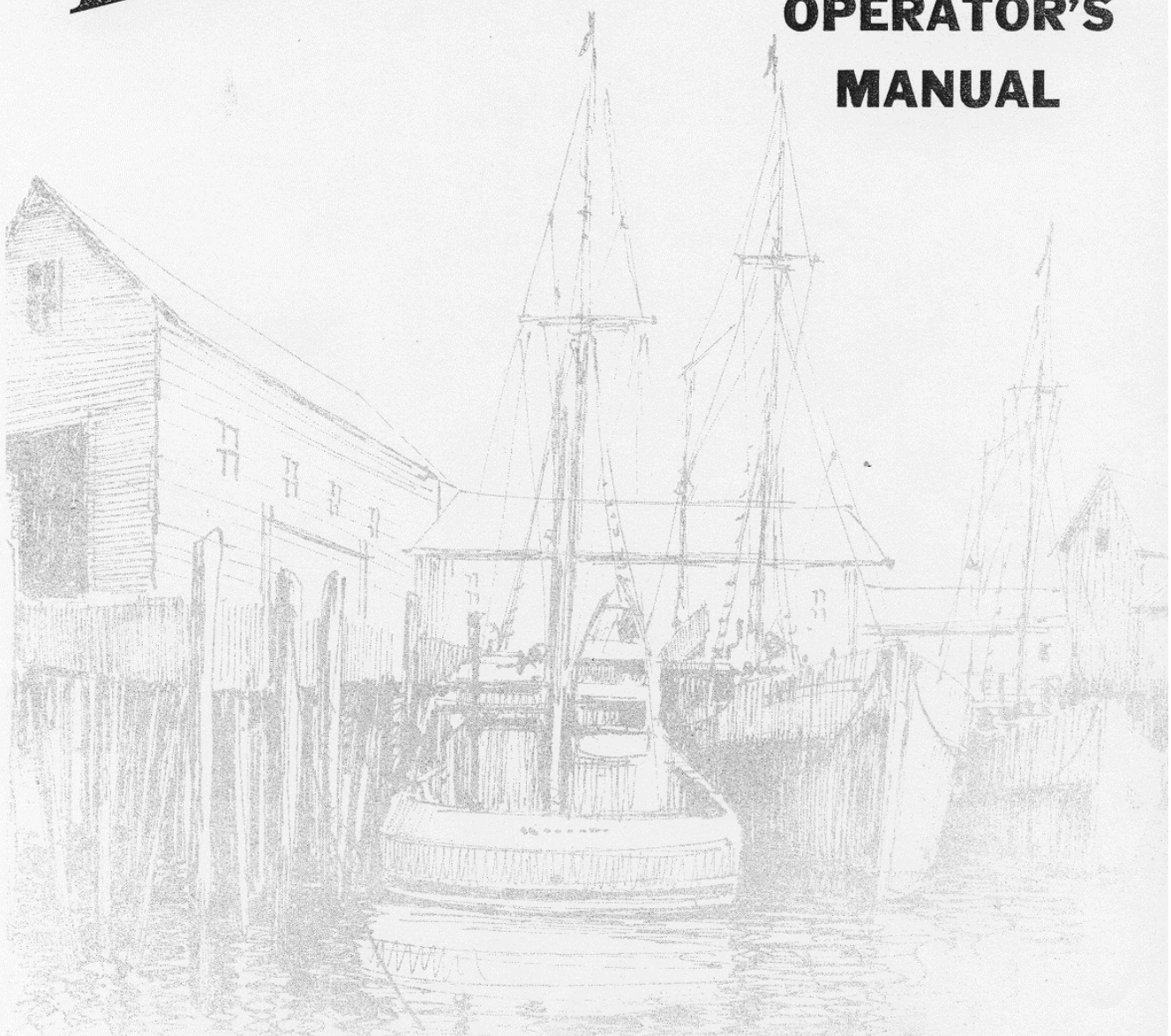
Paragon®

OPERATOR'S MANUAL



HYDRAULIC TRANSMISSIONS

Models P 200, P 300, P 400

PARAGON GEAR WORKS INC., TAUNTON, MASS., U.S.A.

OPERATOR'S MANUAL

FOR

PARAGON

MODELS P200 - P300 - P400

HYDRAULIC TRANSMISSIONS

TABLE OF CONTENTS

I. SPECIFICATIONS

A. Description Chart

MODEL P200	MODEL P300	MODEL P400	REDUCTION RATIO	DIRECTION OF ROTATION
P21R	P31R	P41R	DIRECT	RIGHT
P21L	P31L	P41L	DIRECT	LEFT
P22R	P32R	P42R	1.5:1	RIGHT
P22L	P32L	P42L	1.5:1	LEFT
P23R	P33R	P43R	2.0:1	RIGHT
P23L	P33L	P43L	2.0:1	LEFT
P24R	P34R	P44R	2.5:1	RIGHT
P24L	P34L	P44L	2.5:1	LEFT
P25R	P35R	P45R	3.0:1	RIGHT
P25L	P35L	P45L	3.0:1	LEFT

B. Model and Serial Numbers

Each reverse gear has a model number and a serial number. These numbers are on the name plate, located on the housing of the transmission.

MODEL AND SERIAL NUMBER CHART

DIRECT DRIVE MODEL AND SERIAL NUMBERS

REDUCTION GEAR MODEL AND SERIAL NUMBERS

II. INTRODUCTION

The Models P200, P300 and P400 hydraulic transmissions have been designed for smooth operation and dependability in marine use. The transmission is self-contained, having an oil pressure system and oil supply completely separated from engine lubricating oil systems.

Transmission oil under pressure is used to engage a forward or reverse drive. The forward drive is through a multiple disc clutch arrangement, while the reverse drive utilizes a reverse clamp band and planetary gear train. The transmission oil is circulated and cooled through a separate external oil cooler core, which is in turn cooled by the engine water. Paragon transmissions are furnished with either direct drive or reduction gears. Gear reduction ratios and corresponding model identification numbers are listed in Section I, under "SPECIFICATIONS".

III. INSTALLATION

A. The installation instructions below are for use when the original transmission has been removed for servicing and must be re-installed, or when the transmission unit is to be adapted as non-original equipment to a marine engine.

B. It is important that the engine and transmission rotations are matched. The direction of rotation of an engine is defined in this manual as the direction of rotation of the engine crankshaft as viewed from the output end of the transmission. A clockwise rotation of the engine is a right hand rotation and a counterclockwise rotation of the engine is a left hand rotation.

   A letter "R" or "L" appearing on the transmission serial number plate illustrated in Section I, "SPECIFICATIONS", indicates whether the transmission is for use with a right or left hand rotating engine.

C. The hydraulic transmission is attached to the engine in the following manner:

   1. Insert two 3-1/2" studs in opposite transmission mounting holes in the engine adapter plate.

   2. Place the transmission against the studs so that the studs go through two of the matching holes in the transmission housing flange.

   3. Slide the transmission along the studs toward the engine so that the spline on the shaft at the front of the transmission enters the matching splined hole in the engine vibration dampener.

   4. Install and tighten four bolts with lockwashers through the transmission housing flange into the engine adapter plate. Remove the 3-1/2" studs. Install and tighten the two remaining bolts with lockwashers through the transmission housing flange.

D. The transmission and propeller shaft coupling must be carefully aligned before the propeller shaft is connected to the transmission, in order to avoid vibration and consequent damage to the transmission, engine, and boat hull during operation. To align the coupling, move the propeller shaft, with attached coupling flange, toward the transmission so that the faces of the propeller shaft coupling flange and transmission shaft coupling flange are in contact. The coupling flange faces should be in contact throughout their entire circumference. The total runout or gap between the faces should not exceed .002" at any point. If the runout exceeds .002", reposition the engine and attached transmission by loosening the engine support bolts and adding or removing shims to raise or lower either end of the engine. If necessary, move the engine sideways to adjust the runout or to align the coupling flange faces laterally. Tighten the engine support bolts and recheck the alignment of the coupling before bolting the coupling flanges together. Connect the coupling flanges with bolts, lockwashers, and nuts.

E. Connect the oil cooler lines to the transmission.

F. Connect the shift control cable from the cockpit control station to the transmission control valve lever, shown in Figure on page 5. Place the transmission control valve lever in the neutral position and

adjust the shaft control cable length until the cockpit control station hand lever is in the neutral position. Move the cockpit control hand lever to forward and reverse positions several times while observing the transmission control valve lever motion. The transmission control valve lever should move fully into forward or reverse position when the hand lever is moved into forward or reverse position, and should return exactly to the neutral position when the hand lever is in the neutral position.

G. Remove the oil dipstick, shown in Figure on page 5, and fill the transmission with Type A transmission fluid to the mark on the dipstick. Replace the dipstick in the transmission housing.

IV. OPERATION

Principle of Operation

The transmission forward and reverse drives are operated by transmission oil under pressure. An internal gear type oil pump delivers the transmission oil, under pressure, to the external oil cooler. The transmission oil is returned, still under pressure, to the oil distribution tube and relief valve. The relief valve maintains the oil pressure by remaining closed until the oil pressure reaches 60 PSI. When the control lever is shifted to the forward position, oil under pressure is delivered to the multiple disc clutch piston, which moves to clamp the clutch discs and planetary reverse gear case together. The discs and case then revolve as a solid coupling in the direction of engine rotation. The reverse drive is engaged by shifting the control lever to the reverse position, so that oil under pressure is delivered to the reverse piston. The reverse piston moves to clamp the reverse band around the planetary gear case, preventing the planetary gear case from moving but allowing the planetary gears to revolve to drive the output or propeller shaft in a direction opposite to the rotation of the engine. With the control lever in the neutral position, pressurized oil is prevented from entering the clutch piston or reverse band piston and the propeller shaft remains stationary.

Starting Procedure

1. Always start the engine with the transmission in NEUTRAL to avoid moving the boat suddenly forward or back.

2. When the engine is first started, allow it to idle for a few moments. Stop the engine and check the transmission oil level. Add oil if necessary to bring the oil level up to the mark on the transmission dipstick.

NOTE

ON SUBSEQUENT START-UPS, THE TRANSMISSION OIL LEVEL MAY BE CHECKED BEFORE RUNNING THE ENGINE, WHEN ENGINE OIL IS CHECKED.

3. Start the engine again, with the transmission in NEUTRAL, and allow the engine to warm up to operating temperature.

4. Shift the transmission into FORWARD or REVERSE as desired. If the engine should stall when the transmission is shifted to FORWARD or REVERSE, place the transmission in NEUTRAL before restarting the engine.

   It is recommended that shifting be done at speeds below 1000 RPM, and preferably in the 800 RPM, or idle engine range, to prolong the life of the engine, transmission, and boat. EMERGENCY shifts may be at higher engine speeds, but this is not a recommended practice.

V. MAINTENANCE

A. Lubrication

The Models P200, P300 and P400 transmissions are self-contained units, independent of the engine lubricating systems. The units are lubricated by pressure and by splash from its own oil. The type of oil recommended is "Transmission Fluid, Type A", commonly used for automatic transmissions in automobiles.

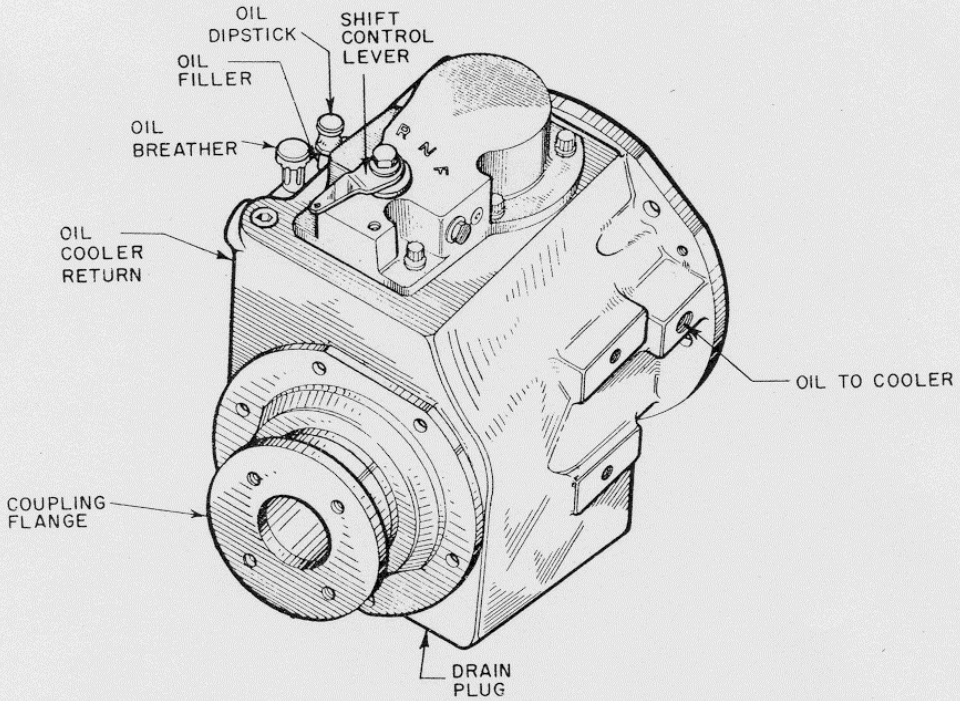
The quantity of oil depends upon the angle of installation, as well as the reduction model. The level must be maintained at the mark on the dipstick and should be checked periodically to ensure satisfactory operation.

When filling for the first time or refilling after an oil change, check the level after running for a few minutes to make certain that the oil cooler and the various passages are full. If necessary, refill to the mark on the dipstick to ensure proper operation of the transmission. The transmission oil level should be checked each time the engine oil level is checked, before running the engine.

The oil in the transmission should be changed every 100 hours, or each season under normal conditions. However, the number of hours that can be run between oil changes varies with the operating conditions. Drain plugs are located at the bottom of the reverse gear housing and the reduction gear housing.

B. Adjustments

No adjustment is necessary for the FORWARD drive multiple disc clutches, and the reverse band is self adjusting to compensate for lining wear, so that no external reverse band adjustment is necessary.



PARAGON TRANSMISSION

C. Trouble Shooting Chart

PROBLEM	POSSIBLE CAUSES AND METHODS OF CORRECTION	
GEAR INOPERATIVE Drive Shaft does not operate with selector valve in forward or reverse.	1. Low Oil Pressure.	a. Low oil supply. Add oil, refer to lubrication.
		b. Faulty oil gauge. Replace gauge. Oil gauge slow to register, air or obstruction in oil gauge line. Clean and bleed oil gauge line.
		c. Plugged oil lines or passages. Clean lines or passages.
		d. Oil pressure relief valve scored and sticking. Remove relief valve. Clean valve and valve bore in control valve housing with crocus cloth to free valve, or replace.
		e. Defective pistons and oil distributor seal rings. Replace seal rings.
		f. Defective oil pump. Check for wear, and replace if necessary.
	2. High Oil Temperature	a. Low oil supply. Add oil, refer to lubrication.
		b. Low water level in cooling system. Add water, and check for leaks.
		c. Plugged raw water inlet screen. Clean screen.
		d. Collapsed or disintegrated water inlet hose. Replace hose.
		e. Air leak in cooling water suction line. Replace suction line.
		f. Raw water pump impeller worn or damaged. Replace impeller.
		g. Clogged or dirty oil cooler element. Remove and clean
	3. Reverse Band not engaging Planetary Gear Cage.	a. Reverse band lining worn out. Replace lining.
		b. Defective reverse piston "O" ring. Replace "O" ring.
	4. Failure of Planetary Assembly.	Remove gear case assembly, and check for defective or damaged parts. Replace defective or damaged parts.
	5. Failure of Reduction Gear.	Remove reduction gear assembly and check for defective or damaged parts. Replace defective or damaged parts.

PROBLEM	POSSIBLE CAUSES AND METHODS OF CORRECTION	
GEAR DRAGGING Drive Shaft rotates either forward or reverse with Selector Valve in neutral position.	1. Defective forward Clutch Plates.	Forward clutch plates warped and sticking. Remove clutch plates and replace.
	2. Defective forward Clutch Piston Release Spring.	Forward clutch piston release spring broken or weak. Replace spring.
	3. Binding in Planetary Assembly.	a. Bearings and gears worn excessively in gear case. Replace necessary parts. b. Input shaft bearings worn excessively, causing misalignment of input shaft. Replace necessary parts.
GEAR SLIPPING OR SLOW TO ENGAGE With Selector Valve in forward or reverse position.	1. Low Oil Pressure.	See "Gear Inoperative", (1).
	2. Worn forward Clutch Plates.	Remove forward clutch plates and check for wear excessively, replace clutch plates.
	3. Reverse Band not engaging Gear Case.	See "Gear Inoperative", (3).
INTERNAL AND EXTERNAL LEAKS	1. Water in Lubricating Oil.	a. Hole in oil cooler element permitting water to seep into oil compartment. Replace oil cooler element. b. Oil cooler gaskets. Check gaskets and replace.
	2. Excessive Oil in Engine Crankcase or Flywheel Housing.	Defective front end plate oil seal. Replace oil seal.
	3. Oil on Exterior of Marine Gear.	a. Oil seeping from breather. Check for too high oil level. b. Defective rear end oil seal. Replace oil seal.
	4. Loss of Oil from Transmission.	a. Check for defective gaskets and seal.

VI. PARTS

Each part illustrated in the exploded views has a key number and an arrow pointing from the key number to the part. Refer to the key number in the parts list to determine the part number and name.

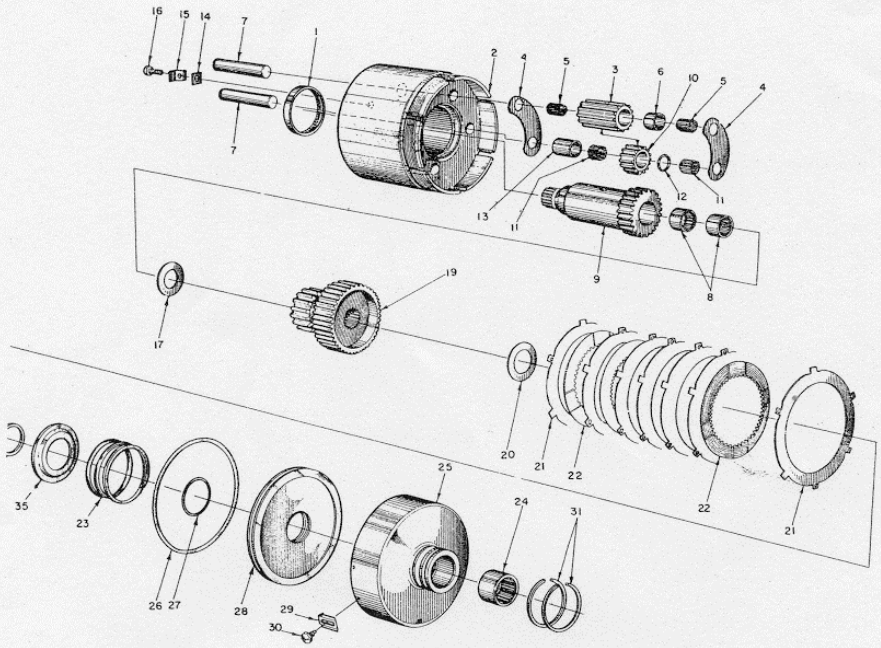
ALWAYS GIVE THE PART NUMBER, PART NAME, TRANSMISSION MODEL NUMBER, AND TRANSMISSION SERIAL NUMBER WHEN ORDERING PARTS.

PARTS LIST

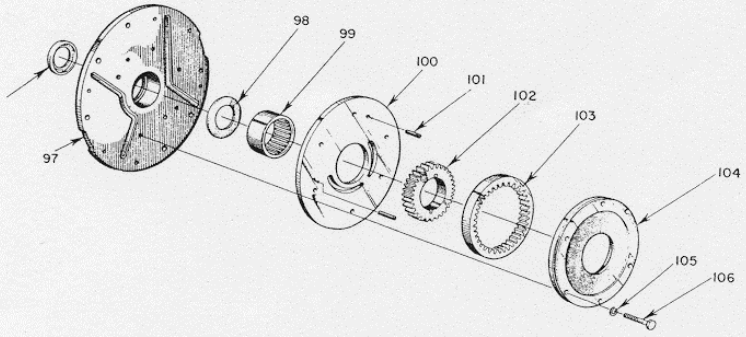
Key No.	Description
1	Gear Case - Needle Bearing
2	Gear Case
3	Long Pinion
4	Pinion Thrust Pad
5	Roller Bearing
6	Long Pinion Bearing Spacer
7	Pinion Shaft
8	Engine Gear - Roller Bearing
9	Engine Gear
10	Short Pinion
11	Roller Bearing
12	Short Pinion Bearing Spacer
13	Short Pinion Spacer
14	Pinion Shaft Locking Tab
15	Case Clip
16	Capscrew
17	Engine Gear Thrust Washer
18	Direct Drive Tailshaft
19	Propeller Gear
20	Propeller Gear Thrust Washer
21	Steel Clutch Plate
22	Bronze Clutch Plate
23	Screw Collar Spring
24	Screw Collar - Needle Bearing
25	Screw Collar
26	Forward Piston "O" Ring - Outer
27	Forward Piston "O" Ring - Inner
28	Forward Piston
29	Clip - Screw Collar
30	Lockscrew
31	Oil Distributor Seal Rings
32	Tailshaft Thrust Washer
33	Tailshaft Seal Washer
34	Woodruff Key
35	Spring Retainer
36	Retaining Ring
37	Cover Gasket
38	Distributor Tube
39	Tailshaft Needle Thrust Race
40	Tailshaft Needle Thrust Bearing
41	Retaining Ring
42	Ball Bearing
43	Reduction Pinion Tailshaft
44	Reduction Adapter Plate
45	Adapter Plate Seal
46	Capscrew
47	Gasket
48	Crescent
49	Plain Steel Washer
50	Lockwasher
51	Capscrew
52	Locknut
53	Lockwasher
54	Capscrew
55	Lockwasher
56	Ball Bearing
57	Direct Drive Plate
58	Oil Seal
59	Gear Half Coupling
60	Rear Gasket
61	Housing
62	Dipstick Tube
63	Front Gasket
64	Reverse Band Housing Pin
65	Baffle
66	Flat Head Socket Capscrew

Key No.	Description
67	Hold Down Spring
68	Socket Head Pipe Plug
69	Pipe Plug
70	Control Lever Pin
71	Capscrew
72	Lockwasher
73	Plain Washer
74	Control Lever
75	Control Lever Bushing
76	Control Lever Pawl
77	Control Valve "O" Ring
78	Control Valve
79	Control Valve Retaining Ring
80	Cover
81	Reverse Piston "O" Ring
82	Reverse Piston and Shaft Assembly
83	Piston Back Up Plate
84	Reverse Piston Shaft Pin
85	Retaining Ring
86	Reverse Band Roll Pin
87	Reverse Band Lever
88	Reverse Band Roll
89	Piston Back-Up Plate "O" Ring
90	Relief Valve Plug
91	Relief Valve Spring
92	Relief Valve Retaining Ring
93	Relief Valve "O" Ring
94	Relief Valve Pin
95	Relief Valve Housing
96	Front Plate Oil Seal
97	Front Plate
98	Front Plate Thrust Washer
99	Roller Bearing
100	Pump Port Plate
101	Pump Housing Pin
102	Inner Pump Gear
103	Outer Pump Gear
104	Pump Housing
105	Lockwasher
106	Capscrew
107	Dipstick
108	Flat Head Socket Capscrew
109	Breather
110	Pump Key
111	Reverse Band
112	Pipe Plug
113	Brass Washer
114	Brake Band Support Screw
115	External Socket Head Cap Screw
116	Detent Seal Washer
117	Detent Ball
118	Capscrew
119	Detent Spring
120	Lockwasher
121	Capscrew
122	Reduction Gear Housing
123	Pipe Plug
124	Oil Seal
125	Gear Half Coupling
126	Lockwasher
127	Locknut
128	Internal Gear
129	Bearing Assembly
130	Retaining Ring
131	"O" Ring
132	Suction Tube
133	Washer

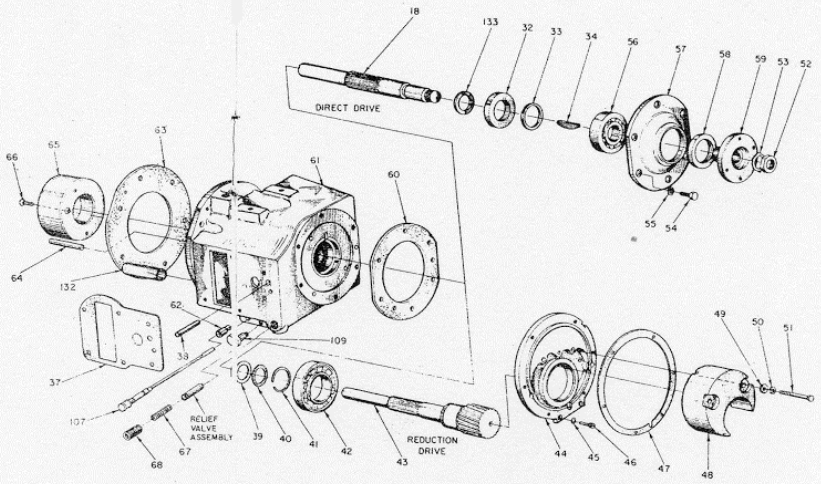
GEAR CASE ASSEMBLY



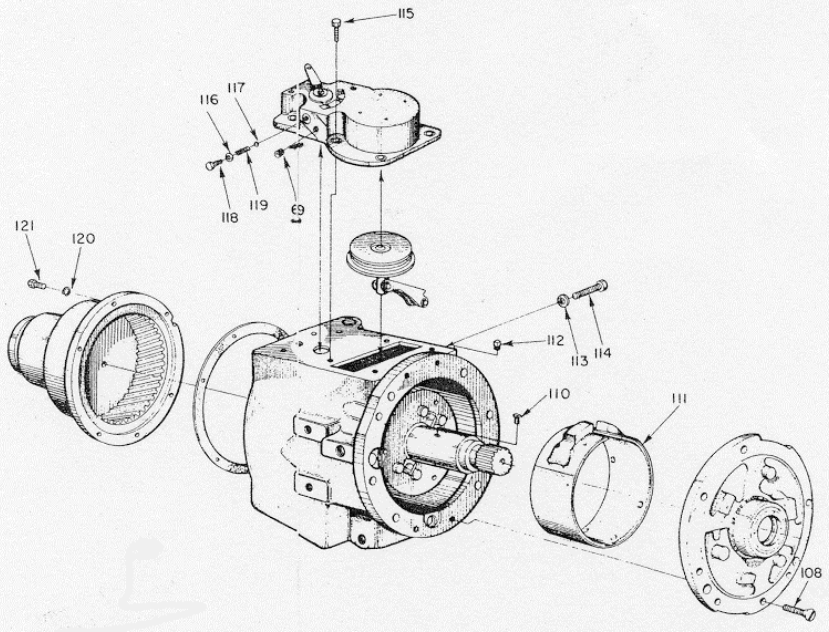
FRONT END PLATE AND PUMP ASSEMBLY



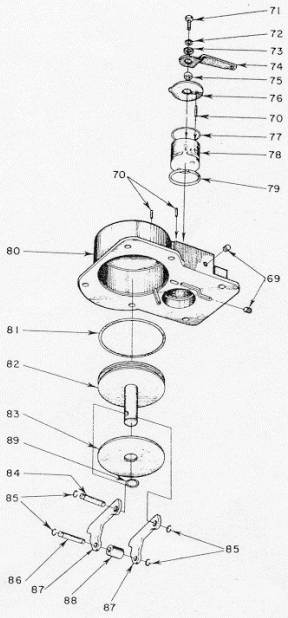
REVERSE GEAR HOUSING ASSEMBLY



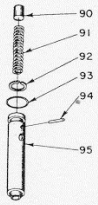
COMPLETE ASSEMBLY



COVER ASSEMBLY



RELIEF VALVE ASSEMBLY



REDUCTION GEAR ASSEMBLY