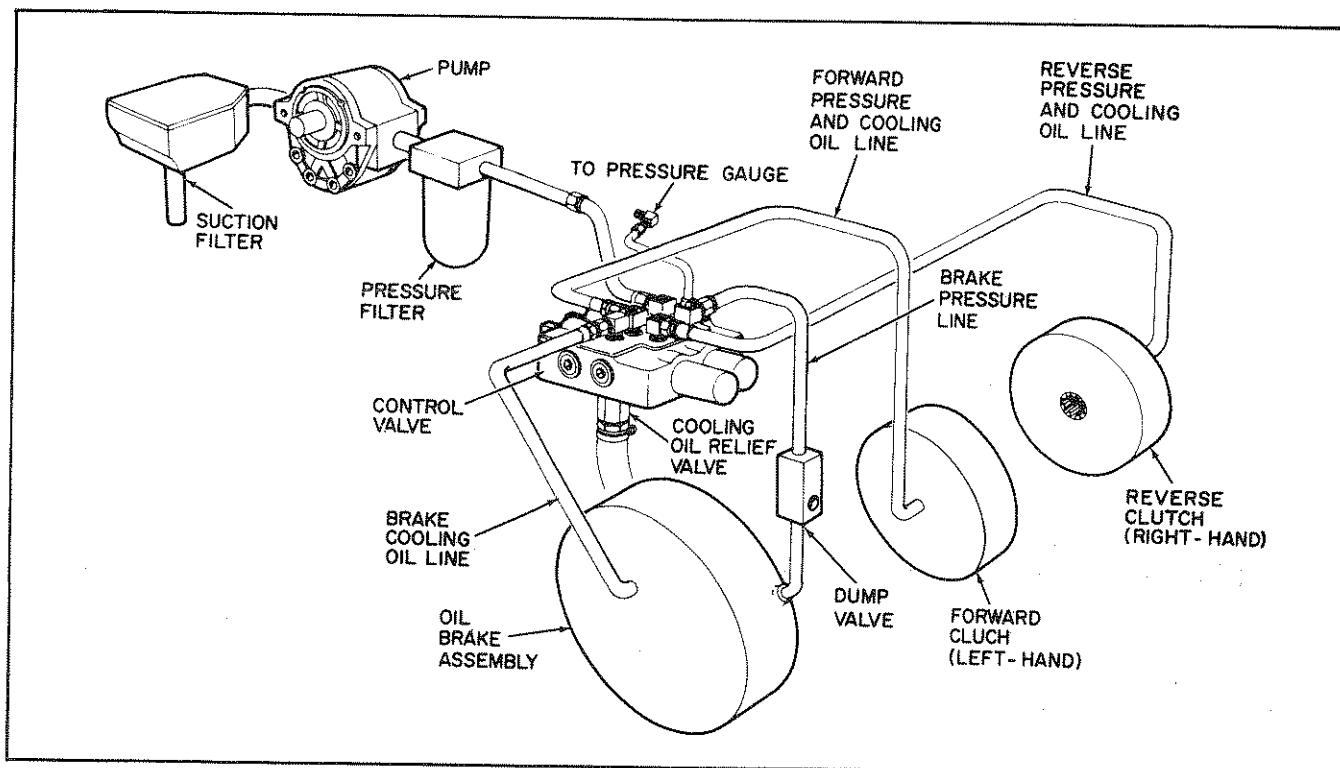


Figure 1-16. Hydraulic System Inter-Connection Diagram

1-39. HYDRAULIC SYSTEM, NEUTRAL, NORMAL CONTROL. (See Figure 1-17.) On earlier production Handling Gear, the system is placed in NEUTRAL, Normal Control by: (1) Moving the Control Lever down and locking it in place and (2) shifting the Selector Lever to the Neutral Position. On the current production Handling Gear this is accomplished by: (1) Locking the Inching Lever to the Brake-Off position and (2) shifting the Selector Lever to the Neutral Position. When the control lever is locked in the down position or the inching lever is locked in the Brake-Off position, the inching spool is pulled to its extreme OUT position. With the Selector Lever in the Neutral Position, the selector spool is in its relaxed position. With the spool in these

positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the control valve inlet port. Oil will then flow through the valve, past both spools, and fill up the complete hydraulic circuit. At this point there is no exit from the circuit for the hydraulic fluid and the pressure will increase. This pressure increases until the low pressure cooling oil relief valve opens and dumps the oil. The oil in the circuit is now regulated at cooling oil pressure. This pressure is not high enough to release the brake or actuate either directional clutch, but is adequate to lubricate both clutches and the oil brake assembly.

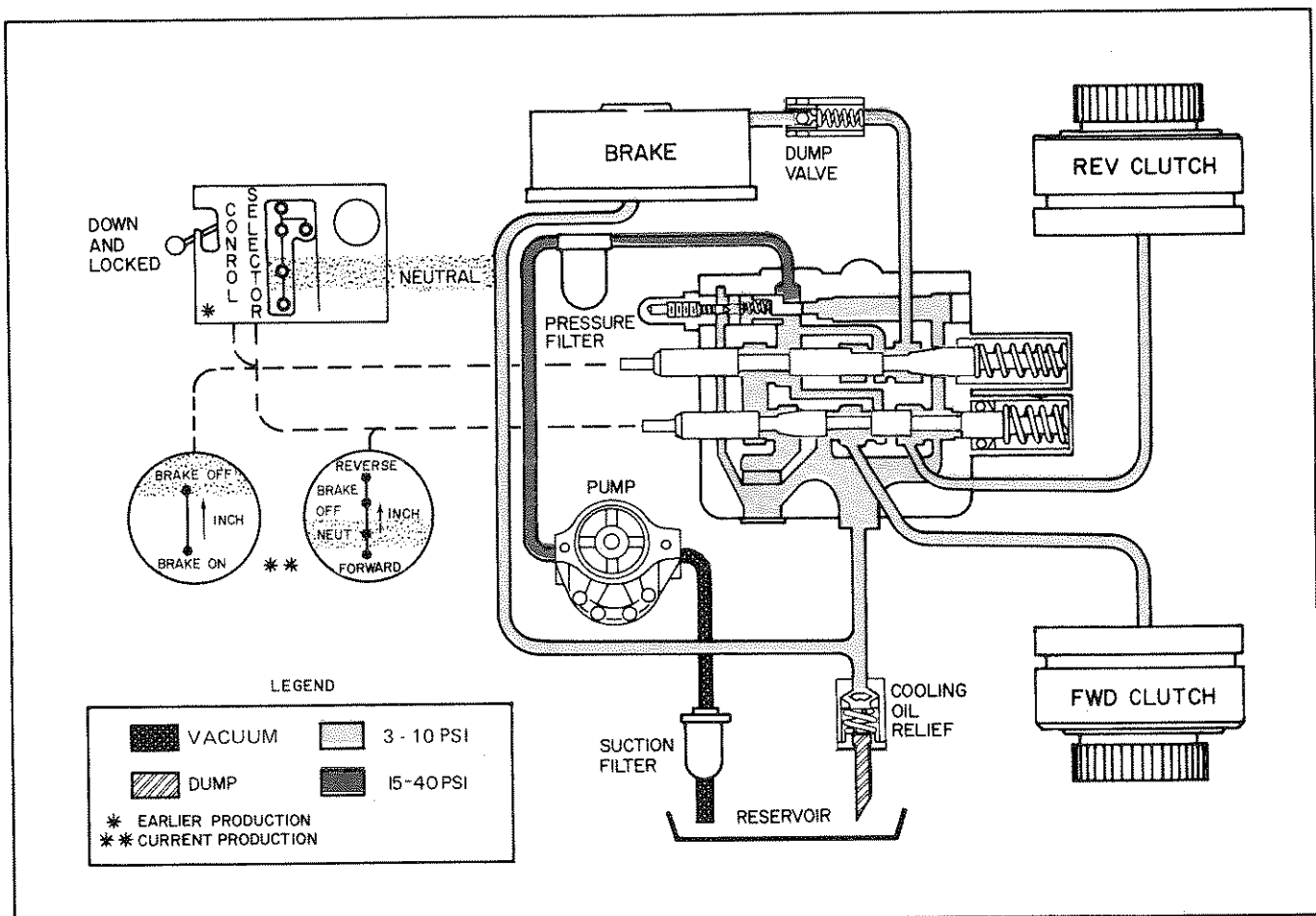


Figure 1-17. Flow Diagram, Neutral, Normal Control

1.40. HYDRAULIC SYSTEM, FORWARD, NORMAL OPERATION. (See Figure 1-18.) On earlier production Handling Gear, the system is placed in FORWARD, Normal Control by: (1) Moving the Control Lever down and locking it in place and (2) shifting the Selector Lever to the Forward position. On current production Handling Gear this is accomplished by: (1) Locking the Inching Lever to the Brake-Off position and (2) shifting the Selector Lever to the Neutral position. When the Control Lever is locked in the down position or the Inching Lever is locked to the Brake-Off position, the inching spool is pulled to its extreme OUT position. With the Selector Lever in the Forward position, the selector spool is pushed to its extreme IN position. With the spools in these positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the

control valve inlet port. Oil will then enter the control valve inlet and flow past the inching spool to the selector spool. At this point, the oil is dead-headed since the selector spool has been pushed back into the valve, closing off the passage between the valve body and the spool. The oil will back up and fill the cavities leading to the forward clutch and the brake. Once the valve cavities are filled with oil, the oil pressure to the forward clutch and brake will increase. The pressure increases very quickly and acts to engage the forward clutch and to release the brake at the same time. This pressure will continue to increase until it is relieved through the pilot operated relief valve. Overflow from the pilot operated relief valve is regulated by the cooling oil relief valve. This low pressure oil circulates to the reverse clutch and oil brake to cool these assemblies.

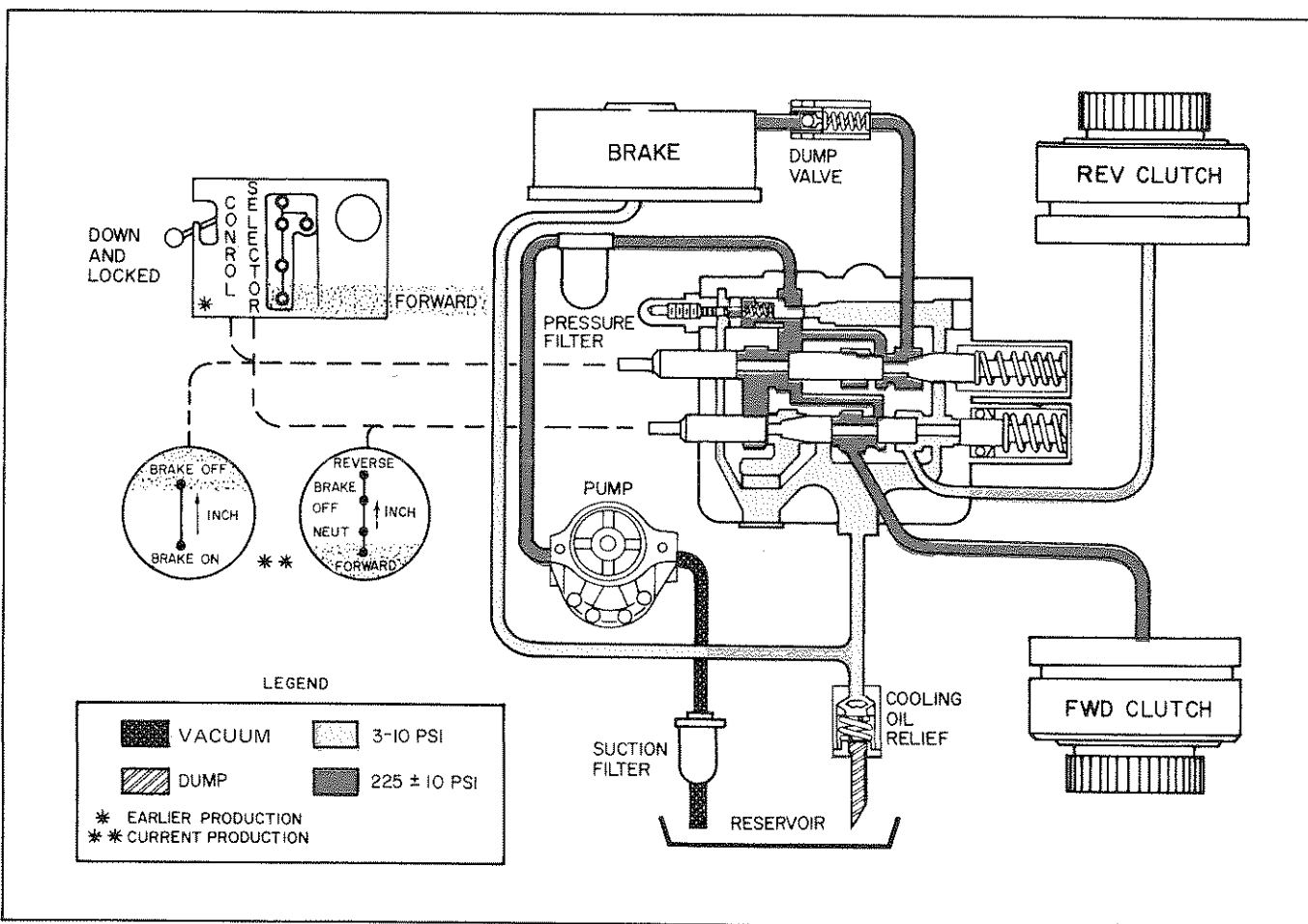


Figure 1-18. Flow Diagram, Forward, Normal Control

1-41. HYDRAULIC SYSTEM, GRADUAL BRAKE RELEASE, NORMAL OPERATION. (See Figure 1-19.)

On earlier production Handling Gear, the system is placed in NEUTRAL, Normal Control by: (1) Moving the Control Lever down and locking it in place and (2) shifting the Selector Lever to the Inch position. On the current production Handling Gear this is accomplished by: (1) Locking the Inching Lever to the Brake-Off position and (2) shifting the Selector Lever to the Inch position. When the Control Lever is locked in the down position or the Inching Lever is locked to the Brake-Off position, the inching spool is pulled to its extreme OUT position. With the Selector Lever in the Inch position, the selector spool is slightly pulled out from its relaxed position. With the spools in these positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the control valve inlet port. Oil will then flow through the valve, past both spools, and fill up the complete hydraulic circuit. At this point, there is no exit from the

circuit for the entire hydraulic flow and the pressure will increase. This pressure will increase until the cooling oil relief valve opens and dumps. The oil in the circuit is now regulated by the cooling oil relief valve. To gradually release the brake, the Selector Lever is slowly moved towards the Brake-Off position. This pulls the selector spool out of the valve, thus metering the oil between the spool and the control valve body. This metering of the oil causes a partial restriction and a slow pressure increase to the brake. This gradual pressure increase will gradually release the brake. When the selector spool is pulled out to the Brake-Off position (D-23 Spool is detented to this position), the oil flow between the selector spool and the valve body will stop. The pressure will now increase to a pressure that will completely release the brake and relieve itself through the pilot operated relief valve. Overflow from the pilot operated relief valve is regulated by the cooling oil relief valve. This low pressure oil circulates to both clutches and the oil brake to cool these assemblies.

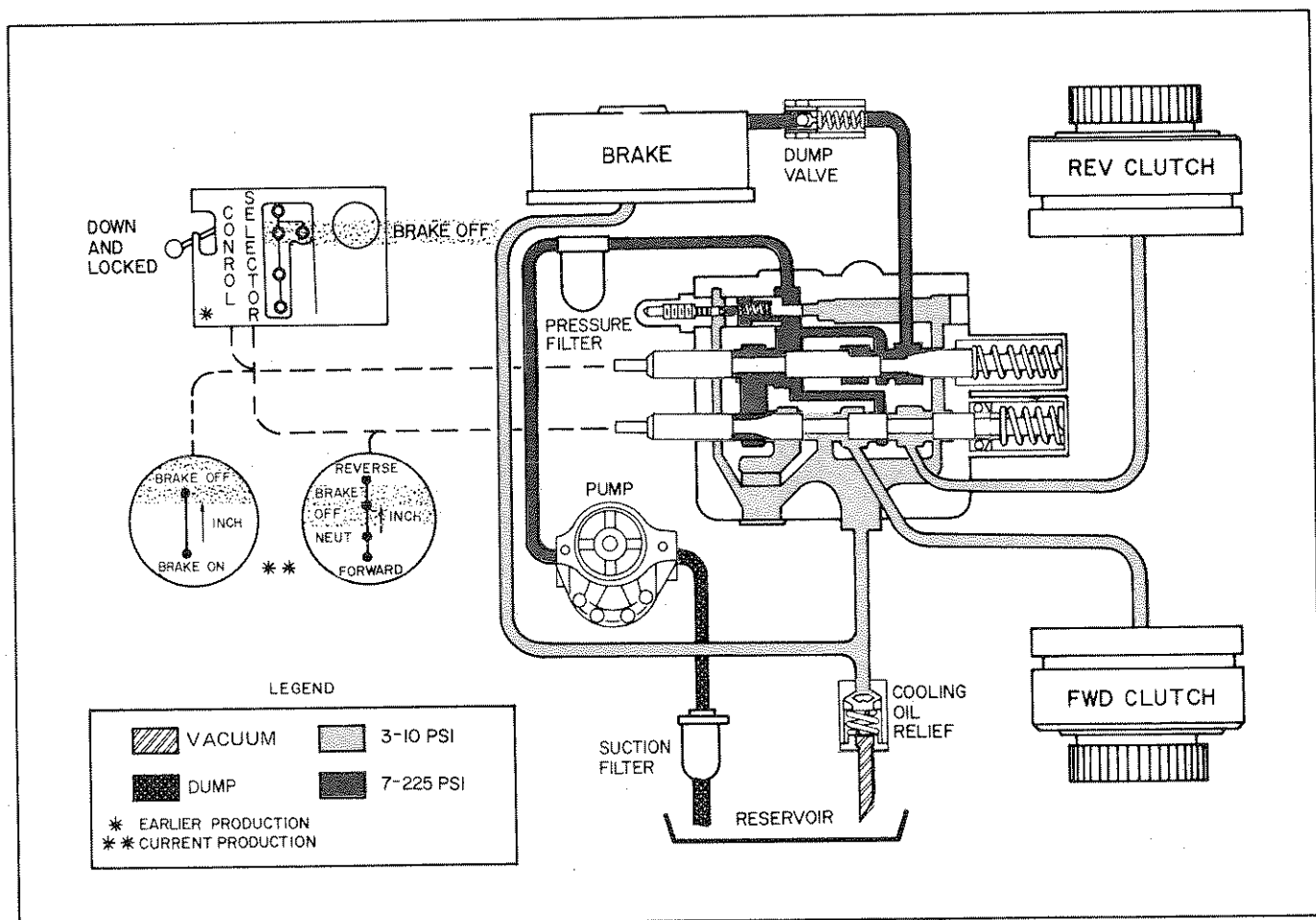


Figure 1-19. Flow Diagram, Gradual Brake Release, Normal Control

1-42. HYDRAULIC SYSTEM, REVERSE, NORMAL OPERATION. (See Figure 1-20.) On earlier production Handling Gear, the system is placed in REVERSE, Normal Control by: (1) Moving the Control Lever down and locking it in place and (2) shifting the Selector Lever to the Reverse position. On the current production Handling Gear this is accomplished by: (1) Locking the Inching Lever to the Brake-Off position and (2) shifting the Selector Lever to the Reverse position. When the Control Lever is locked in the down position, or the Inching Lever is locked to the Brake-Off position, the inching spool is pulled to its extreme OUT position. With the Selector Lever in the Reverse position, the selector spool is pulled to its extreme OUT position. With the spools in these positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the control valve inlet port. Oil

will then enter the control valve inlet and flow pass the inching spool to the selector spool. At this point, the oil is dead-headed since the selector spool has been pulled to the extreme OUT position which closes the passage between the valve body and spool. The oil will back-up and fill the cavities leading to the reverse clutch and the brake. Once the valve cavities are filled with oil, the oil pressure to the reverse clutch and brake will increase. The pressure increases very quickly and acts to engage the reverse clutch and to release the brake at the same time. This pressure will continue to increase until it relieves itself through the pilot operated relief valve. Overflow from the pilot operated relief valve is regulated by the cooling oil relief valve. This low pressure oil circulates to the forward clutch and oil brake to cool these assemblies.

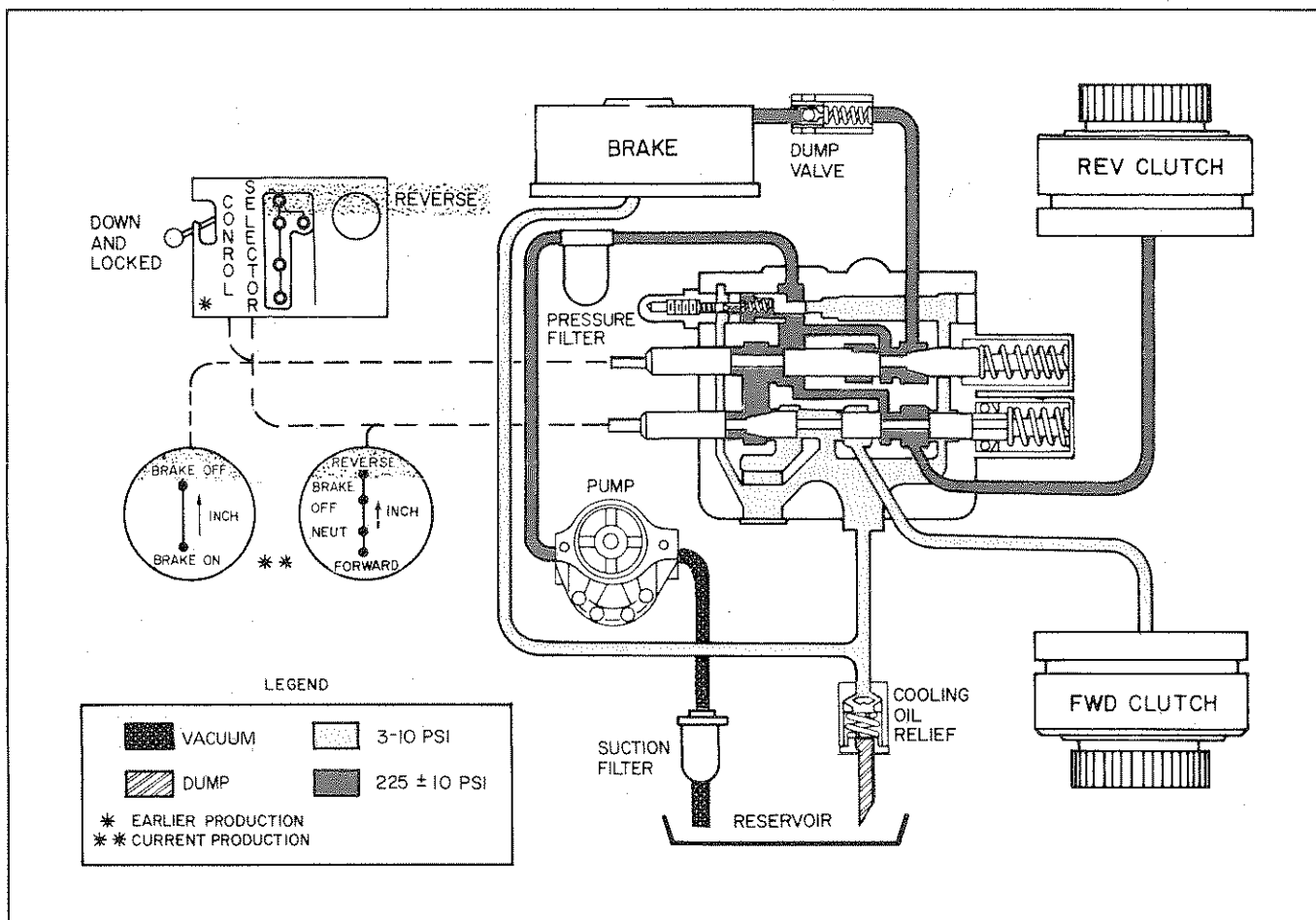


Figure 1-20. Flow Diagram, Reverse, Normal Control

1-43. HYDRAULIC SYSTEM, FORWARD, INCHING OPERATION (Brake Applied). (See Figure 1-21.)

On earlier production Handling Gear, the system is placed in FORWARD, Fine Inching Control by: (1) Moving the Control Lever up and locking it in place and (2) holding the Selector Lever in the Forward position. On the current production Handling Gear this is accomplished by: (1) Lifting the Stop Latch away from the Inching Lever which will allow the Inching Lever to spring-return to the Brake-On position and (2) holding the Selector Lever in the Forward position. When the Control Lever is up and locked in place or the Inching Lever is in the Brake-On position, the inching spool is spring-returned to its neutral position. With the Selector Lever in the Forward position, the selector spool is pushed to its extreme IN position. With the spools in these positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the control valve inlet. Oil will then enter the control valve inlet and flow past the

inching spool to the selector spool. At this point, the oil is dead-headed since the selector spool has been pushed back into the valve, closing off the passage between the valve body and the spool. The oil will back up and fill the cavities leading to the forward clutch and the brake. It should be noted that the entrance to the brake port is much smaller than the exit from the brake port. Therefore, the oil entering the brake port will not create a great pressure increase in that port. Pressure upstream of the brake port will continue to increase until it is relieved at the high pressure relief valve. This pressure engages the forward clutch. Overflow from the pilot operated relief valve is regulated by the cooling oil relief valve. This low pressure oil circulates to the reverse clutch and oil brake to cool these assemblies. At this point, the forward clutch has been applied, but the brake has not been released. The torque converter on the tractor will therefore assume a stalled condition.

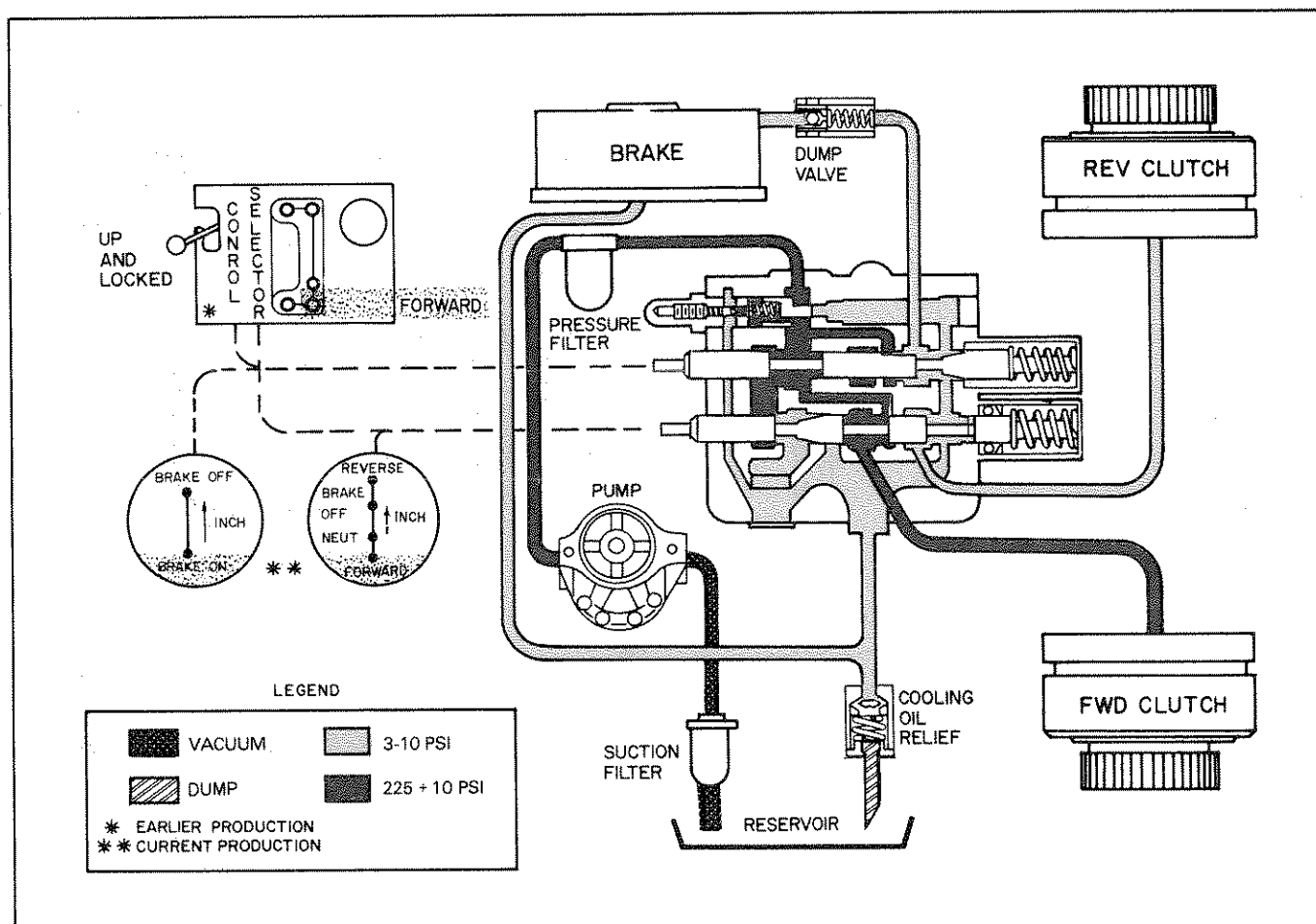


Figure 1-21. Flow Diagram, Forward, Fine Inching Control (Brake Applied)

1-44. HYDRAULIC SYSTEM, FORWARD, INCHING

OPERATION (Brake Slipping). (See Figure 1-22.) On earlier production Handling Gear, the system is placed in FORWARD, Fine Inching Control by: (1) Having the Control Lever up and locked in place and (2) moving the Selector Lever toward the front of the handlever housing. On the current production Handling Gear this is accomplished by: (1) Holding the Selector Lever in the Forward position and (2) moving the Inching Lever toward the Brake-Off position. When the Selector Lever (earlier production) is moved toward the front of the handlever housing or the

Inching Lever (current production) is moved towards the Brake-Off position, the inching spool is gradually pulled OUT of the control valve. This movement gradually stops the flow of oil exiting at the brake release port. This is because the orifice entering the port remains the same, but the orifice for the oil exiting the port is gradually reduced. This change in orifice size causes a pressure build up within the brake release port which slowly releases the brake. As the brake is released the forward clutch and the tractor torque converter gradually over-power the brake and inch the load in under power.

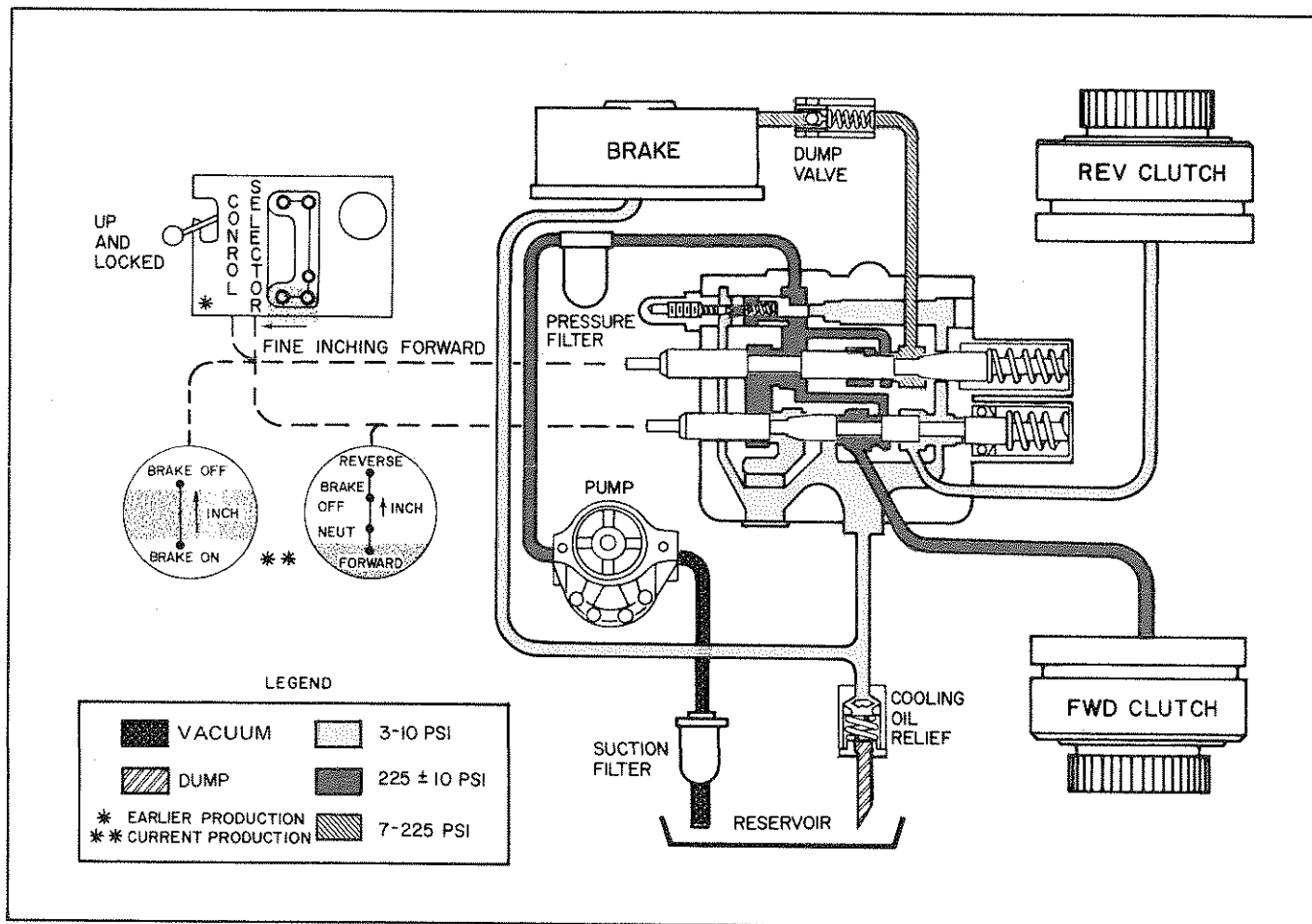


Figure 1-22. Flow Diagram, Forward, Fine Inching Control (Brake Slipping)

1-45. HYDRAULIC SYSTEM, REVERSE, INCHING OPERATION (Brake Applied). (See Figure 1-23.)

On earlier production Handling Gear, the system is placed in REVERSE, Fine Inching Control by: (1) Moving the Control Lever up and locking it in place and (2) holding the Selector Lever in the reverse position. On the current production Handling Gear this is accomplished by: (1) Lifting the Stop Latch away from the Inching Lever which will allow the Inching Lever to spring-return to the Brake-On position and (2) holding the Selector Lever in the reverse position. When the Control Lever is up and locked or the Inching Lever is in the Brake-On position, the inching spool is spring-returned to its neutral position. With the Selector Lever in the reverse position, the selector spool is pushed to its extreme OUT position. With the spools in these positions the pump draws oil from the reservoir through the suction filter and pushes it through the pressure filter to the control valve inlet. Oil will then enter the control valve inlet and flow past the

inching spool to the selector spool. At this point, the oil is dead-headed since the selector spool has been pulled to its extreme OUT position which closes off the passage between the valve body and the spool. The oil will back up and fill the cavities leading to the reverse clutch and the brake. It should be noted that the entrance to the brake port is much smaller than the exit from the brake port. Therefore, the oil entering the brake port will not create a great pressure increase in that port. Pressure upstream of the brake port will continue to increase until it is relieved at the high pressure relief valve. This pressure engages the reverse clutch. Overflow from the pilot operated relief valve is regulated by the cooling oil relief valve. This low pressure oil circulates to the forward clutch and oil brake to cool these assemblies. At this point, the reverse clutch has been applied, but the brake has not been released. The torque converter on the tractor will therefore assume a stalled condition.

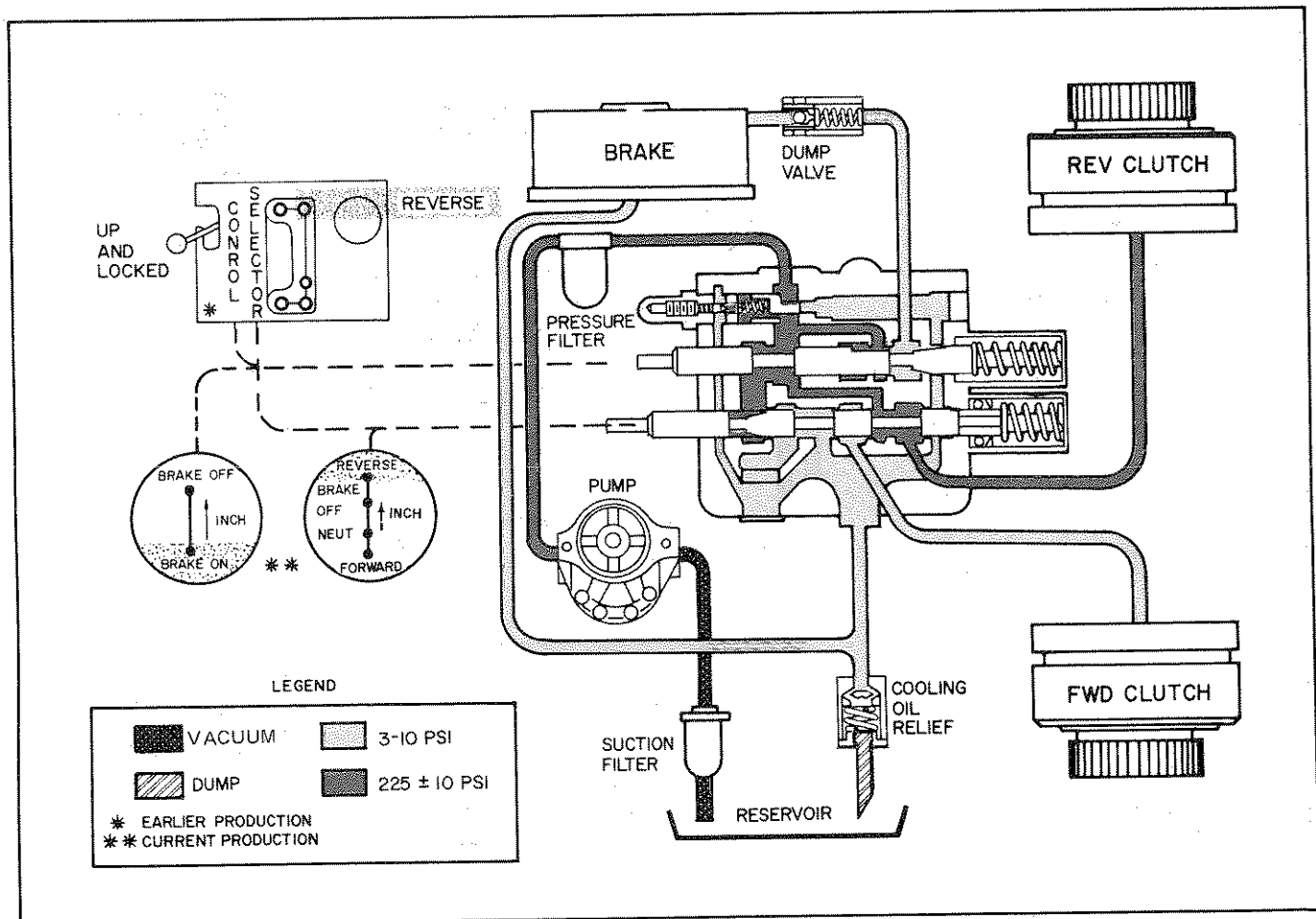


Figure 1-23. Flow Diagram, Reverse, Fine Inching Control (Brake Applied)

1-46. HYDRAULIC SYSTEM, REVERSE, INCHING

OPERATION (Brake Slipping). (See Figure 1-24.)

On earlier production Handling Gear, the system is placed in REVERSE, Fine Inching Control by: (1) Having the Control Lever up and locked in place and (2) moving the Selector Lever toward the front of the handlever housing. On the current production Handling Gear, this is accomplished by: (1) Holding the Selector Lever in the Reverse position and (2) moving the Inching Lever toward the Brake-Off position. When the Selector Lever (earlier production) is moved toward the front of the handlever housing or

the Inching Lever (current production) is moved towards the Brake-Off position, the inching spool is gradually pulled OUT of the control valve. This movement gradually stops the flow of oil exiting at the brake release port. That is because the orifice entering the port remains the same, but the orifice for the oil exiting the port is gradually reduced. This change in orifice size causes a pressure build up within the brake release port which slowly releases the brake. As the brake is released, the reverse clutch and the tractor torque converter gradually overpower the brake and inch the load out under power.

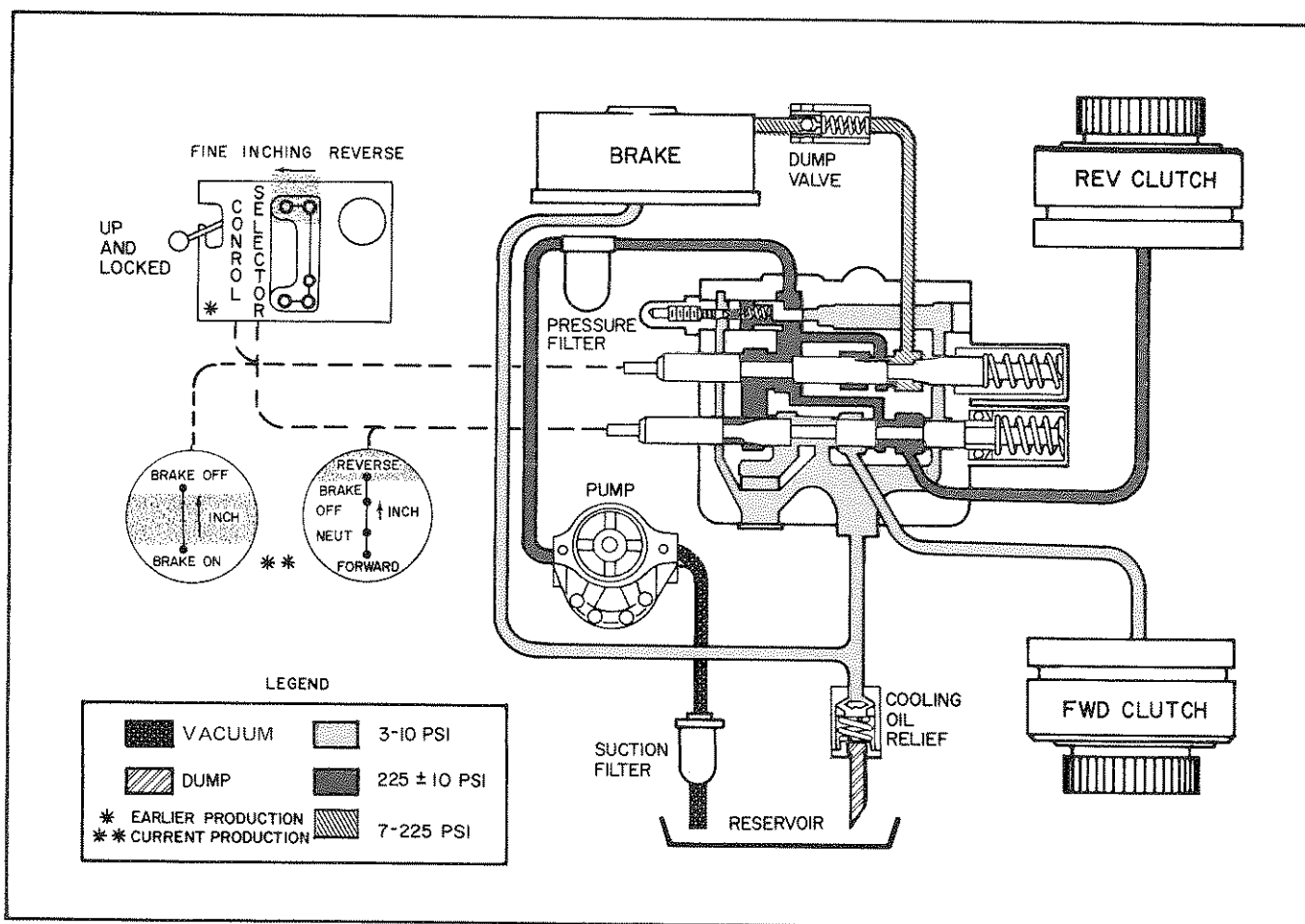


Figure 1-24. Flow Diagram, Reverse, Fine Inching Control (Brake Slipping)



2-1. GENERAL.

2-2. The D7J Direct Drive and Power Controlled winches use tractor mounted controls. These controls allow the operator to either pay-out or pull-in line easily without leaving the tractor. 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 SAFETY RULES to prevent injury to personnel and damage to equipment:

- a. Report damage or erratic operation of winch or pressure gauge immediately.
- b. Operate the unit efficiently, but not carelessly.
- c. Do not stand up while operating the tractor or the winch.
- d. Be sure instruments and controls are operative before operating 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 clothing, 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 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 tractor while the winchline is under tension.

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

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

q. Authorized operators only!

2-5. OPERATING PROCEDURES.

2-6. DIRECT DRIVE WINCH. (See Figure 2-1.)

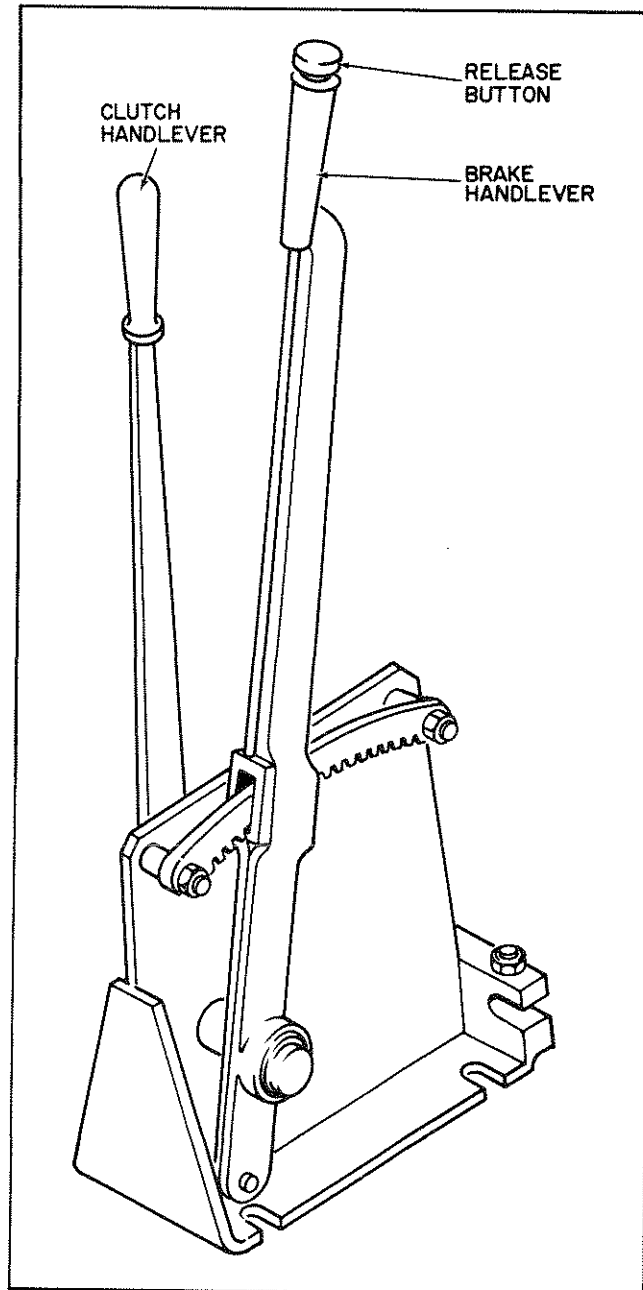


Figure 2-1. Operating Controls, Direct Drive Winch

2-7. SETTING THE BRAKE. To set the brake, pull back on the Brake Handlever. The brake will remain in the brake applied position until manually moved.

2-8. RELEASING THE BRAKE. To release the brake, proceed as follows:

- a. Pull back slightly on the Brake Handlever.
- b. Depress the release button.
- c. Push the Brake Handlever forward.

NOTE: If the winch is equipped with the optional automatic brake (see figure 1-9), the winch may haul-in line with the mechanical brake set, but the brake must be released to pay-out line.

2-9. HAULING-IN LINE. To haul-in line, proceed as follows:

- a. Disengage the tractor master clutch.
- b. Place the tractor transmission in Neutral.
- c. Pull the Clutch Handlever all the way back to the Forward position.
- d. Release the Brake (Refer to paragraph 2-8).
- e. Engage the tractor's master clutch.

NOTE: Line speed is varied by throttling the engine.

2-10. STOPPING THE WINCH. To stop the winch, proceed as follows:

- a. Throttle down the engine.
- b. Disengage the tractor master clutch and apply the brake at the same time.

NOTE: The brake may be set before the tractor master clutch is disengaged if the winch is equipped with an automatic brake.

2-11. PAY-OUT LINE UNDER POWER. To pay-out line under power, proceed as follows:

- a. Disengage the tractor master clutch.
- b. Push the winch Clutch Handlever past Neutral and into the Reverse position.
- c. Release the brake (Refer to paragraph 2-8).

- d. Engage the master clutch.

NOTE: Line speed is varied by throttling the engine.

2-12. SHIFTING TO NEUTRAL. To shift to Neutral, proceed as follows:

- a. Disengage the tractor master clutch.
- b. Move the Clutch Handlever to the Neutral position (straight up).

CAUTION: Do not operate the winch while the tractor is in motion.

2-13. POWER CONTROLLED WINCH. There are two different handling gear designs on the Power Controlled Winch. These will be referred to as earlier production and current production. Although the winch is the same, the operational procedure of these two handling gear designs are different. (Refer to paragraphs 2-14 and 2-17.)

2-14. EARLIER PRODUCTION HANDLING GEAR. (See Figure 2-2.) There are two different shift patterns that can be selected for winch operation. These are Normal Control and Fine Inching Control. The Normal Control shift pattern should be used for routine or normal operation encountered in logging and heavy construction. The Fine Inching Control should be used in: (1) Pipelining for positioning pipe and lowering backhoes, (2) Oil field work in rigging wells, towing and leveling derricks, and placing pipe, (3) Mining for towing control stations and matching pipe flanges, (4) General Construction for various handling, raising, lowering, towing, yo-yo operation and rescue work. Operating procedures for Normal Control and Fine Inching Control are given in paragraphs 2-15 and 2-16.

2-15. OPERATING IN NORMAL CONTROL. To operate earlier production handling gear in the Normal Control shift pattern, move the Control Lever down and lock in place. This will allow the selector lever to be shifted as follows:

a. For Neutral, shift the Selector Lever to the Neutral position. In Neutral the brake is applied. The winch brake oil pressure gauge will be in the lower green zone.

b. For Forward, hold the Selector Lever in the Forward position. In Forward the brake is completely released and the drum will haul-in line. The winch Brake Oil Pressure Gauge should be the upper green zone.

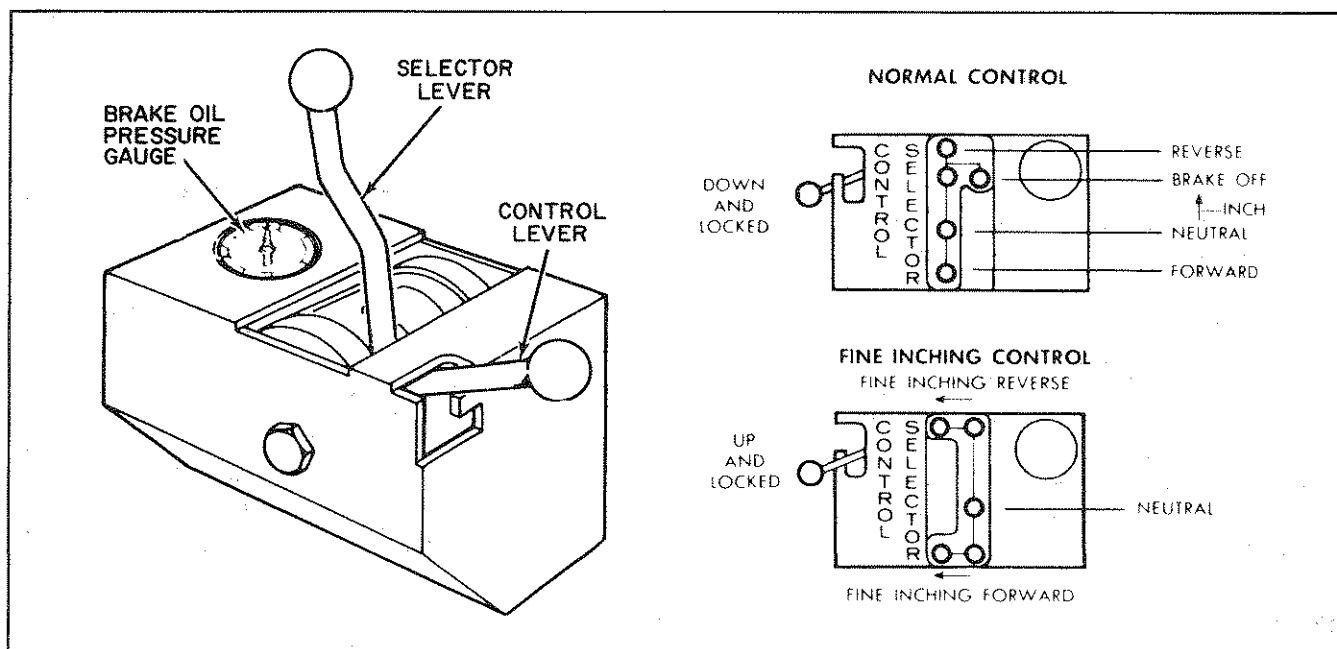


Figure 2-2. Operating Controls, Earlier Production Power Controlled Winch

c. For Gradual Brake Release (INCH), move the Selector Lever from the NEUTRAL Position towards the BRAKE-OFF position. The closer the Selector Lever is moved toward the BRAKE-OFF position, the more the brake will be released. This will allow the drum to gradually pay-out line. During Gradual Brake Release the winch Brake Oil Pressure Gauge will be in the red zone.

d. For BRAKE-OFF, shift the Selector Lever to BRAKE-OFF position. In BRAKE-OFF, the brake is completely released which allows the drum to free-wheel. The Brake Oil Pressure Gauge should be in the upper green zone.

NOTE: It will be necessary to shift the Selector Lever into the BRAKE-OFF notch of the handlever gate on some earlier production winches to maintain a Brake-Off condition. On current production winches (equipped with earlier production handling gear), the Selector Lever linkage is detented to the BRAKE-OFF position.

CAUTION: Do not operate the winch for extended periods in the Brake-Off position.

e. For Reverse, hold the Selector Lever in the REVERSE position. In Reverse, the brake is completely released and the drum will pay-out line under power. The winch Brake Oil Pressure Gauge will be in the upper green zone.

2-16. OPERATING IN FINE INCHING CONTROL. To separate in the Fine Inching Control shift pattern, move the Control Lever up and lock in place. This will allow the Selector Lever to be shifted as follows:

CAUTION: Keep the tractor stationary while operating in Fine Inching control.

a. For Neutral, shift the Selector Lever to the NEUTRAL position. In Neutral the brake is applied and neither clutch pack is locked up. The winch brake oil pressure gauge will be in the lower green zone.

b. For Forward (Brake Applied), hold the Selector Lever in the FORWARD position. In the FORWARD position the winch brake will remain applied and the forward clutch pack will be locked. This will stall the tractor torque converter. The winch Brake Oil Pressure Gauge will be in the red zone, close to the lower green zone.

CAUTION: Do not stall the tractor's converter for prolonged periods of time.

c. For Forward (Brake Slipping), slowly move the Selector Lever from the FORWARD position towards the Control Lever end of the handlever housing. This will gradually release the brake. As the brake is gradually released, the tractor's torque converter

and the forward clutch will assume control of the load to inch IN under power. The winch Brake Oil Pressure Gauge will be in the red zone while inching, however, when the Selector Lever is moved as far as possible toward the Control Lever, the Brake Oil Pressure Gauge will be in the upper green zone.

NOTE: Low engine speed is recommended for Fine Inching in Forward. The engine speed may need to be increased when inching IN a heavy load.

d. For Reverse (Brake Applied), hold the Selector Lever in the REVERSE position. In the REVERSE position the winch brake will remain applied and the reverse clutch pack will be locked up. This will stall the tractor torque converter. The winch Brake Oil Pressure Gauge will be in the red zone close to the lower green zone.

CAUTION: Do not stall the tractor's converter for prolonged periods of time.

e. For Reverse (Brake Slipping), slowly move the Selector Lever from the REVERSE position towards the Control Lever end of the handlever housing. This will gradually release the brake. As the brake is gradually released, the tractor's torque converter and the reverse clutch will assume control of the load to inch OUT under power. The winch Brake Oil Pressure Gauge will be in the red zone while inching, however, when the Selector Lever is moved as far as possible toward the Control Lever, the Brake Oil Pressure Gauge will be in the upper green zone.

NOTE: Low engine speed is recommended for Fine Inching in Reverse.

2-17. CURRENT PRODUCTION HANDLING GEAR.

(See Figure 2-3.) There are two different shift patterns that can be selected for winch operation. These are Normal Control and Fine Inching Control. The Normal Control shift pattern should be used for routine or normal operation encountered in logging and heavy construction. The Fine Inching Control should be used in: (1) Pipelining for positioning pipe and lowering backhoes, (2) Oil field work in rigging wells, towing and leveling derricks, and placing pipe, (3) Mining for towing control stations and matching pipe flanges, (4) General Construction for various handling, raising, lowering, towing, yo-yo operation and rescue work. Operating procedures for Normal Control and Fine Inching Control on current production handling gear are contained in paragraphs 2-18 and 2-19.

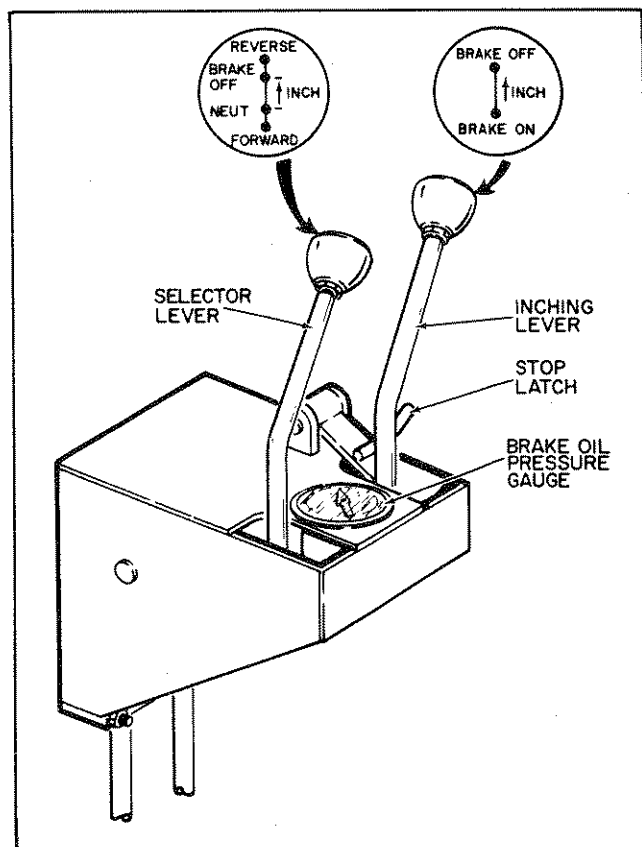


Figure 2-3. Operating Controls, Current Production Power Controlled Winch

2-18. OPERATING IN NORMAL CONTROL. To operate current production handling gear in Normal Control, lock the Inching Lever in the BRAKE-OFF position. This will allow the Selector Lever to be shifted as follows:

a. For Neutral, shift the Selector Lever to the NEUTRAL position. In Neutral the brake is applied. The winch brake oil pressure gauge will be in the lower green zone.

b. For Forward, hold the Selector Lever in the FORWARD position. In forward the brake is completely released and the drum will haul-in line. The winch Brake Oil Pressure Gauge should be in the upper green zone.

c. For gradual Brake Release (INCH), move the Selector Lever from the NEUTRAL position towards the BRAKE-OFF position. The closer the Selector Lever is moved toward the BRAKE-OFF position, the more the brake will be released. This will allow the drum to gradually pay-out line. During Gradual Brake Release the winch Brake Oil Pressure Gauge will be in the red zone.

d. For Brake-Off, shift the Selector Lever to BRAKE-OFF position. In Brake-Off, the brake is completely released which allows the drum to free-wheel. The Brake Oil Pressure Gauge should be in the upper green zone.

NOTE: The Selector Lever linkage is detented to the Brake-Off position.

CAUTION: Do not operate the winch for extended periods in the Brake-Off position.

2-19. OPERATING IN FINE INCHING CONTROL. To operate in Fine Inching Control, lift the stop latch away from the Inching Lever. This will allow the Inching Lever to spring return to the BRAKE-ON position. The winch will now operate as follows:

CAUTION: Keep the tractor stationary while operating in Fine Inching control.

a. For Neutral, shift the Selector Lever to the NEUTRAL position. In Neutral, the brake is applied and neither clutch pack is locked up. The winch Brake Oil Pressure Gauge will be in the lower green zone.

b. For Forward (Brake Applied), hold the Selector Lever in the FORWARD position. In the FORWARD position the winch brake will remain applied and the forward clutch pack will be locked up. This will stall the tractor torque converter. The winch Brake Oil Pressure Gauge will be in the red zone close to the lower green zone.

CAUTION: Do not stall the tractor's converter for prolonged periods of time.

c. For Forward (Brake Slipping), hold the Selector Lever in the FORWARD position and slowly move the Inching Lever towards the BRAKE-OFF position. This will gradually release the brake. As the brake is gradually released, the tractors torque converter and the forward clutch will assume control of the load to inch IN under power. The winch Brake Oil Pressure Gauge will be in the red zone while inching, however, when the Inching Lever is moved to the BRAKE-OFF position, the Brake Oil Pressure Gauge will be in the upper green zone.

NOTE: Low engine speed is recommended for Fine Inching in Forward. The engine speed may need to be increased when inching IN a heavy load.

d. For Reverse (Brake Applied), hold the Selector Lever in the REVERSE position. In the REVERSE position the winch brake will remain applied and the reverse clutch pack will be locked up. This will stall the tractor torque converter. The winch Brake Oil Pressure Gauge will be in the red zone close to the lower green zone.

CAUTION: Do not stall the tractor's converter for prolonged periods of time.

e. For Reverse (Brake Slipping), hold the Selector Lever in the REVERSE position and slowly move the Inching Lever towards the BRAKE-OFF position. This will gradually release the brake. As the brake is gradually released, the tractor's torque converter and the reverse clutch will assume control of the load to inch OUT under power. The winch Brake Oil Pressure Gauge will be in the red zone while inching, however, when the Inching Lever is moved to the BRAKE-OFF position, the Brake Oil Pressure Gauge will be in the upper green zone.

NOTE: Low engine speed is recommended for Fine Inching in Reverse.

TROUBLESHOOTING

3-1. GENERAL.

3-2. Tables 3-1 and 3-2 are trouble analysis check charts that include the most common troubles that may be encountered, the probable causes of the trouble, and the corrective action that should be

taken to restore the winch to normal operating condition. The information contained in table 3-1 applies to the Direct Drive winch. The information contained in table 3-2 applies to the Power Controlled winch.

Table 3-1. Trouble Analysis Check Chart For Direct Drive Winches (Sheet 1 of 2)

Trouble	Probable Cause	Corrective Action
Hard to shift into Forward or Reverse	Control cable damaged.	Check for pinched, rusted, or broken cable housing. Replace if found defective.
	Control cable improperly adjusted.	Check and adjust as necessary. Refer to paragraph 4-11.
	Linkage binding or rusted.	Clean, straighten, repair or replace parts as necessary.
	Shifting collar too tight on on splines or splines rough.	Remove shifting collar, dress splines with fine stone, and replace parts if necessary.
Will not stay in NEUTRAL position.	Detent ball and spring damaged or sticking.	Replace spring if broken. Check that ball is free in the bore. Lubricate ball, spring and bore.
	Annular groove on shifter shaft elongated.	Replace shifter shaft.
Jumps out of gear.	Dental teeth worn.	Check for wear on dental teeth of: <ul style="list-style-type: none"> a. Dental Clutch b. Dental Clutch hub c. Forward pinion gear d. Reverse pinion gear Replace above components if teeth are rounded.
	Shifter fork improperly positioned on the shifter shaft.	Check for loose anchor screw on: <ul style="list-style-type: none"> a. Forward shifter fork b. Reverse shifter fork Tighten securely and lock with lockwire.
	Dental clutches installed backwards.	Install the dental clutch so chamfered ramp will face pinion gear.
	Shifter forks installed backwards.	Install the shifter fork so anchored end faces toward the center of the winch.
Brake not holding or hard to apply.	Water in brake compartment resulting from condensation or marine use.	Drain water from brake compartment every day if necessary.
	Brake lining saturated with oil.	Replace lining, clean brake wheel and brake compartment, locate source of oil leakage and repair leak.

Table 3-1. Trouble Analysis Check Chart For Direct Drive Winches (Sheet 2 of 2)

Trouble	Probable Cause	Corrective Action
Brake not holding or hard to apply (Continued)	Improper clearance between brake band assembly and brake wheel.	Check that clearance is approximately 1/32-inch. Refer to paragraph 4-13.
	Brake cable improperly adjusted.	Adjust cable ends so Brake Handlever applies brake before it reaches end of travel. Refer to paragraph 4-14.
	Brake control cable assembly not anchored securely.	Check for loose connection of control cable housing to: a. Handling Gear mounting bracket. b. Winch control housing bracket. Tighten securely and lock with Jam Nut.
	Control cable damaged.	Check for pinched, rusted, or broken cable housing. Replace if found defective.
	Brake linkage set for overwind operation and winch is used for underwind operation.	Change linkage for underwind operation. Refer to paragraph 4-21.
	Brake linkage set for underwind operation and winch is used for overwind operation.	Change linkage for overwind operation. Refer to paragraph 4-17.

Table 3-2. Trouble Analysis Check Chart For Power Controlled Winches (Sheet 1 of 4)

Trouble	Probable Cause	Corrective Action
Erratic Operation	Low oil level.	Add oil as necessary to raise to proper level. Refer to table 4-1.
	Pump cavitating due to air-leaks in hydraulic system.	Check the following for air leaks: a. Suction manifold cover gasket. b. Suction manifold anchor screw stato-seals. c. Suction hose to manifold connection. d. Suction hose to pump connection. e. Suction hose for cracks or collapsed condition. f. Suction manifold pick-up tube welded connection to manifold. g. Pump shaft seal. NOTE: Damaged stato-seals are the most common cause of air leaks. ALWAYS replace with new stato-seals when suction manifold has been loosened. See figure 5-23. CAUTION: Use only Hyster approved seals and hoses.

Table 3-2. Trouble Analysis Check Chart For Power Controlled Winches (Sheet 2 of 4)

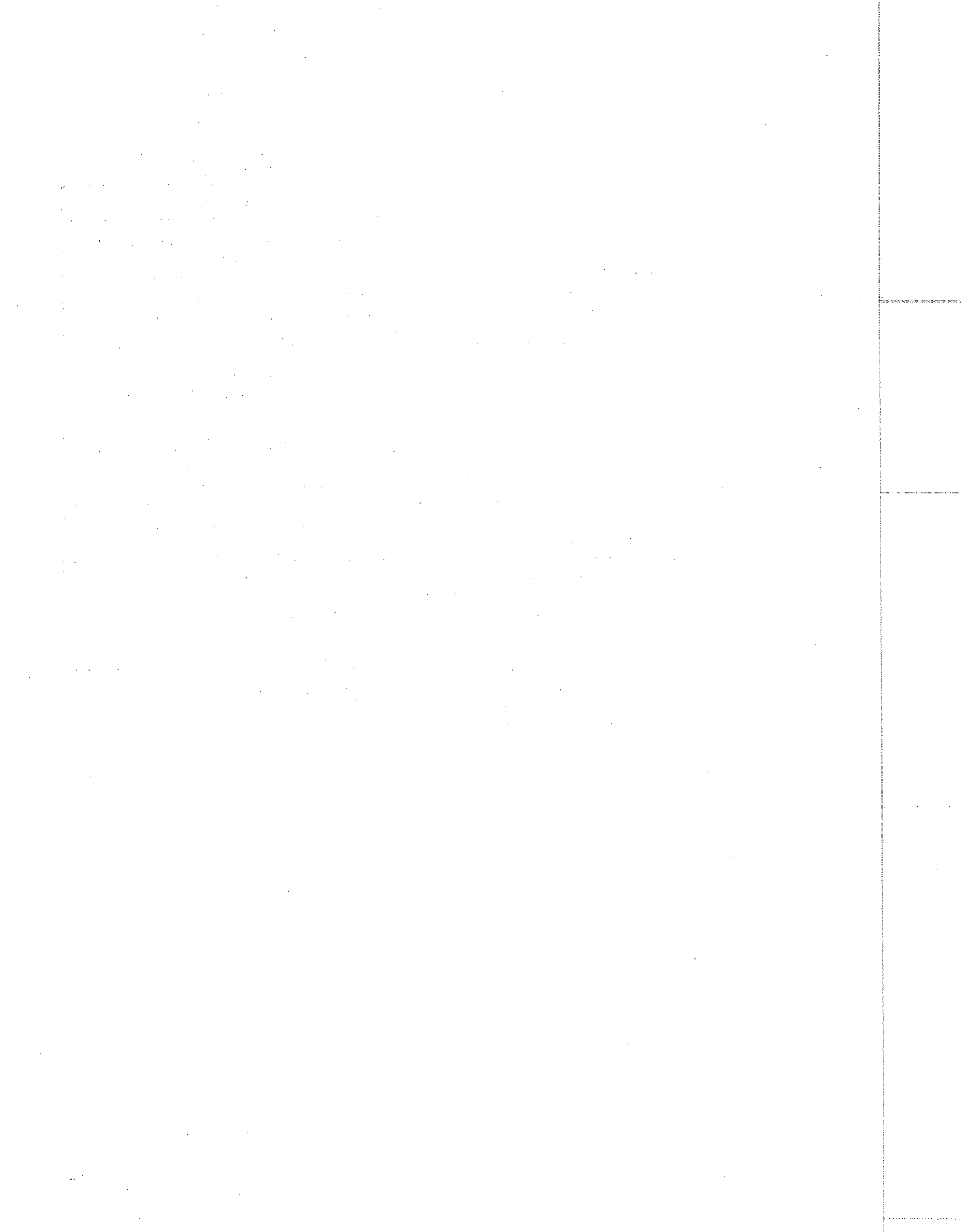
Trouble	Probable Cause	Corrective Action
Erratic Operation (Continued)	Push-pull cables out of adjustment.	Check for proper adjustment as outlined in paragraph 4-26. Adjust if necessary. Double check push-pull cable housing to be sure it is securely anchored on both ends.
	Tractor engine idling too low.	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.	Allow oil to warm before operating the winch.
	Low oil pressure.	Refer to LOW OIL PRESSURE troubleshooting procedures.
Low oil pressure	Refer to ERRATIC OPERATION troubleshooting procedures.	Refer to ERRATIC OPERATION troubleshooting procedures.
	Leaking pressure hoses and fittings.	Check for leaks and replace components where necessary.
	Defective or improperly adjusted relief valve.	Check relief valve setting with pressure gauge as outlined in paragraph 4-25. Replace Relief Valve Assembly if defective. NOTE: Do not rely on brake release pressure gauge when adjusting relief pressure. Always use a calibrated gauge.
	Dump Valve spool stuck open.	Replace dump valve assembly, then drain oil, flush and refill with oil. NOTE: Dump valve cannot tolerate contamination.
	Damaged brake piston retainer or O-rings.	Check piston retainer cavity for damage. Replace if scored or broken. Always replace both O-rings when brake is repaired.
	Brake Oil Pressure Gauge defective.	Check gauge reading against a calibrated gauge. Replace if gauge is faulty.
	Internal slippage (leakage) in the pump.	Check pump for pressure output only after all the above checks have been made. If pump is at fault, remove and overhaul or replace as outlined in paragraph 5-33.
Oil Brake not releasing.	Refer to LOW OIL PRESSURE troubleshooting procedure.	Refer to LOW OIL PRESSURE troubleshooting procedure.

Table 3-2. Trouble Analysis Check Chart For Power Controlled Winches (Sheet 3 of 4)

Trouble	Probable Cause	Corrective Action
Overheating	Operating in Brake-Off too long.	Position Selector Lever in NEUTRAL when free spool condition is not required. In BRAKE-OFF position the pump continually works against high pressure release.
	Improperly adjusted inching spool travel.	Check and adjust as necessary. Refer to paragraph 4-27.
	Excessive Inching	Allow oil to cool periodically. NOTE: Install heat exchanger if excessive inching is necessary.
	Defective clutch cooling oil valves.	Replace valve. See figure 5-8, step 6.
	Plugged suction filter.	Remove suction filter, clean, and replace. See figure 4-3.
	High cooling oil pressure.	Check cooling oil pressure. Replace cooling oil relief valve assembly if reading is over 10 PSI at the forward or reverse port. See figure 5-13, step 6.
	Insufficient Clutch Assembly clearance.	Adjust to correct clearance. See figure 5-16, step 10.
	Check causes listed above.	Check all points listed above.
Variation of pressure between ports.	Control valve spool travel improperly adjusted.	Check spools for correct travel. Refer to paragraph 4-27.
	Broken cast iron seal ring on the bevel gear shaft.	Replace: a. The left-hand seal ring if low pressure is indicated when the Selector Lever is shifted to the FORWARD position. b. The right-hand seal ring if low pressure is indicated when the Selector Lever is shifted to the REVERSE position. NOTE: A broken seal ring is the most common cause of a pressure differential between the two clutches. Check preload on bevel gear shaft and adjust if necessary to prevent additional breakage of seal rings. See figure 5-20.
	Damaged bevel gear 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.

Table 3-2. Trouble Analysis Check Chart For Power Controlled Winches (Sheet 4 of 4)

Trouble	Probable Cause	Corrective Action
Variations of pressure between ports (Continued)	Damaged bevel gear shaft bearing retainers.	Check retainers for grooves, scoring, and rust. Replace retainers if found defective.
	Defective spline seals on the bevel gear shaft.	Always replace these seals when the bevel gear shaft has been removed. See figure 5-20, steps 6 and 7.
	Damaged clutch piston retainer or O-rings.	Check piston retainer cavity for damage. Replace if scored or broken. Always replace both O-rings when clutch is repaired. See figure 5-16, step 1.
Oil Brake slipping	Worn friction disc.	Replace the friction discs and the separator plates if scored. See figure 5-21.
	Notches worn in brake assembly cage or hub.	Replace the cage and/or hub. See figure 5-21.
	Broken belleville spring.	Replace with a new spring. See figure 5-21.
Instant shifting from Brake-Off to Reverse.	D-20 Selector spool	Replace with D-23 Selector spool.
High Oil Level	Engine oil transferring past pump shaft seal into winch hydraulic system.	Replace pump shaft seal. Refer to paragraph 5-33.





SERVICE INSTRUCTIONS

4-1. GENERAL.

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

4-3. SAFEGUARD MAINTENANCE.

4-4. SafeGuard Maintenance is a planned maintenance program which includes periodic inspection and

lubrication. SafeGuard Maintenance should be correlated closely with the operating hours recorded on the tractor SERVICE METER.

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

4-6. The following table is outlined in two systems; 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. Safeguard Maintenance And Service Inspection Schedule (Sheet 1 of 3)

Refer To Fig. No.	Item	Schedule (Hour/Period)				Quan.	Type	Procedure
		8/dy	50/wk	500/3 mo	1000/6 mo			
4-1	Oil Level (Direct Drive)		✓		C H A N G E	18 Gals.	SAE 90, MIL-L-2105B NOTE: In freezing temperatures it may be necessary to use a lighter oil to make shifting easier.	Check winch oil at level plug (A) on right side of winch. Add oil as required at plug (B). Drain oil at plugs (C) and (D) as required.
4-1	Oil Level (Power Controlled)		✓		C H A N G E	20 Gals.	SAE 10, MIL-L-2104B NOTE: Series 3 oil may be substituted for 2104B. In temperatures -10°F and lower, dilute oil with kerosene so it will be fluid enough to insure free circulation. This should be done before stopping, then operate the winch for a few minutes to mix kerosene and oil. Evaporation in the winch reservoir under steady operation may make it necessary to again add kerosene to maintain proper fluidity.	NOTE: When checking winch oil level on winches mounted on powershift tractors, stop engine to obtain correct reading. For winches mounted on direct drive tractors, disengage tractor master clutch to obtain correct reading. CAUTION: If winch is new, drain after 50 hours of operation, then flush and refill.

Table 4-1. Safeguard Maintenance And Service Inspection Schedule (Sheet 2 of 3)

Refer To Fig. No.	Item	Schedule (Hour/Period)				Quan.	Type	Procedure
		8/dy	50/wk	500/3 mo	1000/6 mo			
4-1	Brake and Transmission Compartments (Direct Drive Only)		✓			Variable	Water and/or oil	Remove drain plug ① and allow any accumulation of water or oil to drain out. Replace drain plug ①. Loosen plug ② and drain any accumulation of water in transmission compartment. Tighten plug ② when oil appears.
2-1 2-2 2-3	Handling Gear	✓				Few Drops	SAE 30	Lubricate fulcrum pin connections and other moving parts at end of each eight hour shift.
4-2	Pressure Filter (Power Controlled Only)			C H A N G E		One	Refer to Parts Manual	Replace with Hyster approved filter. Coat O-ring and backup ring with film of multi-purpose grease to insure a leak proof seal between filter head and case.
4-3	Suction Filter (Power Controlled Only)			S E R V I C E		One	Refer to Parts Manual	Remove suction filter, clean thoroughly, and re-install. CAUTION: Suction manifold cover gasket must be in good condition to prevent air leaks. Replace with Hyster approved gasket.
5-2 5-12	Suction Hose Clamps (Power Controlled Only)		✓					Check both ends of suction hose to see that hose clamps are tight. Retighten hose clamps as necessary.
5-2	Control Cables		✓					Check both ends of each cable housing to see that they are securely anchored. Retighten set screw as necessary.

Table 4-1. Safeguard Maintenance And Service Inspection Schedule (Sheet 3 of 3)

Refer To Fig. No.	Item	Schedule (Hour/Period)				Quan.	Type	Procedure
		8/ dy	50/ wk	500/ 3 mo	1000/ 6 mo			
1-9 4-1	Automatic Brake (Optional, Direct Drive Only)				S E R V I C E		High Temperature Grease Atlantic Richfield: Thermogrease Mobil Oil: Mobiltemp Grease #1 Shell Oil: Darina Grease 1 Standard Oil: Chevron Industrial Grease Texaco: Thermax EP #1 Union Oil: Strona HT-1 Sun Oil: Sunaplex 991 EP BP Australia: Energrease HTB2	Remove automatic brake assembly. Disassemble and clean automatic brake assembly components. Pack the two bearings with a high temperature grease. Put a heavy film of high temperature grease on ratchet ring, pawl assembly, and hub. DO NOT completely fill automatic brake assembly with grease or attempt to grease brake through the vent plug. CAUTION: Always install oil seals so that lips of both seals are pointing inward.
4-1	Cable Guide Rolls (Optional)	✓					Multi-purpose Grease	Lubricate two grease fittings.
4-1	Fairlead (Optional)	✓					Multi-purpose Grease	Lubricate six grease fittings.
4-1	Swiveling Drawbar (Optional)	✓					Multi-purpose Grease	Lubricate one grease fitting.

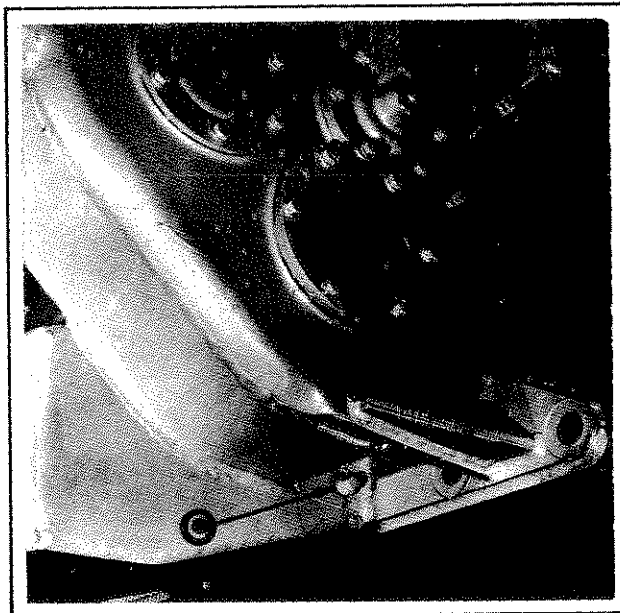
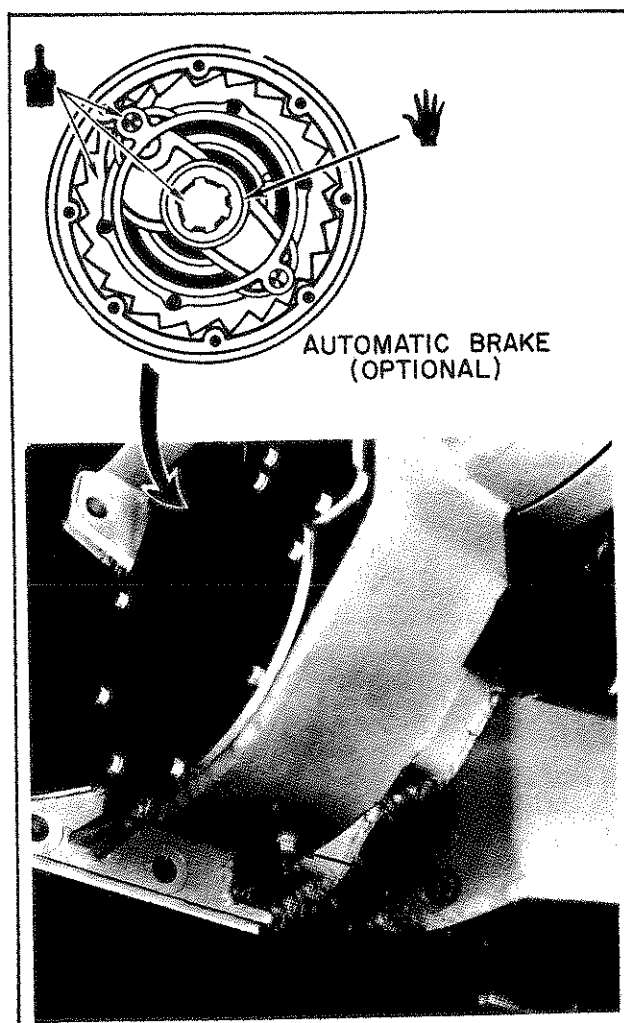
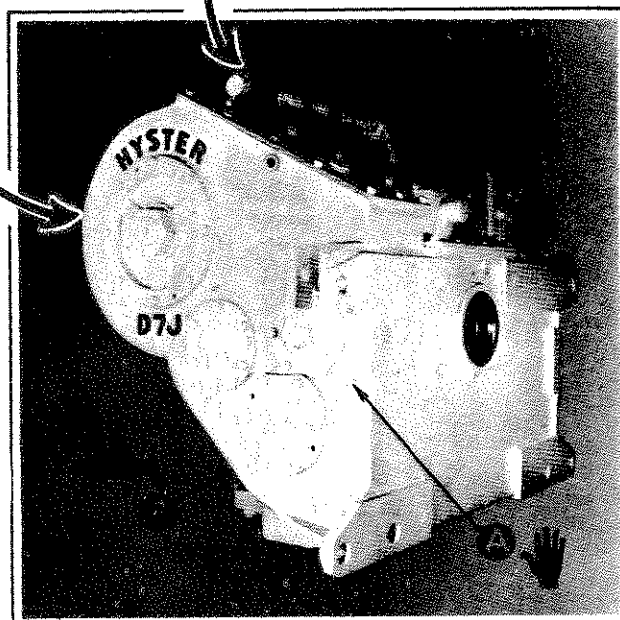
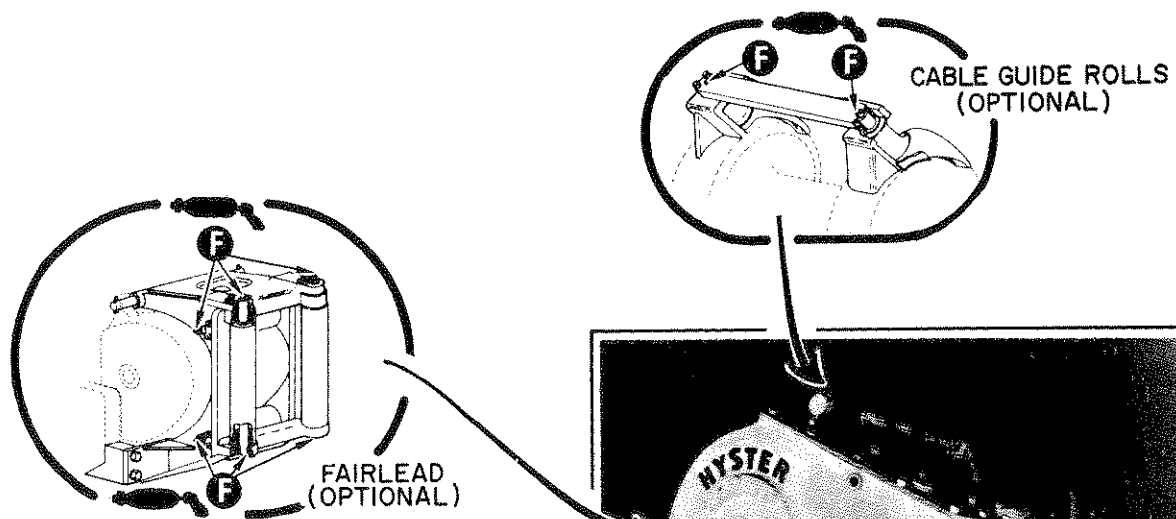


Figure 4-1. SafeGuard Maintenance Diagram.

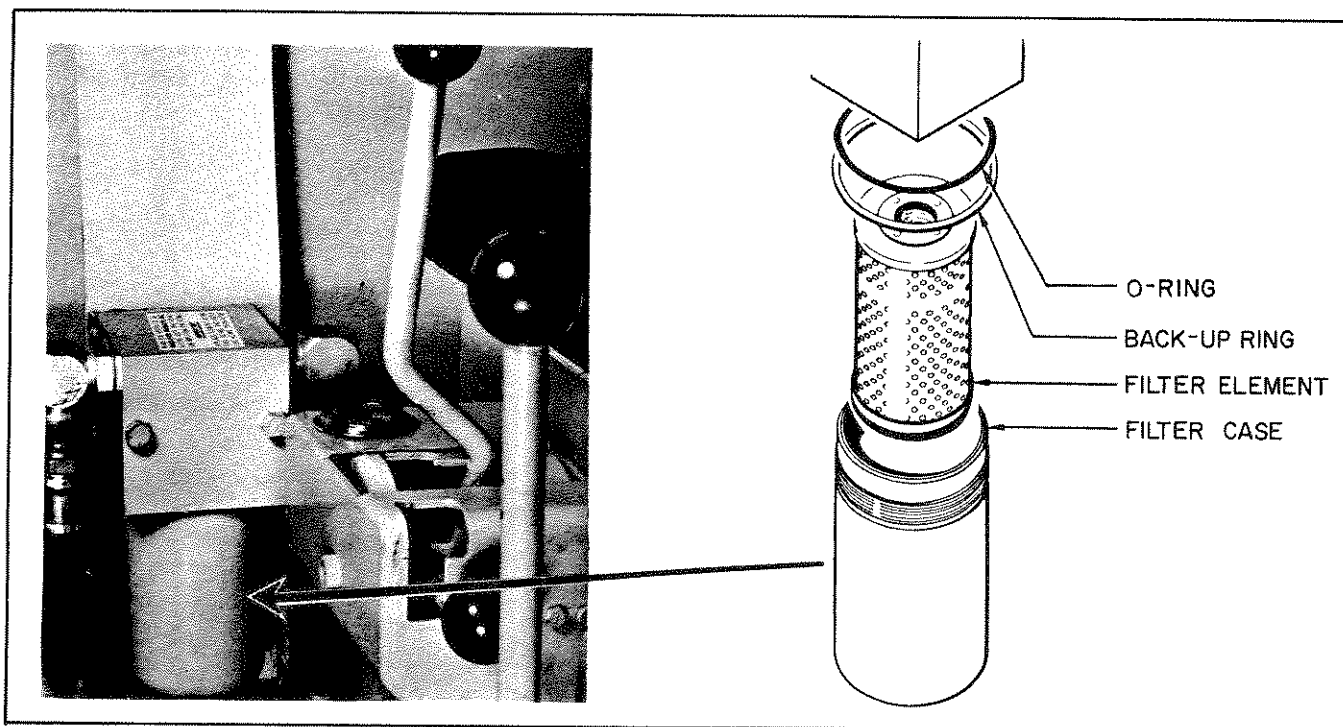


Figure 4-2. Pressure Filter, Power Controlled Winch.

4-7. ADJUSTMENT PROCEDURES.

4-8. The adjustments on the Direct Drive winch are mostly minor mechanical linkage adjustments. The Power Controlled winch requires mechanical linkage plus hydraulic system adjustments.

4-9. DIRECT DRIVE WINCH ADJUSTMENTS.

4-10. The handling gear assembly that controls the operation of the Direct Drive winch is mounted to the floor plate at the front, left side of the operator's seat. The linkage connecting the handlevers to the clutches and brake will periodically require minor adjustments.

4-11. **ADJUSTING CLUTCH HANDLEVER.** The clutch handlever controls the dental clutches through a plastic-lined control cable. The shifter assembly will shift the dental clutches into Forward, Neutral, and Reverse positions when the control cable to the clutch handlever is properly adjusted. To adjust the positioning of the clutch handlever proceed as follows:

a. Place the shifter assembly in neutral. (See figure 4-4.) The shifter linkage will positively detent to this position.

b. Adjust the control cable rod ends as necessary to place the clutch handlever in the center of its travel when shifter assembly is in neutral.

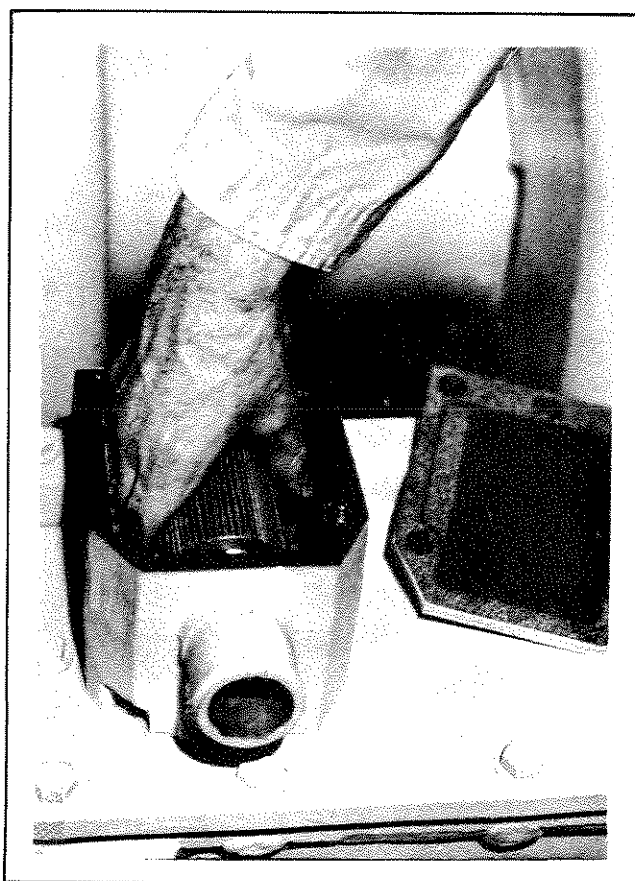


Figure 4-3. Suction Filter, Power Controlled Winch.

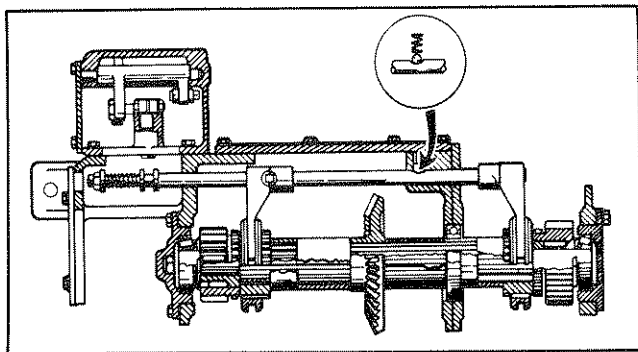


Figure 4-4. Direct Drive Shifter Assembly.

c. Make sure that Forward, Neutral, and Reverse can be selected by moving the clutch handlever to corresponding position.

4-12. **ADJUSTING THE BRAKE.** The brake handlever controls the brake through a plastic-lined control cable (identical to clutch control cable). Two adjustments are required to properly adjust the brake. Refer to paragraphs 4-13 and 4-14.

4-13. **BRAKE BAND ADJUSTMENT.** (See Figure 4-5.) To adjust the brake band proceed as follows:

a. Remove the small brake cover from the left-hand side of the winch.

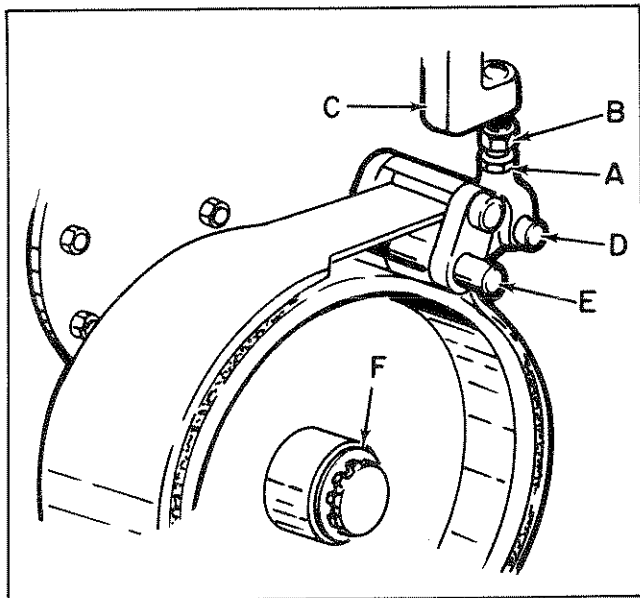


Figure 4-5. Direct Drive Brake Band And Adjusting Linkage.

b. Push the brake handlever to its full release position.

c. Loosen jam nut (A).

d. Turn adjusting link (B) until there is approximately 1/32-inch clearance between the brake band and brake wheel or until there is just enough clearance to prevent "brake drag".

e. Tighten jam nut (A).

f. Replace the brake cover.

4-14. **BRAKE HANDLEVER ADJUSTMENT.**

(See Figure 4-6.)

To adjust the positioning of the brake handlever proceed as follows:

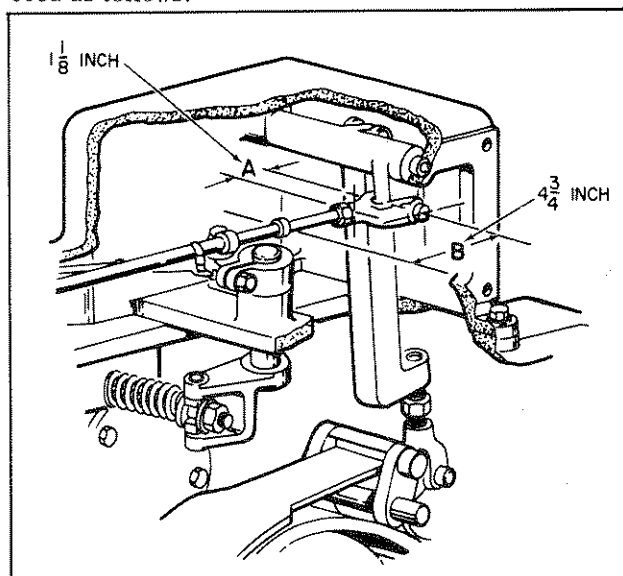


Figure 4-6. Direct Drive Brake Crankarm and Control Cable.

a. Adjust the brake band. (Refer to paragraph 4-13.)

b. Loosen cable rod end jam nut.

c. Adjust the control cable at the winch control housing end until dimension (A) is obtained (distance between the cable end and the center line of the rod end pin).

d. Tighten the jam nut.

e. Push the brake handlever to the full release position.

f. Adjust the push-pull cable at the brake handlever end (see figure 1-2) until dimension "B" is obtained.

4-15. **OVERWIND ADJUSTMENT PROCEDURE.** When the cable passes over the top of the drum during forward rotation, the drum is said to be overwinding.

Unless otherwise specified, the winch is set to overwind at the factory. The bevel gear shaft assembly, brake assembly, and drum assembly must be re-arranged when using an original underwind winch for overwind operation (refer to paragraphs 4-16 through 4-18.)

4-16. BEVEL GEAR SHAFT ARRANGEMENT. (See Figure 4-7.)

To arrange the bevel gear shaft for overwind operation proceed as follows:

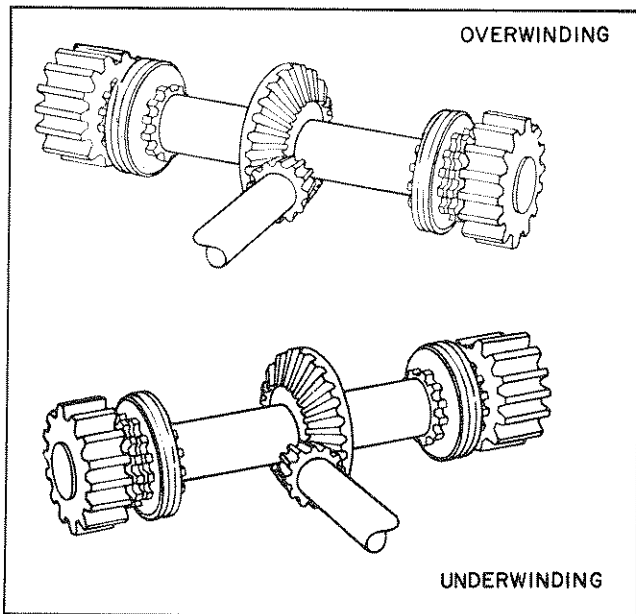


Figure 4-7. Bevel Gearshaft Arrangement.

a. Pull the bevel gear shaft from the right-hand side of the winch (see figure 5-7) far enough to enable switching places of the bevel gear and the spacer.

b. Arrange the spacer and bevel gear so the bevel gear meshes on the right-hand side of the PTO shaft assembly.

c. Install bevel gear shaft. (See figure 5-20.)

NOTE: This change in operation may affect gear lash, but should not affect the shaft endplay. However, both should be checked and adjusted if necessary.

4-17. BRAKE ASSEMBLY. If the winch is equipped with a standard brake band, follow procedure a. Follow procedure b if the winch is equipped with an optional automatic brake.

a. Brake band arrangement. (See figure 4-8.) Change the anchoring end of the brake band by changing the positions of pins A and B.

NOTE: Pin A connects the moveable end of the band to the crank; this pin is 4-5/8 inches long and has a cotter pin hole in the center. Pin B is 6-3/8 inches long, and has a tapped hole in the end. It anchors the band and provides a pivot for the crank.

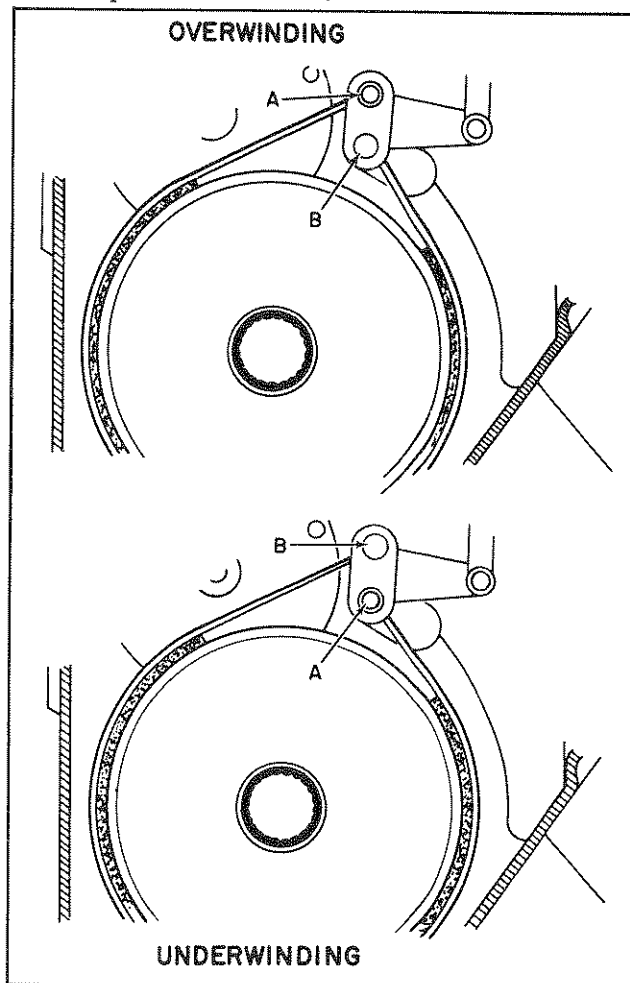


Figure 4-8. Brake Band Arrangement.

b. Automatic brake (optional) arrangement (See figure 4-9.) Remove the automatic brake assembly and re-install it with the word OVERWINDING to the outside.

4-18. DRUM ASSEMBLY. (See Figure 4-10.) The cable on the drum must be anchored and wound in the opposite direction for overwind operation. For lo-speed drum follow procedure a. For slo-or standard speed drum follow procedure b.

a. Lo-speed drum. Unwind the cable. Unscrew capscrew (4). Remove ferrule lock (3) and ferrule (2). Break or cut the tack welds securing the filler (1). Smooth the ragged edges of filler and groove by

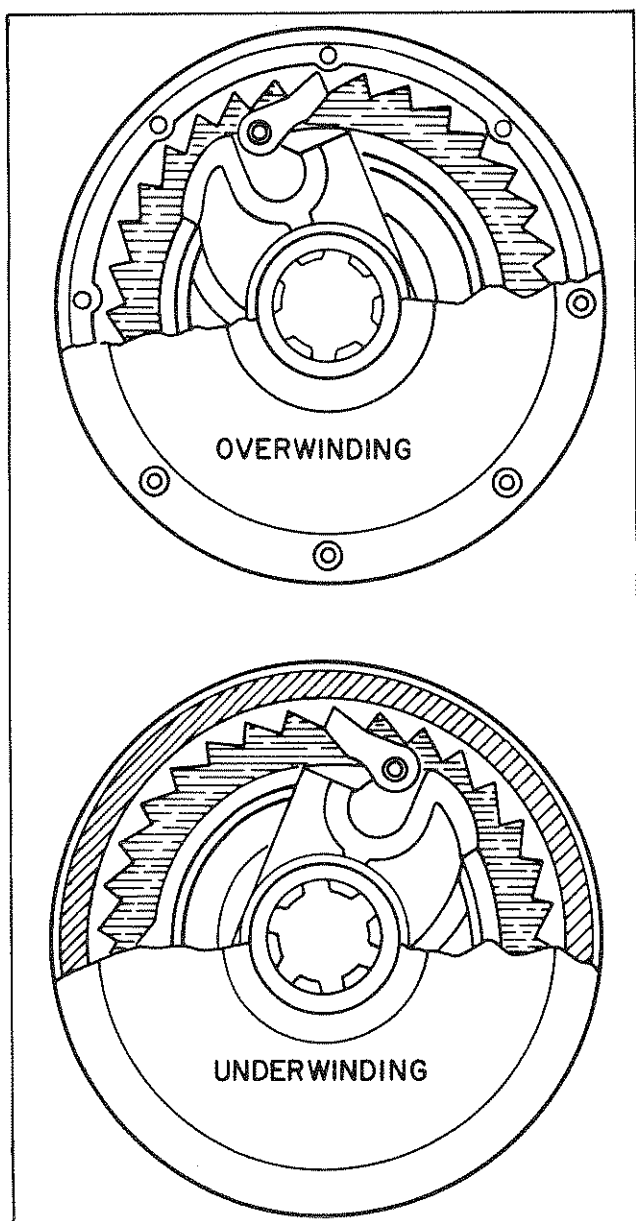


Figure 4-9. Automatic Brake (Optional) Arrangement.

grinding. Tack weld the filler in the overwind position. Lock ferrule (2) in overwind position with ferrule lock (3) and capscrew (4).

b. Slo- and standard-speed drum. Unwind the cable. Unscrew capscrew (3). Remove ferrule lock (5) and ferrule (4). Change the position of the filler (2), from underwind to overwind. Place ferrule (4) in overwind position and secure with ferrule lock (6) and capscrew (3).

NOTE: The ferrule lock for a D7 standard-speed over-winding winch is different than that of an under-winding winch; for this reason number (5) was used in Step b.

4-19. UNDERWIND ADJUSTMENT PROCEDURE.

When the cable is pulled under the drum during forward rotation, the drum is said to be UNDERWINDING. Unless otherwise specified, the winch is set to overwind at the factory. The bevel gear shaft assembly, brake assembly, and drum assembly must be rearranged when using an original overwind winch for underwind operation. (Refer to paragraphs 4-20 through 4-22.)

4-20. BEVEL GEAR SHAFT ARRANGEMENT.

(See Figure 4-7.)

To arrange the bevel gear shaft for underwind operation proceed as follows:

- a. Pull the bevel gear shaft from the right-hand side of the winch (See figure 5-7) far enough to enable switching of the bevel gear and the spacer.
- b. Arrange the spacer and bevel gear so the bevel gear meshes on the left-hand side of the PTO shaft assembly.
- c. Install bevel gear shaft. (See figure 5-20.)

NOTE: This change in operation may affect gear lash, but it should not affect the shaft endplay. However, both should be checked and adjusted if necessary.

4-21. BRAKE ASSEMBLY. If the winch is equipped with a standard brake band follow procedure a. Follow procedure b if the winch is equipped with an optional automatic brake.

a. Brake band arrangement. (See figure 4-8.) Change the anchoring end of the brake band by changing the positions of pins A and B.

NOTE: Pin A connects the moveable end of the band to the crank; this pin is 4-5/8 inches long and has a cotter pin hole in the center. Pin B is 6-3/8 inches long and has a tapped hole in the end. It anchors the band and provides a pivot for the crank.

b. Automatic Brake (optional) arrangement (See figure 4-9) Remove the automatic brake assembly and replace it with the word UNDERWINDING to the outside.

4-22. DRUM ASSEMBLY. (See Figure 4-10.) The cable on the drum must be anchored and wound in the opposite direction for UNDERWIND operation. For lo-speed drum follow procedure a. For slo- and standard speed drum follow procedure b.

a. Lo-speed drum. Unwind the cable. Unscrew capscrew (4). Remove ferrule lock (3) and ferrule

(2). Break or cut the tack welds securing the filler (1). Smooth the ragged edges of filler and groove by grinding. Tack weld the filler in the underwind position. Lock ferrule (2) in underwind position with ferrule lock (3) and capscrew (4).

b. Slo- and standard-speed drum. Unwind the cable. Unscrew capscrew (3). Remove ferrule lock (5) and ferrule (4). Change the position of the filler (2), from overwind to underwind. Place ferrule (4) in underwind position and secure it with ferrule lock (6) and capscrew (3).

NOTE: The ferrule lock for a D7 standard-speed over-winding winch is different than that of an under-winding winch; for this reason item (5) was used in Step b.

4-23. POWER-CONTROLLED WINCH ADJUSTMENTS.

4-24. The handling gear assembly that controls the Power Controlled winch has been manufactured in two different designs: earlier production and current production (refer to paragraphs 1-13 and 1-14). Perform the adjustment procedure outlined in paragraphs 4-25 through 4-28 for both the earlier production and the current production handling gear.

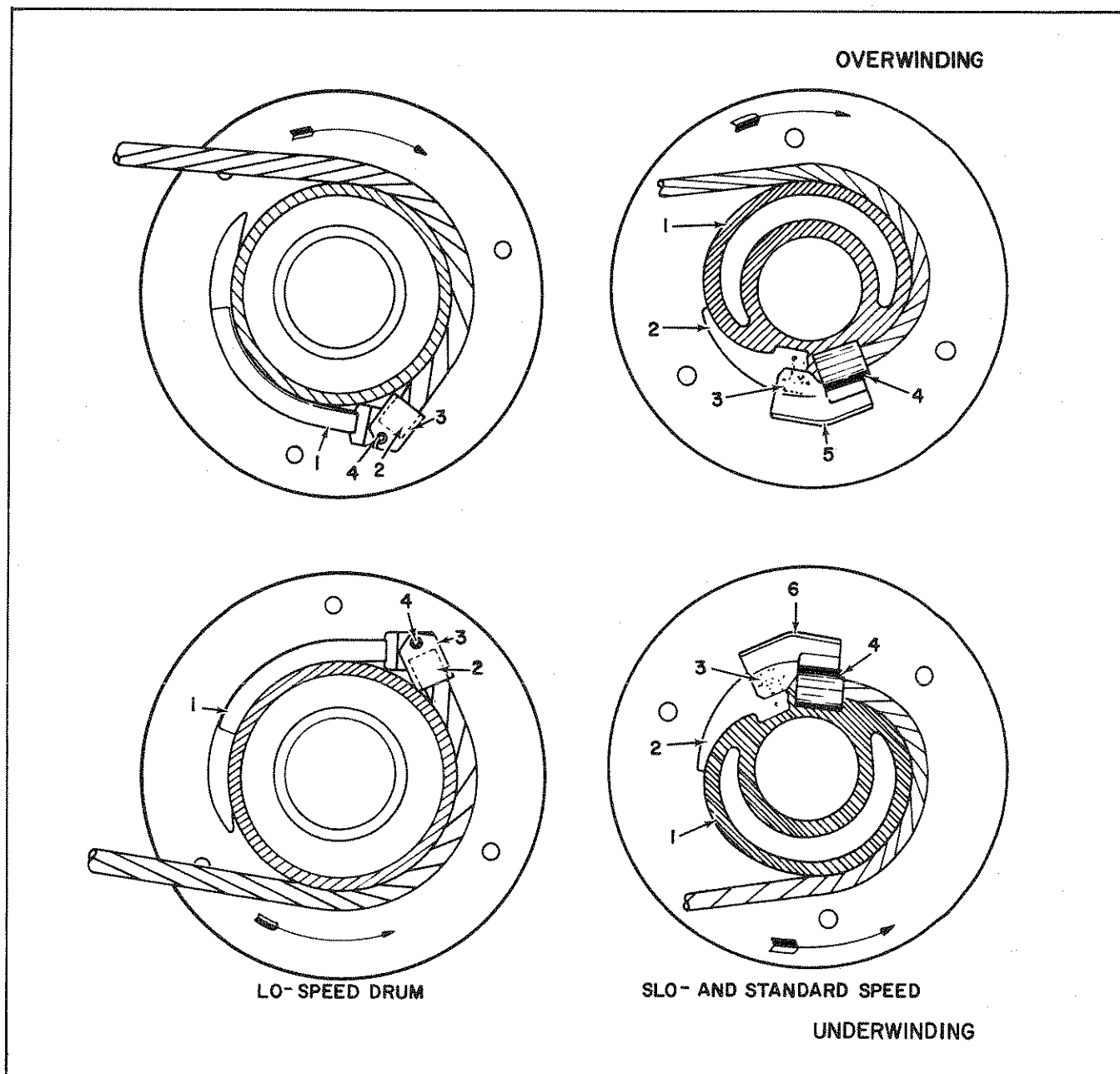


Figure 4-10. Winch Drum Arrangement.

4-25. HYDRAULIC SYSTEM PRESSURE CHECKS.

(See Figure 4-11.) To check hydraulic system pressures proceed as follows:

NOTE: Winch oil should be at least 70°F before making pressure checks.

a. Remove the cable from the drum to prevent entanglement during pressure checks.

WARNING: Tractor engine must be OFF before disconnecting pressure line.

b. Disconnect the small pressure line from the front of the control valve housing. Connect a 400 PSI gauge to the bulkhead fitting (Port A). This will eliminate the possibility of inaccurate readings from a faulty winch pressure gauge.

c. Start the engine and set speed at 1000 RPM.

d. Place the hydraulic system in NORMAL CONTROL. On the earlier production handling gear this is accomplished by moving the control lever to the down position. On the current production handling gear this is accomplished by locking the inching lever in the BRAKE-OFF position.

e. Check the pressure readings when the SELECTOR lever is moved to the FORWARD, BRAKE-OFF, and REVERSE positions. These pressures should be 225 (±10) PSI.

(a) If these three pressure readings ARE WITHIN 7 PSI of each other, but not 225 (±10) PSI then:

1. Remove the cover from control valve housing.

2. Change the relief pressure by turning the relief pressure adjusting screw IN to increase pressure or OUT to decrease pressure.

(b) If these three pressures ARE NOT WITHIN 7 PSI of each other, then perform steps f, g, and h.

f. Remove the plugs from the forward (B) and reverse (C) ports. Install a 400 PSI gauge in each port.

g. Check the CONTROL CABLE ADJUSTMENT and make necessary adjustments to correct pressures. (Refer to paragraph 4-26.)

h. The COOLING OIL pressure (non-adjustable) should be checked with a low pressure gauge.

CAUTION: Do not engage the reverse clutch with low pressure gauge in reverse port.

(a) Engage the FORWARD clutch and note the pressure indicated at the REVERSE pressure port. Pressure should be 3 - 10 PSI.

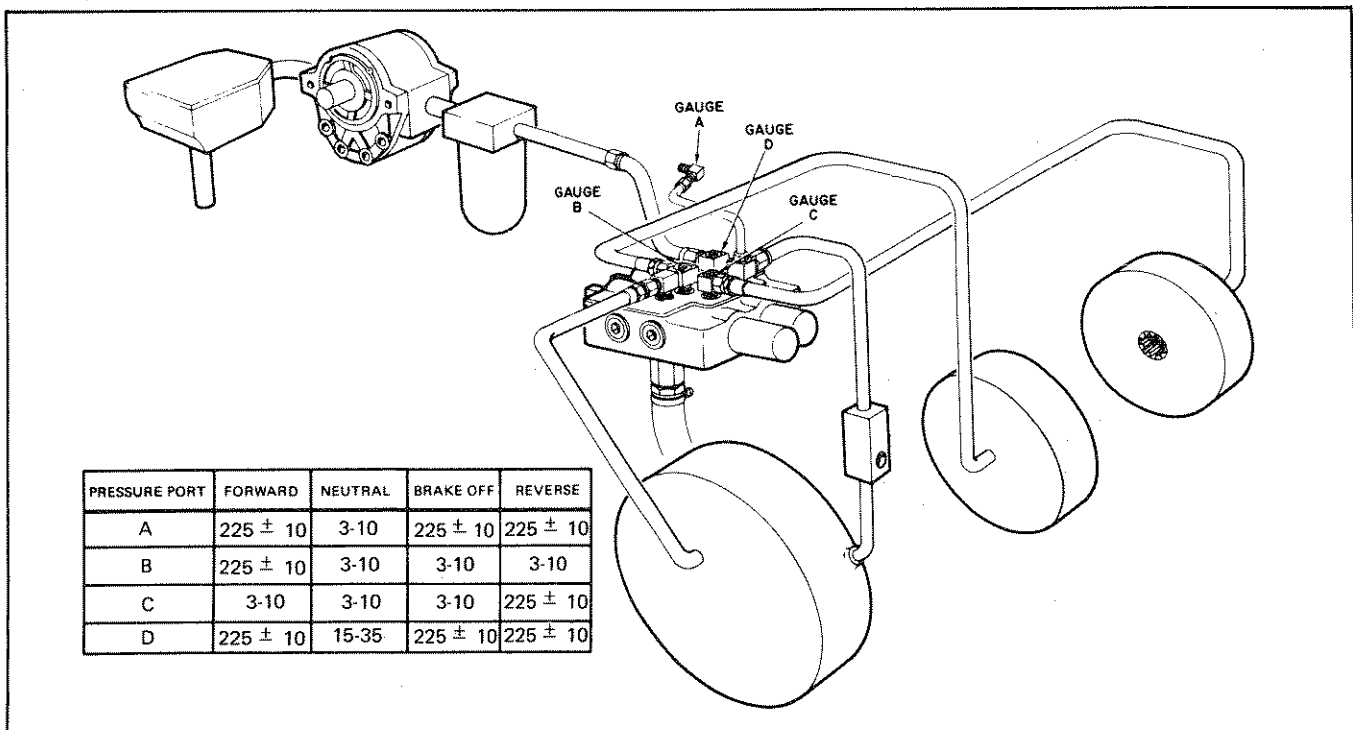


Figure 4-11. Hydraulic System Pressure Check Diagram.

(b) Engage the REVERSE clutch with low pressure gage in FORWARD pressure port and note the pressure indicated. Pressure should be 3 - 10 PSI.

NOTE: The high pressure (225 ± 10 PSI) is clutch lock-up pressure and the low (3 - 10 PSI) is cooling oil pressure.

4-26. ADJUSTING THE CONTROL CABLES. (See Figure 4-12.)

Two teflon-lined control cables connect the handling gear assembly to the winch control valve. Be certain that each control cable housing is securely anchored on each end before making any adjustments. The control cable adjustment determines spool travel in the control valve. The distance each spool travels is extremely important. In all cases the spools are stopped internally at their extremes and should be adjusted to these locations. The correct spool travel should be obtained first, then the measured spool travel should be double checked by making pressure checks when the winch is operating.

4-27. MEASURING SPOOL TRAVEL. Adjust the cable ends of the control cables so the following spool movement is obtained:

NOTE: The position that the spools assume before the cables are connected is the Spool Neutral Position. In this position the spool ends should protrude about 1-1/4 inch from the retainer plate.

a. The inching spool (P-9), should move OUT 11/16-inch from its neutral position when the Control

Lever (earlier production) is moved down and locked or when the Inching Lever (current production) is moved from the BRAKE-ON position to the BRAKE-OFF position.

NOTE: The spool stamped D-20 was used in earlier production control valves. The spool stamped D-23 is used in current production control valves. These spool assemblies are interchangeable; however, they DO NOT have the same spool travel.

b. The selector spool should move IN 3/16-inch (D-23) or 3/8-inch (D-20) from neutral position when the SELECTOR lever is moved to FORWARD.

c. The selector spool should move OUT 19/32-inch (D23) or 7/16-inch (D-20) from neutral position when the SELECTOR lever is moved to BRAKE-OFF. (Spools marked D-23 are detented to this position.)

d. The selector spool should move OUT 3/4-inch (D-23) or 9/16-inch (D-20) from neutral position when the SELECTOR lever is moved to REVERSE.

4-28. SPOOL TRAVEL PRESSURE CHECKS. The spool travel must be correct to obtain normal operating pressures. The handlever ends of the control cables should be adjusted to obtain maximum pressure readings (except in neutral) when the selector lever is moved to the following positions:

NOTE: The Control Lever (earlier production) must be down and locked or the Inching Lever (current production) must be in the Brake-Off position.

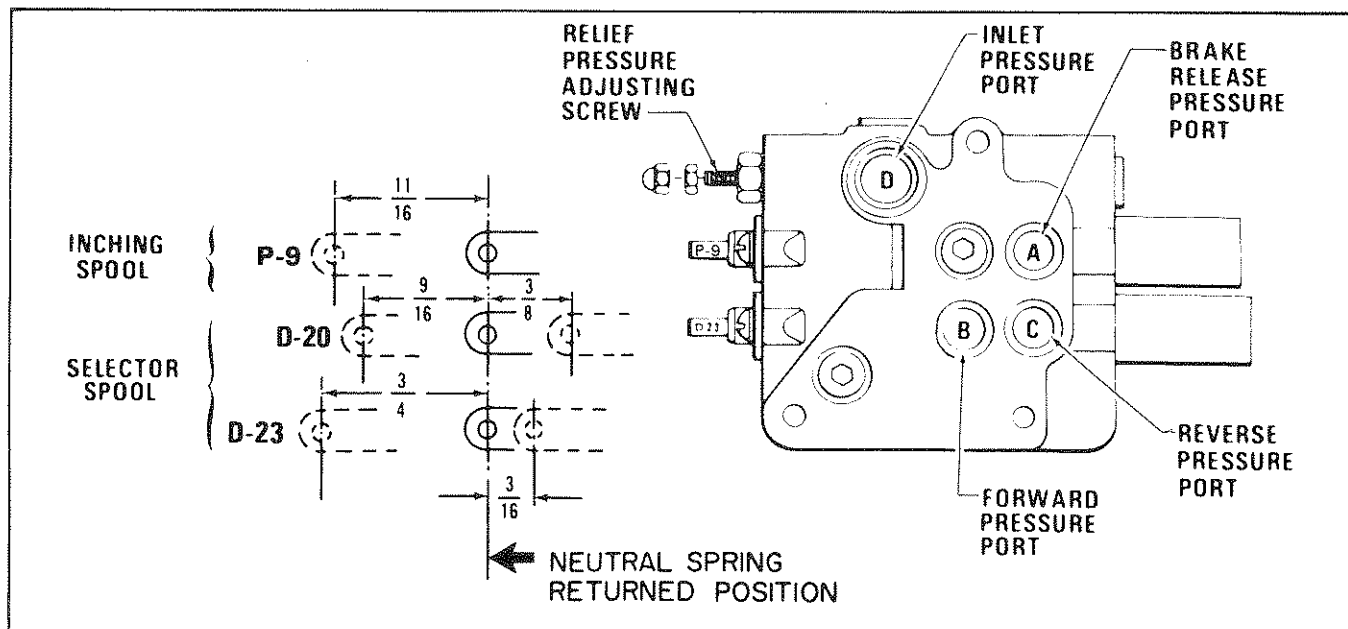


Figure 4-12. Control Cable Adjustment Diagram.

a. In FORWARD, the pressure should be 225 (± 10) PSI at forward, inlet, and brake release ports.

b. In NEUTRAL, the pressure should be 15 - 35 PSI at the inlet pressure port.

c. In BRAKE-OFF, the pressure should be 225 (± 10) PSI at the brake and inlet pressure ports.

d. In REVERSE, the pressure should be 225 (± 10) PSI at the reverse, inlet, and brake release ports.

4-29. OVERWIND AND UNDERWIND ADJUSTMENT PROCEDURE. Follow the same procedure as listed for the Direct Drive winches except a brake assembly re-arrangement is NOT necessary. (Refer to paragraphs 4-15 and 4-19.)

4-30. PAINTING AND DECAL INSTALLATION. (See Figure 4-13.)

4-31. Paint the entire winch Hyster yellow except paint the D7J model designation and the HYSTER letters black. The Power Controlled winch has two decals, OIL BRAKE and CAUTION. There are no decals on the Direct Drive winch. Position the decals on the Power Controlled winch as follows:

a. Locate the OIL BRAKE decal (part number 166816) on the center of the control housing cover.

b. Locate the CAUTION decal (part number 145781) on the left center of the top, right-hand cover plate.

NOTE: Prior to painting, cover serial name plate with a light film of grease or masking tape.

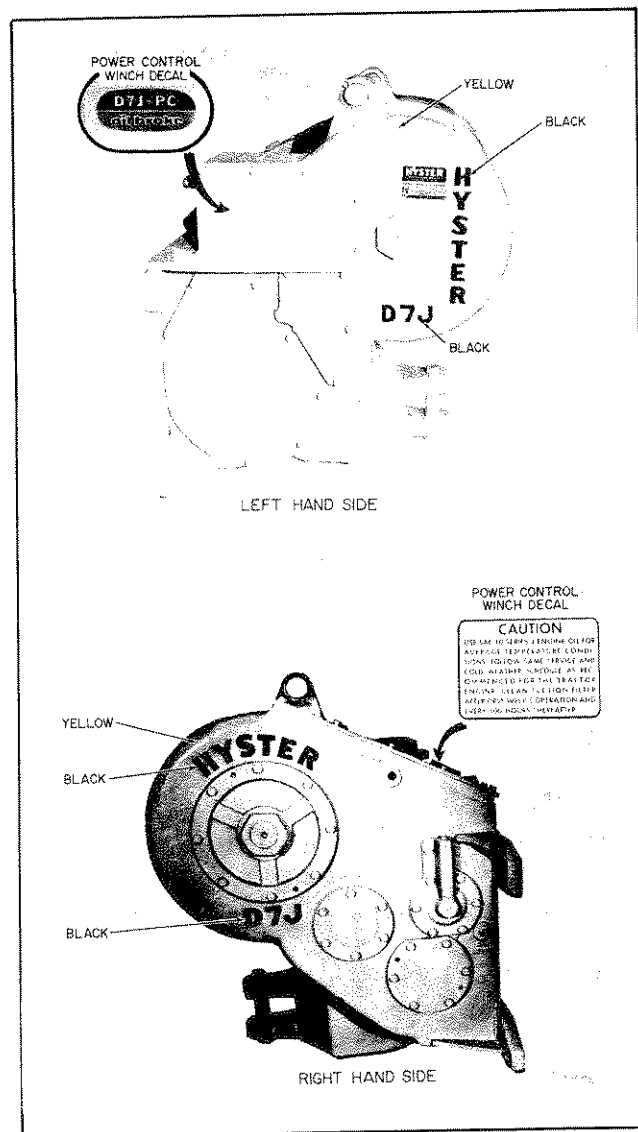



Figure 4-13. Painting And Decal Installation.



OVERHAUL INSTRUCTIONS

5-1. GENERAL.

This section contains overhaul instructions for the D7J Direct Drive and Power Controlled Winches. Overhaul instructions include removal of the winch from the tractor, removal and disassembly of all major shaft assemblies, inspection of components, reassembly and installation. Micrometer symbols  have been added to the disassembly illustrations to show critical wear points. It is recommended that these measurements be taken at the time of disassembly so that defective parts may be ordered and replaced prior to reassembly. If a 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 III 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 IV).

5-2. REMOVAL AND DISASSEMBLY INSTRUCTIONS.

5-3. REMOVAL OF WINCH FROM TRACTOR.

5-4. All major assemblies (except the brake shaft and PTO shaft) can be removed with the winch mounted on the tractor. Most major components of the brake shaft can be removed with the winch mounted, however, the brake shaft will not clear the tractor tracks for complete removal of the shaft. The winch must therefore be removed from the tractor before removing the brake shaft.

5-5. REMOVAL OF DIRECT DRIVE WINCH. Removal of the Direct Drive Winch is shown in figure 5-1. Make sure that the two control cables between the handling gear and winch are removed before separating the winch from the mounting pad.

WARNING: Make sure the lifting device has a minimum capacity of 3,000 pounds before lifting the winch off of the mounting pad.

5-6. REMOVAL OF POWER CONTROLLED WINCH.

Removal of the Power Controlled Winch is shown in figure 5-2. Make sure that the two control cables and three hydraulic hoses between the tractor and winch are removed before separating the winch from the mounting pad.

WARNING: Make sure that the lifting device has a minimum capacity of 3,000 pounds before lifting the winch off of the mounting pad.

5-7. REMOVAL AND DISASSEMBLY OF PTO SHAFT ASSEMBLY (DIRECT DRIVE AND POWER CONTROLLED WINCHES).

5-8. Removal and disassembly of the PTO shaft is shown in figure 5-3. Before removing the PTO shaft assembly, the winch must be removed from the tractor as shown in figure 5-1 or 5-2.

5-9. REMOVAL AND DISASSEMBLY OF OIL BRAKE ASSEMBLY (POWER CONTROLLED WINCH).

5-10. Removal and disassembly of the oil brake assembly used in the Power Controlled Winch is shown in figure 5-4. Removal and disassembly of the oil brake can be accomplished while the winch is mounted on the tractor. During disassembly, place all parts in a clean container to protect from dust, dirt and moisture.

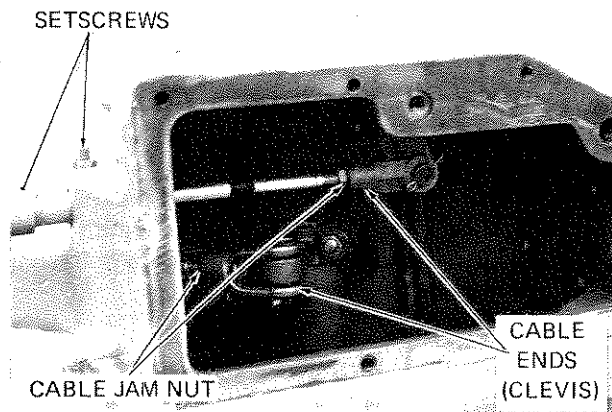
5-11. REMOVAL OF DRY BRAKE AND AUTOMATIC BRAKE (DIRECT DRIVE WINCHES).

5-12. Removal of the dry brake (or optional automatic brake) used in the direct drive winch is shown in figure 5-5. Removal of the dry brake can be accomplished when the winch is mounted on the tractor. During disassembly, check parts for damage and wear.

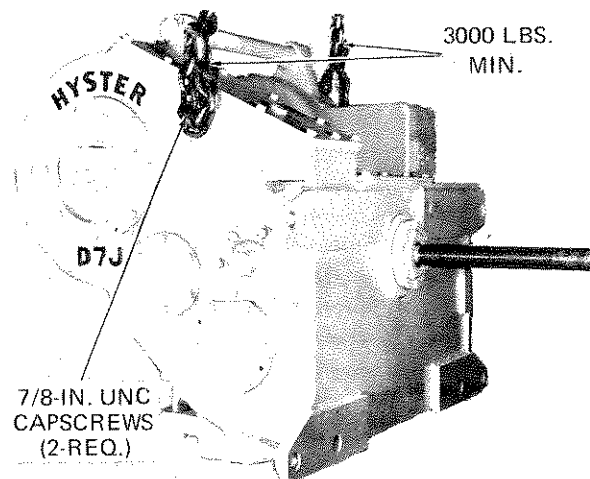
5-13. REMOVAL AND DISASSEMBLY OF BEVEL GEAR SHAFT ASSEMBLY.

5-14. Removal and disassembly of the bevel gear shaft assembly is shown in figure 5-7. Removal of the bevel gear shaft and associated components can be accomplished with the winch mounted on the tractor. Prior to removal of the bevel gear shaft, perform the following:

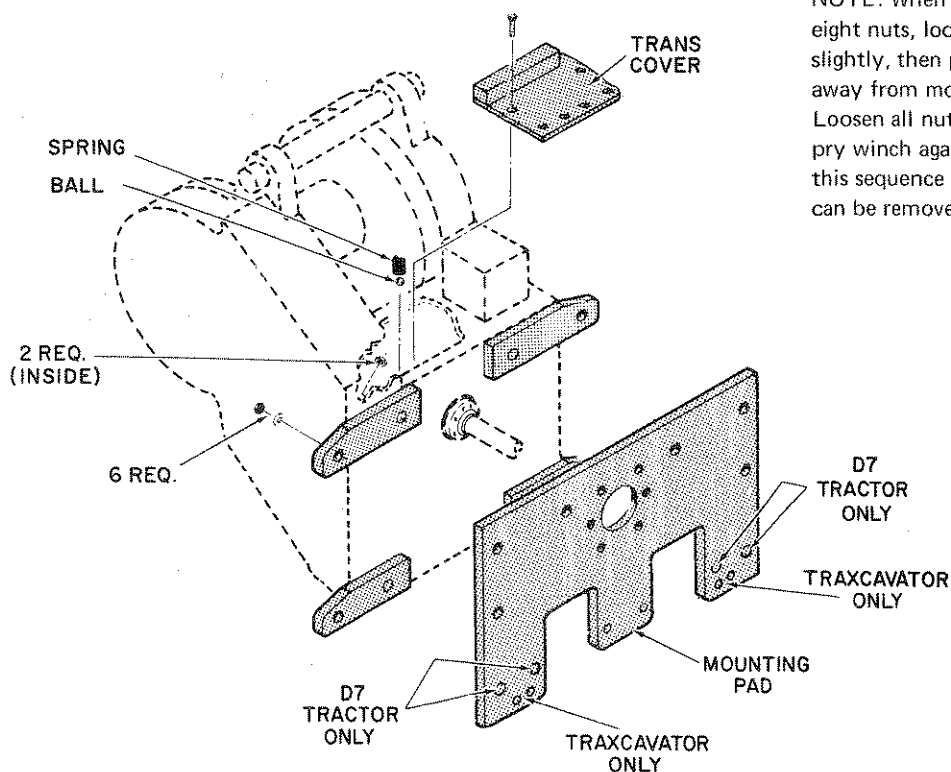
- a. Drain oil from winch (see figure 4-1).
- b. Remove all brake components as shown in figures 5-4 or 5-5 depending upon the winch model.
- c. Remove the hydraulic hose from the bearing retainer at each end of the bevel gear shaft.
- d. On Direct Drive Winches, remove the brake connecting linkage.



STEP 1. Loosen the two setscrews on the cable anchor block. Remove the control housing cover, then disconnect the cable end (clevis) at end of each cable.



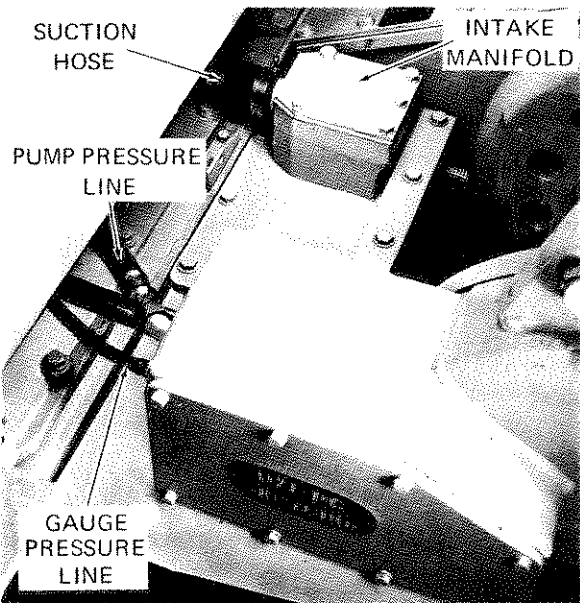
STEP 2. Connect lifting device to winch. Winch will be balanced when connected as shown.



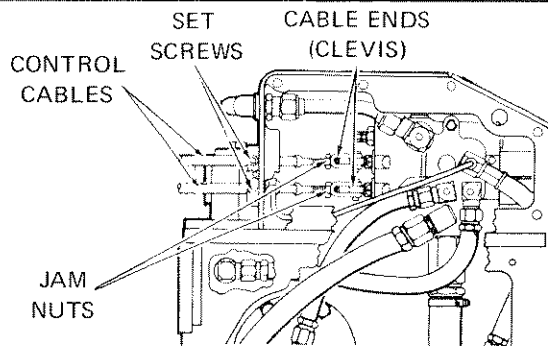
NOTE: When removing the eight nuts, loosen all nuts slightly, then pry winch away from mounting pad. Loosen all nuts again and pry winch again. Continue this sequence until winch can be removed.

STEP 3. Remove transmission cover. Be careful not to lose detent ball and spring. Remove the eight nuts and lockwashers attaching winch to mounting pad.

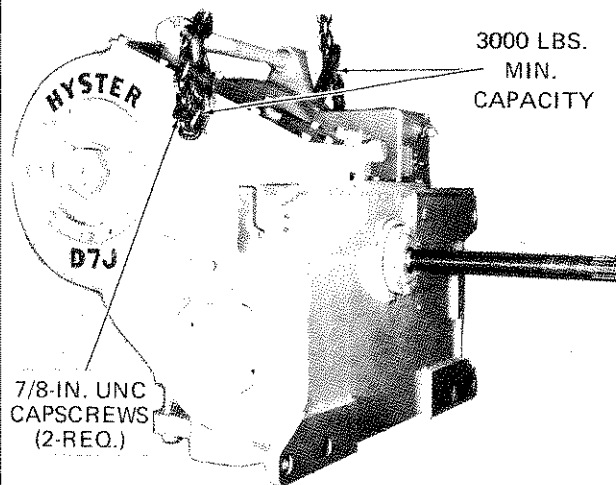
Figure 5-1. Removal of Direct Drive Winch from Tractor



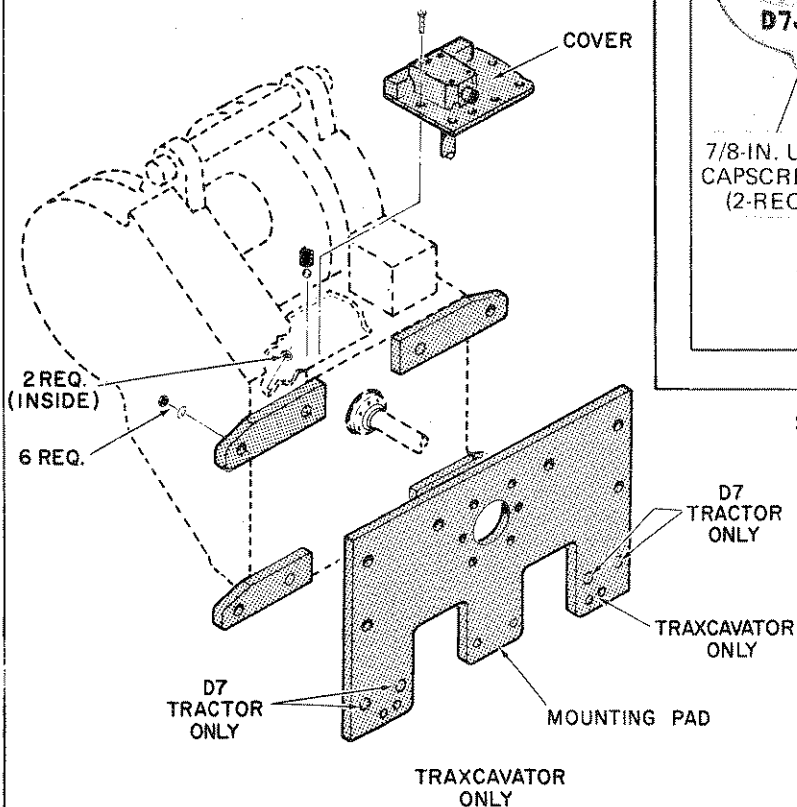
STEP 1. Remove suction hose from intake manifold. Disconnect pump pressure line. Disconnect gauge pressure line.



STEP 2. Loosen the two setscrews on cable anchor block. Remove control housing cover, then disconnect the cable end (clevis) at end of each cable. Pull out cables.



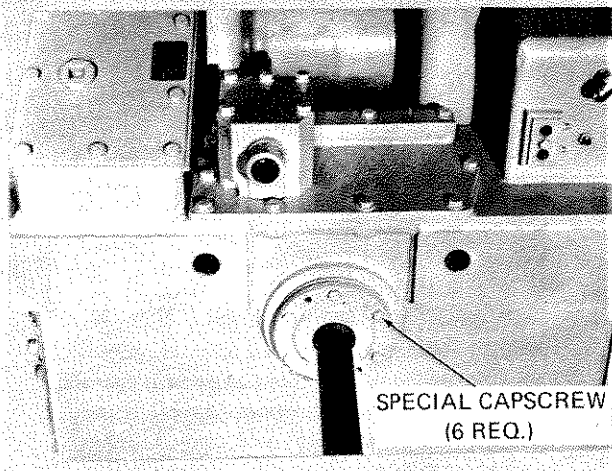
STEP 3. Connect lifting device to winch. Winch will be balanced when connected as shown.



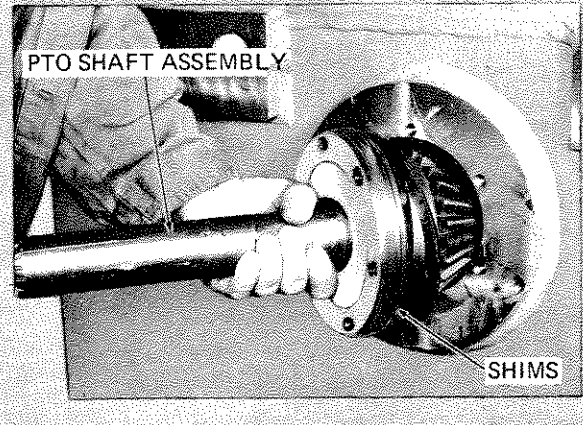
STEP 4. Remove suction manifold and cover. Remove the eight nuts and lockwashers attaching winch to mounting pad.

NOTE: When removing the eight nuts, loosen all nuts slightly, then pry winch away from mounting pad. Loosen all nuts again and pry winch again. Continue this sequence until winch can be removed

Figure 5-2. Removal of Power Controlled Winch from Tractor

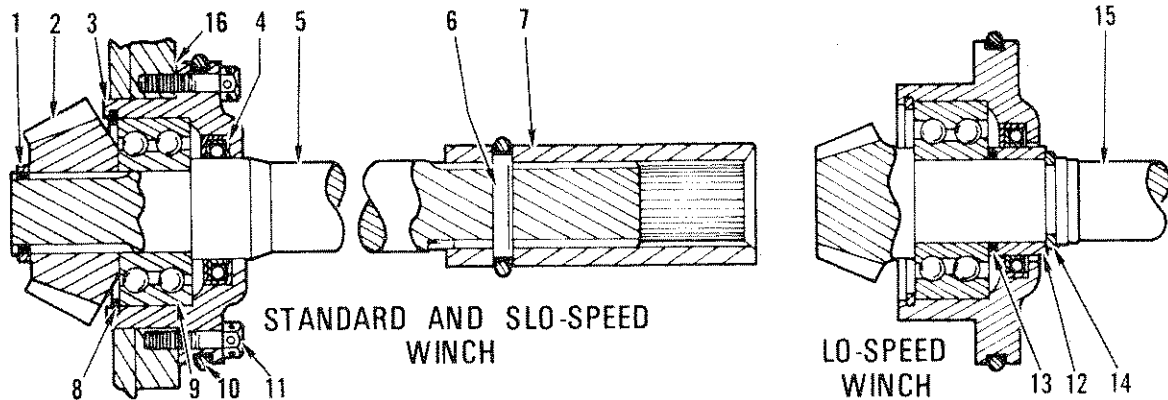


STEP 1. Remove the wire locking the six special cap screws, then remove the cap screws



STEP 2. Pull PTO shaft assembly straight out.

CAUTION: Tag the shim pack so that exact number of shims are re-installed.



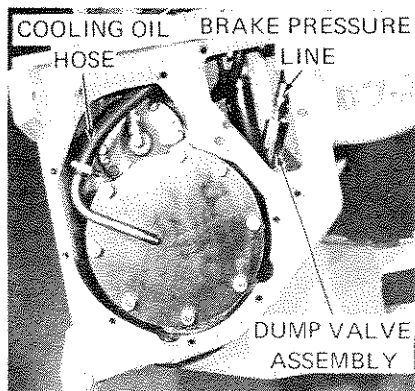
STEP 3. Disassemble PTO shaft as required

- | | |
|----------------------------------|----------------------------|
| 1. Snap ring | 9. Ball bearing |
| 2. Bevel pinion gear | 10. O-ring |
| 3. Bearing carrier | 11. Drilled head cap screw |
| 4. Oil seal | 12. Spacer |
| 5. PTO shaft (Std and Slo-speed) | 13. O-ring |
| 6. Pin and lock ring | 14. Snap ring |
| 7. Coupling | 15. PTO shaft (Lo-speed) |
| 8. Snap ring | 16. Shim pack |

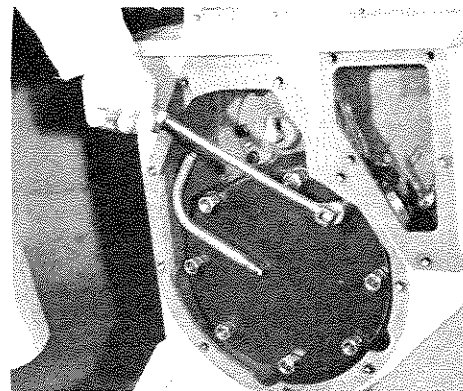
NOTE: On Lo-speed winches the PTO shaft and pinion are integral. On Standard and Slo-speed winches, pinion gear is splined on the shaft and locked in place by a snap ring.

Figure 5-3. Removal and Disassembly of PTO shaft assembly; Direct Drive and Power Controlled Winch

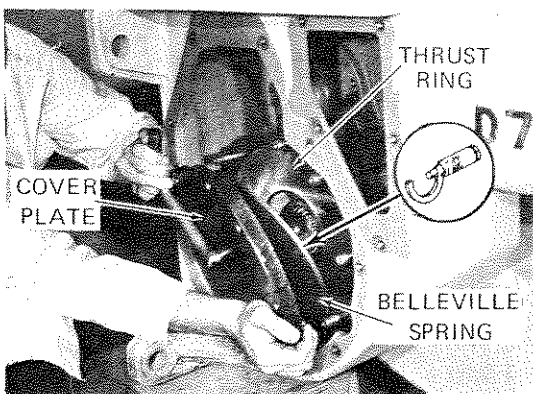
NOTE: Drain oil from winch (See Figure 4-1) or position winch with lefthand side up. Remove brake assembly covers.



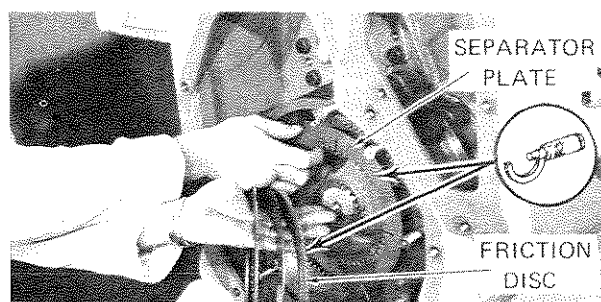
STEP 1. Remove cooling oil hose, brake pressure line, and dump valve assembly.



STEP 2. Remove eight locknuts and lockwashers from oil brake assembly.

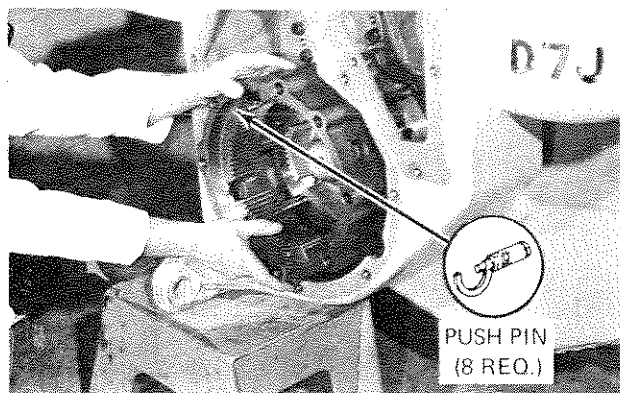


STEP 3. Remove cover plate, bellville spring and thrust ring from cage assembly.

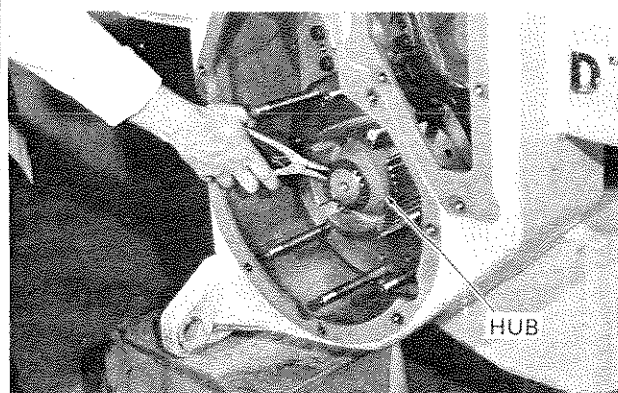


STEP 4. Remove 11 friction discs and 10 separator plates from the hub.

CAUTION: Keep friction discs and separator plates in order. They must contact the same mating surface when re-installed.

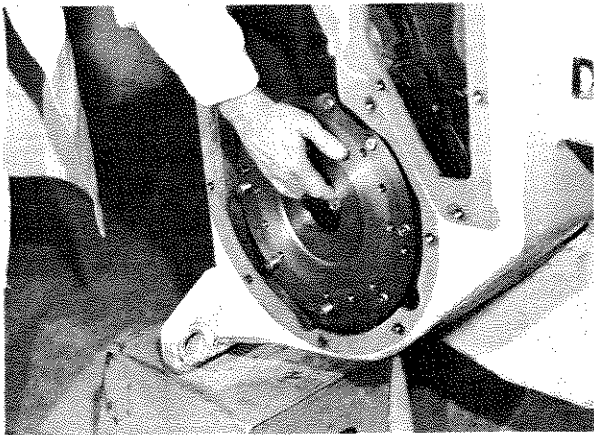


STEP 5. Remove cage from studs. It may be necessary to tap cage with a soft hammer to loosen.

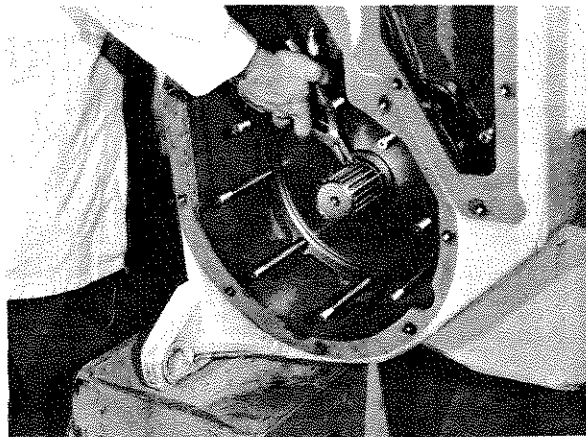


STEP 6. Remove snap ring from brake shaft, pull hub off brake shaft.

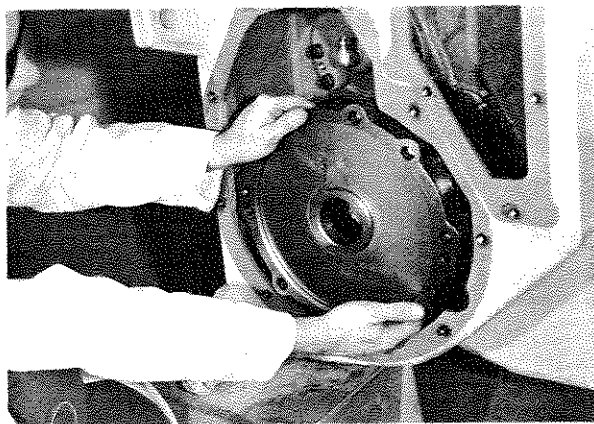
Figure 5-4. Removal And Disassembly Of Oil Brake Assembly, Power Controlled Winch (Sheet 1 of 2)



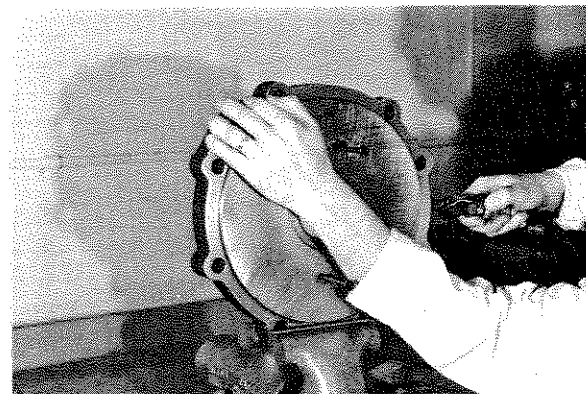
STEP 7. Remove pressure plate from studs.



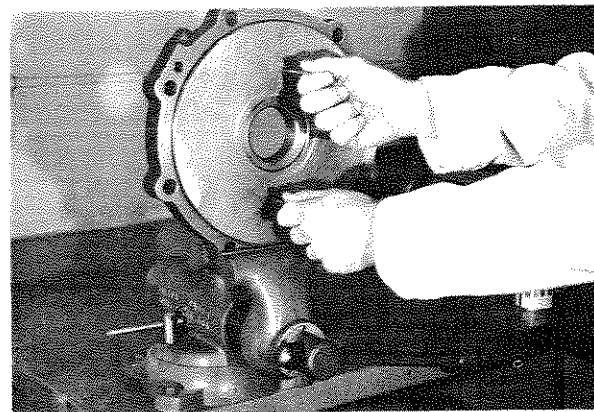
STEP 8. Remove snap ring from brake shaft.



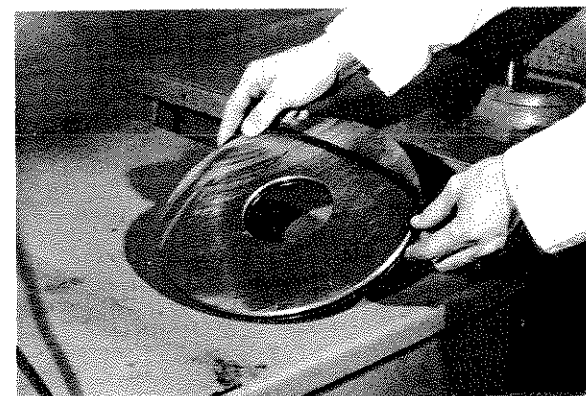
STEP 9. Remove piston housing with piston in place.



STEP 10. Place piston housing in vise. Start piston from housing by applying compressed air to piston housing pressure port.



STEP 11. Pull piston out of housing using two 1/4-inch capscrews.



STEP 12. Remove two O-rings from the piston.

Figure 5-4. Removal And Disassembly Of Oil Brake Assembly, Power Controlled Winch (Sheet 2 of 2)

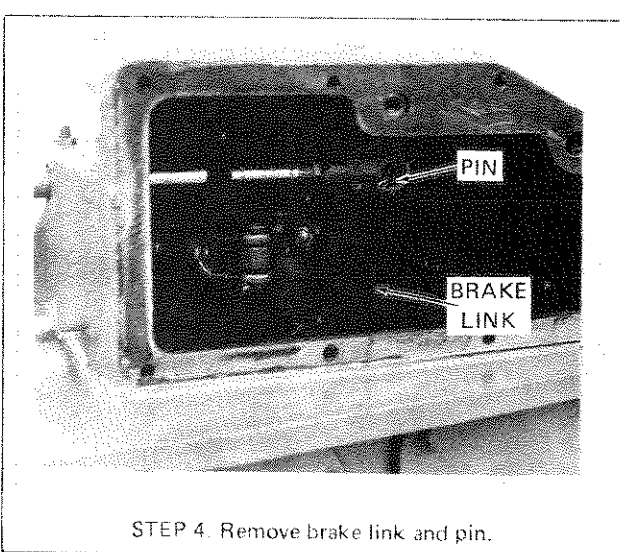
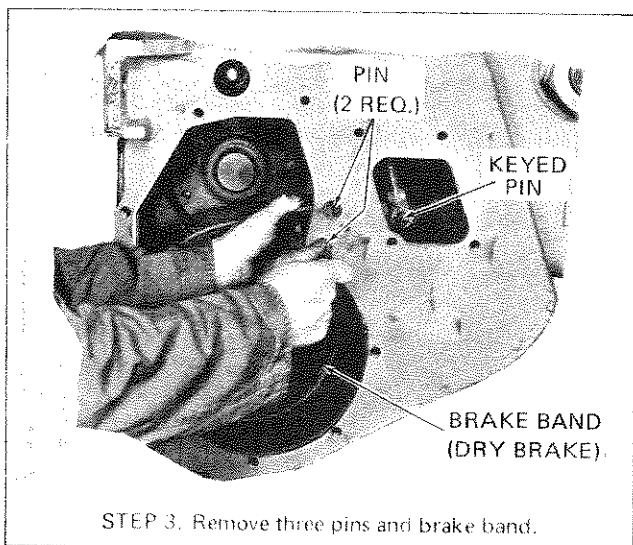
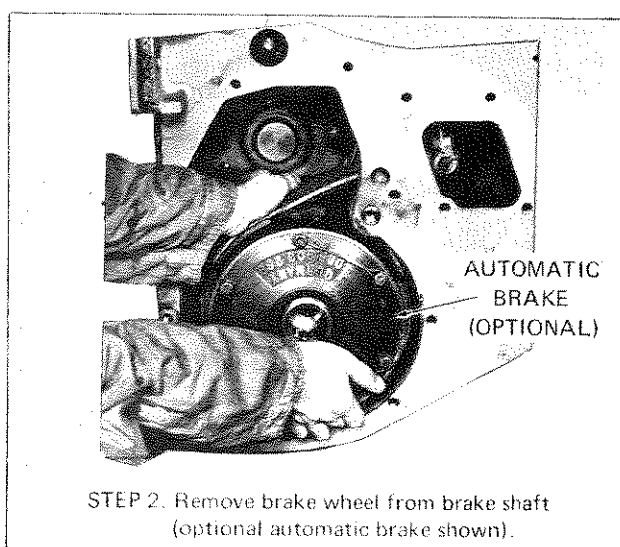
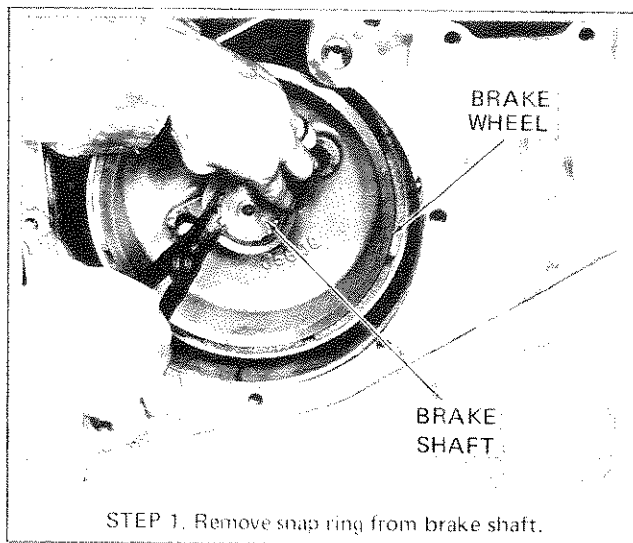


Figure 5-5. Removal Of Dry Brake And Automatic Brake, Direct Drive Winch

e. Unscrew and remove the nut from the left-hand end of shifter shaft. Cut the lockwire retaining shifter forks. Pull out shifter shaft being careful not to drop the forks (see figure 1-12).

NOTE: Procedures given in figure 5-7 are for the bevel gearshaft used in Power Controlled Winches. These procedures can be used for Direct Drive Winches by omitting all references to hydraulic components. Figure 5-6 shows the bevel gear shaft assemblies used in both the Power Controlled and Direct Drive Winches.

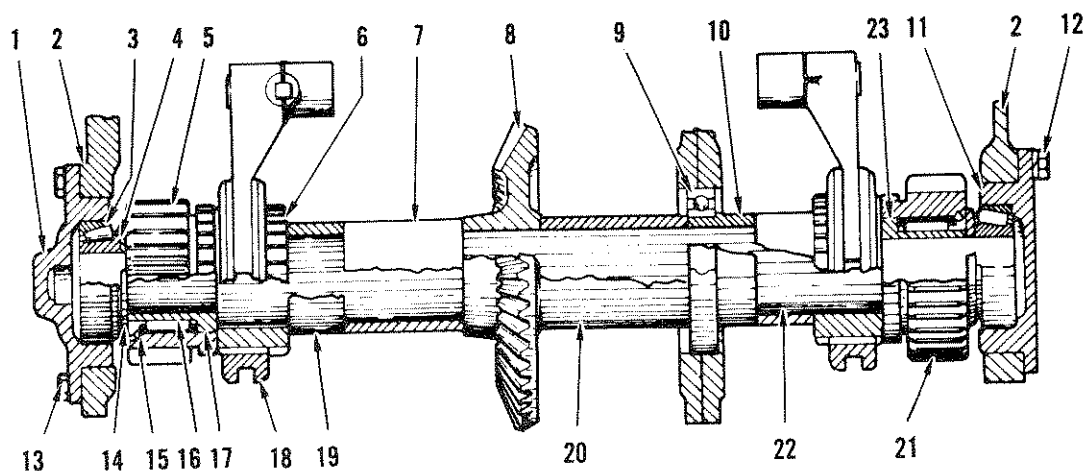
5-15. DISASSEMBLY OF CLUTCH ASSEMBLIES (POWER CONTROLLED WINCH).

5-16. Disassembly of the clutch assembly is shown in figure 5-8. Removal of the clutch assemblies is shown in figure 5-7.

5-17. REMOVAL OF BRAKE SHAFT ASSEMBLY.

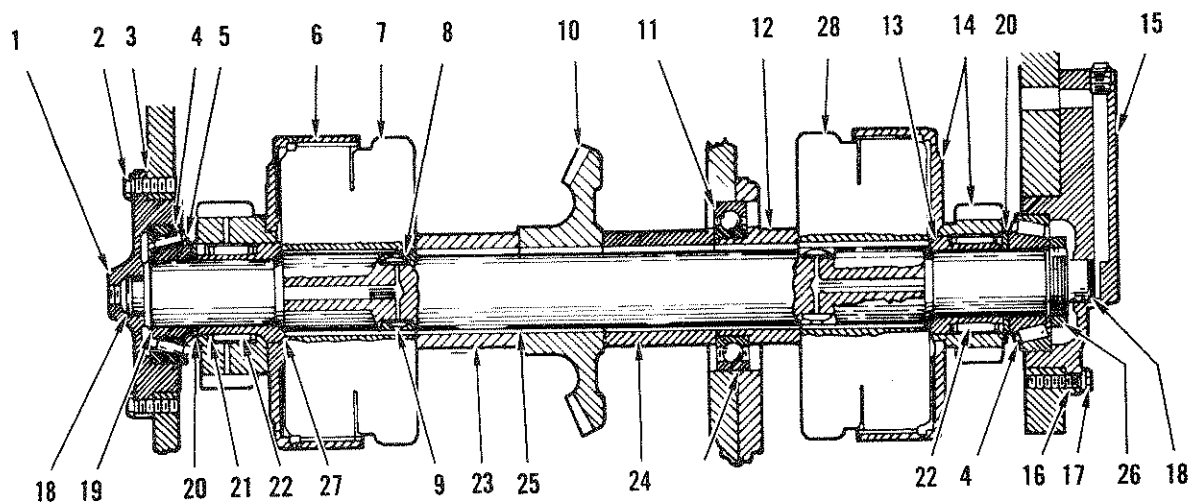
5-18. Removal of the brake shaft assembly is shown in figure 5-9. The brake shaft cannot be removed when the winch is mounted on the tractor. Prior to removal of the brake shaft assembly, perform the following:

FOR DIRECT DRIVE WINCH



- | | | |
|--------------------------|-------------------------|-------------------------|
| 1. L.H. BEARING RETAINER | 9. BALL BEARING | 17. BEARING CARRIER |
| 2. SHIM | 10. BEARING CARRIER | 18. DENTAL CLUTCH |
| 3. BEARING CUP | 11. BEARING RETAINER | 19. SPACER |
| 4. BEARING CONE | 12. CAPSCREW-LOCKWASHER | 20. SPACER |
| 5. FORWARD PINION | 13. CAPSCREW-LOCKWASHER | 21. REVERSE PINION GEAR |
| 6. DENTAL CLUTCH HUB | 14. THRUST WASHER | 22. BEVEL GEAR SHAFT |
| 7. SPACER | 15. SNAP RING | 23. BEARING CARRIER |
| 8. BEVEL RING GEAR | 16. ROLLER BEARING | |

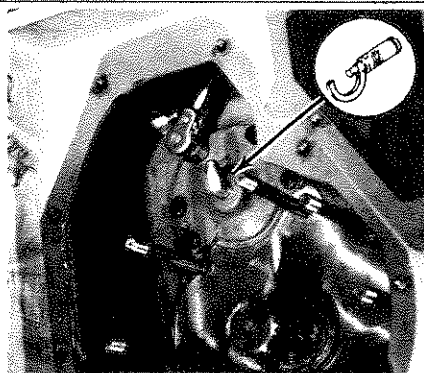
FOR POWER CONTROLLED WINCH



- | | | | |
|----------------------------|-------------------------|---------------------------|-----------------------------|
| 1. L.H. BEARING RETAINER | 8. SEAL (THREE TEETH) | 15. R.H. BEARING RETAINER | 22. ROLLER BEARING |
| 2. CAPSCREW-LOCKWASHER | 9. SEAL (TWO TEETH) | 16. SHIM | 23. SPACER |
| 3. SHIM | 10. BEVEL GEAR | 17. CAPSCREW-LOCKWASHER | 24. SPACER |
| 4. BEARING CUP | 11. BALL BEARING | 18. SEAL RING | 25. BEVEL GEAR SHAFT |
| 5. BEARING CONE | 12. BEARING CARRIER | 19. SNAP RING | 26. LOCKWASHER-LOCKNUT |
| 6. FORWARD SPIDER GEAR | 13. BEARING CARRIER | 20. THRUST WASHER | 27. BEARING CARRIER |
| 7. FORWARD CLUTCH ASSEMBLY | 14. REVERSE SPIDER GEAR | 21. SNAP RING | 28. REVERSE CLUTCH ASSEMBLY |

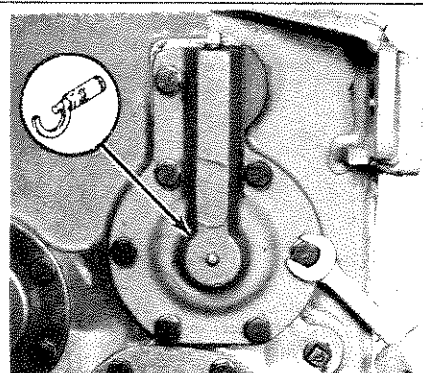
Figure 5-6. Bevel Gear Shaft, Location Of Components (Direct Drive And Power Controlled Winch)

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



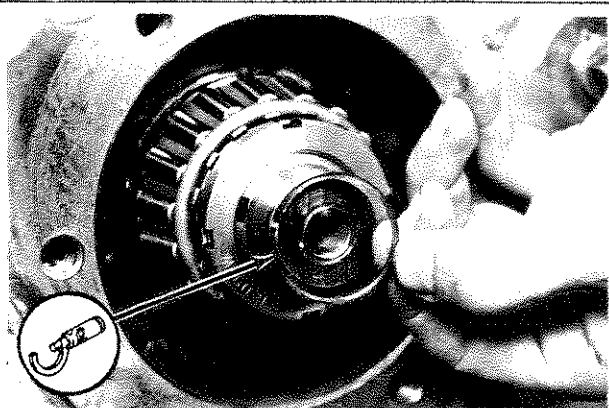
STEP 1. Remove left-hand bearing retainer with shims by removing the five capscrews.

NOTE: Keep shim pack with the retainer.

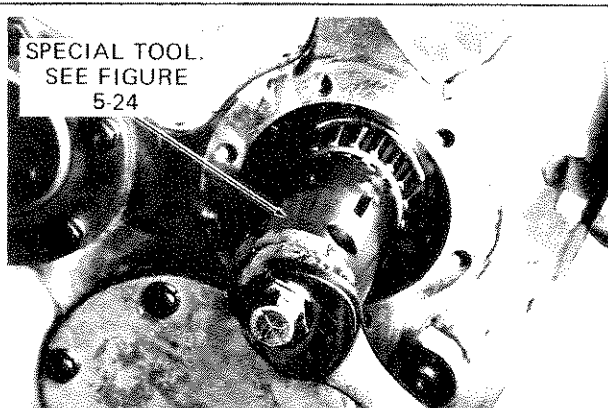


STEP 2. Remove right hand bearing retainer with shims by removing the seven capscrews.

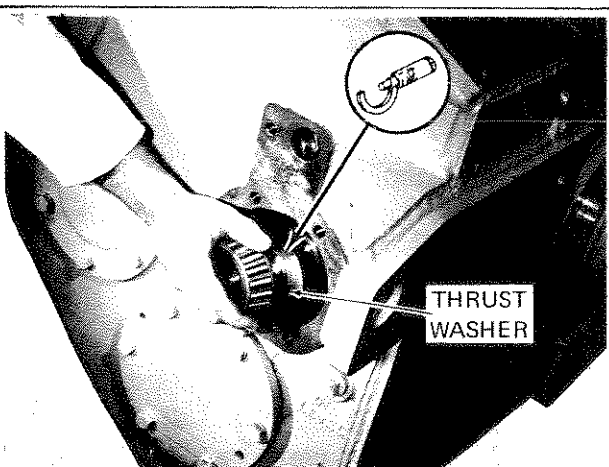
NOTE: Keep shim pack with the retainer.



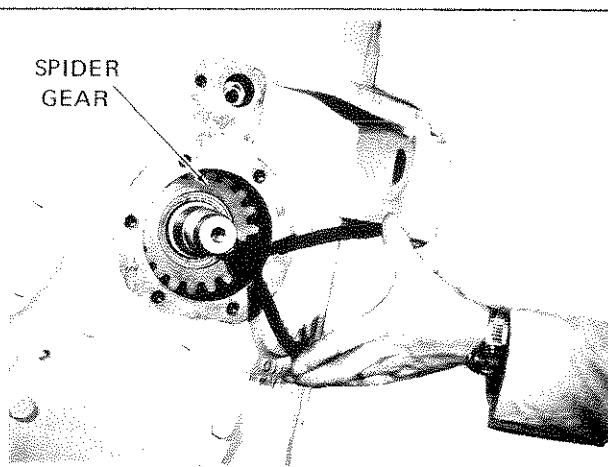
STEP 3. Remove cast-iron seal rings (one on each end of bevel gear shaft). Expand seal rings just enough to slip over the end of the shaft.



STEP 4. Straighten the lockwasher tangs securing the locknut. Remove locknut by turning counterclockwise. Remove lockwasher.

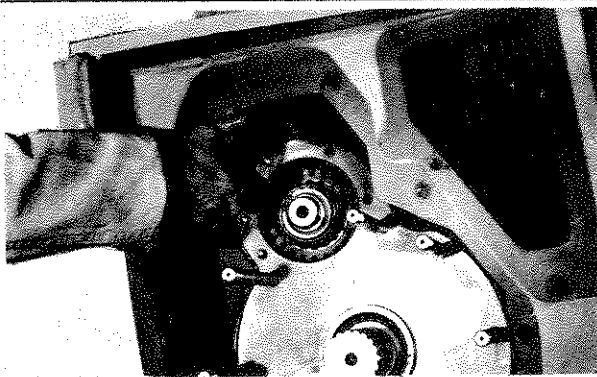


STEP 5. Remove taper roller bearing and thrust washer.

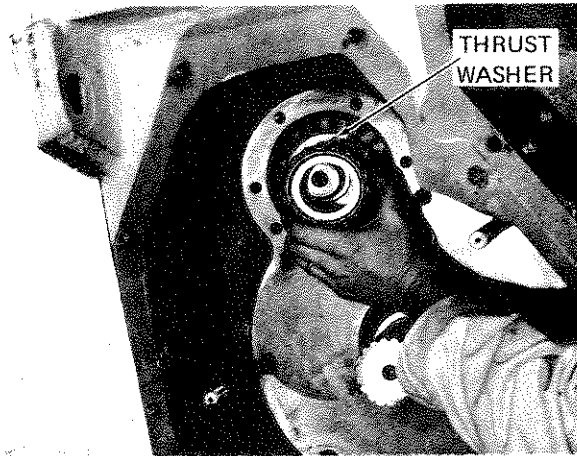


STEP 6. Remove the internal snap ring from the reverse spider gear bore.

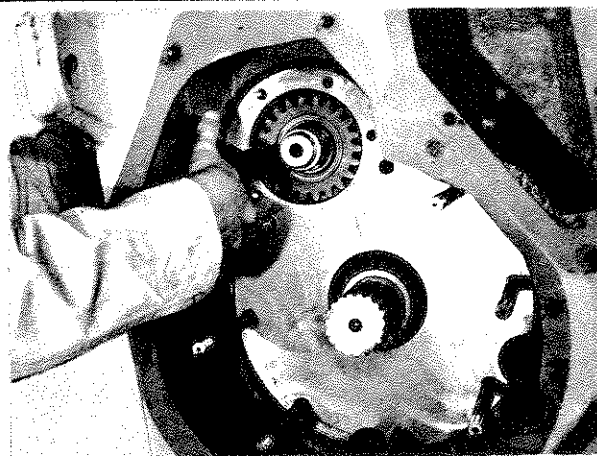
Figure 5-7. Removal And Disassembly Of Bevel Gear Shaft Assembly (Sheet 1 of 3)



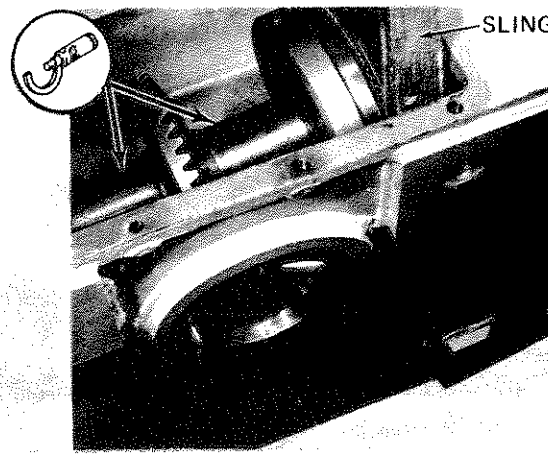
STEP 7. Remove external snap ring from left-hand end of the bevel gear shaft. It may be necessary to tap right-hand end of bevel gear shaft to relieve pressure on snap ring.



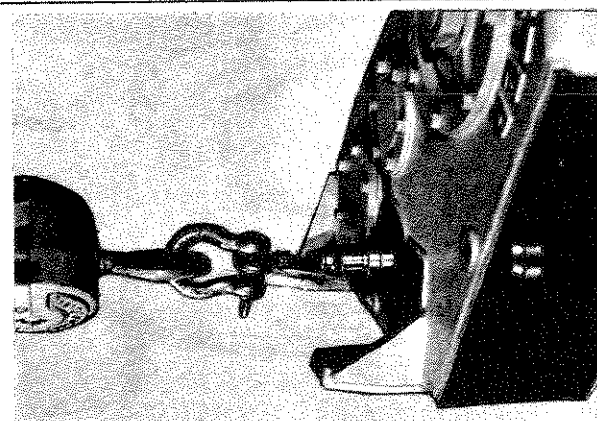
STEP 8. Remove taper roller bearing and thrust washer.



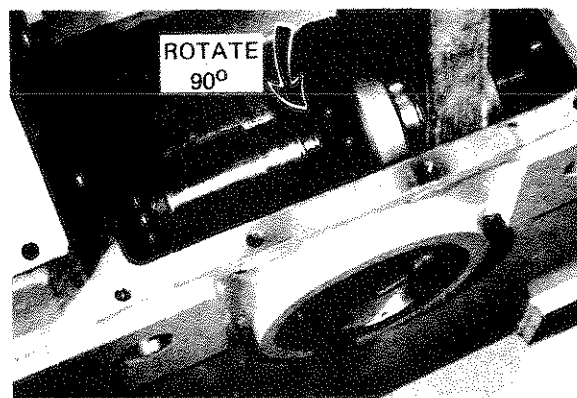
STEP 9. Remove the internal snap ring from the forward spider gear bore



STEP 10. Install a sling around forward clutch assembly. Hoist until sling just starts to lift clutch assembly.



STEP 11. Pull bevel gear shaft straight out.
CAUTION: Pull out just far enough for removal of forward clutch pack.

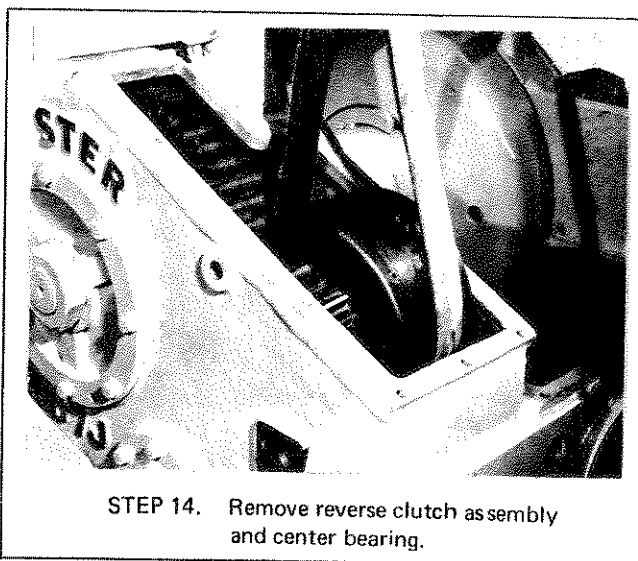


STEP 12. Remove forward clutch pack by rotating 90° from position shown. Lift straight out after rotating. Remove bevel gear and two spacers.

Figure 5-7. Removal And Disassembly Of Bevel Gear Shaft Assembly (Sheet 2 of 3)



STEP 13. Install a sling around the reverse clutch pack. Hoist until sling just starts to lift clutch pack, then remove bevel gear shaft.



STEP 14. Remove reverse clutch assembly and center bearing.

Figure 5-7. Removal And Disassembly Of Bevel Gear Shaft Assembly (Sheet 3 of 3)

a. Remove the winch from the tractor (see figure 5-1 or 5-2).

b. Drain oil from winch (see figure 4-1).

c. Remove all brake components as shown in figure 5-4 or 5-5 depending upon the winch model.

NOTE: If removal of the brake shaft reduction gear is not necessary, the brake shaft can be removed with the bevel gear shaft installed. To remove the brake shaft reduction gear, the bevel gear shaft must be removed as shown in figure 5-7.

5-19. REMOVAL OF INTERMEDIATE SHAFT ASSEMBLY.

5-20. Removal of the intermediate shaft and associated components is shown in figure 5-10. The intermediate shaft can be removed with the winch mounted on the tractor. Prior to removal of the intermediate shaft, intermediate gear, and drum pinion gear, sufficient clearance can be obtained by removing the drum shaft bearing retainer as shown in figure 5-11, step 3.

NOTE: Figure 5-10 shows the winch removed from the tractor with the bevel gear shaft 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 DRUM SHAFT AND DRUM.

5-22. Removal of the drum shaft and drum is shown in figure 5-11. The winch must be removed from the tractor before the drum shaft and drum can be removed. During removal of the drum shaft and drum, see the illustration of special tools (figure 5-24) and locally fabricate the tools if possible. Do not attempt to remove heavy components (such as the drum or drum gear) by hand. Use the recommended attachments whenever possible. Removal of the intermediate shaft (see figure 5-10) and the reverse clutch assembly (see figure 5-7) is required prior to removal of the drum shaft and drum.

5-23. REMOVAL OF CONTROL VALVE (POWER CONTROLLED WINCH).

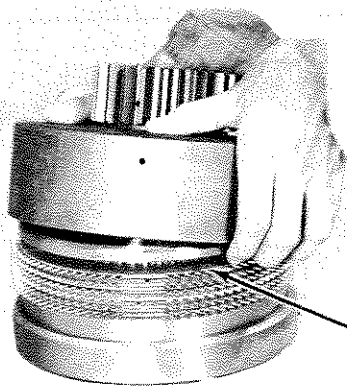
5-24. Access to the control valve may be obtained by removing the control housing cover. When removing the control valve, the brake cover must also be removed for access to the hydraulic hose fittings. To remove the control valve, proceed as follows (see figure 5-13):

a. Disconnect the cable end (clevis) at the end of each control cable.

b. Disconnect the inlet pressure line, brake pressure line, two clutch pressure lines and brake cooling line.

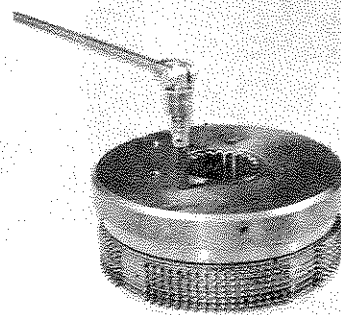
c. Unscrew and remove the cooling oil relief valve.

d. Remove the three capscrews securing the control valve to the control housing.

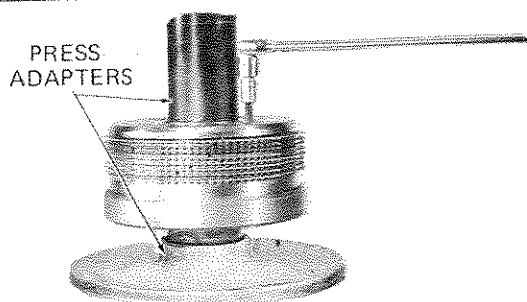


NOTE: Two feeler gauges placed 180° apart are required to obtain an accurate measurement. (See Step 10 figure 5-16.)

STEP 1. Lift spider gear from clutch pack. Measure clearance between cover plate and friction disc.

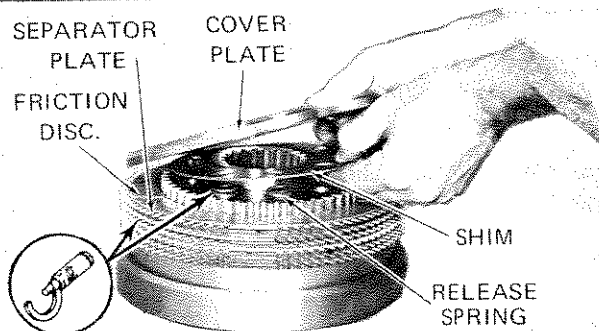


STEP 2. Remove six set screws that lock the special capscrews on opposite end of clutch.



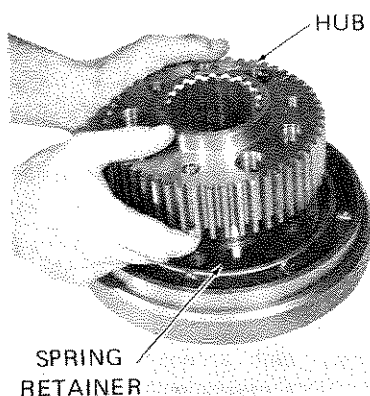
STEP 3. Remove six special capscrews. Hold assembly in press as shown.

CAUTION: The press adapters should contact the hub only. Apply only enough pressure to prevent the assembly from turning when capscrews are removed.

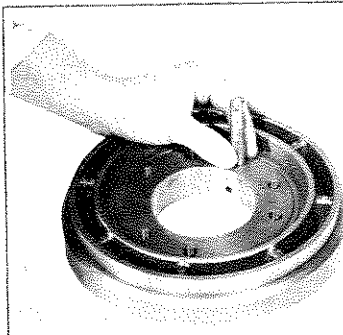


STEP 4. Lift cover plate, shim, six release springs, eight friction discs, and eight separator plates from clutch hub.

CAUTION: Keep friction discs and separator plates in order. They must contact same surface when Re-installed



STEP 5. Remove hub and spring retainer from clutch piston.



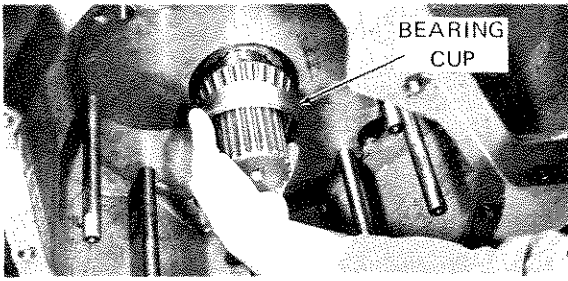
STEP 6. Remove clutch cooling oil valve. Use special tool (See figure 5-24.)

CAUTION: Do not insert any tool through valve body.



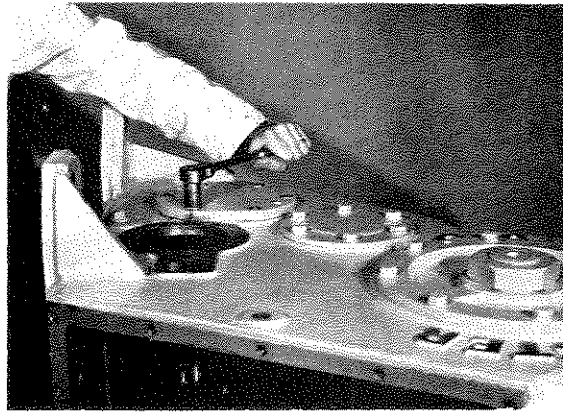
STEP 7. Remove clutch piston from piston retainer by applying compressed air at the cooling oil valve port. Then remove two o-rings.

Figure 5-8. Disassembly Of Clutch Assembly, Power Controlled Winch

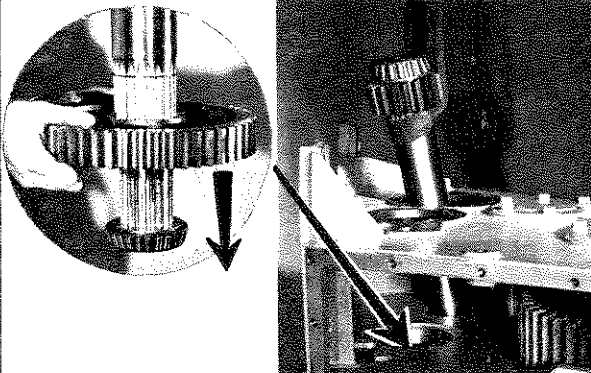


NOTE: Prior to removal and disassembly of the brake shaft, perform the procedures given in paragraph 5-18.

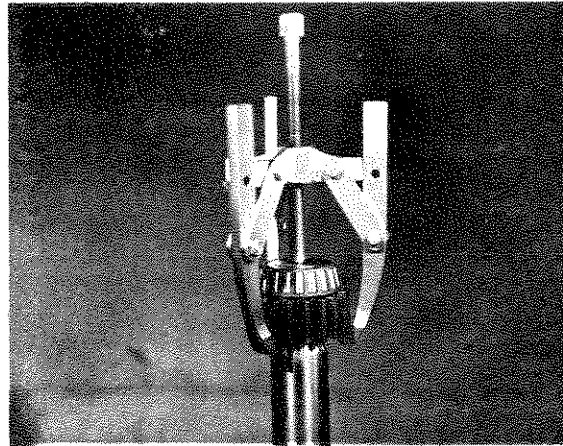
STEP 1. Remove left-hand bearing cup (outer race). Tag cup for reference during reassembly.



STEP 2. Position winch with right-hand side facing upward. Remove bearing retainer.



STEP 3. Pull brake shaft out of winch housing to approximate position shown. Tap bearing off of shaft using reduction gear as driver.



STEP 4. Remove bearing and pinion gear.

Figure 5-9. Removal Of Brake Shaft Assembly

NOTE: Control valve repairs are given in paragraph 5-32.

5-25. REMOVAL OF HYDRAULIC PUMP. (See Figure 5-12.)

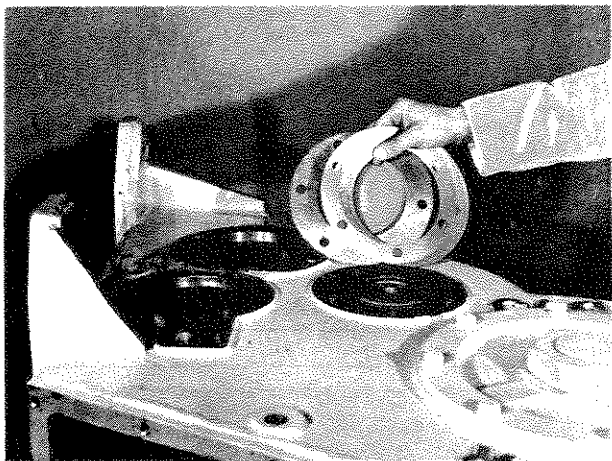
5-26. The hydraulic pump is located under the floor plate in the operator's compartment. The hydraulic pump is attached to the pump drive housing by two 5-1/8 inch long capscrews with lockwashers. Disconnect the suction hose and high pressure hose before removing the two capscrews.

NOTE: Hydraulic pump repair procedures are given in paragraph 5-33.

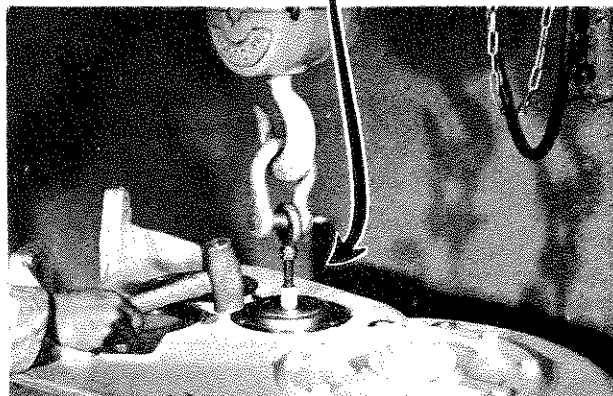
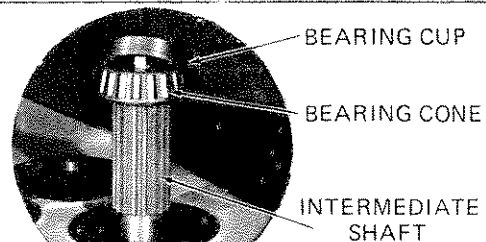
5-27. CLEANING.

5-28. 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.

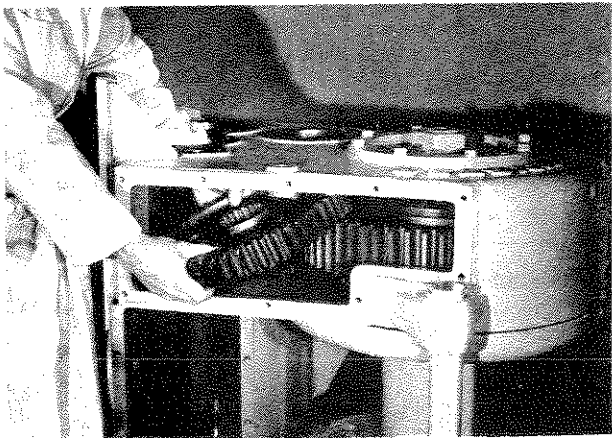
NOTE: The following illustrations show the winch removed from the tractor and positioned on its side with the brake shaft and bevel gear shaft removed. Removal of these shafts is not necessary for ON TRACTOR REPAIR of the intermediate shaft. Remove the drum shaft bearing retainer (see figure 5-11) to obtain the necessary clearance for removal of the intermediate shaft gears.



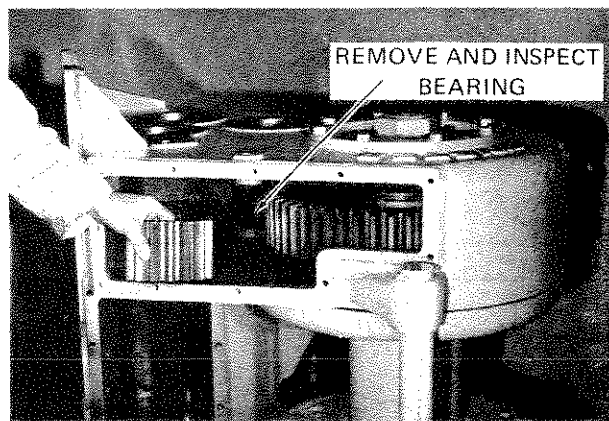
STEP 1. Remove the right-hand bearing retainer with shims. Tag shims for reference during reassembly.



STEP 2. Screw a 5/8-inch eyebolt into the end of intermediate shaft and pull out shaft. Tap on winch frame to break loose the bearing.

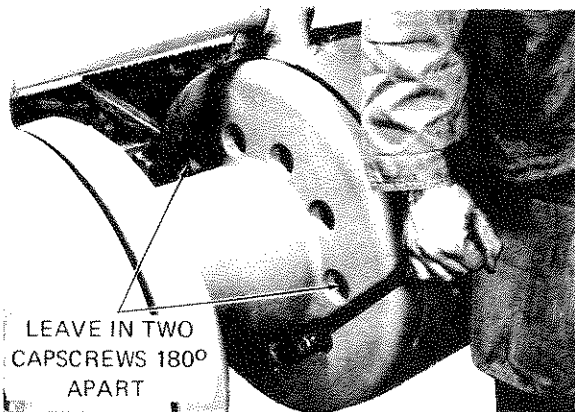


STEP 3. Remove intermediate gear.

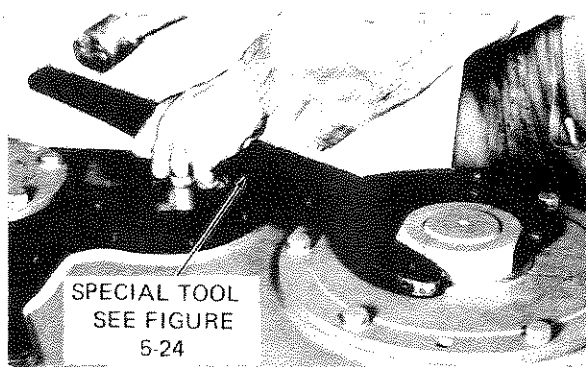


STEP 4. Remove drum pinion and bearing.

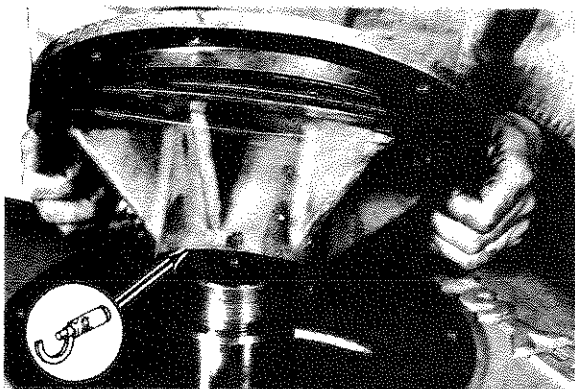
Figure 5-10. Removal Of Intermediate Shaft Assembly



STEP 1. Loosen the 12 drum capscrews, then remove 10 capscrews leaving two located 180 degrees apart.

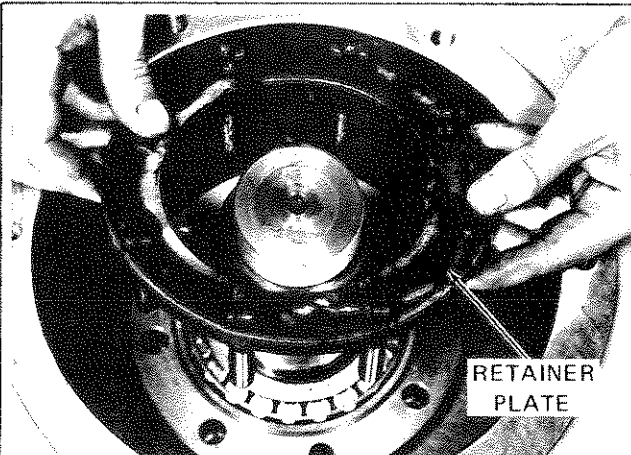


STEP 2. Remove left-hand drum shaft locknut, then turn winch so that right-hand side faces upward. Remove second drum shaft locknut.

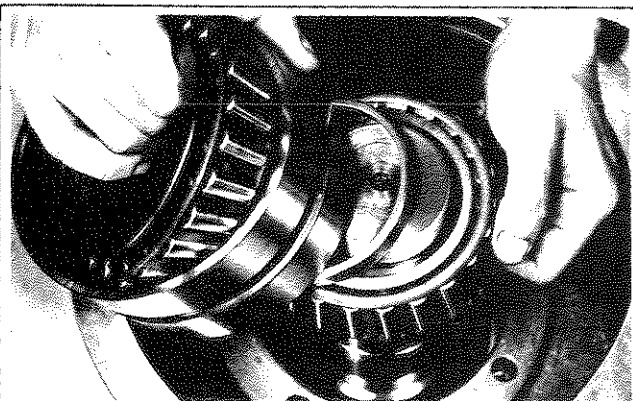


STEP 3. Remove bearing retainer and shim pack.

NOTE: Tag shim pack for reference during reassembly.

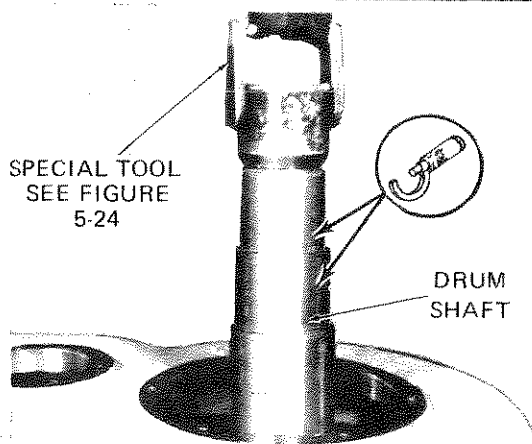


STEP 4. Remove retainer plate by removing the eight special capscrews.



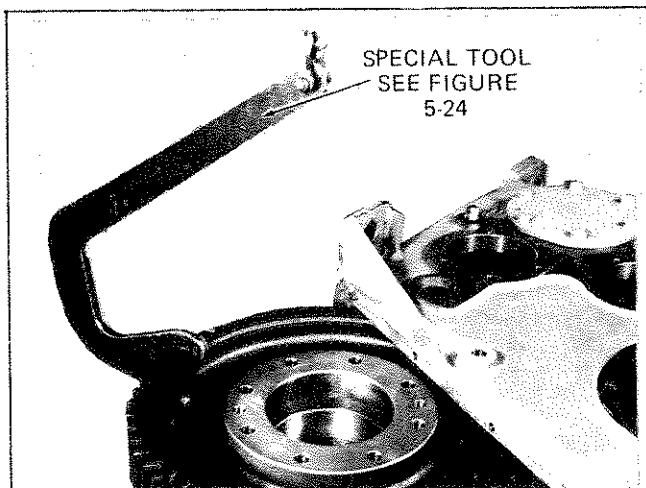
STEP 5. Remove double taper roller bearing assembly.

NOTE: Bearing assembly may be removed with the drum shaft if it is seized to the shaft.



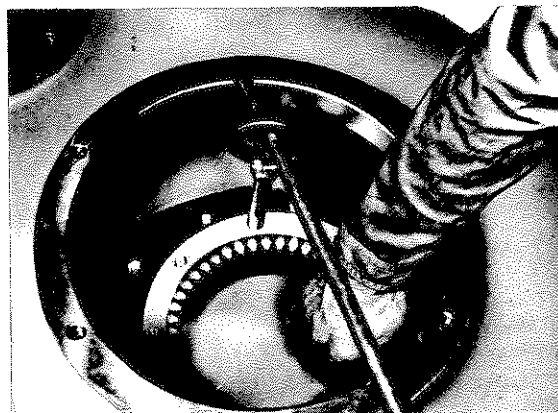
STEP 6. Remove drum shaft using special attachment.

Figure 5-11. Removal Of Drum Shaft And Drum, Direct Drive And Power Control Winch (Sheet 1 of 2)

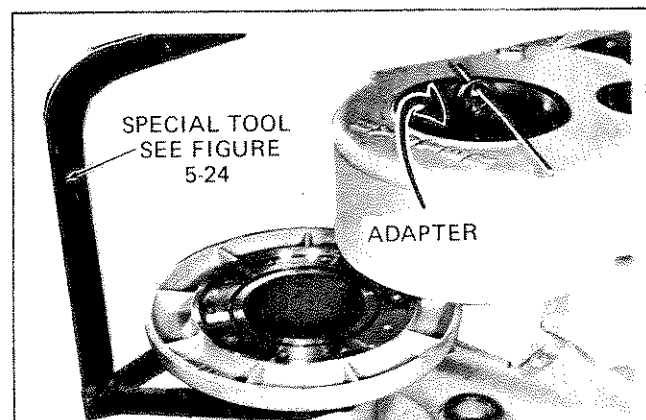


SPECIAL TOOL
SEE FIGURE
5-24

STEP 7. Remove drum gear using special attachment.



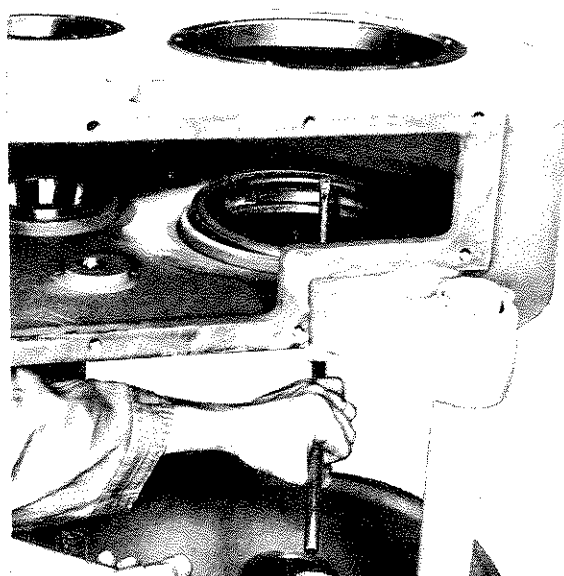
STEP 8. Hold adapter as shown, then remove two remaining drum capscrews.



SPECIAL TOOL
SEE FIGURE
5-24

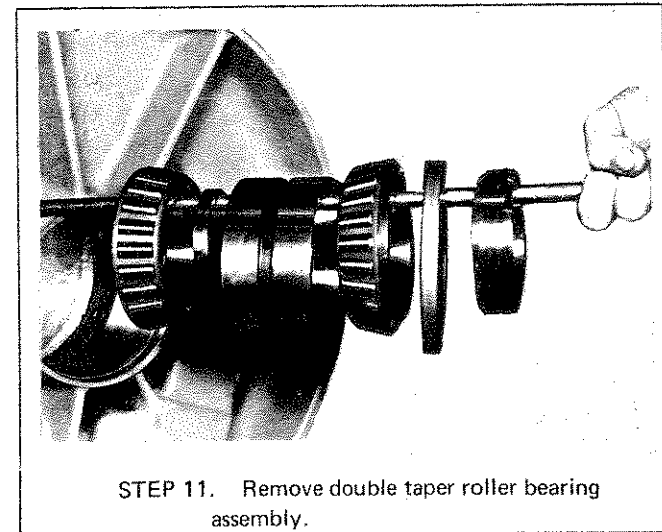
ADAPTER

STEP 9. Remove from winch frame using attachment as shown. Remove adapter.



STEP 10. Remove drum seal.

NOTE: This seal must be replaced with a new Hyster Approved seal during installation.



STEP 11. Remove double taper roller bearing assembly.

Figure 5-11. Removal Of Drum Shaft And Drum, Direct Drive And Power Control Winch (Sheet 2 of 2)

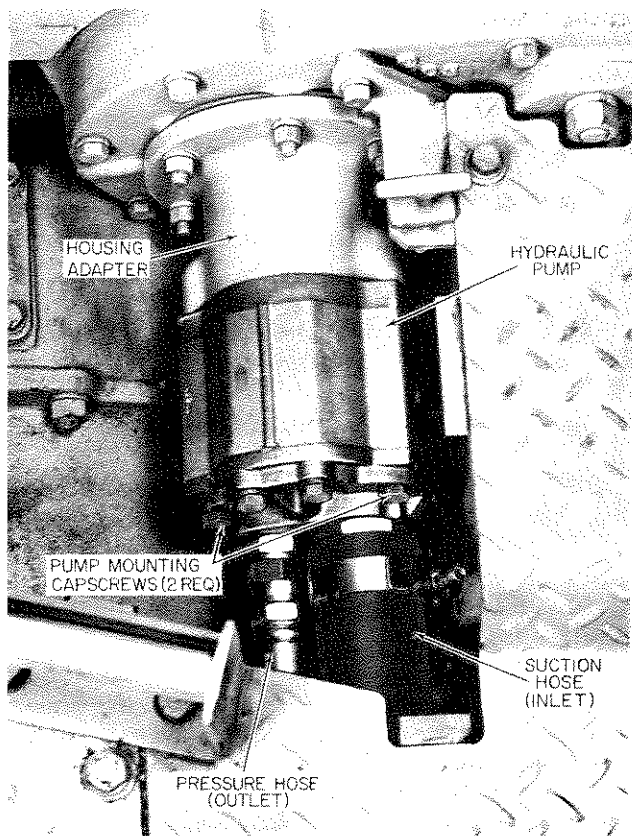


Figure 5-12. Removal Of Hydraulic Pump

CAUTION: Do not use oily (dirty) solvents to clean the brake band used in the direct drive winch. Use only clean solvents to remove grease or oil from the brake lining.

5-29. VISUAL INSPECTION.

5-30. Table 5-1 contains procedures for visual inspection of all critical parts of the winch assembly.

5-31. MINOR REPAIRS.

5-32. CONTROL VALVE REPAIRS (POWER CONTROLLED WINCH).

Repair of the control valve is limited to removal and replacement of individual components shown in figure 5-13. Replace defective components as required, observing the following:

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. Lubricate all O-rings with hydraulic oil before installation.

b. Tag valve spools when removed to make sure that they are re-installed in the correct bores.

c. Check all threads in the valve body and on external fittings. If threads in valve body have been damaged, re-thread using same size tap. Make sure that all metal chips are removed from the valve ports.

CAUTION: When removing the end caps, tag the caps for reference during reassembly. THESE CAPS ARE NOT INTERCHANGEABLE.

5-33. HYDRAULIC PUMP REPAIRS (POWER CONTROLLED WINCH ONLY).

Seal wear or deterioration is the most common failure occurring in the hydraulic pump. The pump bearings, gears and shafts 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.

5-34. PUMP DISASSEMBLY. Disassemble the pump as required, observing the following (see figure 5-14, View A):

a. Clean the pump exterior prior to disassembly.

b. Scribe a thin line across the pump covers and pump body before disassembly. This will assure proper installation of the covers. (See View G.)

c. After removal of the front cover, place match marks on pump body and bearings as shown in VIEW C. DO NOT SCRIBE: use prussion blue for marking.

d. Push on rear end of gears (7 and 8, VIEW A) until front bearings are free of the pump body. (See VIEW D.)

5-35. INSPECTION AND REPAIR OF PUMP PARTS.

Inspect or repair pump parts as follows:

NOTE: Recommended repair of parts is limited to dressing bearing faces.

a. Check gears and shafts for nicks, burrs, cracks or deep scratches. Discard any damaged components.

b. Check interior section of pump body. Although wear greater than 0.015-inch is abnormal, it is not

critical if bearings are not worn or damaged. Bearings can be dressed as shown in VIEW E. Use fine sandpaper on a true-flat surface plate when dressing bearing faces. Dress the flats until the bearings slide into place freely. Clearance between the flats when assembled in the body should be 0.0002 to 0.0005 inch.

c. Check bearing flats and bearings for wedging in the respective housings. This is evident by a smooth shiny appearance on the bearing flat and circumference.

d. Check milled seal and gasket recess in the front cover for any obstruction that will prevent normal seating. Make sure that internal threads in pump body are clean.

5-36. PUMP REASSEMBLY. Observe the following during reassembly of the pump:

a. Apply a light coat of non-hardening gasket cement to the shaft seal bore in the front cover (see VIEW B). Press the new shaft seal into cover. Remove excess cement, then stake seal in place by peening the cover in three places around the seal.

b. Apply a liberal amount of SAE 10W oil to all parts during reassembly.

c. When installing bearings and gears, make sure that all match marks (VIEW C) are aligned.

CAUTION: Do not distort or attempt to straighten the high pressure seal (VIEW B) during installation.

d. When installing the covers, align the scribe line made during disassembly (see VIEW G).

e. Torque cover capscrews to 28-32 ft-lbs.

CAUTION: Do not overtighten the cover capscrews. Threads in the aluminum casting are easily damaged.

5-37. DUMP VALVE REPAIRS (POWER CONTROLLED WINCH ONLY).

Repair of the dump valve is limited to replacement of parts. Do not attempt to hone the valve body bore. If the valve bore is severely scratched or otherwise damaged, replacement of the complete valve assembly is recommended. If the valve bore is not damaged, replace the spring assembly (1) or spool (2) as required.

Table 5-1. Visual Inspection (Sheet 1 of 4)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
PTO Shaft, Lo-Speed	Check for broken or worn bevel gear teeth. Also check spline for wear or twisting.	Replace shaft if gear teeth are broken or severely worn or if splines are not true.
PTO Shaft, Standard and Slo-Speed.	Check splines for wear or twisting.	Replace shaft if splines are severely worn or twisted.
PTO Shaft Bevel Gear Standard and Slo-Speed.	Check for broken or worn bevel gear teeth.	Replace bevel gear if teeth are broken or severely worn.
Bevel Gear Shaft, Direct Drive	Check for deep scratches or scoring on bearing journals at each end of shaft.	Machine bearing journal as required but do not exceed minimum dimensions given in Table 1-1.
Bevel Gear Shaft, Power Controlled Winch	Check for deep scratches or scoring on bearing journals at each end of shaft.	Machine bearing journal as required but do not exceed minimum dimensions given in Table 1-1.
	Inspect bevel gear shaft seal ring grooves for taper, scoring, burrs, and corrosion.	Replace or repair shaft if mating surfaces between the inner side of groove and seal are not FLAT.

Table 5-1. Visual Inspection (Sheet 2 of 4)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
Bevel Gear Shaft, Power Controlled Winch (Continued)	Check for broken, scored, pitted, and corroded cast iron seal rings.	Replace seal rings if worn or damaged slightly.
	Check threads on right-hand end of bevel gear shaft for scoring or distortion: a. Puller Hole (internal threads) b. Locknut (external threads)	Dress threads with a thread chaser.
	Check for broken or severely worn splines.	Replace shaft if splines are broken or severely worn.
	Inspect spline seal counterbore for damage.	Replace or rebuild shaft if a new spline seal will not seat properly.
Bevel Gear Shaft Bearing Retainers	Check retainer seal ring bore for grooves, scoring, and rust.	Replace if scored, rusted, or if they are not within specifications given in Table 1-1.
Dental Clutch, Direct Drive Winch	Check for broken or worn teeth.	Replace dental clutch if teeth are broken or severely worn.
Bevel Gear Shaft Spacers	Inspect spacer ends for scoring, mushrooming, or corrosion.	Replace if damaged in any way or if they are not within specifications given in Table 1-1.
Bevel Gear Shaft Pinion Gears, Direct Drive Winch	Check for broken or worn teeth.	Replace pinion gears if teeth are broken or severely worn.
Bevel Gear	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. NOTE: Do not machine gear faces. Overall length of components is critical.
Clutch Assembly, Power Controlled Winch	Check for plugged oil holes in clutch hub and cooling oil valve. Also check cooling oil valve plunger for free movement.	Clean oil holes as necessary. See figure 5-9, Step 4.
	Carefully inspect friction discs for facing wear, distortion, and damaged teeth.	Replace friction disc if oil grooves are worn from sintered bronze facing or if distorted in any way.
	Carefully inspect separator plates to verify that surfaces are conical (dished).	Replace separator plate if surface is flat, warped, or scored. NOTE: Separator plates must be dished to assist clutch release.
	Inspect piston retainer O-ring grooves for scoring, burrs, and corrosion.	Replace piston retainer if damaged.
	Inspect spider gear for broken or worn gear teeth. Check for broken welds between gear hub and clutch housing.	Replace gear if teeth are broken or severely worn or if there are any apparent cracks.

Table 5-1. Visual Inspection (Sheet 3 of 4)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
Oil Brake Assembly, Power Controlled Winch	Check for cracked or broken bellville spring.	Replace spring if cracked or broken.
	Inspect oil brake cover for scoring, burrs, or cracks.	Replace cover if severely damaged.
	Carefully inspect friction disc for facing wear, distortion, and damaged teeth.	Replace friction disc if oil grooves are worn from sintered bronze facing or if distorted in any way.
	Carefully inspect separator plates to verify that surfaces are conical (dished).	Replace separator plates if surface is flat, warped, or scored.
	Inspect piston retainer grooves for scoring, burrs, and corrosion.	Replace piston retainer if damaged.
	Inspect brake cage for wear, scoring, burrs, and cracks.	Replace cage if splines are notched or cage is cracked.
	Inspect brake hub for wear, scoring, burrs, and cracks.	Replace hub if splines are notched or hub is cracked.
	Check push rods for grooves and mushrooming.	Replace if slightly damaged.
	Carefully check aligning dowels for grooves and distortion.	Replace if slightly damaged.
Brakeshaft	Check for deep scratches or scoring on bearing journals at each end of shaft, and oil seal surface on Direct Drive.	Machine bearing journal as required but do not exceed minimum dimensions in Table 1-1.
	Check for broken or severely worn splines.	Replace if splines are broken or severely worn.
Brakeshaft Gears	Check for broken or worn gear teeth. Pay particular attention to leading edges of straight-cut gear teeth.	Replace gear if teeth are broken or severely worn.
Intermediate Shaft	Check for deep scratches or scoring on bearing journals at each end of shaft.	Machine bearing journal as required but do not exceed minimum dimensions in Table 1-1.
	Check for broken or severely worn splines.	Replace if splines are broken or severely worn.
Intermediate Gears	Inspect both gears for broken or severely worn teeth. Pay particular attention to leading edges of straight-cut gear teeth.	Replace gears if teeth are broken or severely worn.
Drum Shaft	Check for deep scratches or scoring on bearing journal at each end of shaft.	Machine shaft as required but do not exceed minimum dimensions specified in Table 1-1.

Table 5-1. Visual Inspection (Sheet 4 of 4)

ITEM	INSPECTION REQUIREMENTS	CORRECTIVE ACTION
Drum Shaft (Continued)	Check for cross threaded or damaged threads.	Dress threads with thread chaser.
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	Inspect quad-ring groove for burrs, scoring, and rust.	Replace drum or repair drum groove if a new quad-ring will not seat properly.
Drum Adapter	Carefully inspect double seal contact surface for deep scratches, burrs, and rust.	Replace if damaged.

5-38. REASSEMBLY AND INSTALLATION.

5-39. Before reassembly and installation of the winch, make sure that all removed parts have been inspected as specified in Table 5-1. Check all measurements specified in Table 5-1 and as shown in the disassembly illustrations. Replace any part that is not within the specified limits. 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. New bearings may prevent future troubles.

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

5-40. REASSEMBLY OF CLUTCH ASSEMBLIES (POWER CONTROLLED WINCH).

5-41. Reassembly of the clutch assemblies used in the power controlled winch is shown in figure 5-16.

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

5-42. INSTALLATION OF DRUM AND DRUM SHAFT.

5-43. Reassembly and installation of the drum and drum shaft is shown in figure 5-17. During installation of the drum and drum shaft, see the illustration of special tools (figure 5-24) and locally fabricate the tools if possible. The intermediate shaft and

reverse clutch assembly must be removed before installation of the drum and drum shaft.

5-44. INSTALLATION OF INTERMEDIATE SHAFT.

5-45. Installation of the intermediate shaft and associated components is shown in figure 5-18. Figure 5-18 shows the winch removed from the tractor with the bevel gear shaft and brake shaft removed. However, the intermediate shaft can be installed with the winch mounted on the tractor and with only the drum shaft bearing retainer removed for the necessary clearance.

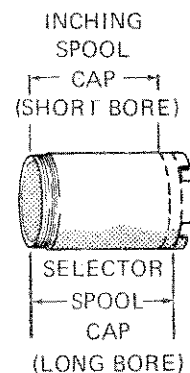
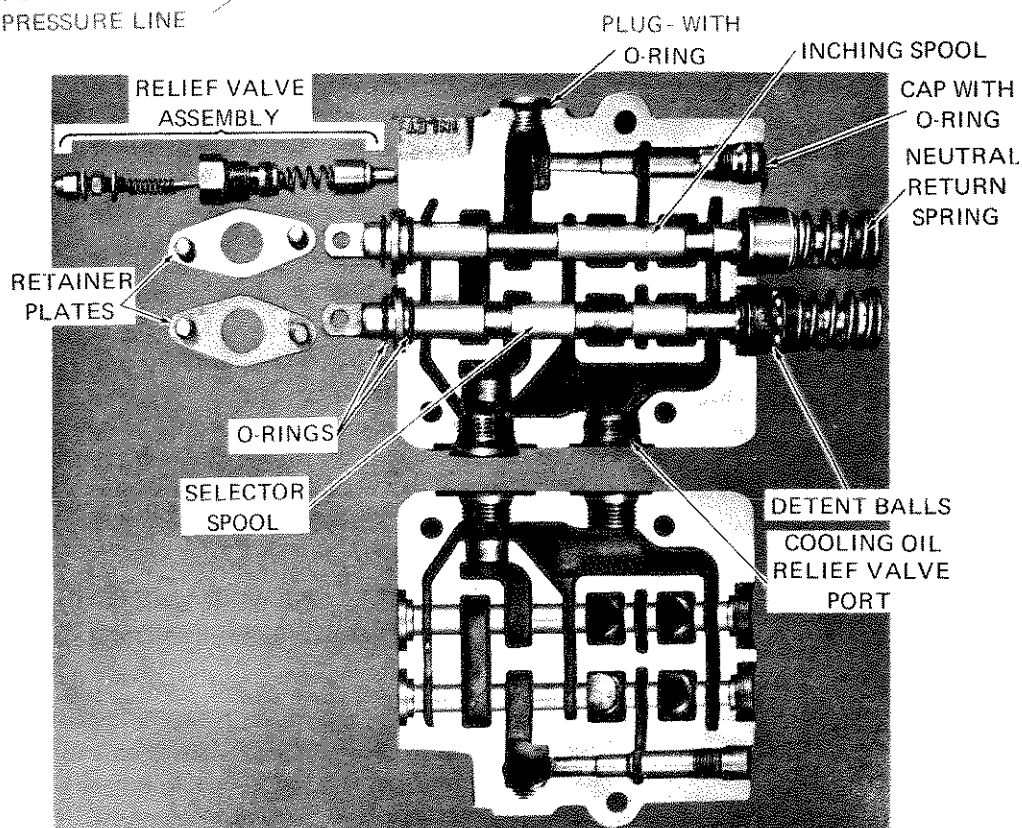
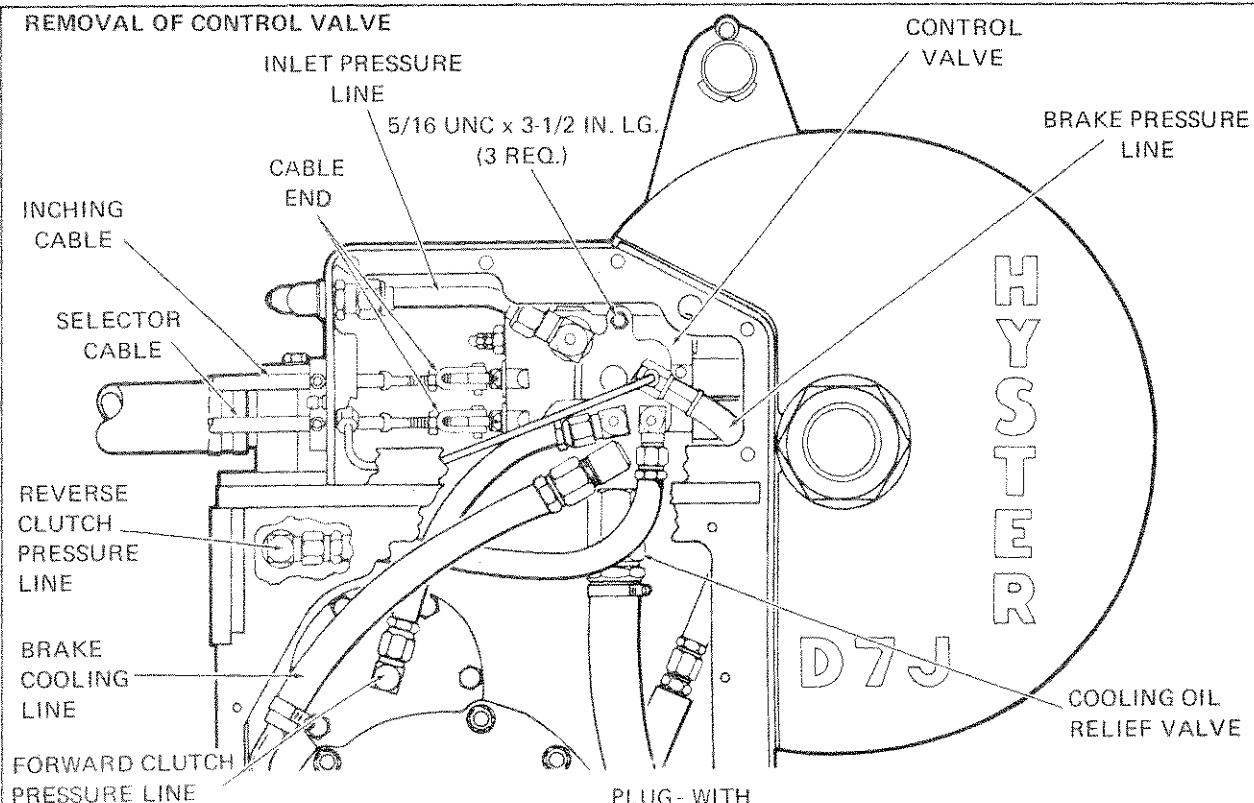
5-46. INSTALLATION OF BRAKE SHAFT ASSEMBLY.

5-47. Installation of the brake shaft and associated components is shown in figure 5-19. The brake shaft and reduction gear must be installed before installation of the bevel gear shaft assembly. The brake shaft cannot be installed when the winch is mounted on the tractor, unless the tractor tracks are removed or disconnected.

5-48. REASSEMBLY AND INSTALLATION OF BEVEL GEAR SHAFT ASSEMBLY (POWER CONTROLLED WINCH).

5-49. Reassembly and installation of the bevel gear shaft assembly used in the Power Controlled Winch is shown in figure 5-20. Installation of the bevel gear shaft can be accomplished with the winch mounted on the tractor.

NOTE: The reduction gear (see figure 5-19) must be installed before installation of the bevel gear shaft assembly. This is due to insufficient clearance for installing the reduction gear when the bevel gear shaft is installed.

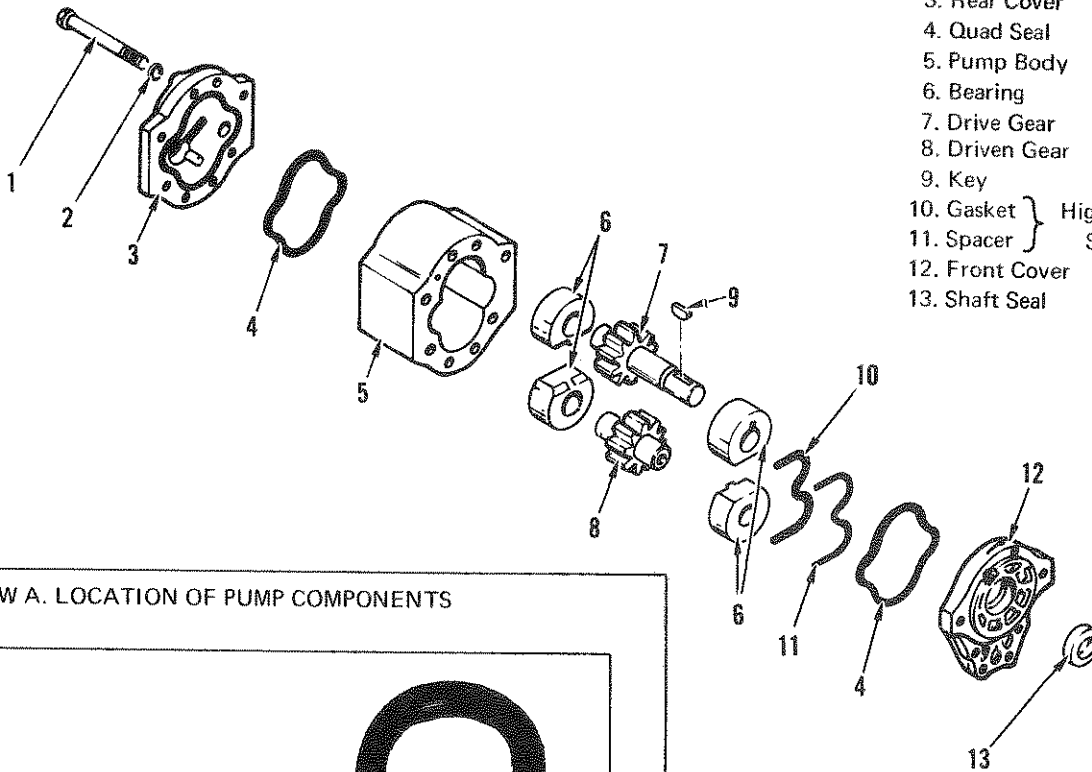


NOTE: Before installing the spool caps, measure the bore depth of each cap. Install cap with GREATEST BORE depth over the SELECTOR SPOOL. On early production winches, spool caps have same bore depth.

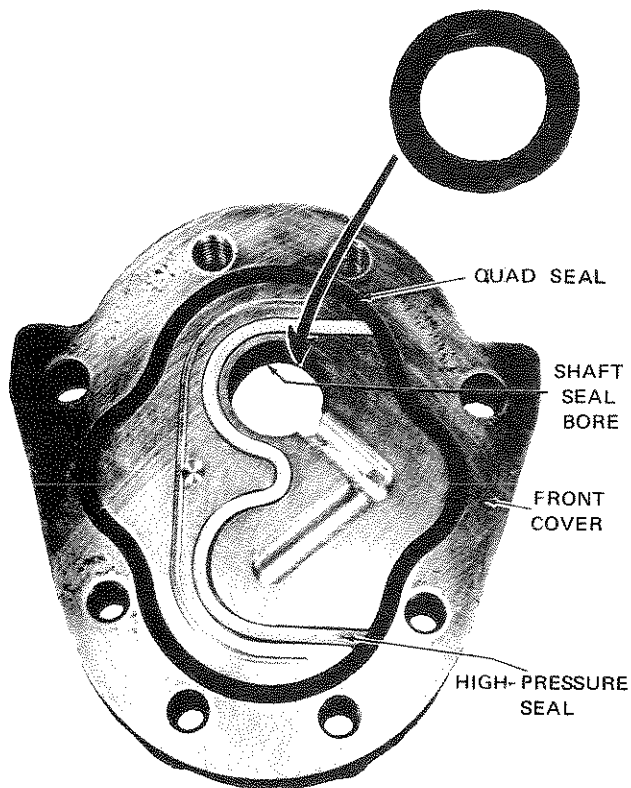
CONTROL VALVE COMPONENTS

Figure 5-13. Control Valve Repair, Power Controlled Winch

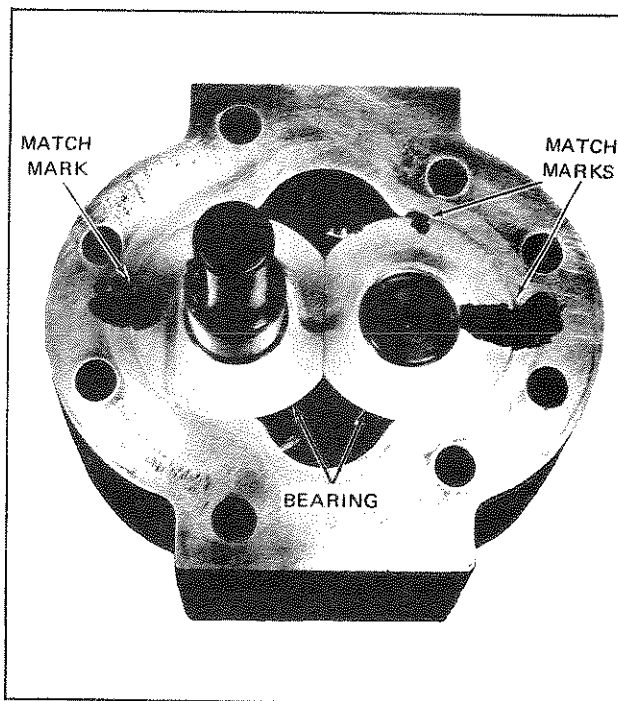
1. Capscrew
2. Lockwasher
3. Rear Cover
4. Quad Seal
5. Pump Body
6. Bearing
7. Drive Gear
8. Driven Gear
9. Key
10. Gasket } High Pressure Seal
11. Spacer }
12. Front Cover
13. Shaft Seal



VIEW A. LOCATION OF PUMP COMPONENTS



VIEW B. FRONT COVER

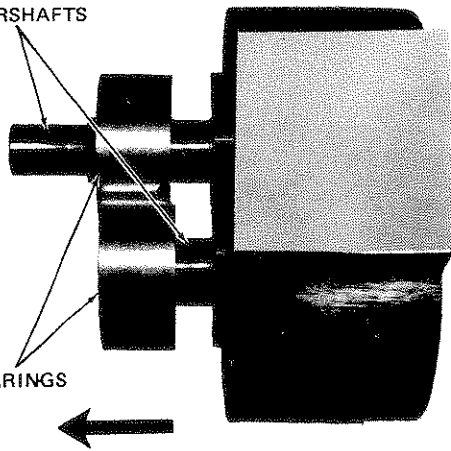


VIEW C. BEARING MATCH MARKS

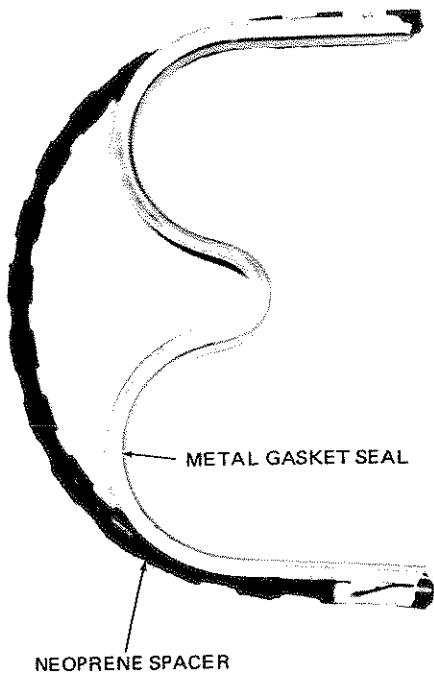
Figure 5-14. Hydraulic Pump Repairs (Sheet 1 of 2)

GEARSHAFTS

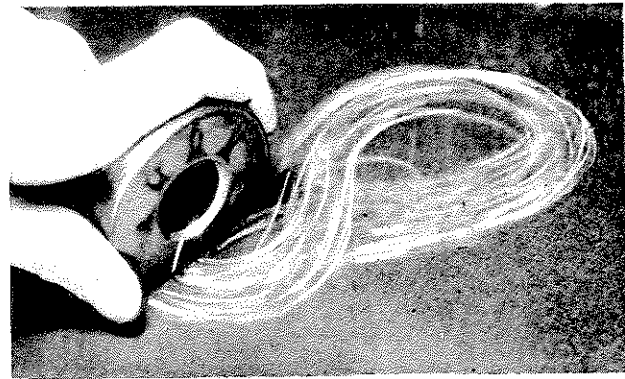
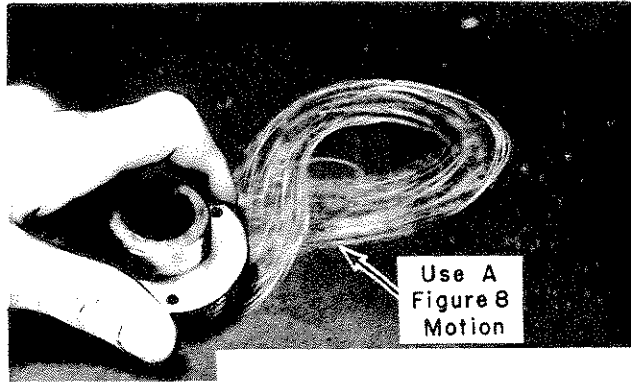
BEARINGS



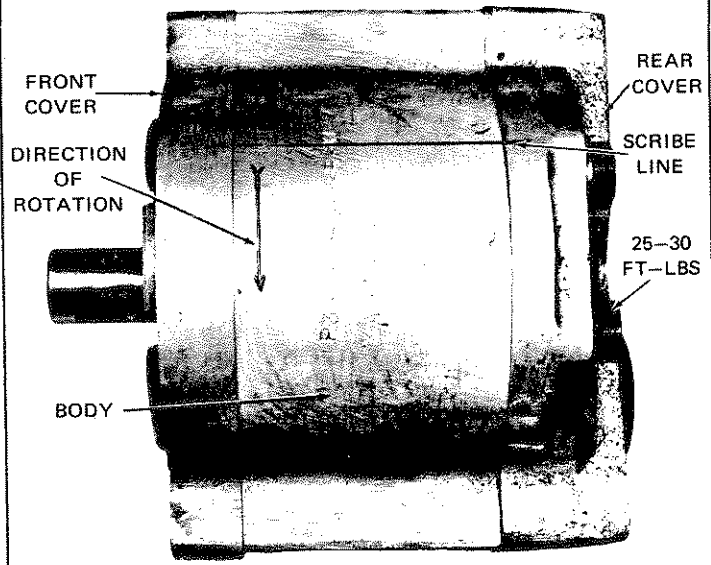
VIEW D. BEARING REMOVAL



VIEW F. SPACER AND GASKET (HIGH PRESSURE SEAL)



VIEW E. DRESSING BEARING FACES



VIEW G. HYDRAULIC PUMP ASSEMBLED

Figure 5-14. Hydraulic Pump Repairs (Sheet 2 of 2)

5-50. REASSEMBLY AND INSTALLATION OF BEVEL GEAR SHAFT ASSEMBLY (DIRECT DRIVE WINCH).

5-51. Reassembly and installation of the bevel gear shaft assembly used in the direct drive winch is essentially the same as for the bevel gear shaft used in the power controlled winch (see figure 5-20). Reassemble and install the bevel gear shaft as shown in figure 5-20, observing the following:

a. See figure 5-6 for location of bevel gear shaft components.

b. The direct drive winch is equipped with dental clutches. Install the dental clutch so that the chamfered ramp faces toward the pinion gear.

c. Install the bevel gear and two spacers for either Underwind or Overwind operation. Refer to paragraphs 4-17 and 4-19.

d. The bevel gear shaft must be adjusted for 0.006 to 0.009 inch endplay. This adjustment is accomplished in the same manner as for power controlled winches.

5-52. REASSEMBLY AND INSTALLATION OF OIL BRAKE ASSEMBLY (POWER CONTROLLED WINCH).

5-53. Reassembly and installation of the oil brake used in the Power Controlled Winch is shown in figure 5-21. Reassembly and installation of the oil brake can be accomplished with the winch mounted on the tractor. Make sure that the bevel gear shaft is installed prior to installation of the oil brake.

5-54. INSTALLATION OF DRY BRAKE AND AUTOMATIC BRAKE (DIRECT DRIVE WINCH).

5-55. Installation of the dry brake (or Optional Automatic Brake) used in the Direct Drive Winch is shown in figure 5-22. Installation procedures shown in figure 5-22 apply to both the dry brake and optional automatic brake.

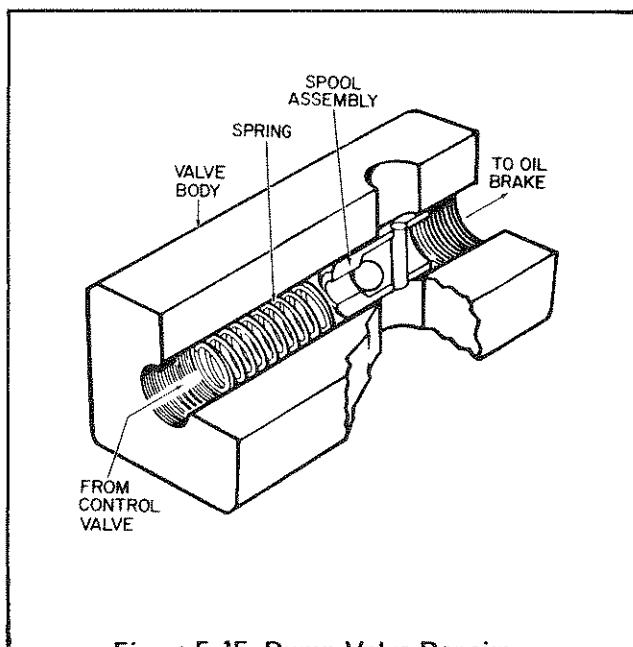


Figure 5-15. Dump Valve Repairs

5-56. INSTALLATION OF WINCH ON TRACTOR.

5-57. The D7J winch is attached to the tractor by eight 1-1/4 UNF studs and nuts with lockwashers (see figure 5-1 or 5-2). Two of the eight nuts are castellated. Install these nuts on the two top-inside studs (inside transmission housing) and install cotter keys. Prior to installing the winch, remove the suction manifold (Power Controlled Winch only) and transmission cover for access to the two inside studs. When installing the winch, observe the following:

WARNING: Make sure that the lifting device has a minimum capacity of 3,000 pounds before lifting the winch. Carefully check the cable or chain for damage.

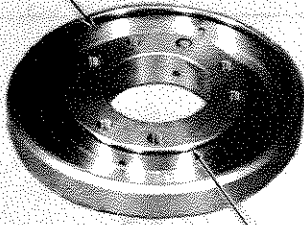
a. Make sure that all shipping plugs are removed before mounting the winch.

b. Carefully check all hydraulic hose fittings for damage (Power Controlled Winch).

c. Carefully check all hydraulic hoses for damage (Power Controlled Winch).

d. Clean the mounting surfaces of the winch and tractor prior to mounting the winch.

LARGE O-RING



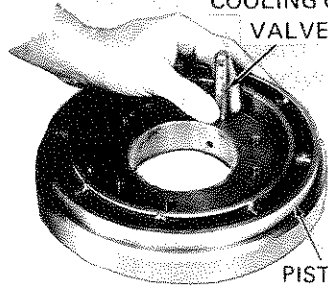
SMALL O-RING

STEP 1. Install two new O-rings.

Lubricate piston retainer cavity.

NOTE: It may be necessary to stretch large O-ring so it will stay in its groove when piston is installed.

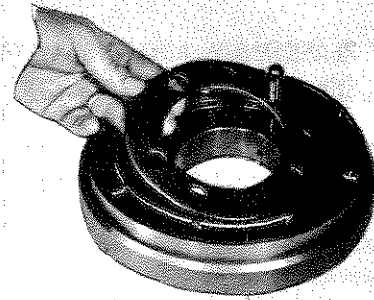
COOLING OIL VALVE



PISTON

STEP 2. Install piston and cooling oil valve. Tighten valve with special tool (See Fig. 5-24).

CAUTION: Do not insert any tool through valve body. It will damage spring.

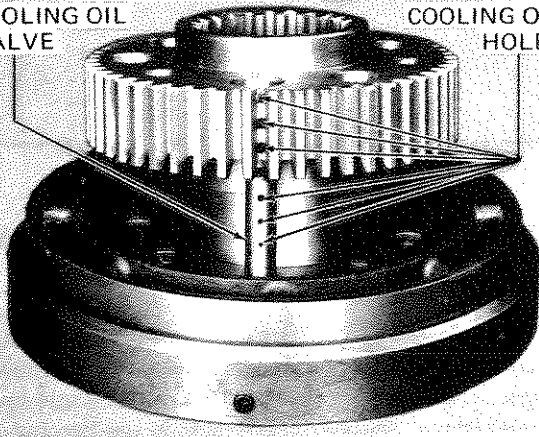


STEP 3. Install spring retainer with smooth side up.

NOTE: Holes are sequenced so spring retainer can only be installed as shown.

COOLING OIL VALVE

COOLING OIL HOLES



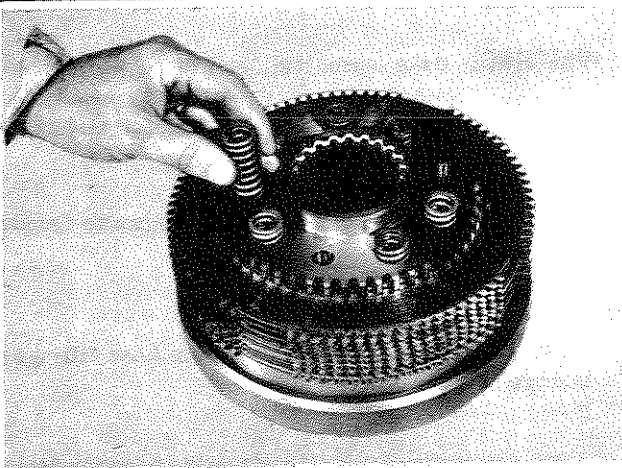
STEP 4. Install clutch hub.

CAUTION: Cooling oil holes in the clutch hub must align with the holes in cooling oil valve.

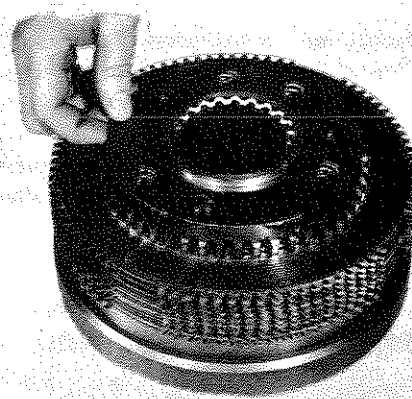


STEP 5. Place eight separator plates and eight friction discs ALTERNATELY on clutch hub.

CAUTION: Separator plate must be placed next to piston. Separator plates are slightly conical (dished). Install ALL the plates facing the same direction.



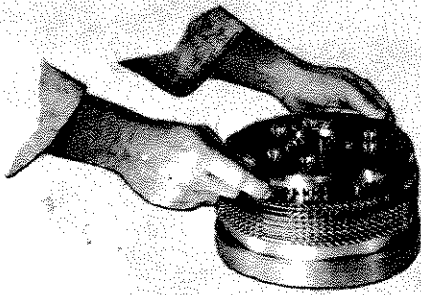
STEP 6. Install six release springs.



STEP 7. Install shim if required (See STEP 10.)

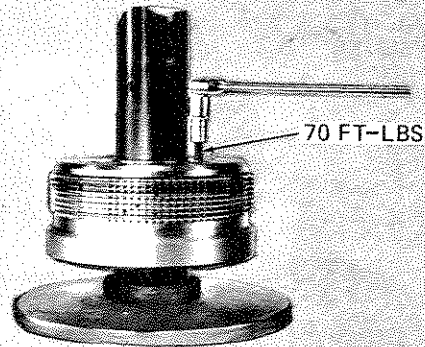
CAUTION: Holes are sequenced so shim can only be installed as shown.

Figure 5-16. Reassembly Of Clutch Assembly, Power Controlled Winch (Sheet 1 of 2)



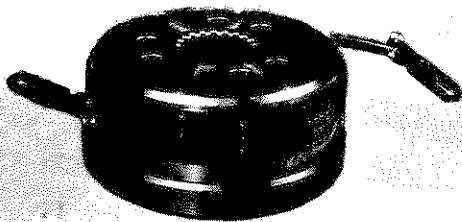
STEP 8. Install cover plate.

CAUTION: Holes are sequenced so cover plate can only be installed as shown.



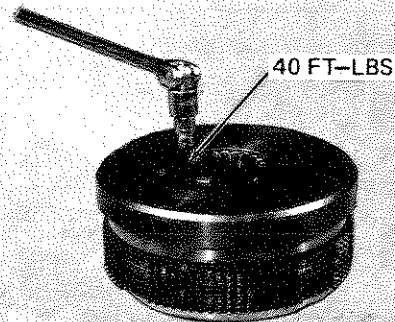
STEP 9. Install and tighten six special cap screws.

CAUTION: The press adapters should contact the hub only. Apply only enough pressure to prevent assembly from turning when cap screws are tightened.

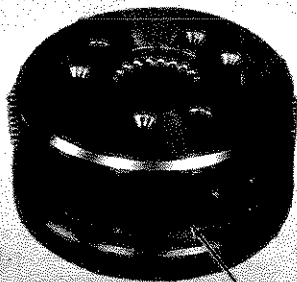


STEP 10. Measure distance between cover plate and top friction disc with two feeler gauges placed 180° apart as shown. Gap should be 0.085 to 0.125 inch. Add or delete shims as required to obtain correct clearance (see Step 7).

CAUTION: When only one feeler gauge is used, friction disc will tip slightly giving false clearance.

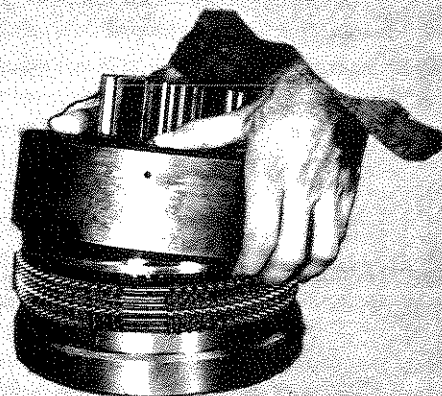


STEP 11. Tighten six set screws that lock the special cap screws.



ALIGN FRICTION DISC TEETH.

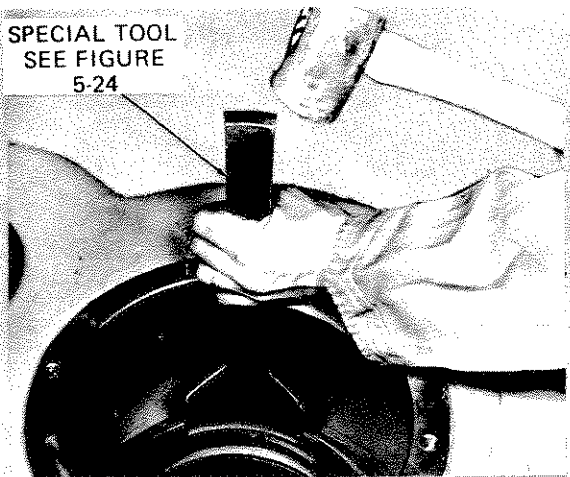
STEP 12. Align friction discs as shown.



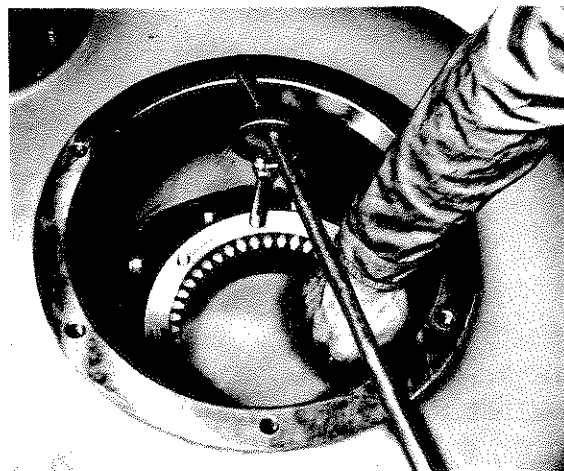
STEP 13. Carefully slide spider gear over clutch pack.

Figure 5-16. Reassembly Of Clutch Assembly, Power Controlled Winch (Sheet 2 of 2)

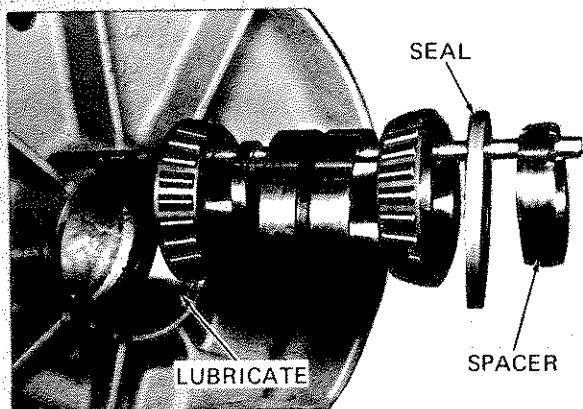
SPECIAL TOOL
SEE FIGURE
5-24



STEP 1. Lubricate seal bore with petrolatum or other suitable lubricant. Install double-lip seal with smooth side down. Use seal driver as shown to prevent seal distortion.

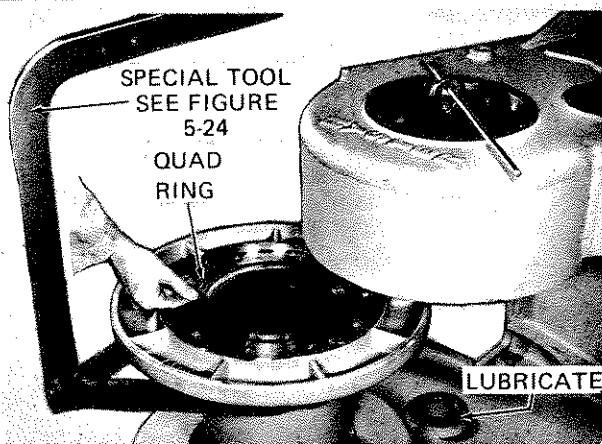


STEP 2. Install drum adapter by lifting it up through double-lip seal. Hold in place with bar and eyebolt as shown.



STEP 3. Lubricate drum bore with petrolatum, then install double-taper roller bearing, seal, and spacer as shown.

NOTE: Smooth side of seal must face inward



STEP 4. Lubricate left-hand drum shaft bore. Coat quad ring and groove with permatex or other suitable compound. Install quad ring, then place drum in position using special attachment.

STEP 5. Align adapter and drum holes, then install the 12 locking dowels and capscrews. Tighten securely to prevent quad ring from shifting.

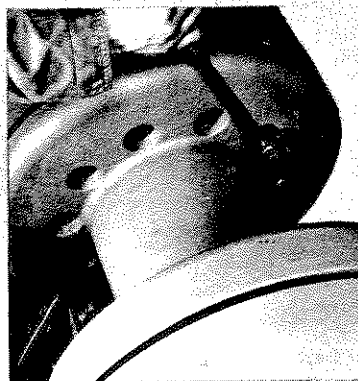
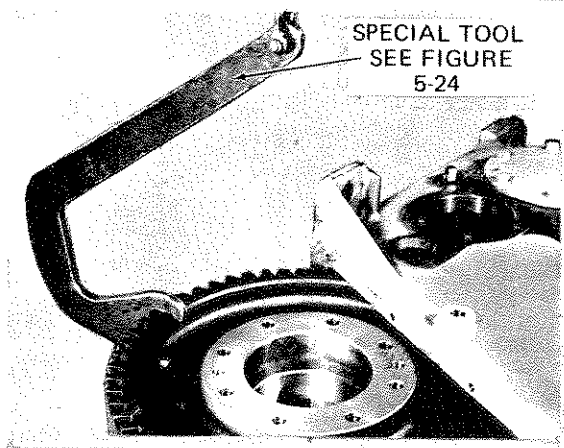
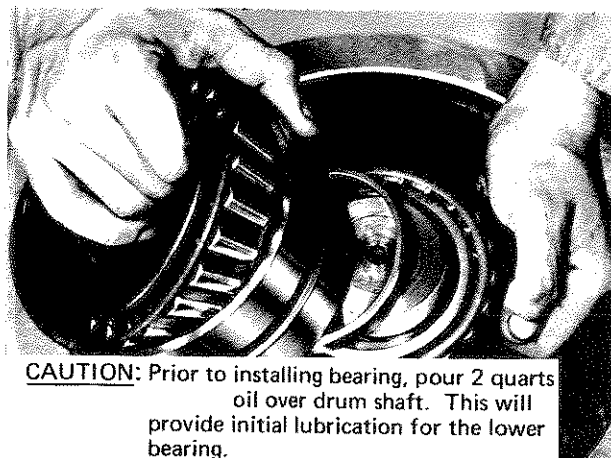


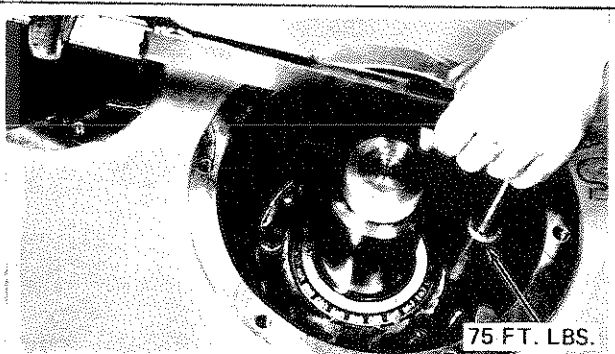
Figure 5-17. Installation Of Drum And Drum Shaft (Sheet 1 of 3)



STEP 6. Install drum gear using special attachment as shown.



STEP 8. Install bearing assembly. Install bearing parts in sequence shown. Tap into place.



STEP 9. Install retainer plate using the eight special cap screws. Tighten cap screws to 75 ft-lbs.

NOTE: Cap screws cannot be installed unless drum gear and drum adapter have been aligned as shown in Step 7.

STEP 7. Rotate drum gear to align match mark on gear with match mark on drum adapter. Make sure that double taper roller bearing, seal and spacer are properly seated in drum (see step 3). Lubricate drum shaft and drum gear bore, then install drum shaft using special attachment as shown. Remove sling and drive shaft down through drum gear until shaft bottoms solidly against lower taper roller bearing.

CAUTION: Hammer on special attachment only. Do not hammer on drum shaft surface.

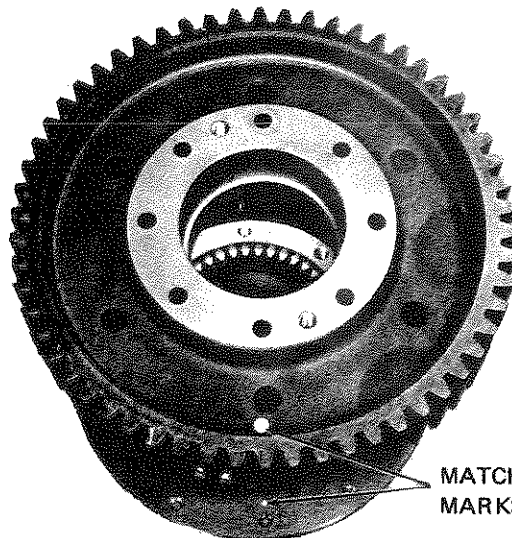
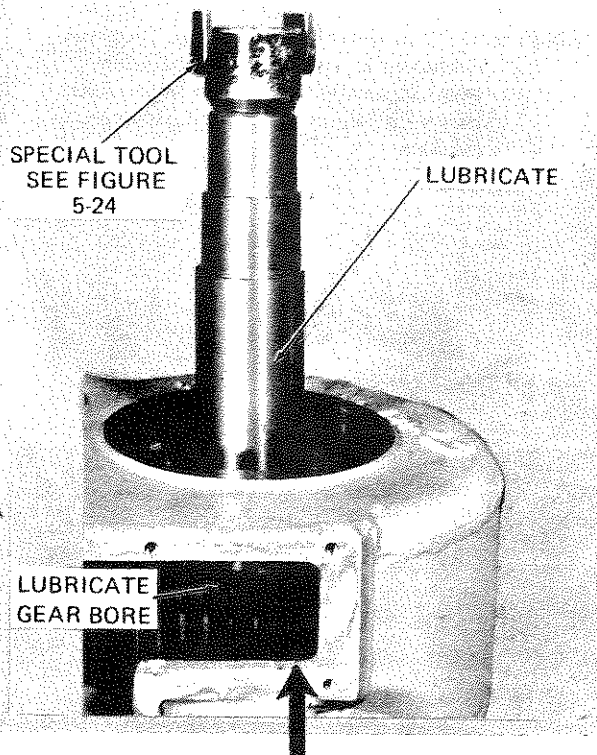
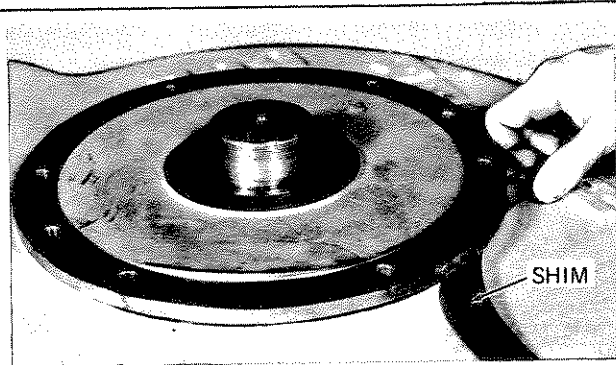
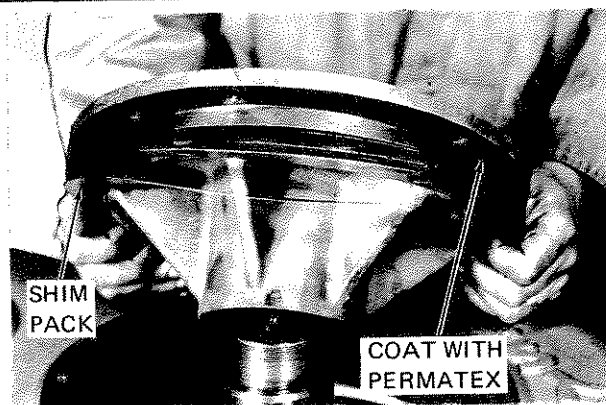


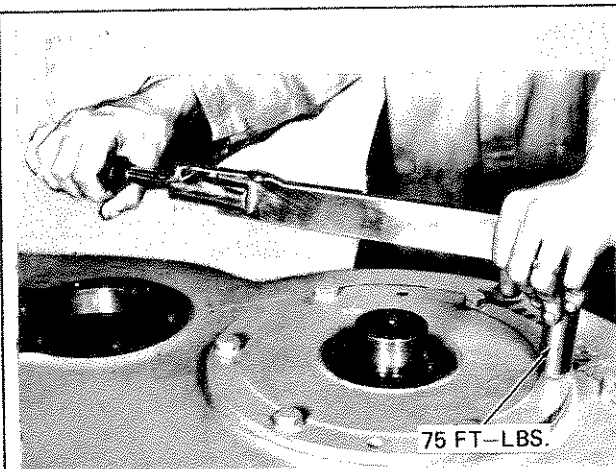
Figure 5-17. Installation Of Drum And Drum Shaft (Sheet 2 of 3)



STEP 10. Set bearing retainer into place. Determine shim pack by sliding segment of shim between retainer and winch frame. Add shims until slight drag is felt. Remove retainer.



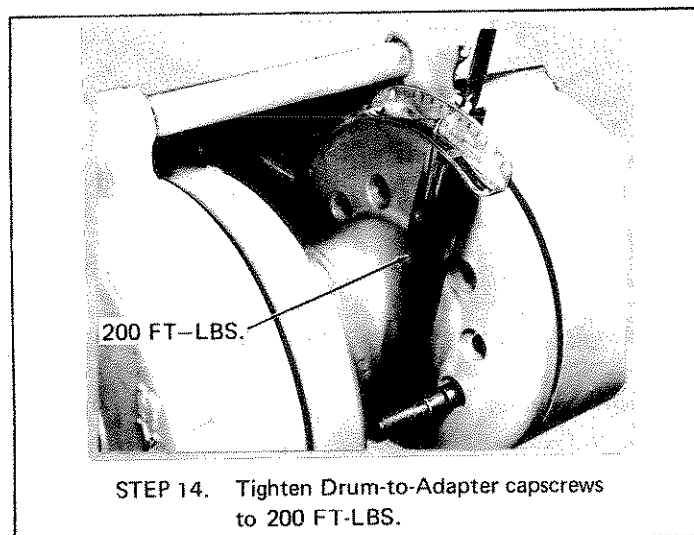
STEP 11. Coat winch frame and bearing retainer flange with permatex or other suitable sealing compound. Install shim pack (determined in Step 10).



STEP 12. Secure retainer using eight cap screws and lockwashers. Tighten cap screws to 75 ft-lbs.

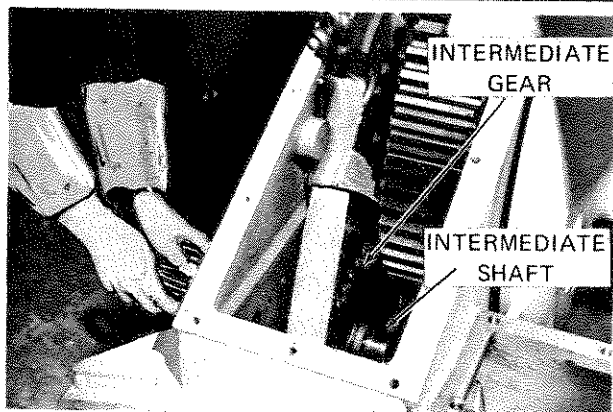


STEP 13. Coat locknut threads with permatex or other suitable sealing compound. Install nut and tighten securely as shown. Place winch in normal operating position and install locknut on opposite end of drum shaft.

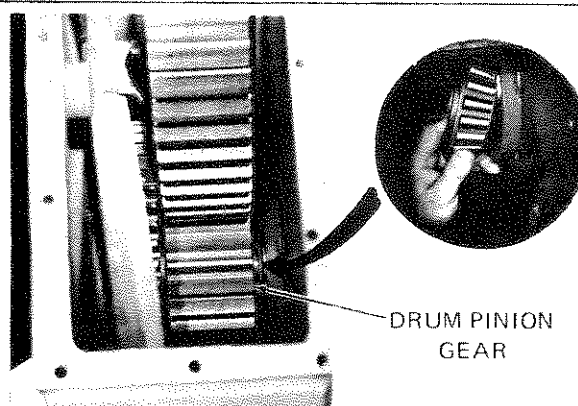


STEP 14. Tighten Drum-to-Adapter cap screws to 200 FT-LBS.

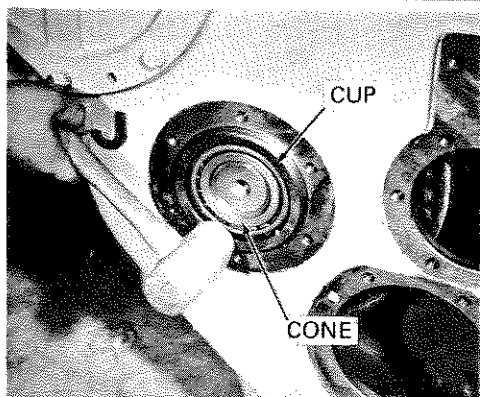
Figure 5-17. Installation Of Drum And Drum Shaft (Sheet 3 of 3)



STEP 1. Position intermediate gear in housing and install intermediate shaft far enough to support the gear.



STEP 2. Install the intermediate shaft bearing and drum pinion gear. Tap the shaft through the pinion gear and against the bearing.



STEP 3. Install the bearing cone (inner race) and bearing cup (outer race). Make sure that cup is firmly seated against the bearing cone.

STEP 4. Measure the distance from the face of the bearing cup to the winch housing. Add shim pack 0.004 to 0.007 inch greater than the measured distance. For example, if the measure distance is 0.004 inch, add a shim pack with a total thickness of 0.008 to 0.011 inch. This will allow 0.004 to 0.007 inch endplay of the shaft. Install bearing retainer.

NOTE: Shafts requiring a shim pack greater than 0.020 are not uncommon.

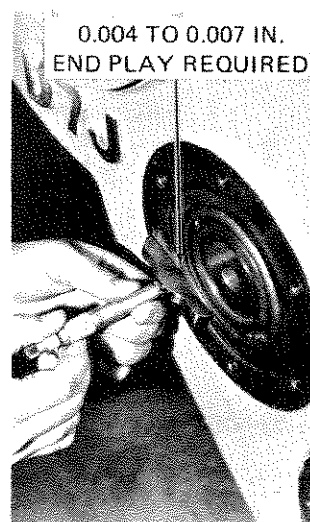
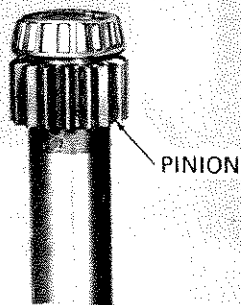
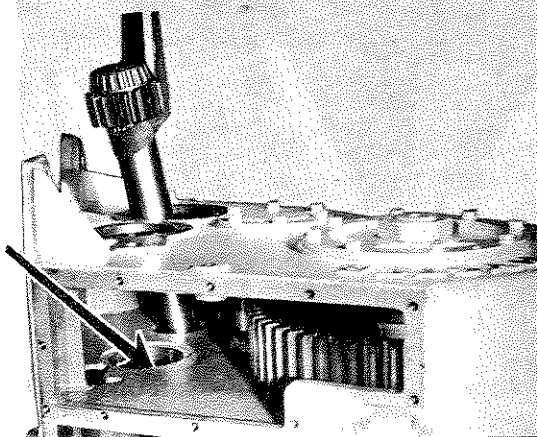
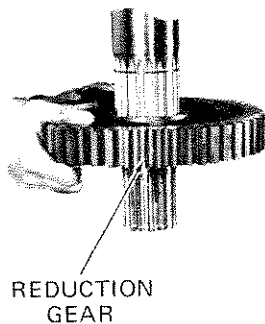


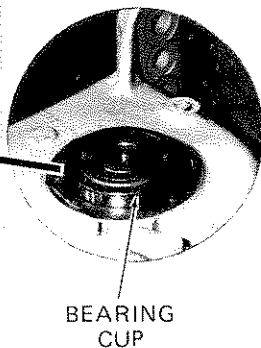
Figure 5-18. Installation Of Intermediate Shaft Assembly



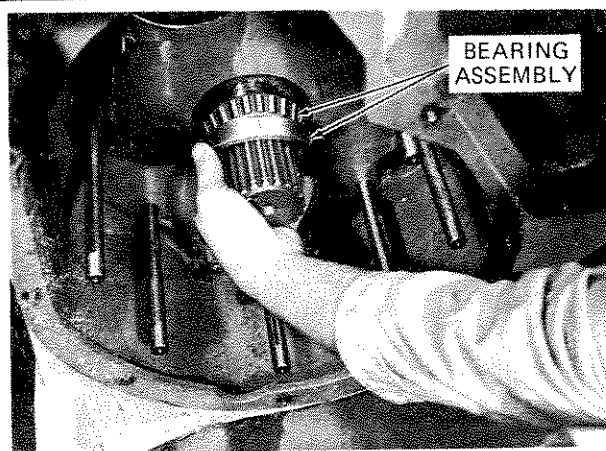
STEP 1. Press pinion and bearing on right-hand end of brake shaft.



STEP 2. Lower shaft into winch housing and install Reduction Gear.



STEP 3. Install bearing cup on right-hand end of shaft. Install retainer using three cap-screws only. Tighten capscrews snugly.



STEP 4. Set winch in normal operating position and install left-hand bearing assembly.

STEP 5. Install brake piston retainer (power controlled winch) or left-hand bearing retainer (direct drive winch). Tighten capscrews securely.

NOTE: On power controlled winch, oil brake piston retainer must be installed as shown. Use spacers on three studs so that nuts can be installed.

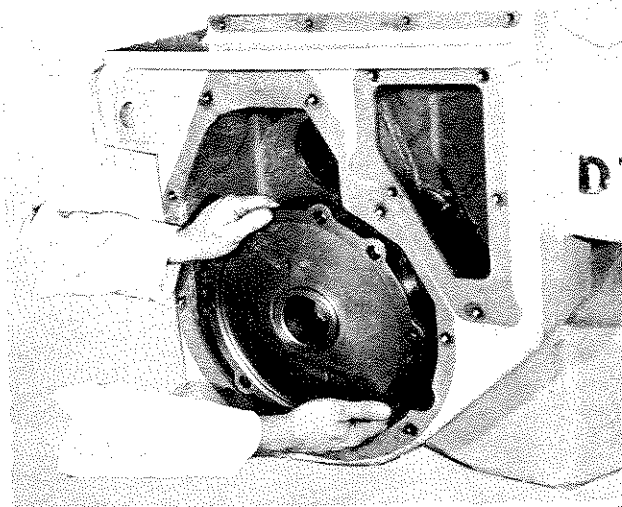


Figure 5-19. Installation Of Brake Shaft (Sheet 1 of 2)

STEP 6. ADJUST SHAFT ENDPLAY AS FOLLOWS:

- a. Using moderate pressure, tap right-hand bearing retainer to seat brake shaft components.
- b. Loosen the three capscrews previously installed in step 3 above. Tighten capscrews finger tight only.
- c. Measure gap between retainer and winch frame. Measure in three places around retainer. Add the three indications and divide by 3. This will give the average gap. Add shim pack 0.007 inch greater than the average gap. This will place 0.007 inch endplay on the brake shaft bearings.

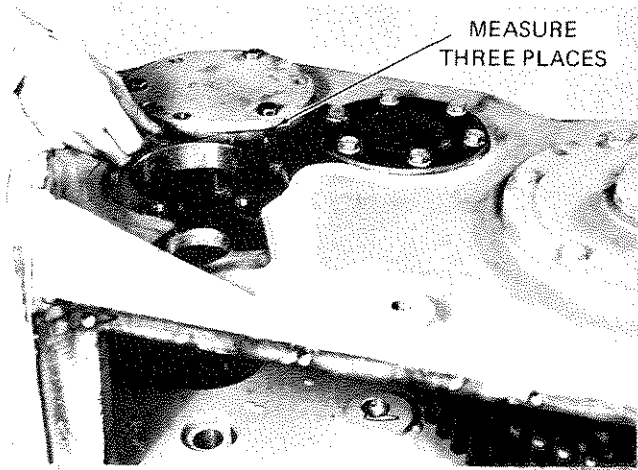


Figure 5-19. Installation Of Brake Shaft (Sheet 2 of 2)

e. Raise the winch and guide the PTO shaft into the tractor flange. Move the winch toward the tractor and align the PTO shaft splines with the tractor power take-off splines. Route the control cables through the anchor block on the control housing.

NOTE: Install two, top-inside nuts before the winch is completely pulled against the tractor.

f. Secure the winch in place using the eight 1-1/4 UNF nuts with lockwashers. Tighten the nuts alternately at each side of the winch to pull the winch evenly against the tractor. Final torque on the nuts should be 550 to 650 ft-lbs.

g. Install the transmission cover with gasket. Tighten cover capscrews to 40 ft-lbs.

h. For Power Controlled Winches, install the suction manifold as shown in figure 5-23.

i. Connect the hydraulic hoses (Power Controlled Winch) as shown in figure 5-2.

WARNING: Make sure that all hydraulic hose clamps are tightened securely.

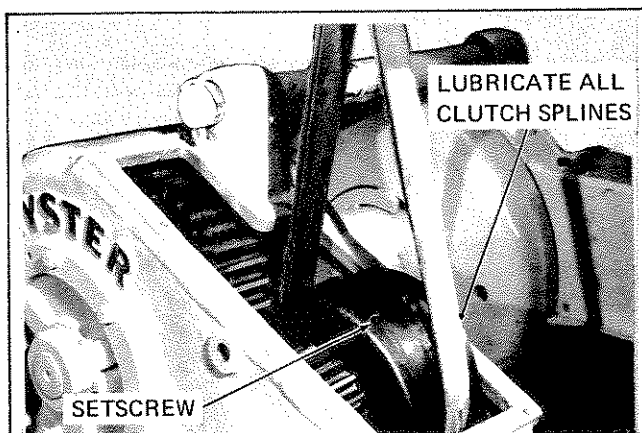
j. Adjust the control linkage as described in paragraph 4-9 or 4-23 depending upon the winch model.

5-58. INSTALLATION OF SUCTION MANIFOLD.

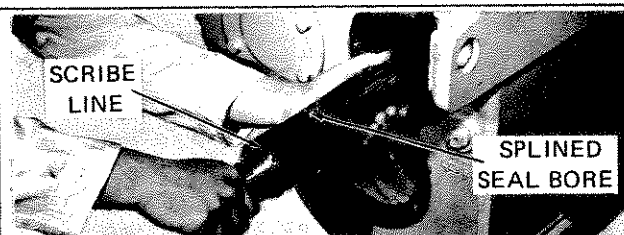
5-59. Installation of the suction manifold with filter used on Power Controlled Winches is shown in figure 5-23. Installation of the manifold should be performed after the winch is mounted on the tractor. Install new gaskets on the manifold cover and at the bottom of the suction manifold. Do not install used gaskets.

5-60. SPECIAL TOOLS.

5-61. Figure 5-24 contains a listing of tools required during repair of the winch.

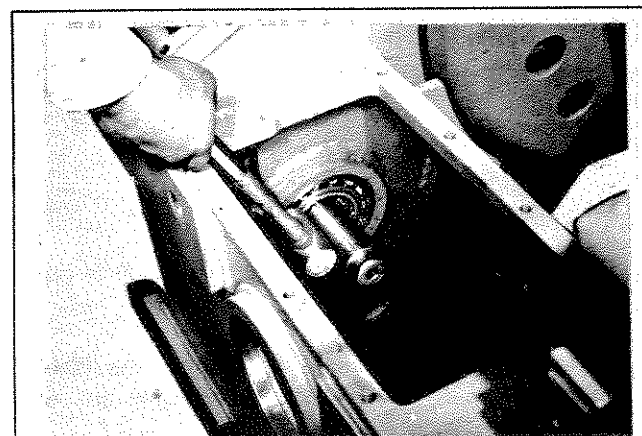


STEP 1. Lower reverse clutch assembly into housing. Rotate clutch assembly so that set-screw is at the top as shown.

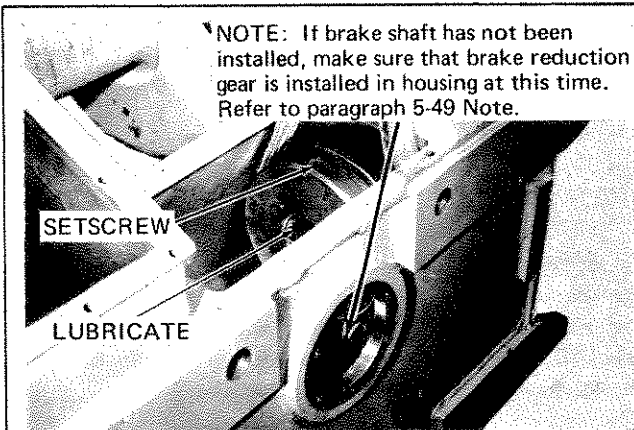


STEP 2. Position bevel gear shaft so that splined seal bore is directly in line with the set-screw at the top of reverse clutch assembly, then insert shaft. Make sure that scribe line on spline faces up. Lubricates entire shaft.

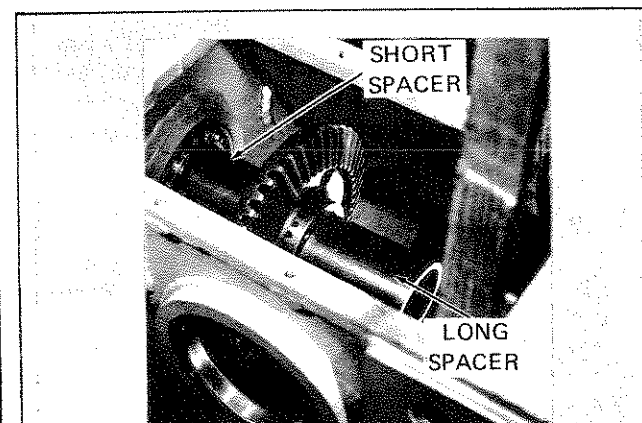
CAUTION: Make sure that the splined seals are removed before inserting the shaft. Splined seals may be damaged if installed at this time.



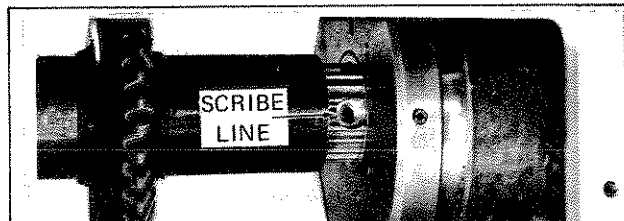
STEP 3. Install bearing. Make sure that bearing face is flush with winch frame.



STEP 4. Lower forward clutch assembly into housing as shown. Rotate clutch assembly so that setscrew is at the top as shown.



STEP 5. Install the two spacers and bevel gear.
NOTE: Bevel gear and spacers are shown in overwind position. Refer to Paragraph 4-19, for underwind.



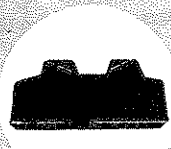
STEP 6. Tap bevel gear shaft through forward clutch assembly to position shown. Make sure that splined seal bore is aligned with setscrew at top of forward clutch assembly.

CAUTION: Splined seal bore and setscrew in clutch assembly must be exactly aligned. Mis-alignment of only one spline distance will impede flow of cooling oil during operation of the winch. Use scribe line on shaft spline for reference.

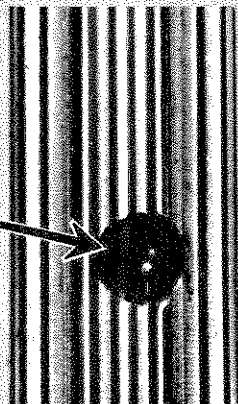
Figure 5-20. Reassembly And Installation Of Bevel Gear Shaft Assembly (Sheet 1 of 4)

(PART A)

INSTALL TWO SEALS
ON BOTTOM OF SHAFT.



NOTE: SEAL
CONFIGURATION



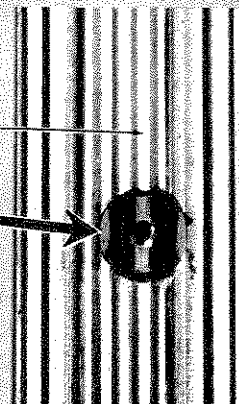
(PART B)

INSTALL TWO SEALS
ON TOP OF SHAFT.



NOTE: SEAL
CONFIGURATION

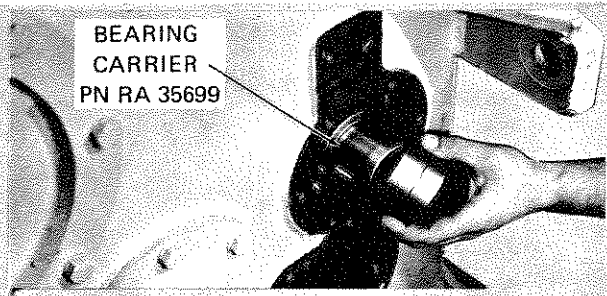
SCRIBE
LINE



STEP 7. Carefully insert the four splined seals.

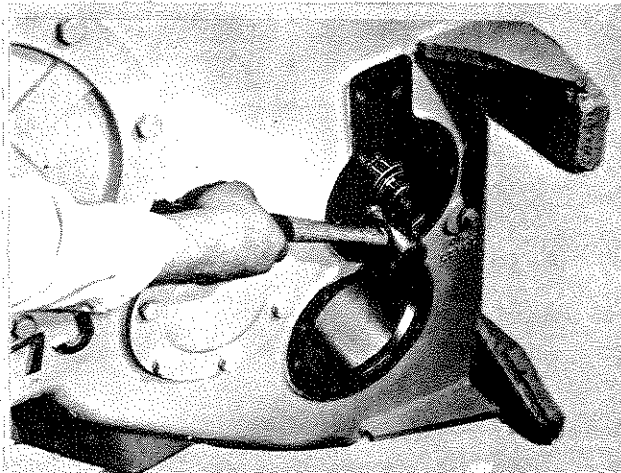
CAUTION: Lubricate spline seals prior to installation.

BEARING
CARRIER
PN RA 35699

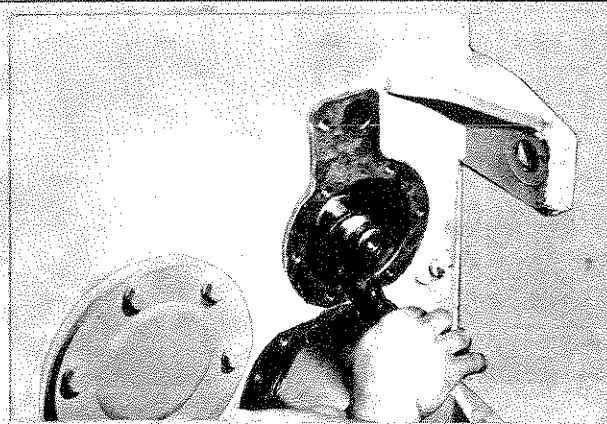


STEP 8. Carefully tap bevel gear shaft through the
clutch assemblies. Install bearing assembly on
right-hand end of gear shaft.

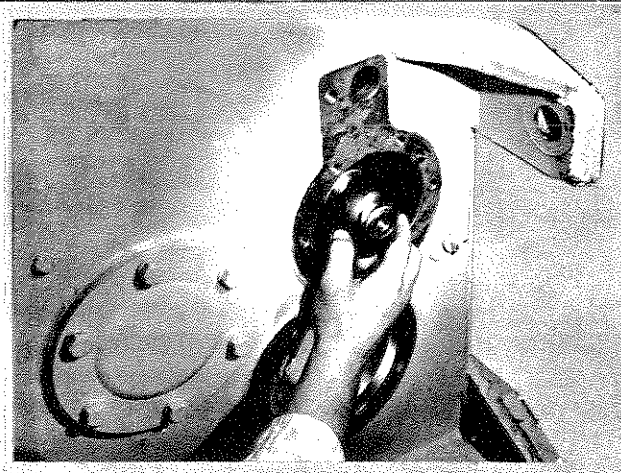
CAUTION: Bearing carrier Part Number RA35649 must
be installed on this end of the shaft. The
bearing carrier part number is stamped on
the end of the carrier flange.



STEP 9 Tap bearing assembly into reverse clutch pack.

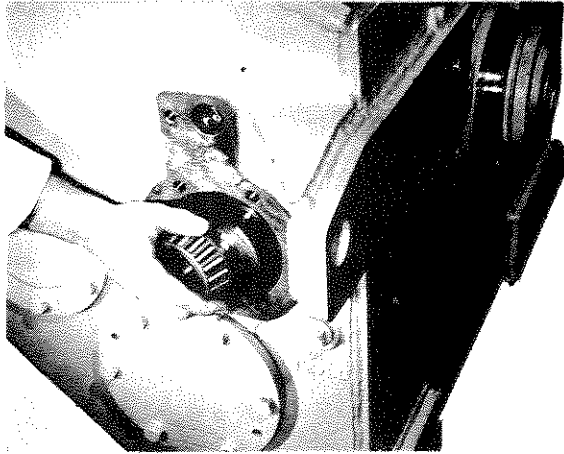


STEP 10. Install snap ring, making sure that it
is properly seated in the clutch
assembly groove.

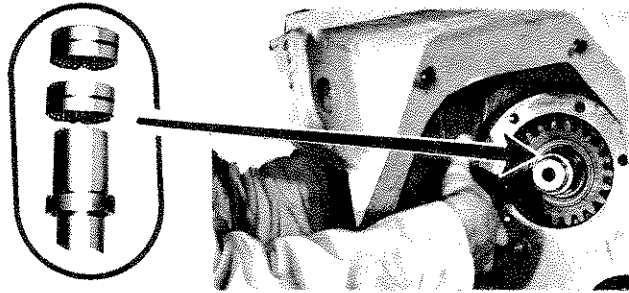


STEP 11. Install washer.

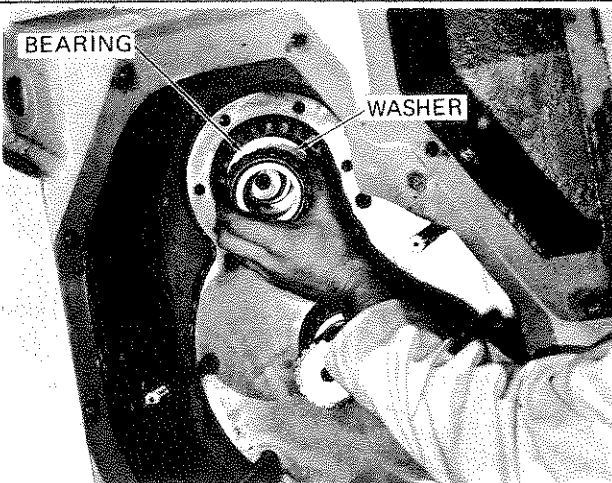
Figure 5-20. Reassembly And Installation Of Bevel Gear Shaft Assembly (Sheet 2 of 4)



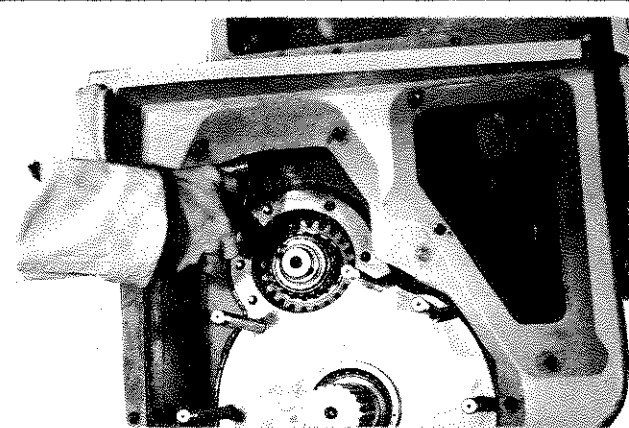
STEP 12. Install bearing.



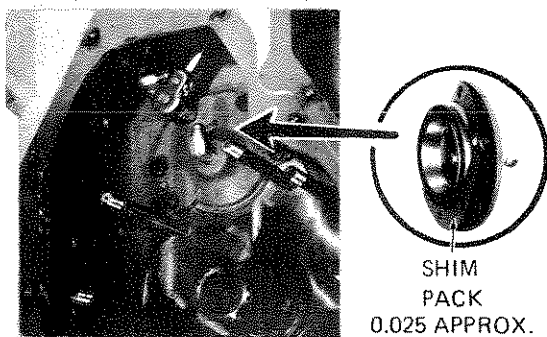
STEP 13. Install bearing assembly on left-hand end of shaft, then install snap ring.
NOTE: If sufficient clearance cannot be obtained for installing the snap ring, the bearing carriers may be installed incorrectly. Check the carrier part numbers. See step 8.



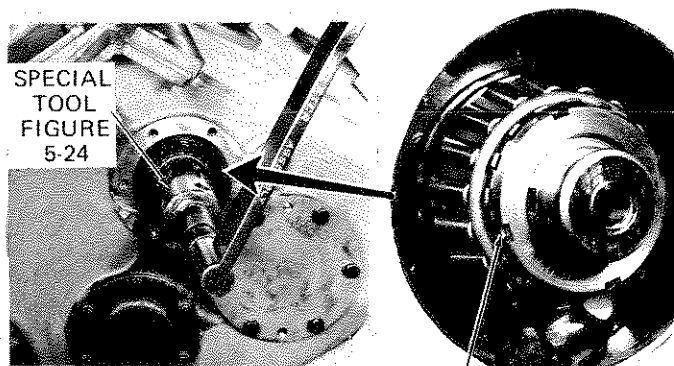
STEP 14. Install washer and bearing.



STEP 15. Tap bearing against clutch assembly, then install snap ring.

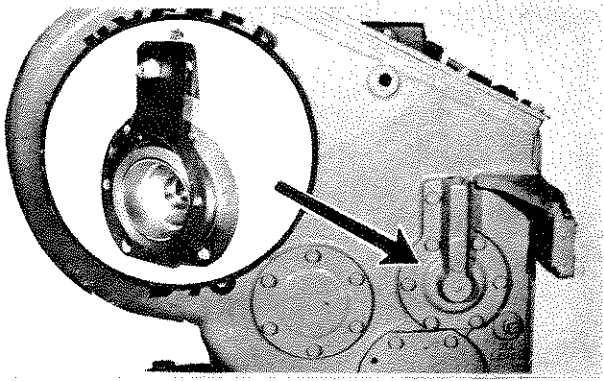


STEP 16. Install approximately 0.025 inch shim pack on left-hand bearing retainer, then install retainer. Tighten capscrews securely. Final torque at this time is not necessary.

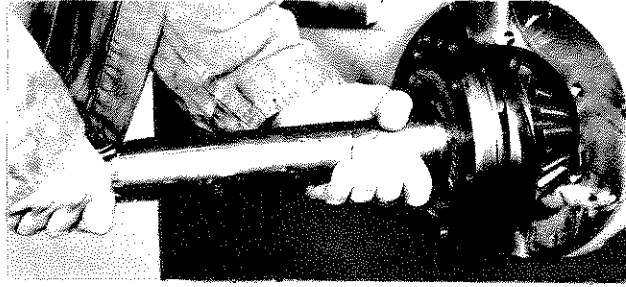


(BEND TANGS ON LOCKWASHER)
STEP 17. Install lockwasher and locknut on right-hand end of gear shaft. Tighten locknut to 200 ft-lbs. Bend lockwasher tangs over flats of locknut.

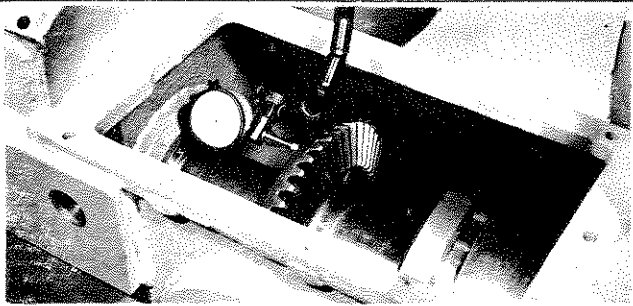
Figure 5-20. Reassembly And Installation Of Bevel Gear Shaft Assembly (Sheet 3 of 4)



STEP 18. Install approximately 0.040 shim pack on right-hand bearing retainer and install retainer. Tighten capscrews securely. Final torque at this time is not necessary.

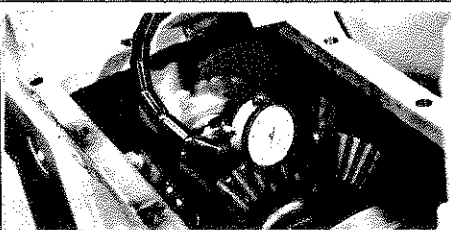


STEP 19. Install approximately 0.025 inch shim pack on PTO shaft and install shaft. Tighten capscrews securely. Check that PTO pinion teeth are positioned in the center of bevel gear teeth. Add or subtract shims at PTO shaft to center gear teeth. Tighten capscrews to 75 ft-lbs.



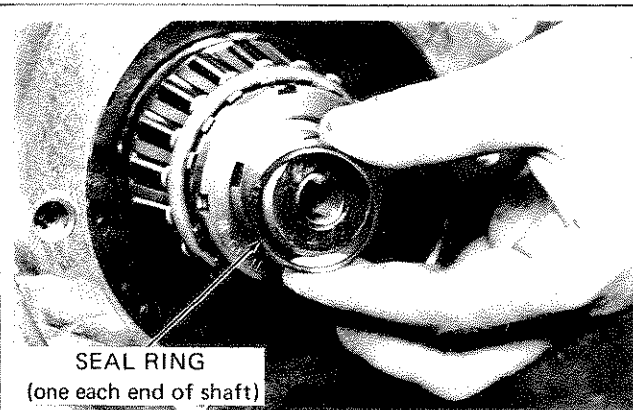
STEP 20. Connect dial indicator as shown to check bevel gear shaft preload. Add or subtract shims from the two bearing retainers to obtain zero endplay as indicated on dial indicator. When zero endplay is obtained, subtract 0.004 inch shim from either the right-hand or left-hand bearing retainer.

NOTE: Adding or subtracting shims from these retainers will effect pinion-to-bevel gear backlash. See step 21.



NOTE: Before checking backlash, place a pry-bar between the forward clutch pack and winch frame. Apply medium pressure to move gear-shaft toward right-hand side of winch. This will place bevel gear in normal operating position. The bevel gear tends to move toward the right-hand side of winch when turned by PTO pinion during winch operation.

STEP 21. Connect dial indicator as shown to check pinion-to-bevel gear backlash. Backlash should be 0.008-0.012 inch. If less than 0.008, remove shims from right-hand bearing retainer as required. Add same amount to retainer at opposite end of shaft to maintain preload. If greater than 0.012, remove shims from left-hand retainer as required. Add same amount to right-hand retainer to maintain preload.

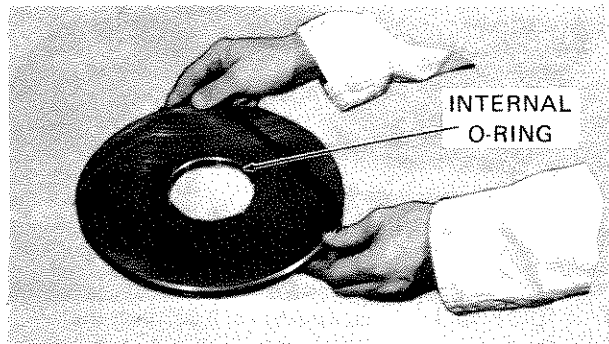


SEAL RING
(one each end of shaft)

STEP 22. Remove right-hand and left-hand bearing retainers, then install two cast-iron seal rings. Re-install retainers (with shims) and tighten capscrews to 75 ft-lbs.

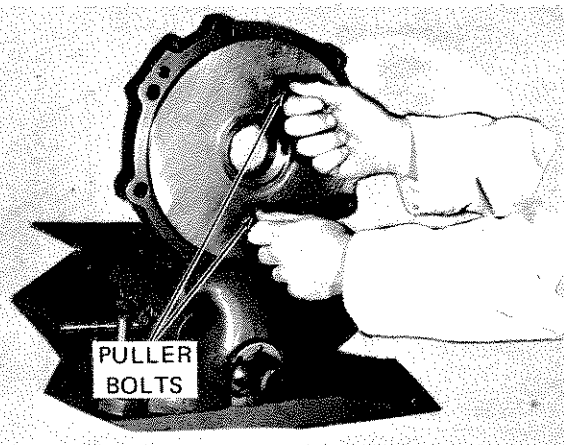
CAUTION: Use care when expanding seal rings. Seal ring material is fragile and breaks easily.

Figure 5-20. Reassembly And Installation Of Bevel Gear Shaft Assembly (Sheet 4 of 4)

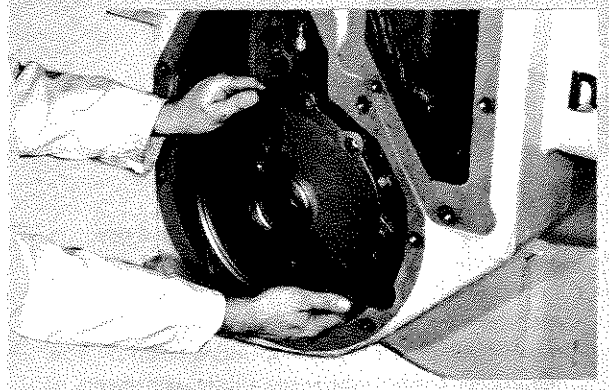


STEP 1. Install two new o-rings in piston. It may be necessary to stretch internal o-ring to hold it in place until piston is installed in piston housing.

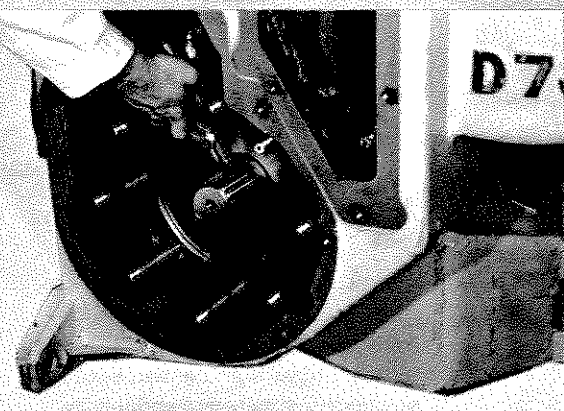
CAUTION: Use only Hyster Approved o-rings to ensure proper sealing.



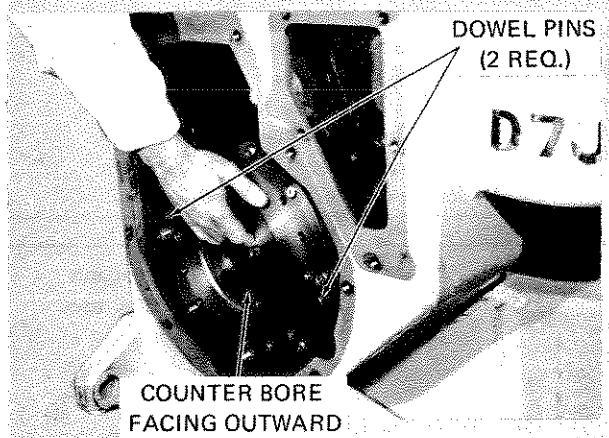
STEP 2. Install piston in housing, then remove puller bolts.



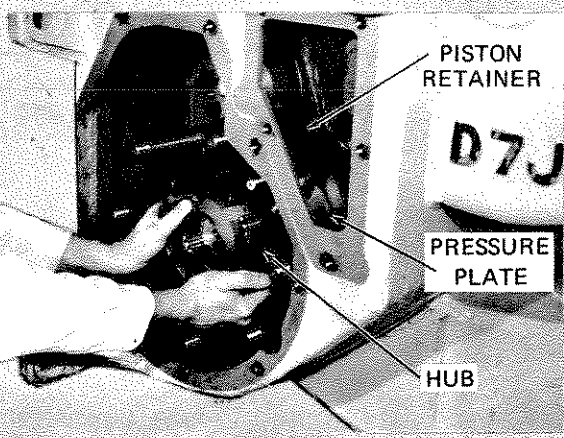
STEP 3. Install assembled piston retainer
NOTE: Make sure that bearing on brake shaft is properly positioned before installing retainer.



STEP 4. Install snap ring
CAUTION: Make sure that snap ring is securely positioned in brake shaft groove.

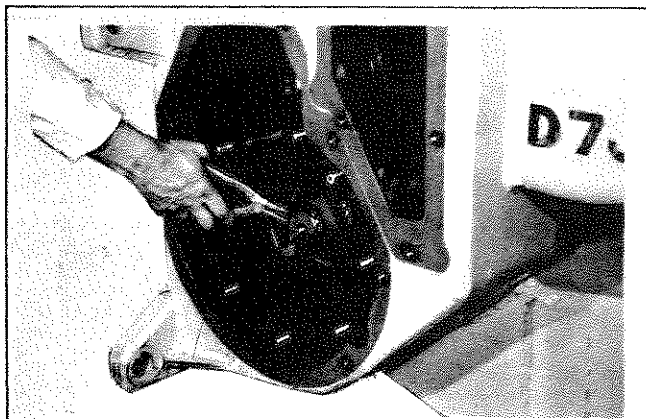


STEP 5. Install pressure plate. Push plate against piston retainer. Then install dowel pins.



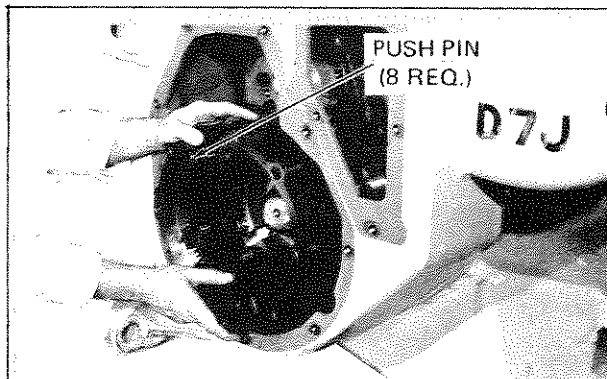
STEP 6. Install hub as shown.
CAUTION: Do not reverse hub.

Figure 5-21. Reassembly And Installation Of Oil Brake Assembly, Power Controlled Winch (Sheet 1 of 2)



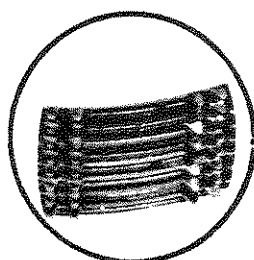
STEP 7. Install snap ring.

CAUTION: Make sure that snap ring is securely positioned in brake shaft groove.



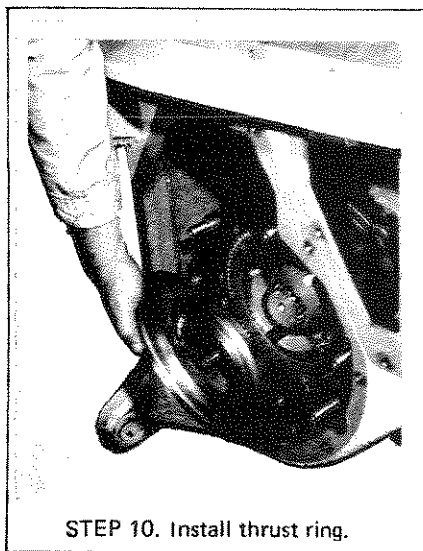
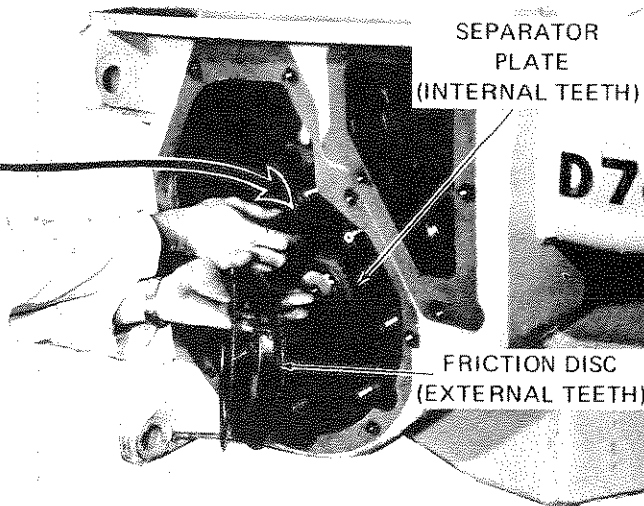
STEP 8. Install cage against pressure plate. Then install eight push pins.

NOTE: Holes in cage are sequenced so that cage can only be installed as shown.

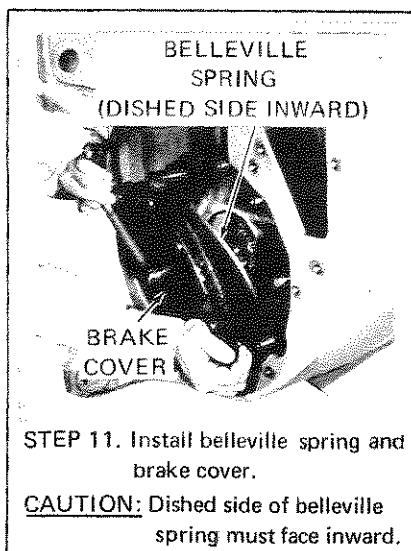


STEP 9. Install the 11 friction discs and 10 separator plates **ALTERNATELY** starting with a friction disc. align friction disc slots as shown.

CAUTION: Separator plates are conical (dished) Face all separator plates in the same direction. All dished sides must face either inward or outward.

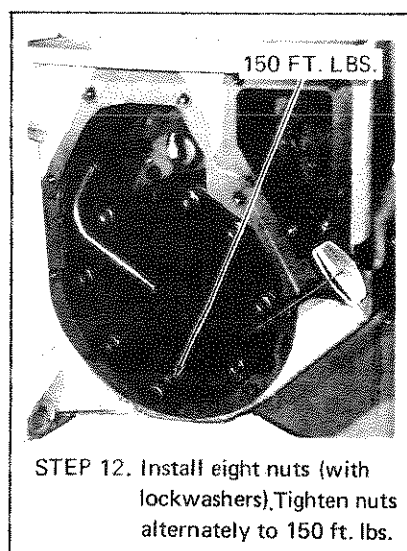


STEP 10. Install thrust ring.



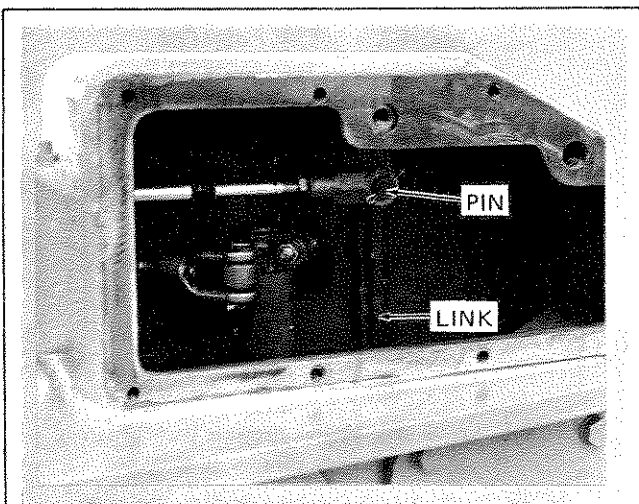
STEP 11. Install belleville spring and brake cover.

CAUTION: Dished side of belleville spring must face inward.

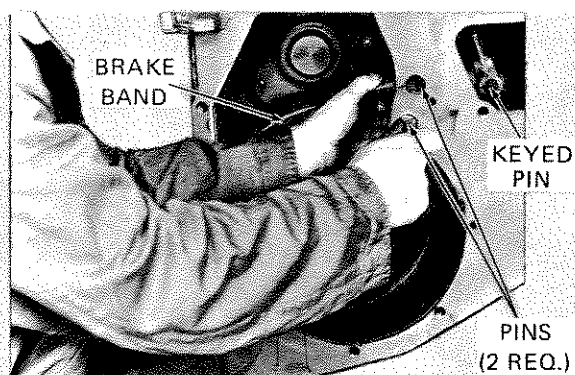


STEP 12. Install eight nuts (with lockwashers). Tighten nuts alternately to 150 ft. lbs.

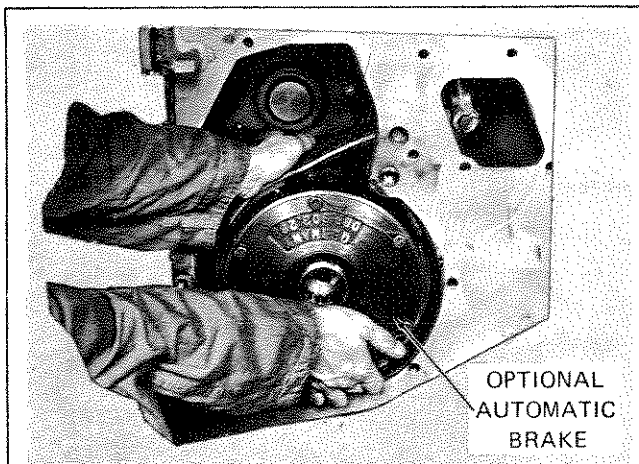
Figure 5-21. Reassembly And Installation Of Oil Brake Assembly, Power Controlled Winch (Sheet 2 of 2)



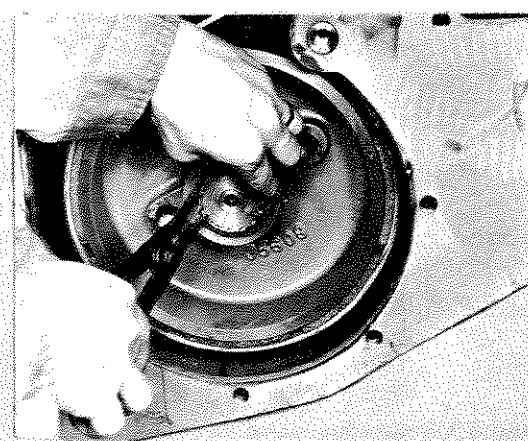
STEP 1. Install brake link and pin.



STEP 2. Install brake band and the three pins.
CAUTION: Refer to paragraph 4-17 or 4-21 for correct pin and band arrangement (overwind or underwind)



STEP 3. Slide brake wheel onto brake shaft (optional automatic brake shown).



STEP 4. Install snap ring on brake shaft. Adjust brake linkage as described in paragraph 4-12.

Figure 5-22. Installation Of Dry Brake And Automatic Brake, Direct Drive Winch

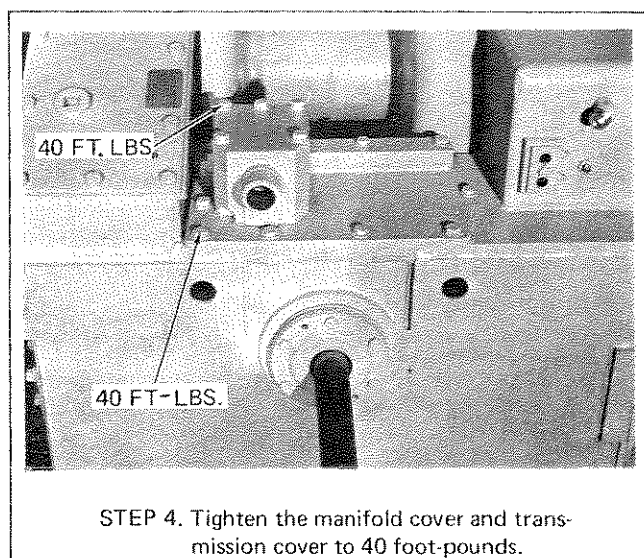
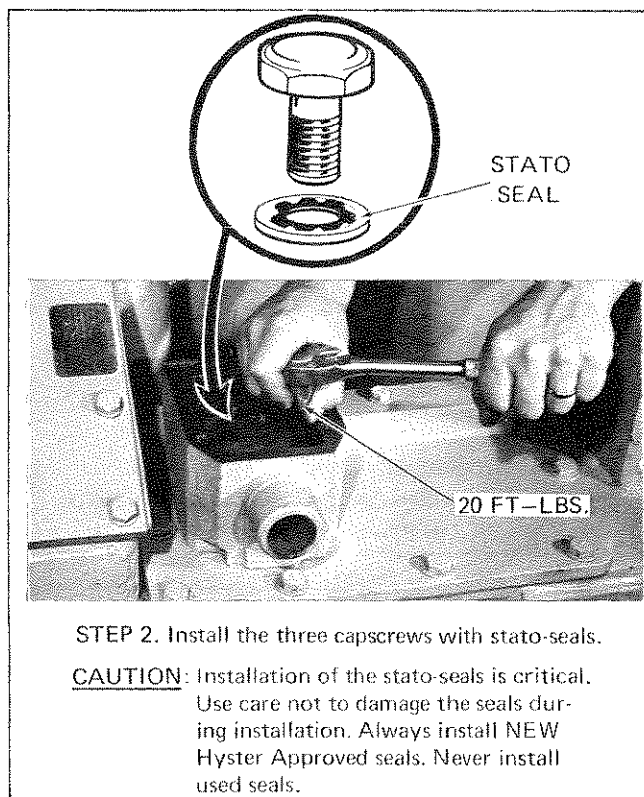
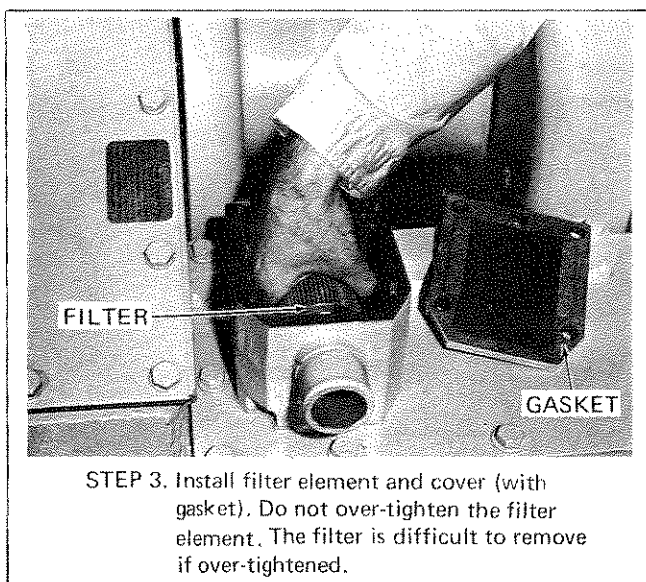
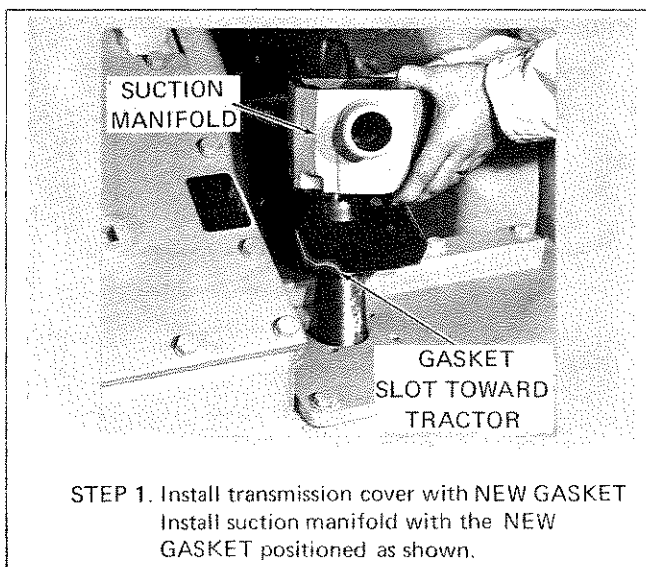
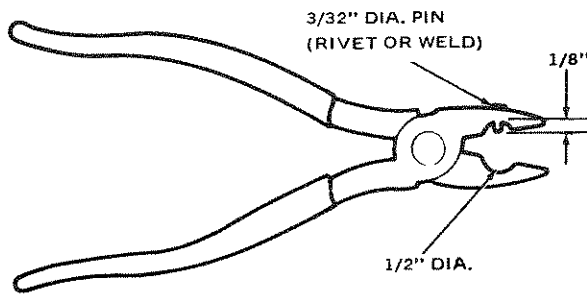


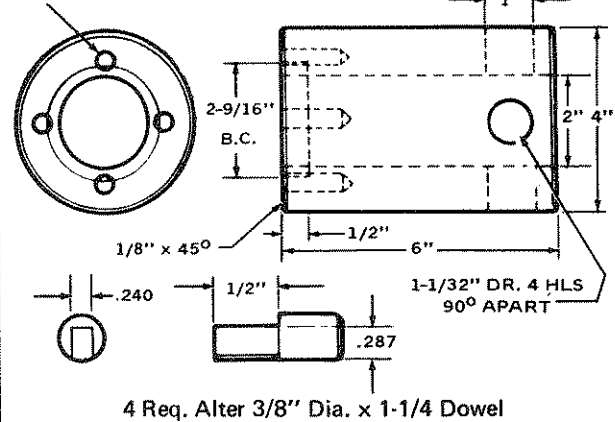
Figure 5-23. Installation Of Suction Manifold, Power Controlled Winch

Note: Modify Lineman's Plier As Shown.

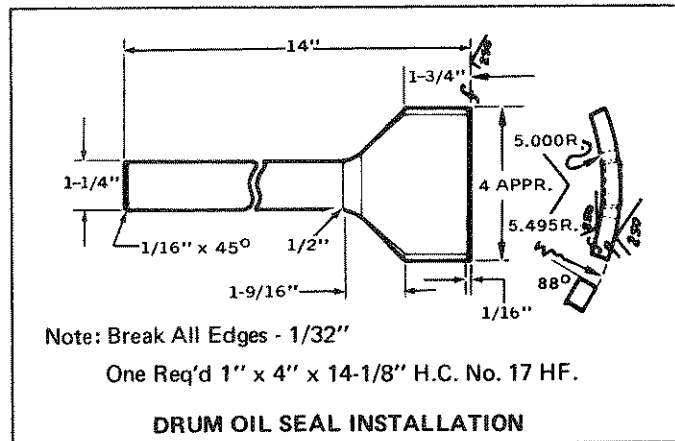


CLUTCH COOLING OIL VALVE REMOVAL AND INSTALLATION (Power Controlled Only)

3/8 RM. P.F. 4HLS On 2-9/16" B.C.



BEVEL GEAR SHAFT LOCKNUT REMOVAL AND INSTALLATION (Power Controlled Only)



DRUM OIL SEAL INSTALLATION

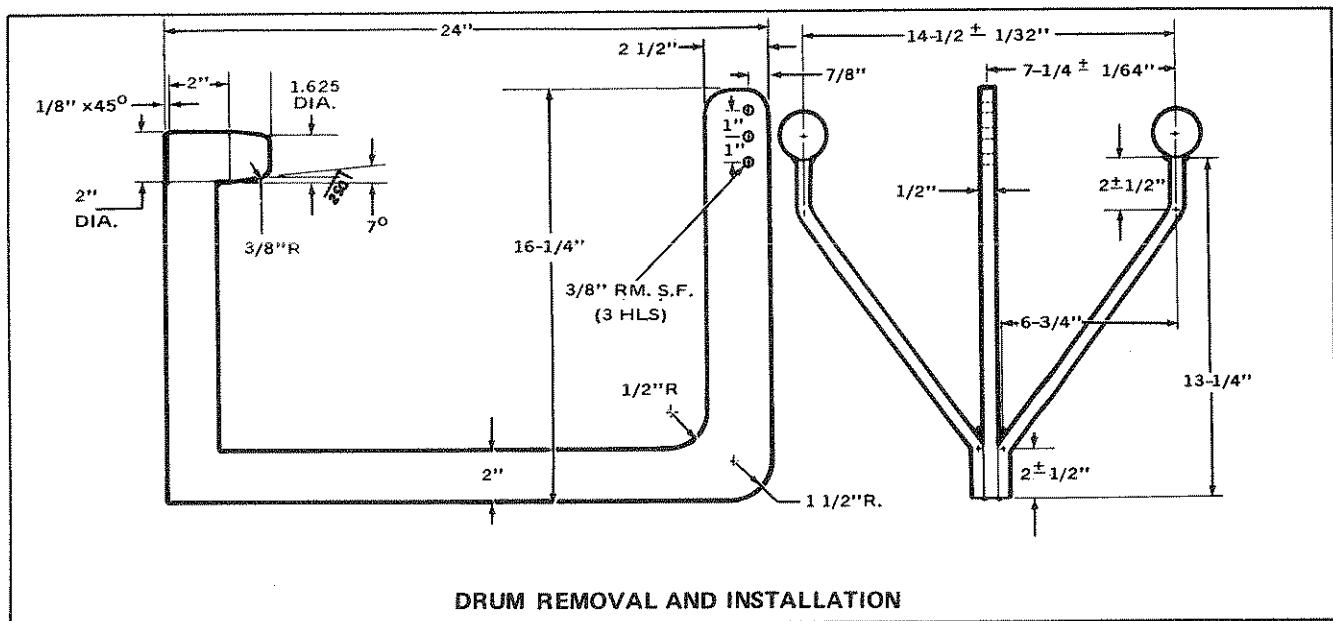
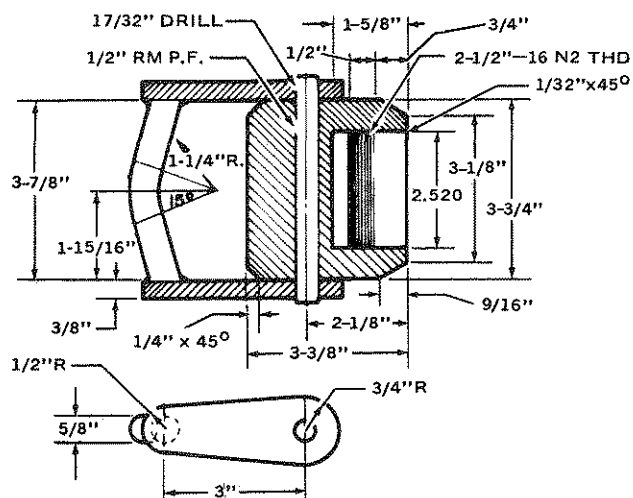
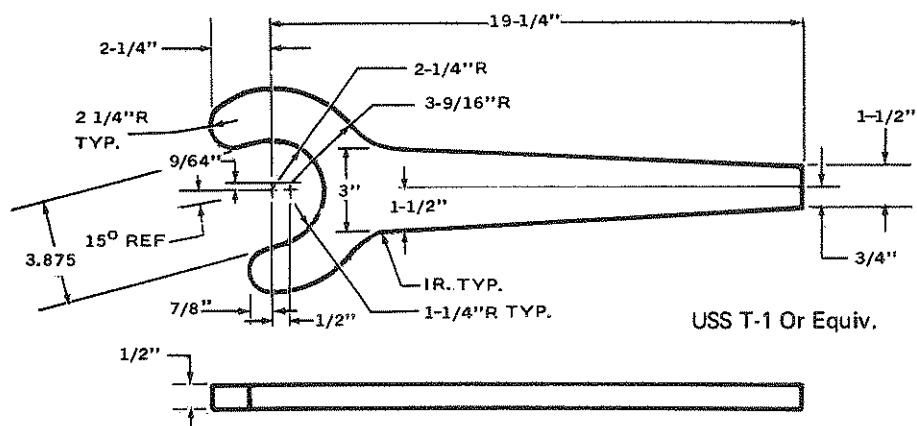


Figure 5-24. Special Tools (Sheet 1 of 2)



DRUM SHAFT REMOVAL AND INSTALLATION



DRUM SHAFT NUT REMOVAL AND INSTALLATION

Figure 5-24. Special Tools (Sheet 2 of 2)

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