



# *Tulsa Winch*

## **RUFNEK 80**

### **DESIGN SERIES 001**

# **SERVICE MANUAL**

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# INTRODUCTION AND THEORY OF OPERATION

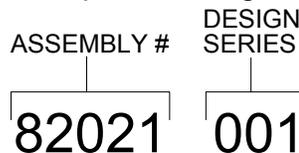
The Rufnek series planetary winch is designed to use a high-speed gear motor, driving through a multiple disc brake, through three planet sets to the cable drum.

The multiple-disc brake is spring applied and hydraulically released through a port in the brake housing. During inhaul, the brake is not released since the load is driven through the one-way cam clutch, bypassing the brake. When the load comes to a stop, the cam clutch locks up and the load is prevented from moving by the brake.

The brake and brake valve receives its signal any time the winch is in pay out. With the brake fully open at about 340 PSI the brake valve will open and dynamically control the lowering of the load.

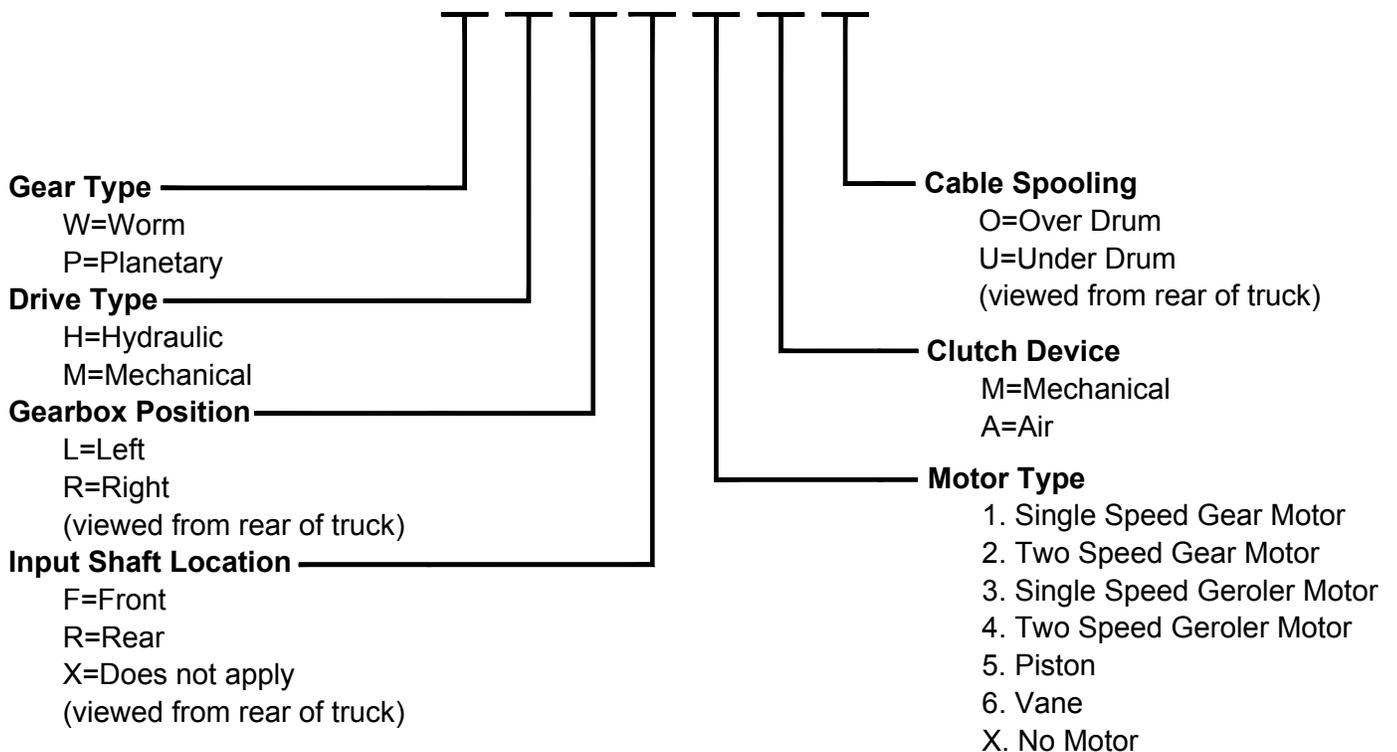
# ASSEMBLY NUMBER EXPLANATION

This manual is for design series 001. In the case of a major design change implementation, a new design series designation number will be issued for the winch. A new manual will also be created for that specific design series.



# WINCH MODEL CODES

**RN80 P H L X O A 1**



# **!WARNING!**

## **FAILURE TO HEED THE FOLLOWING WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH.**

1. Tulsa Winches are not to be used to lift, hoist, or move people. If your task involves lifting or moving people, you **MUST** use the proper equipment, not this winch.
2. Cable anchors on Tulsa Winches are not designed to hold the rated load of the winch. You must keep at least five (5) wraps of cable on the drum to insure that the cable doesn't come loose.
3. Stay clear of the suspended loads and of cable under tension. A broken cable or dropped load can cause serious injury or death.
4. Make sure that all equipment, including the winch and cable, is maintained properly.
5. Avoid shock loads. This type of load imposes a strain on the winch many times the actual weight of the load and can cause failure of the cable or of the winch.
6. Winch operators must be trained in the proper, safe operation of the winch.
7. The hydraulic system should use only high quality hydraulic oils from reputable suppliers. These oils should contain additives to prevent foaming and oxidation in the system. All winch hydraulic systems should be equipped with a return line filter capable of filtering 10-micron particles from the system.

# MAINTENANCE

Tulsa Rufnek series planetary winches, like any other piece of machinery, need to be periodically serviced and well maintained to insure proper operation.

**Good maintenance consists of four steps.**

1. A daily inspection to insure that there are no oil leaks present and that all mounting bolts and other fasteners are tight, and that the wire rope is in good condition.
2. Changing the oil in both the gearbox and the brake section. *(Severity of use will determine the need for oil changes but it should be checked at a minimum of every 500 hours. Factors such as extremely dirty conditions or widely varying temperature changes may dictate even more frequent servicing).*
3. Lubing drum bushings and sliding clutch with grease thru grease fittings located on drum barrel and clutch.
4. Complete teardowns and component inspections. *(Again, severity and frequency of use will determine how often this should be done).* If the equipment that this winch is mounted to is subject to standards for this type of inspection, then those standards must be followed. If oil changes reveal significant metallic particles then a teardown and inspection must be made to determine the source of wear.

Rufnek series planetary winches are designed with a common oil reservoir for the gearbox and brake. The winches are shipped from the factory filled with Mobilube SHC SAE 75W-90 synthetic gear oil which is satisfactory for operation in ambient temperatures from -40°F to +110°F. If winch will be operated in temperatures outside this range, contact Tulsa Winch for recommendations.

The oil is drained by removing the drain plugs (85 & 81) located at bottom of gear cover (55) and bottom of brake cover (2). Then remove the fill plugs (74 & 81) located at the top of the gear cover (55) and the top of the brake cover (2). Inspect the oil for signs of metallic particles and/or burning and dispose of in a proper manner. Then re-install the drain plugs.

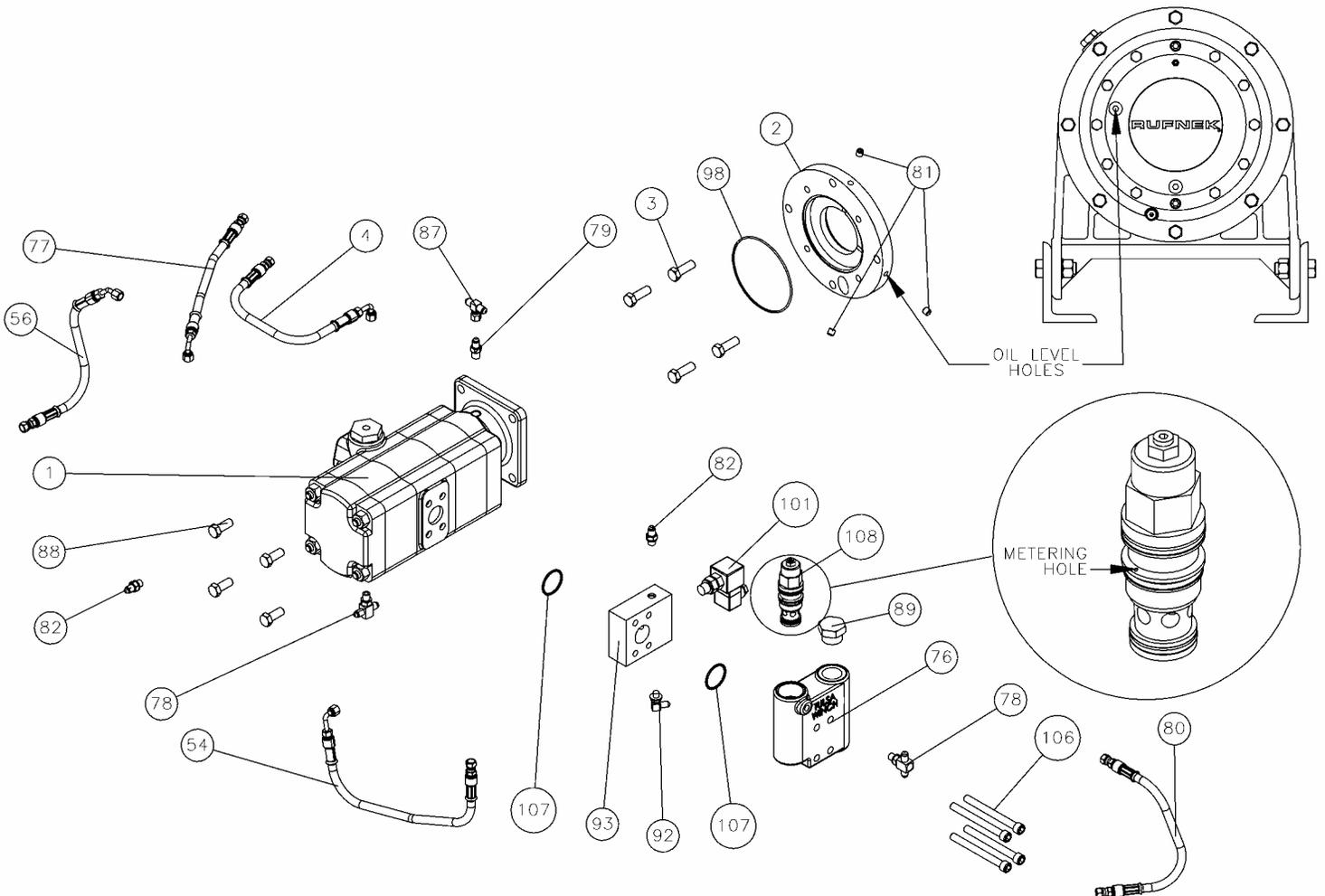
Fill the brake end with Mobilube SHC SAE 75W-90 (1/2 quart), then fill the gear end with Mobilube SHC SAE 75W-90 oil (9 quarts) and replace both of the fill plugs.

**OIL CAPACITIES = 9.5 QUARTS**

# GENERAL DISASSEMBLY

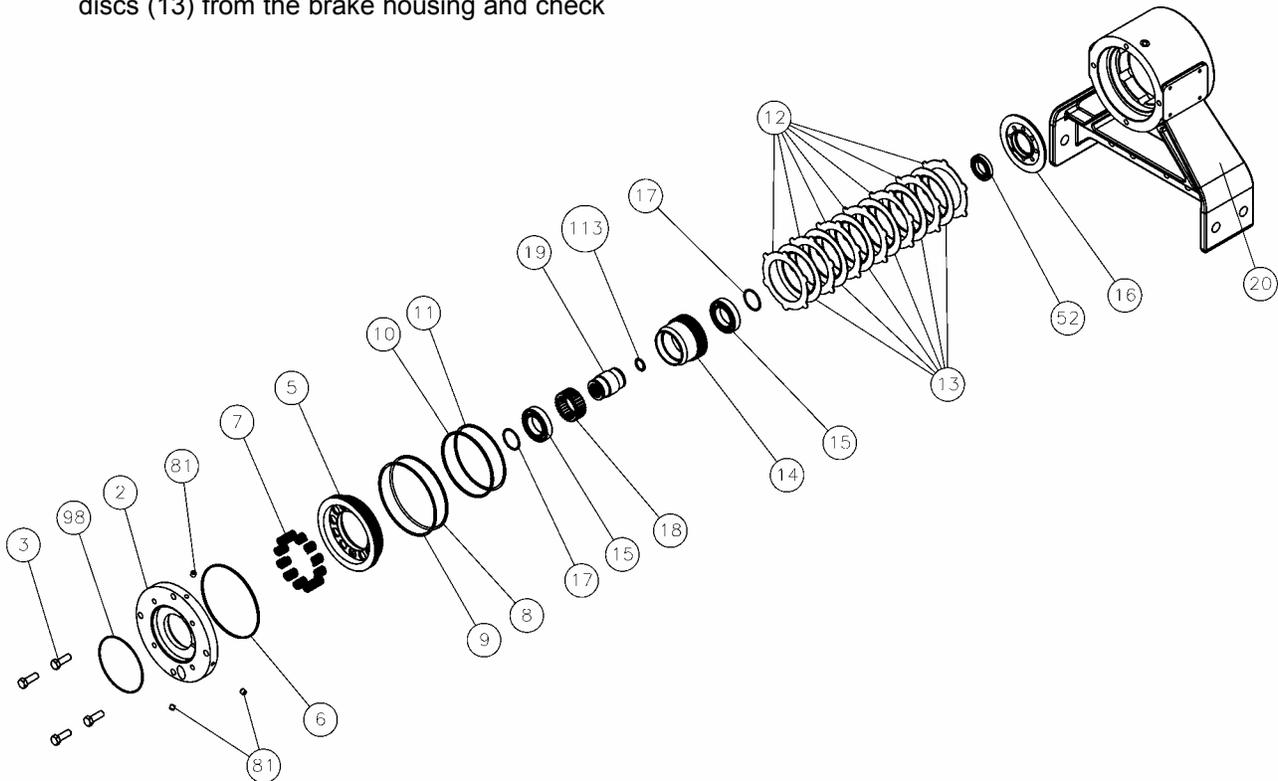
## A. MOTOR DISASSEMBLY

1. Drain the oil from the brake assembly by removing the plug (81) from the bottom of the brake cover (2).
2. Remove hoses (4, 54, 56, 77, & 80).
3. Remove the counterbalance block (76) and the manifold block (93), from the motor by removing the four cap screws (106).
4. Remove the motor from the winch by removing four capscrews (88).
5. Remove the counterbalance valve (108) from the counterbalance block (76) and inspect the metering hole to make sure it is not obstructed. Also, inspect the o-rings on valve to insure that they are not flat or cut. Replace if necessary.
6. Motors and counterbalance valves are not serviceable in the field. Return them to an authorized dealer for service.
7. Inspect o-rings (98) & (107) for damage.



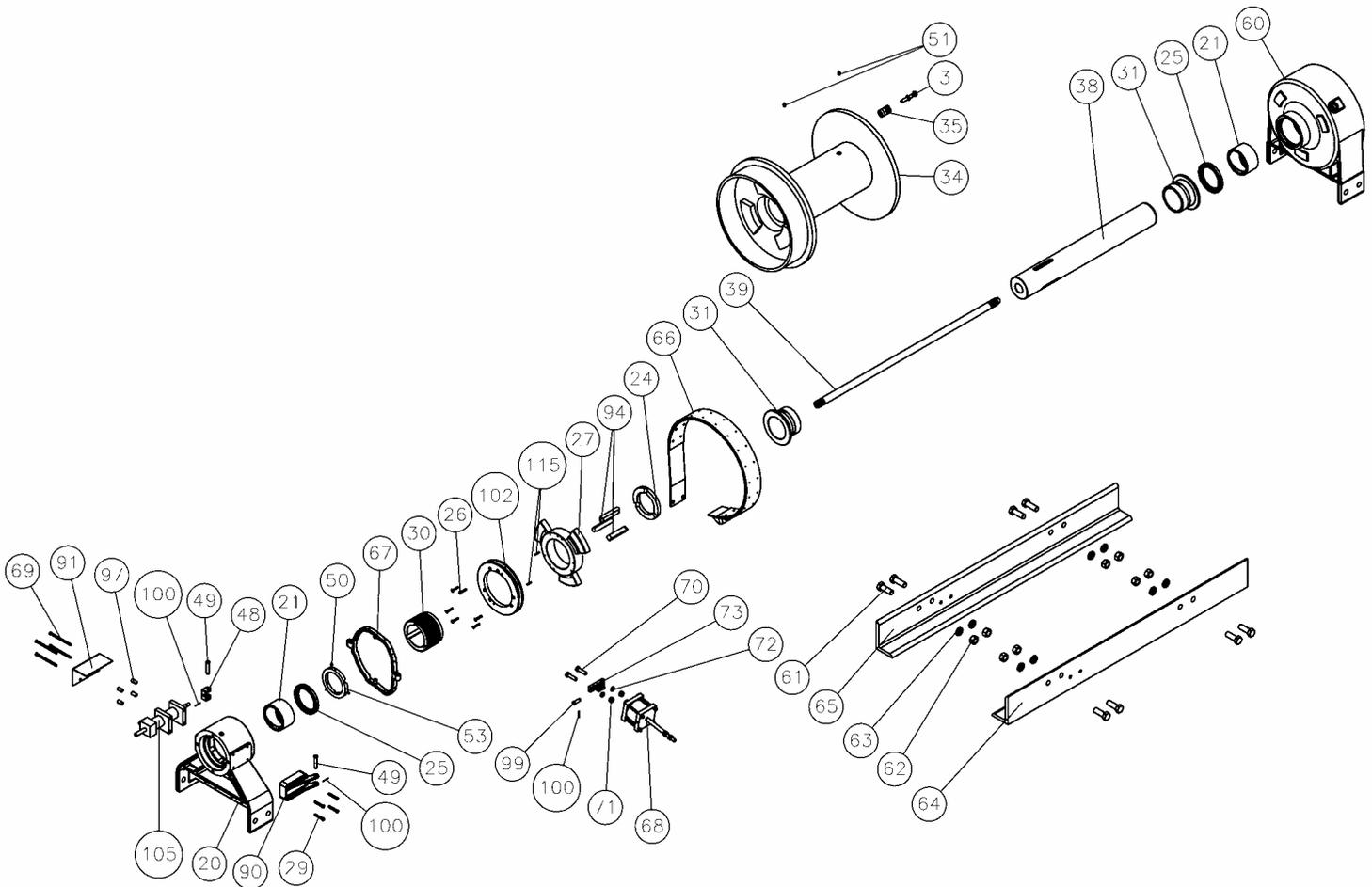
## B. BRAKE SECTION DISASSEMBLY

1. Evenly remove the four cap screws (3) that hold the brake cover (2) in place. Spring pressure will raise the cover up as the cap screws are loosened. Carefully remove the cover (2) from the brake housing (20). Inspect the o-ring (6) on cover for damage.
2. Remove the springs (7) from the piston (5) and check the free height. Each spring should measure at least 1.240 inches with no force on them.
3. Remove the piston (5) by installing two pieces of 3/8"-16NC all thread into the two holes in the top of the piston and run in evenly until the piston is clear of the housing. An alternate way of removing the piston is to use shop air to slowly pressurize the brake cavity to remove the piston from the brake housing (20).
4. Inspect o-rings (8, 10) and back up rings (9, 11) on the piston, replace if necessary. Grasp the brake driver/clutch assembly (assembled items 14, 15, 17, 18, 19, 113) and remove it from the brake housing.
5. Remove the stator plates (12) and friction discs (13) from the brake housing and check them for excessive wear. Replace the parts if necessary. Be sure to check the top stator plate for scoring caused by the removal of the piston and polish if needed. Friction discs should measure no less than .055-in. thickness and stator plates should measure no less than .068-in thickness.
6. To disassemble the brake driver/clutch assembly, remove the retaining ring (17) from either end of the driver. Then, remove the brake driver (14) and bearing (15) from the input driver (19). Next, remove the sprag clutch (18). Finally, remove the retaining ring (17) from the other end of the driver, then remove the second bearing (52) from the input driver. (*Note: Notice the direction of lock-up on the clutch for re-assembly*). Inspect the input driver and brake driver for wear, replace if necessary.
7. Remove bearing housing (16) and inspect the bearing (52).
8. If the bushing or seal in brake housing needs to be replaced, see the drum section of this manual before re-assembly of the brake.



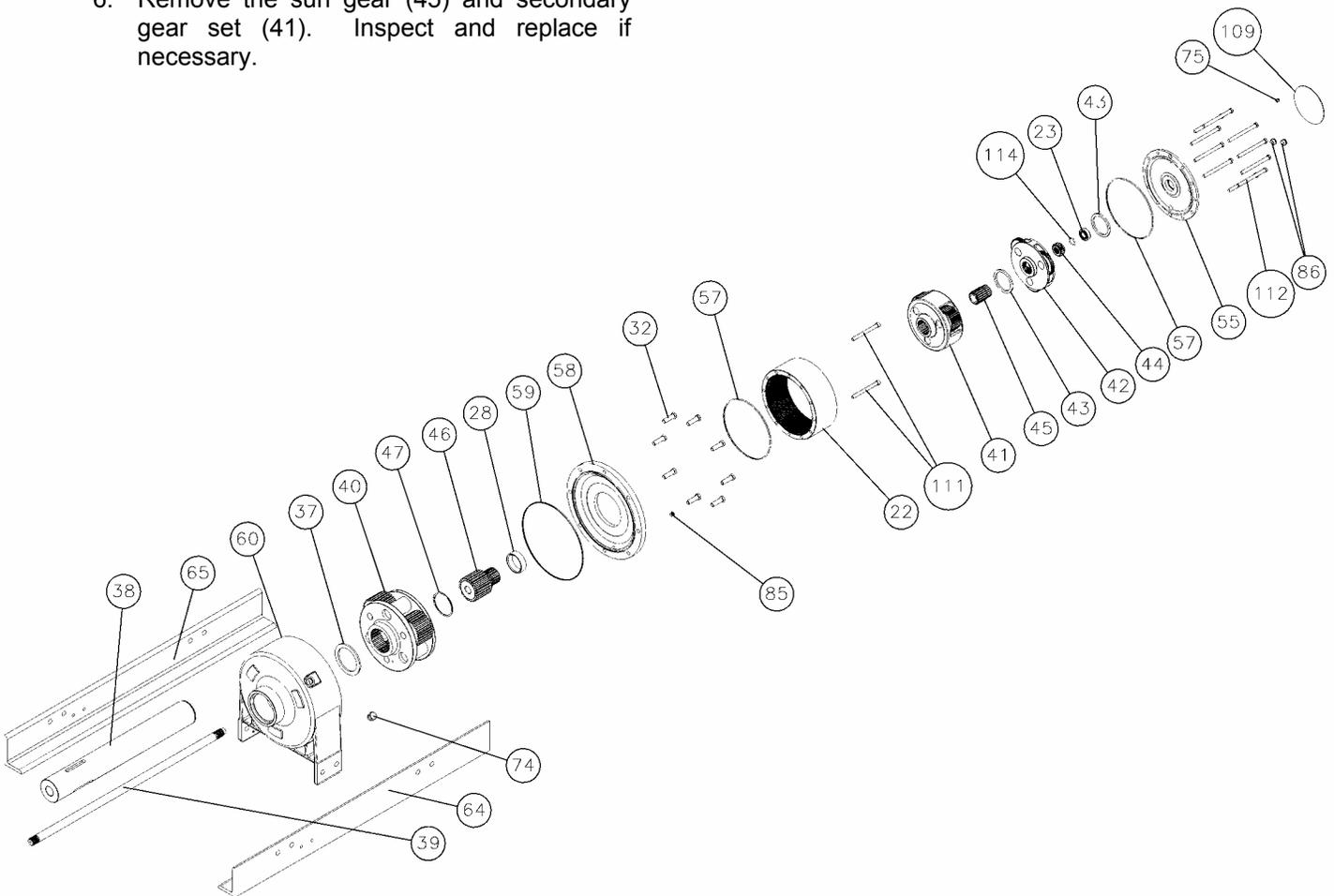
## C. DRUM SECTION DISASSEMBLY

1. To remove the drum, first disconnect the cable from the cable clamp (35) and lay aside. If removing the drum from the motor end with the motor and brake disassembled, first remove the cotter keys (100) and clevis pins (49) connecting the yoke (67) to the bracket (90) & air cylinder (105). Second, remove the eight cap screws (29 & 69), four spacers (97), air cylinder cover (91), air cylinder (105), and bracket (90). (*Note: You may need to remove the air lines so be sure to mark them for re-assembly.*)
2. Support the weight of the drum with a hoist. Remove the four cap screws (61) along with the nuts and washers (63, 62) on the bottom of the brake housing (20). Disconnect the airline running from the air cylinder (68) to the brake housing (20). Remove the brake housing by sliding the housing off the output shaft (38). At this time you will need to remove the two cap screws (70), nuts and washers (71, 72) from the frames (64 or 65). You can now remove the brake band assembly (66). Note which frame the mounting bolts are on for re-assembly. Inspect and replace if needed.
3. Remove the outer thrust collar (53) by loosening the three set screws (50).
4. Remove the yoke (67), sliding clutch (27), and coupler (30). Remove the three keys (94) and the inner thrust collar (24). Remove the drum using a hoist. Inspect the bushings (31) in both ends of the drum. (*Note: You should also inspect the bushing and seal (21, 25) that are located in the end of the brake housing.*)



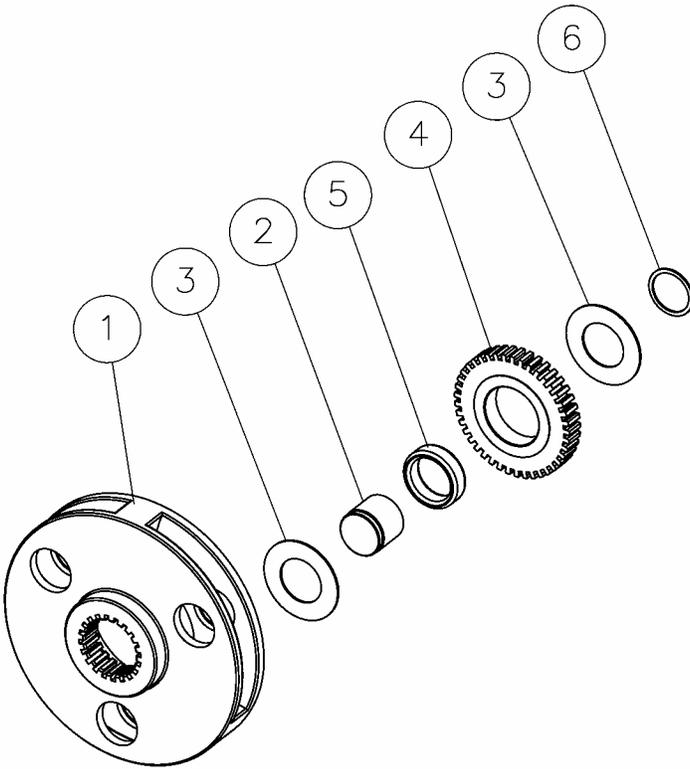
## D. GEAR SECTION DISASSEMBLY

1. Drain the oil by removing the plug (85) located on the bottom of the adapter cover (58).
2. To disassemble the gear section, remove the outer cover (55). By removing the ten capscrews (112). *(Note: Do not remove the capscrews (111) at top and bottom of the cover at this time.)*
3. Inspect the o-ring (57), bearing (23), and outer thrust washer (43).
4. Remove the retaining ring (114) from the input shaft (39).
5. Remove the sun gear (44), the input gear set (42), and inner thrust washer (43). Inspect and replace if necessary.
6. Remove the sun gear (45) and secondary gear set (41). Inspect and replace if necessary.
7. Remove the gear ring (22) by removing the two cap screws (111). Inspect the o-ring (57) and replace if necessary.
8. Remove the adapter (58) by removing eight cap screws (32). Inspect the o-ring (59) and replace if necessary.
9. Remove the spacer (28) and sun gear (46). Inspect for wear and replace if necessary.
10. Remove the snap ring (47) from the output shaft (38).
11. Remove the output gear set (40) and thrust washer (37). Inspect and replace if necessary.



## E. INPUT PLANET SET DISASSEMBLY

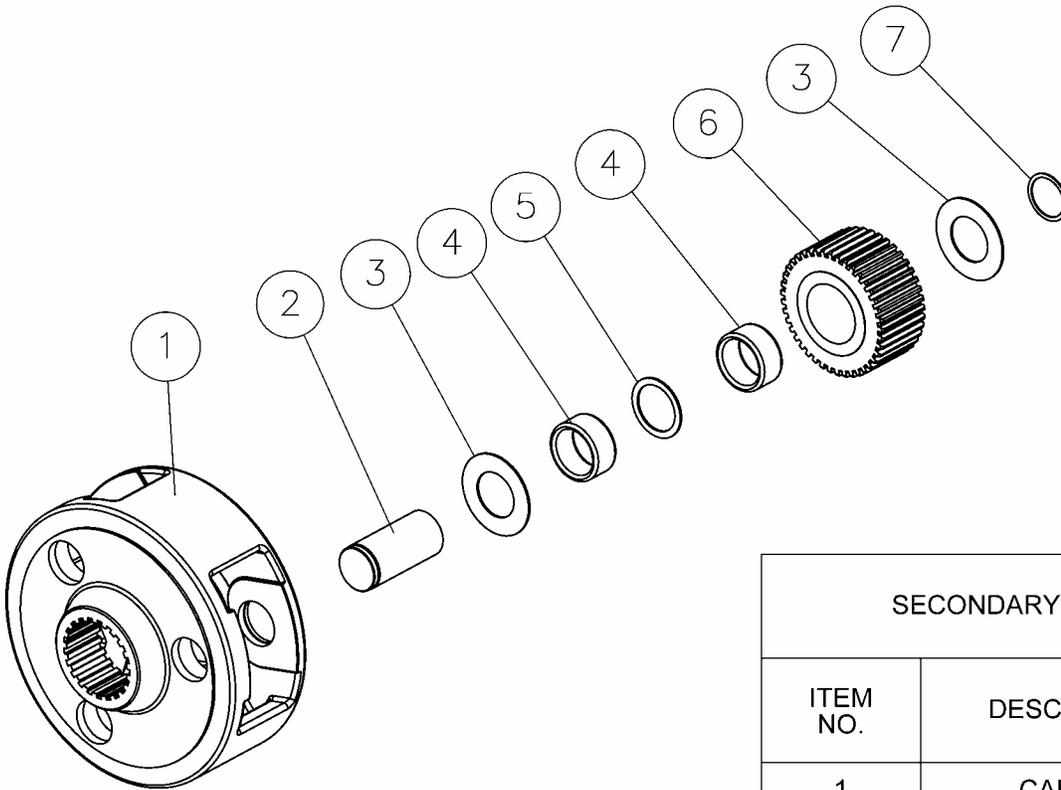
1. Remove the retaining rings (6) from the carrier (1).
2. Remove the planet pins from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (4), thrust washers (3), and bearings (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



INPUT GEAR SET (42)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	PLANET GEAR	3
5	BEARING	3
6	RETAINING RING	3

## F. SECONDARY PLANET SET DISASSEMBLY

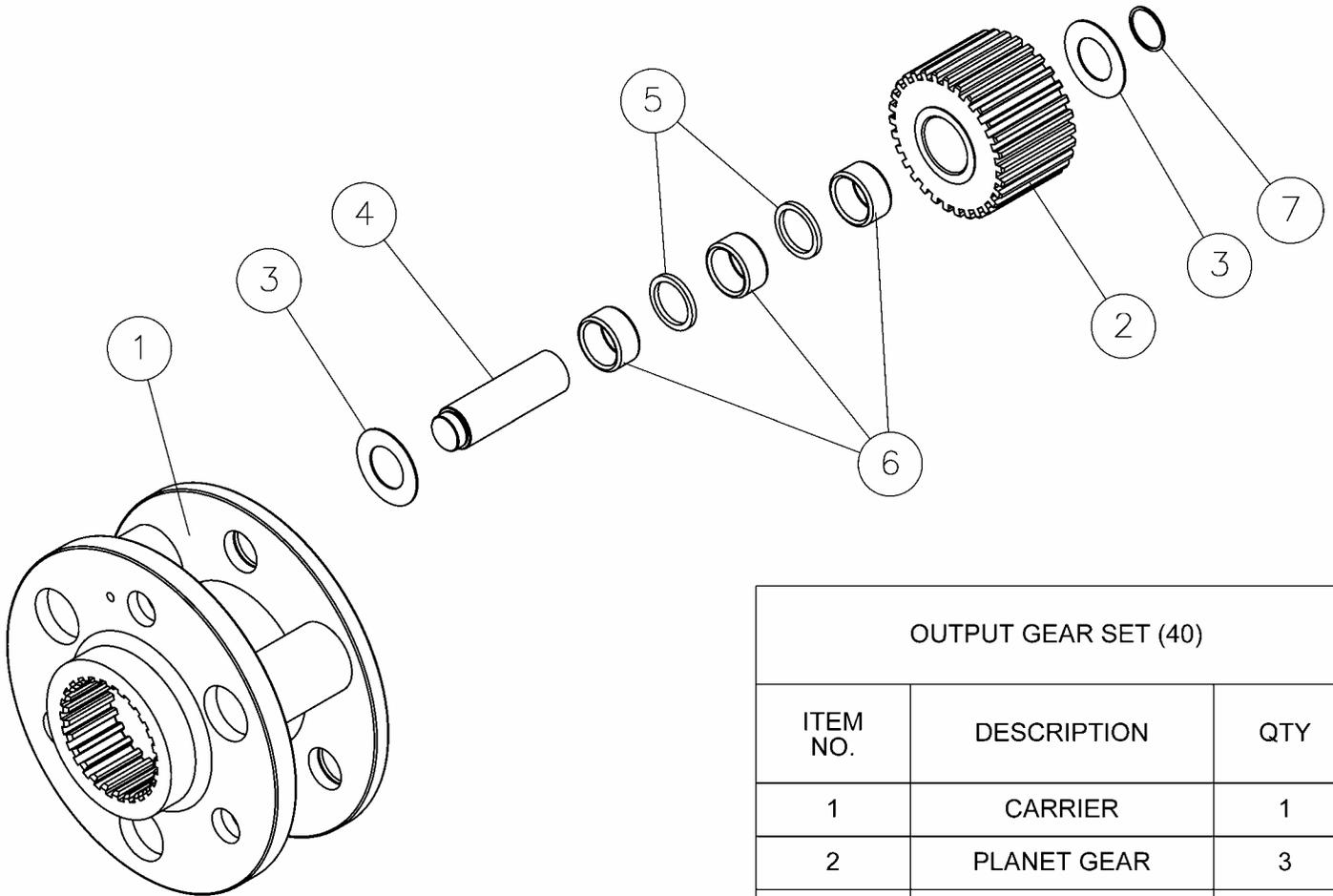
1. Remove the retaining rings (7) from the carrier (1).
2. Remove the planet pins (2) from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (6), thrust washers (3), bearings (4), and spacers (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



SECONDARY GEAR SET (41)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	BEARING	6
5	SPACER	3
6	PLANET GEAR	3
7	RETAINING RING	3

## G. OUTPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (7) from the carrier.
2. Remove the planet pins (4) from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (2), thrust washers (3), bearings (6), and spacers (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



OUTPUT GEAR SET (40)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET GEAR	3
3	WASHER	6
4	PLANET PIN	3
5	SPACER	6
6	BEARING	9
7	RETAINING RING	3

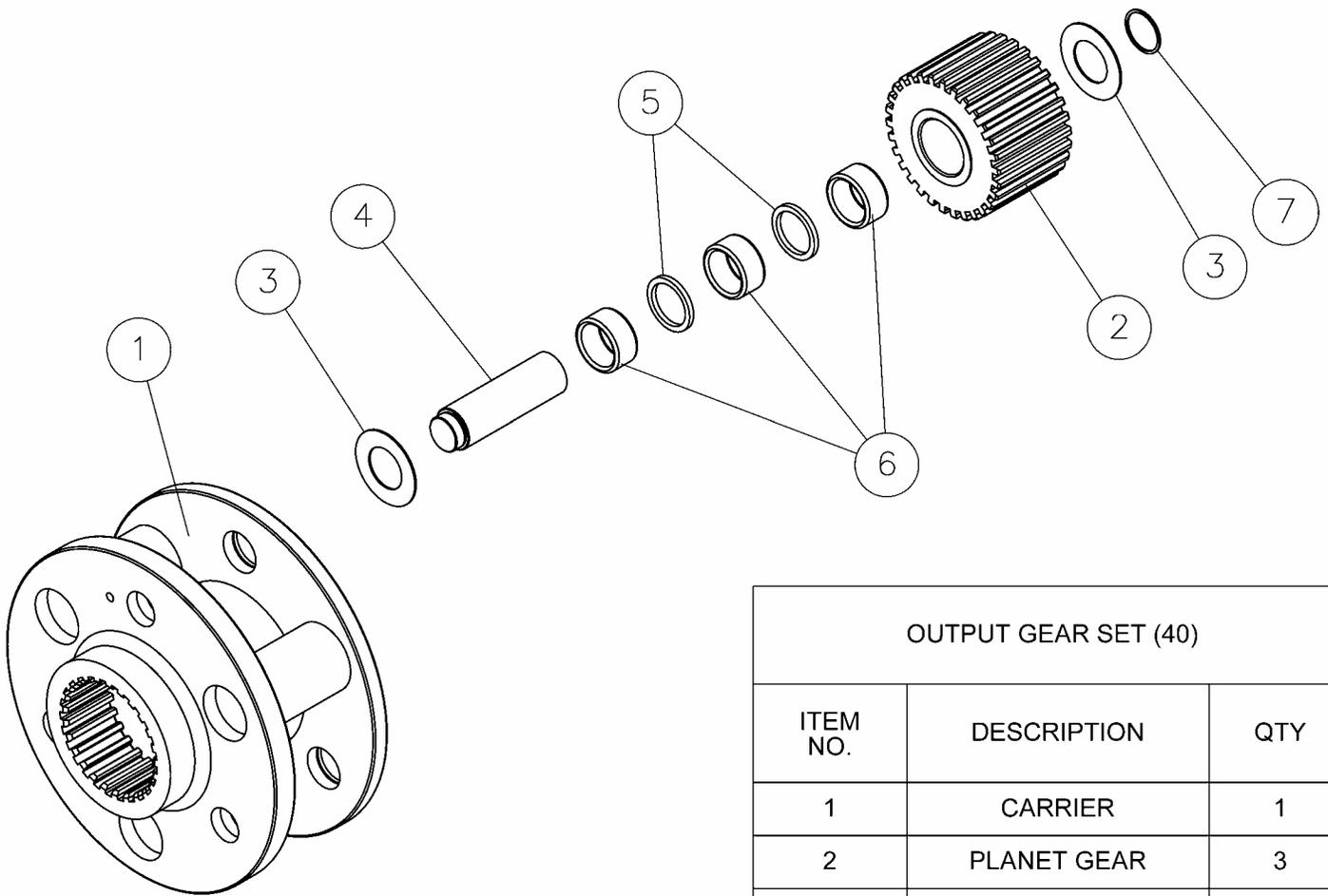
# GENERAL ASSEMBLY

## H. OUTPUT PLANET SET ASSEMBLY

1. Insert the gears (2), bearings (6), spacers (5) and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (6) with the planet pins (4),

press the pins into the carrier. If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.

3. Replace the retaining rings (7).



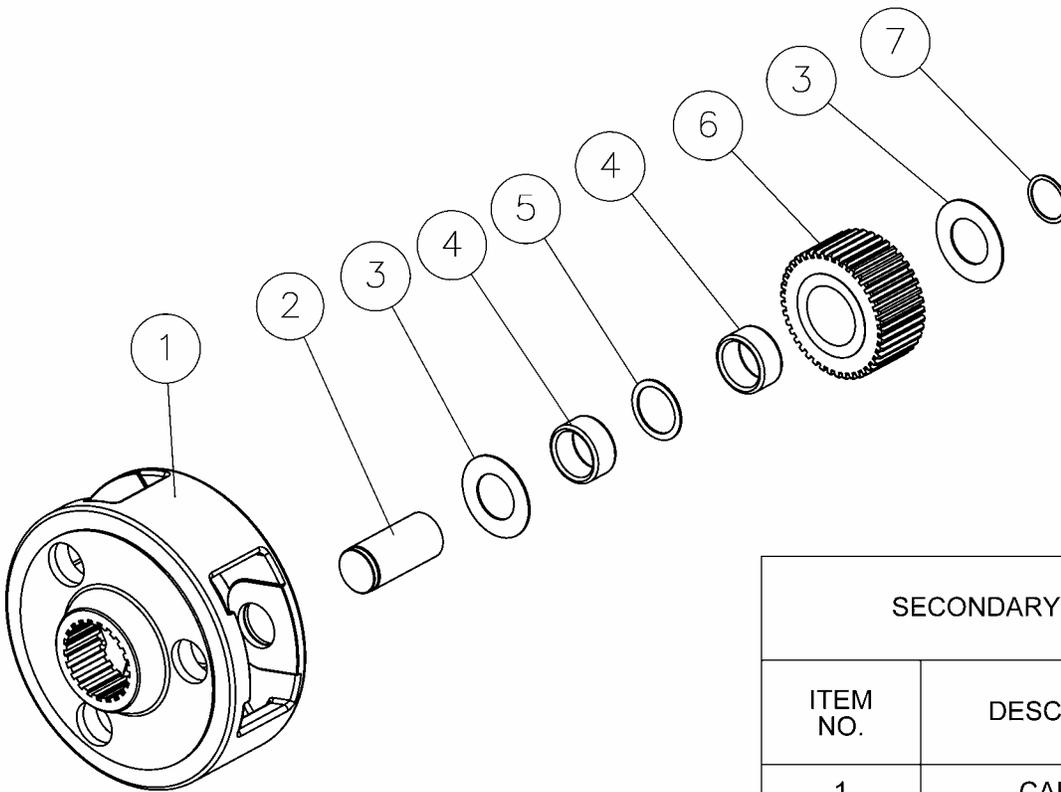
OUTPUT GEAR SET (40)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET GEAR	3
3	WASHER	6
4	PLANET PIN	3
5	SPACER	6
6	BEARING	9
7	RETAINING RING	3

## I. SECONDARY PLANET SET ASSEMBLY

1. Insert the gears (6), bearings (4), spacers (5), and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (4) with the planet pins (2),

press the pins into the carrier. If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.

3. Replace the retaining rings (7).



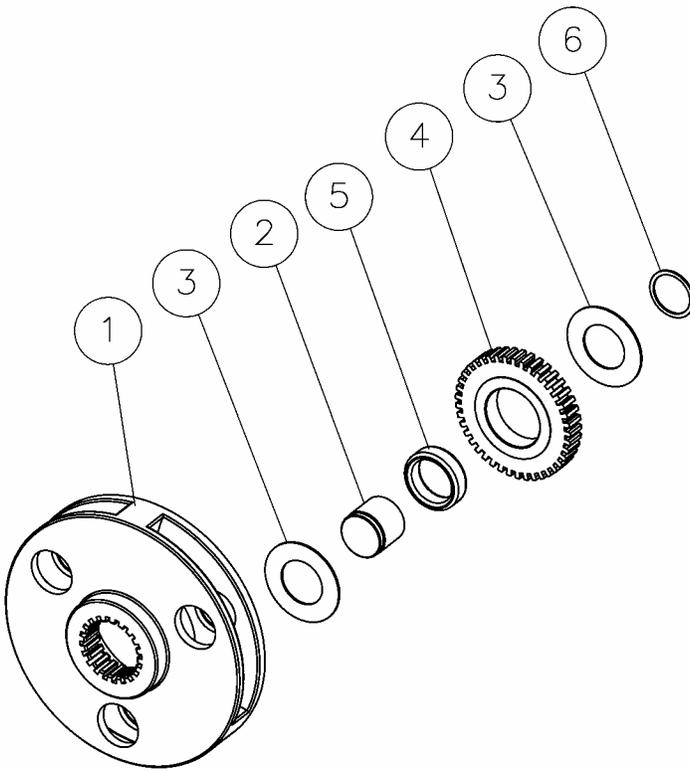
SECONDARY GEAR SET (41)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	BEARING	6
5	SPACER	3
6	PLANET GEAR	3
7	RETAINING RING	3

## J. INPUT PLANET SET ASSEMBLY

1. Insert the gears (4), bearings (5) and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (5) with the planet pins (2), press the pins into the carrier (1). If the pins

are not lined up properly, the thrust washer can be shattered during the pressing operation.

3. Replace the retaining rings (6).



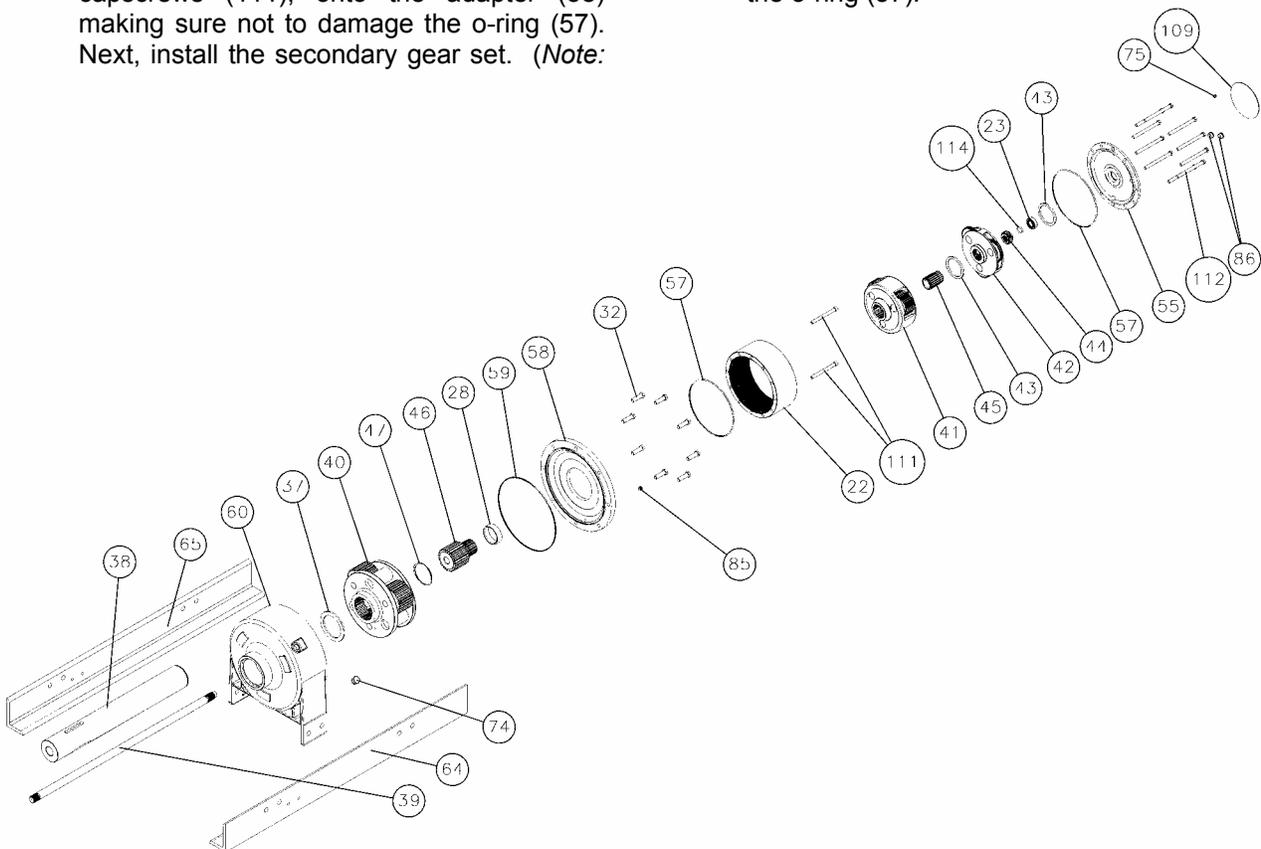
INPUT GEAR SET (42)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	PLANET GEAR	3
5	BEARING	3
6	RETAINING RING	3

## K. GEAR END ASSEMBLY

1. Bolt gear-housing (60) loosely into both frames (64, 65).
2. When reassembling, apply grease to parts such as thrust washers, o-rings, and seals. Install the output shaft (38) into the gear housing (60). Slide the thrust washer (37) onto the output shaft (38). Next, install the output gear set (40). Then install the retaining ring (47) onto the output shaft (38). Push the gear set and shaft back into the housing until it stops against the thrust washer (37). (*Note: Make sure to line up all three planet gears in the output gear set with the gear housing as it starts into the housing*).
3. Install the sun gear (46) and spacer (28).
4. Install the adapter (22) onto the gear housing (60). Making sure not to damage the o-ring (59), use eight capscrews (32) and torque them to specification (see page 25 of this manual).
5. Install the gear ring (22), using two capscrews (111), onto the adapter (58) making sure not to damage the o-ring (57). Next, install the secondary gear set. (*Note:*

*Make sure to line up all three planet gears in secondary gear set with the gear housing and sun gear as it starts into the housing.*)

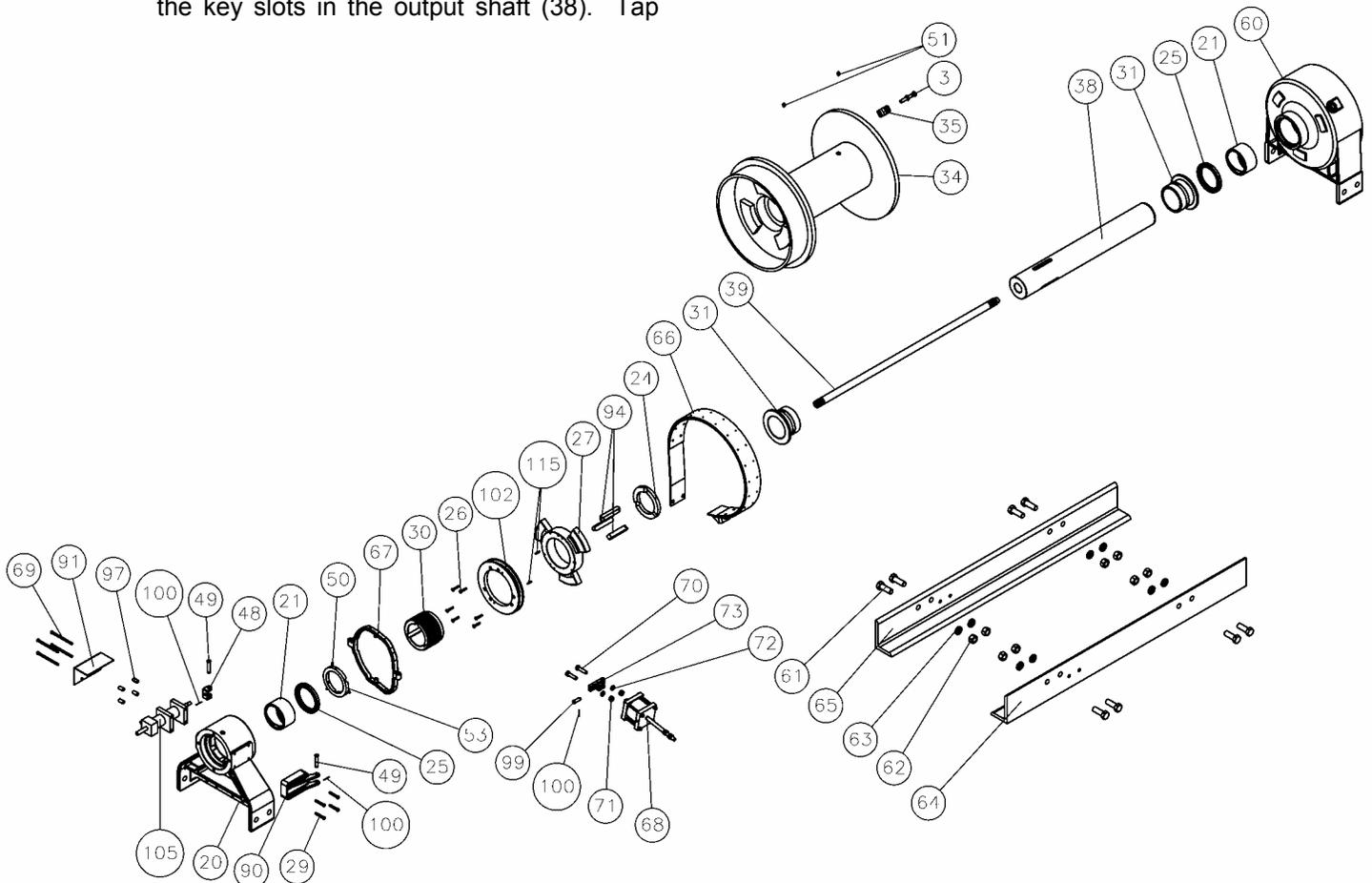
6. Install the secondary sun gear (45).
7. Install the inner thrust washer (43) onto the input gear set (42). Insert the input gear set (42) into the gear housing (60) making sure it is against the thrust washer (43). Put the outer thrust washer (43) in place and slide the input shaft (39) through the sun gears and output shaft (38). Let the input shaft protrude out on the gear end so that all of the spline is showing.
8. Install the input sun gear (44) onto the end of the input shaft (39). Install the retaining ring (114) onto the input shaft (39). Push back on the input shaft and sun gear at the same time until the sun gear engages the three planet gears on the input gear set. Check and verify that the bearing (23) is pressed into the cover (55), then put the cover on and secure it with the ten cap screws (112), being careful not to damage the o-ring (57).



## L. DRUM SECTION ASSEMBLY

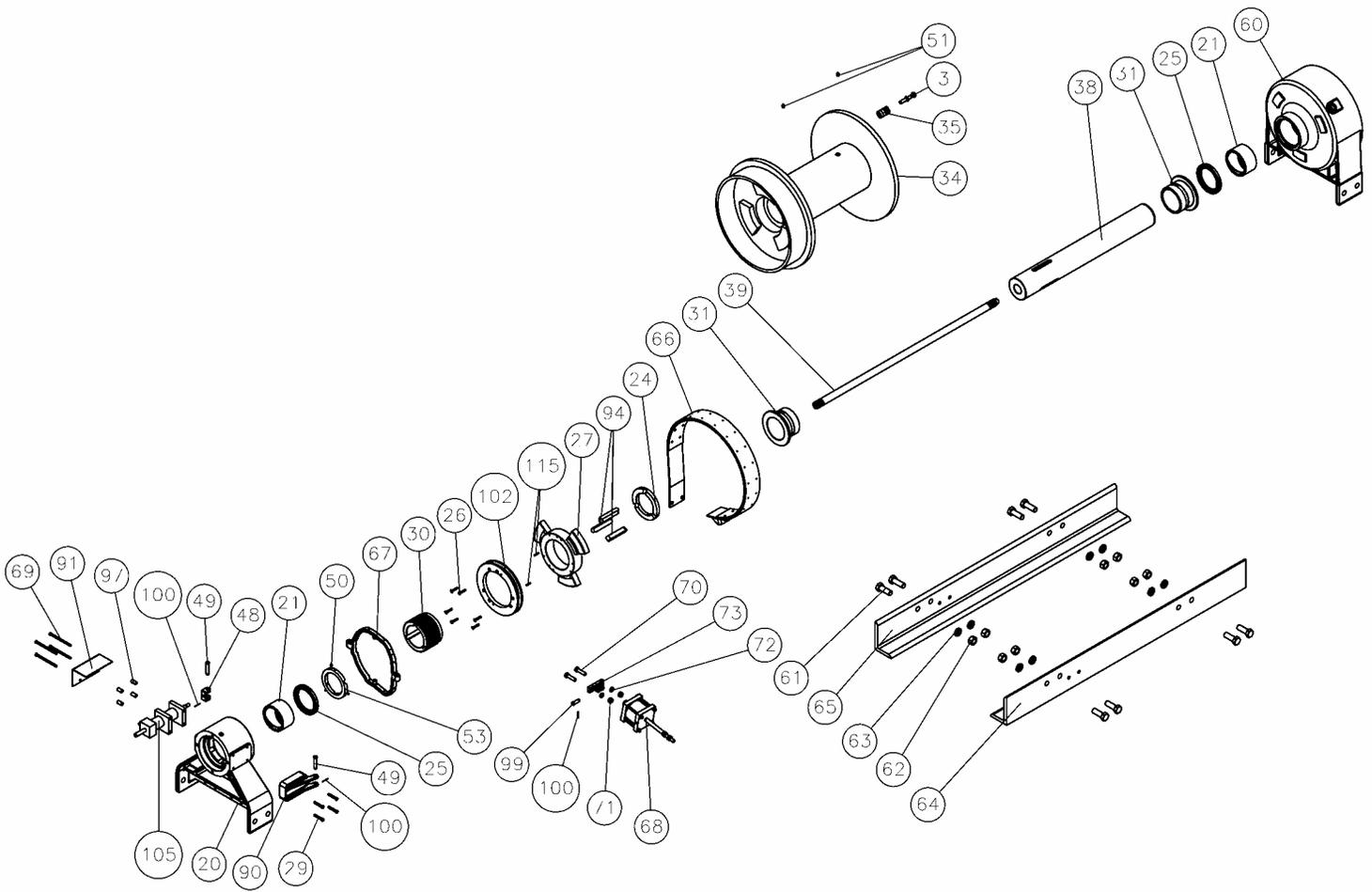
1. After inspecting and replacing the necessary parts, such as the drum bushings (31). Install the drum (34) onto the output shaft (38). This part is very heavy and you will need the assistance of a hoist. With the weight of the drum supported, install the brake band assembly (66) along with the bracket (73), capscrews (70), nuts (71), and washers (72).
2. Install the brake band air cylinder (68), making sure the shaft of the air cylinder (68) is going through the bracket on the brake band (66). Secure it to the bracket (73) with the clevis pin (99) and cotter key (100). Tighten the adjusting nut on the air cylinder shaft until there is not space between the drum (34) and the brake band (66). Then, tighten the jam nut to secure the adjusting nut. *(Note: The brake band may need to be readjusted once it's in the field)*
3. Install the inner thrust collar (24) making sure the half-moon slots are lined up with the key slots in the output shaft (38). Tap the three keys (94) into their slots in the output shaft.
4. Align the coupler (30) with the keys (94) and slide it onto the output shaft (38). Install the sliding clutch (27) onto the coupler (30). Install two pins (115) into the sliding clutch (27) using LOC-TITE 271. Install the yoke (67) onto the clutch plate (102). Slide the clutch plate (102) onto the sliding clutch (27), making sure to line up the pins (115) with the holes in the plate (102). Mount the two together with six capscrews (26) using LOC-TITE 271 and torque to 90-100 in-lbs.
5. Install the outer thrust collar (53), aligning the half moon slots with the keys (94). Tightly hold the thrust collar (53) against the keys and lock down the three set screws (50).
6. Slide the brake housing (20) onto the output shaft (38).

(Continued on page 17)



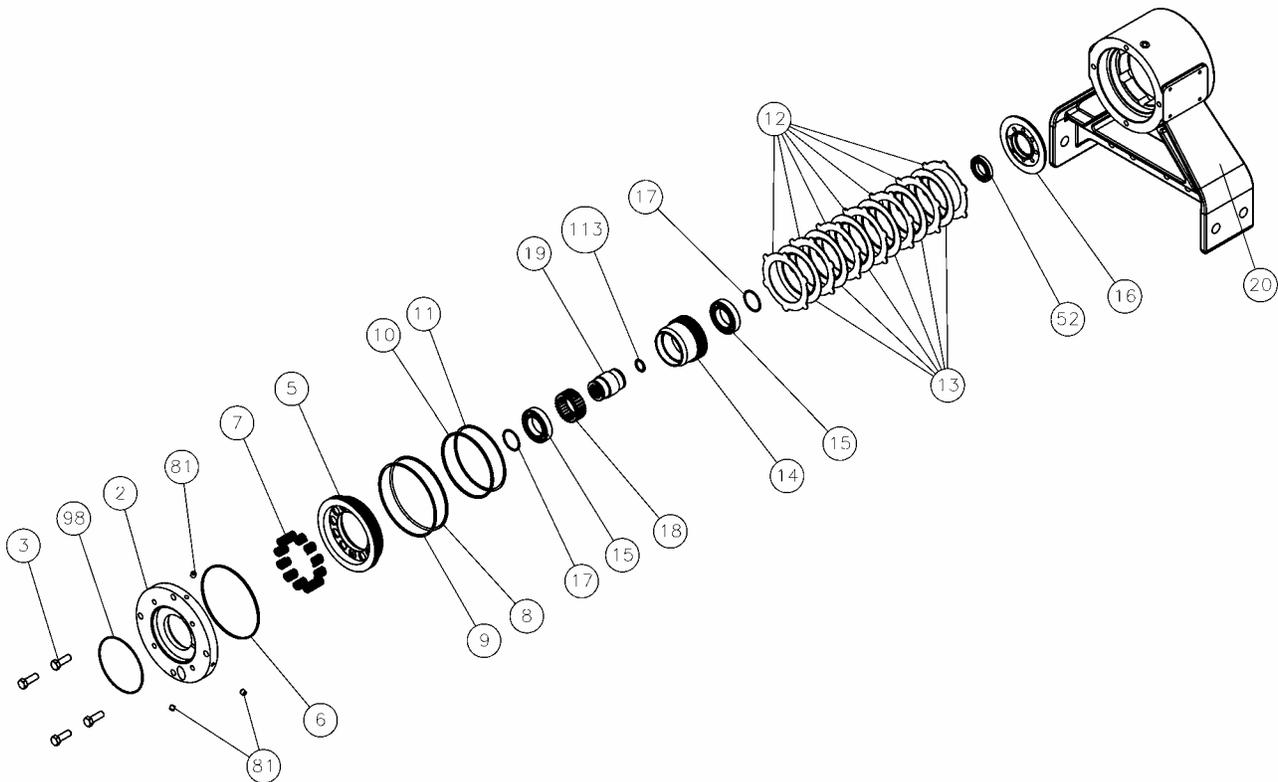
## DRUM SECTION ASSEMBLY CONTINUED

7. Bolt the brake housing (20) loosely into both frames (64, 65). Lower the drum so the weight of the drum is supported by both the brake and gear housings. The air line from the brake band air cylinder can be attached at this time.
8. Disengage the sliding clutch (27) so you can turn the drum freely and tighten all bolts through the frames to the proper torque specification (see page 25 of this manual).
9. Turn the drum to make sure it is not binding.
10. If necessary, install the air cylinder (105) and the air cylinder cover (91) to the brake housing with four capscrews (69) and spacers (97).
11. Install the bracket (90) to the brake housing using four capscrews (29).
12. Attach yoke (67) by installing clevis pins (49) into the bracket (90) and clevis (48). Install cotter keys (100) to clevis pins (49) to secure their positions. Connect shop air to the cylinder and apply air in both directions. With the clutch fully engaged (air applied), there should be slight movement on the clutch plate in both directions. Adjust clevis (48) and air cylinder jam nut accordingly.



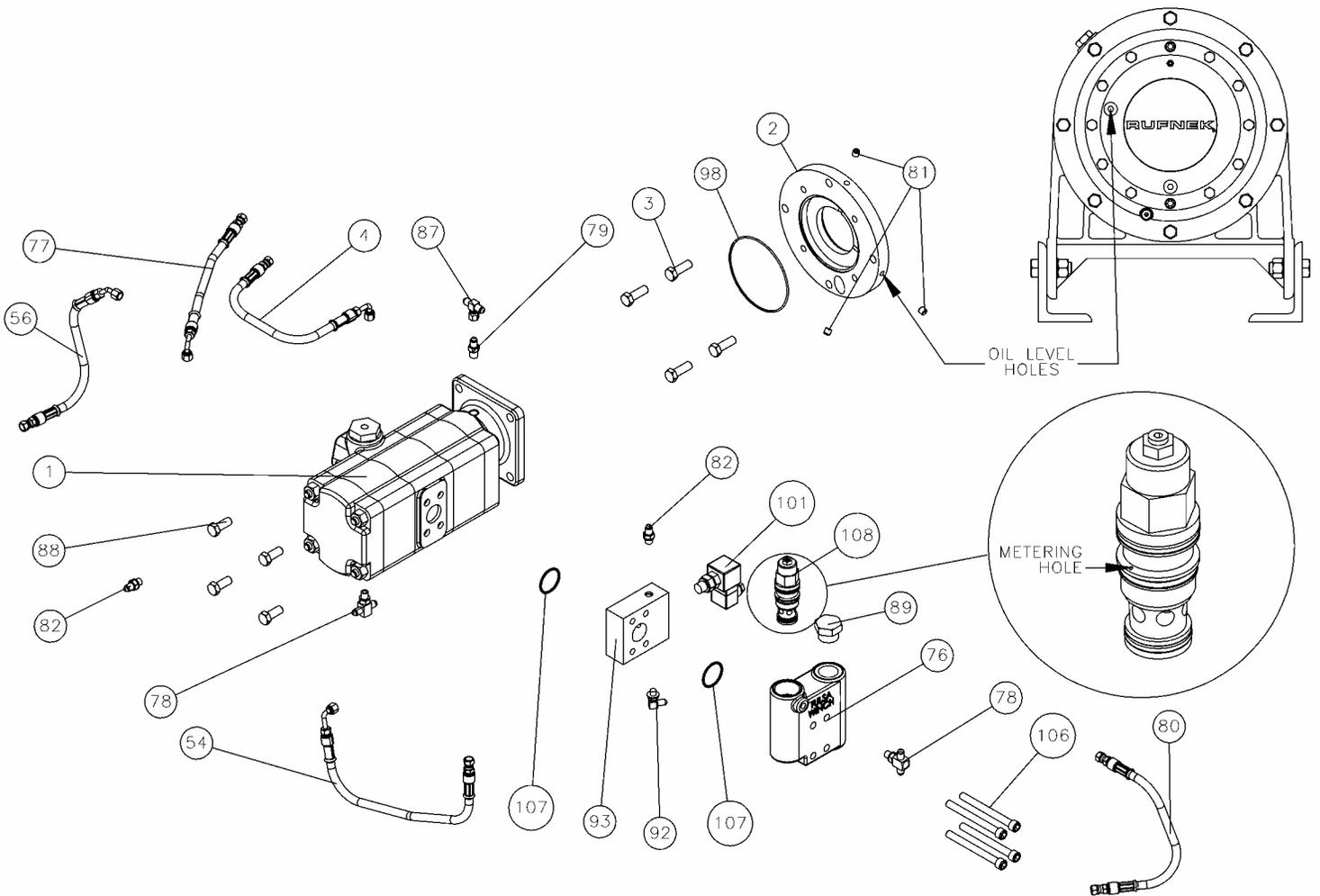
## M. BRAKE SECTION ASSEMBLY

1. Re-assemble the driver/clutch assembly making sure the clutch is installed properly and checking to make sure the cam clutch is free turning in the pay in direction.
2. Install the bearing housing assembly that contains parts 16 and 52 into the brake housing.
3. Install the driver/clutch assembly onto the input shaft (39).
4. Install the stator plates (12) and friction discs (13) starting with a stator plate and alternating between friction discs and stator plates until seven stator plates and six friction discs are used. (*Note: Dip friction discs in lightweight NON-EP oil before installation.*)
5. Install the piston (5) into the brake housing (20) and gently tap it down until it is seated making sure not to damage the o-rings (8, 10) or back-up rings (9, 11).
6. Install the springs (7) into the spring pockets in the piston. If working in a horizontal position, coat the bottom of each spring with chassis lube to keep it in position.
7. Install the cover (2) onto the brake housing (20) using four capscrews (3) making sure the cover is correctly oriented. Then, draw it down evenly, alternating between opposite hex bolts, being careful not to damage the o-ring (6).
8. Check the brake release with a portable hydraulic pump. Full release should be obtained at 400psi, plus or minus 20psi. Also, check the brake for proper operation by applying 104psi to the brake port and adapting a torque wrench to the input shaft. The torque in the payout should be 134 to 154 ft-lbs.



## N. MOTOR ASSEMBLY

1. Install the o-ring (98) then the motor (1) and secure it with four capscrews (88). Tighten the capscrews to the proper torque specification (see page 27 of this manual). *(Note: Make sure you install the motor with the belly of it down and the case drain port up.)*
2. If removed, install cartridge valve (101).
3. Install the o-ring (107) into the manifold block (93) and counterbalance block (76).
4. Install the counter-balance valve (108) into the counterbalance block (76).
5. Install the manifold block (93) and counterbalance block (76) using four capscrews (106).
6. Install hoses (4, 54, 56, 77, and 80).
7. Remove the oil level plugs (81 & 86) from the brake cover (2) and gearbox cover (55). Fill the brake and gearbox through the oil fill hole located on top of the gearbox with the proper oil until the oil reaches the oil level holes. Replace the oil level plugs.



# TROUBLESHOOTING

FAILURE	PROBABLE CAUSE
<b>Winch won't hold load.</b>	<ul style="list-style-type: none"> <li>a) Excessive back pressure in the system. Check the system for restrictions and reduce the backpressure.</li> <li>b) Brake discs are worn out. Replace brake discs.</li> <li>c) Winch clutch is slipping. Inspect the clutch and driver for wear and replace worn parts.</li> </ul>
<b>Winch will not raise the load it should.</b>	<ul style="list-style-type: none"> <li>a) Relief valve setting may be too low to allow proper lifting. Increase relief valve pressure setting. <i>(Note: Do not exceed recommended system pressures.)</i></li> <li>b) Load being lifted may be more than the winch's rating. Reduce the load or re-rig to increase mechanical advantage.</li> </ul>
<b>Oil leaks from the vent located on the top of the gearbox</b>	<ul style="list-style-type: none"> <li>a) The motor shaft seal may have failed. Replace this seal and reduce backpressure if that caused the shaft seal to fail.</li> <li>b) Brake piston seals may have failed. Service the brake section and replace worn parts.</li> </ul>

# RUFNEK 80 BILL OF MATERIAL

SEQ	QTY	P/N	DESCRIPTION
1	1	43399	HYDRAULIC MOTOR
2	1	43419	BRAKE COVER
3	6	28060	CAPSCREW
4	1	42494	HOSE ASSEMBLY
5	1	42942	BRAKE PISTON
6	1	33094	O-RING
7	12	42230	BRAKE SPRING
8	1	32186	O-RING
9	1	42337	BACK-UP RING
10	1	42335	O-RING
11	1	42336	BACK-UP RING
12	7	42148	STATOR PLATE
13	6	32765	FRICTION DISC
14	1	44335	BRAKE DRIVER
15	2	29162	BEARING
16	1	44338	BEARING HOUSING
17	2	44323	RETAINING RING
18	1	41759	CLUTCH
19	1	44337	INPUT DRIVER
20	1	44420	BRAKE HOUSING
21	2	44439	BUSHING
22	1	44417	RING INPUT GEAR
23	1	21042	BEARING
24	1	42938	THRUST COLLAR
25	2	42928	OIL SEAL
26	6	16989	CAPSCREW
27	1	43506	SLIDING CLUTCH
28	1	44498	SUN GEAR SPACER
29	4	29614	CAPSCREW
30	1	44422	COUPLER
31	2	42868	BUSHING
32	8	31141	CAPSCREW
33	-	-	OMIT
34	1	44423	WELDMENT DRUM
35	1	44424	CABLE CLIP
36	-	-	OMIT
37	1	44425	THRUST WASHER
38	1	44426	OUTPUT SHAFT
39	1	44427	INPUT SHAFT
40	1	4397	OUTPUT GEAR SET
41	1	4399	SECONDARY GEAR SET
42	1	4398	INPUT GEAR SET
43	2	44428	THRUST WASHER

## RUFNEK 80 BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
44	1	44429	INPUT SUN GEAR
45	1	44430	SECONDARY SUN GEAR
46	1	44431	OUTPUT SUN GEAR
47	1	43699	RETAINING RING
48	1	43828	CLEVIS
49	2	43827	CLEVIS PIN
50	3	21653	SET SCREW
51	2	21128	ZERK GREASE FITTING
52	1	42932	BALL BEARING
53	1	43696	THRUST COLLAR
54	1	43459	HOSE ASSEMBLY
55	1	44462	GEAR COVER
56	1	42495	HOSE ASSEMBLY
57	2	28933	O-RING
58	1	44433	COVER ADAPTER
59	1	29496	O-RING
60	1	44419	GEAR HOUSING
61	8	30203	CAPSCREW
62	8	20318	NUT
63	8	20559	LOCKWASHER
64	1	44434	RIGHT HAND FRAME
65	1	44435	LEFT HAND FRAME
66	1	44461	BRAKE BAND
67	1	43882	CLUTCH YOKE
68	1	42929	BRAKE BAND AIR CYLINDER
69	4	43880	CAPSCREW
70	2	20525	CAPSCREW
71	2	20521	NUT
72	2	20518	LOCKWASHER
73	1	42955	AIR SHIFT MOUNTING BRK.
74	1	31582	O-RING PLUG
75	1	13050	BREATHER
76	1	42029	1200W COUNTERBALANCE BLOCK
77	1	42031	HOSE ASSEMBLY
78	2	42438	STRAIGHT THREAD BRANCH TEE
79	1	40280	FITTING
80	1	42030	HOSE ASSEMBLY
81	4	21684	PLUG, PIPE
82	2	41838	STRAIGHT ADAPTER
83	-	-	OMIT
84	1	43834	AIR SHIFT KIT
85	1	42392	O-RING PLUG
86	2	43402	O-RING PLUG
87	1	42033	SWIVEL TEE

## RUFNEK 80 BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
88	4	20524	CAPSCREW
89	1	32411	HEX PLUG
90	1	43877	CLUTCH BRACKET
91	1	43835	AIR CYLINDER COVER
92	3	42089	90° ADAPTER
93	1	43368	MANIFOLD BLOCK
94	3	44436	SHAFT KEY
95	-	-	OMIT
96	-	-	OMIT
97	4	43078	SPACER
98	1	34003	O-RING
99	1	939243	CLEVIS PIN
100	3	20514	COTTER PIN
101	1	43367	12 VOLT CARTRIDGE VALVE
102	1	43879	CLUTCH PLATE
103	-	-	OMIT
104	1	42986	CLUTCH OUT LABEL
105	1	44340	AIR CYLINDER
106	4	43372	CAPSCREW
107	2	32182	O-RING
108	1	41867	COUNTERBALANCE VALVE
109	1	44047	RUFNEK LOGO PLATE
110	-	-	OMIT
111	2	44437	SOCKETHEAD CAPSCREW
112	10	44438	CAPSCREW
113	1	29043	RETAINING RING
114	1	44489	RETAINING RING
115	2	44285	PIN
116	-	-	OMIT

# VISCOSITY CHART



SUS VISCOSITY @100°F	KINEMATIC VISCOSITY CENTISTOKES (cSt@40°C)	ISO (cSt)	AGMA NUMBER	SAE CRANKCASE OIL	SAE GEAR OIL
9000	1500	1500	9		
8000					
7000					
6000	1000	1000	8A		250
5000	900				
	800				
4000	700	680	8		
3000	600				
2500	500	460	7		140
2000	400				
1500	300	320	6		
1000	200	220	5	50	90
900	175				
800	150	150	4	40	
700	125				
600	100	100	3	30	85W
500	80				
400	70	68	2		
300	60				
200	50	46	1	20W -20	80W
150	40				
100	30	32	0		
	20	22		10W	75W
	15	15		5W	
	10	10		0W	
	5	7			
50		5			
		3			
		2			



## TORQUE SPECIFICATIONS CHART

Nominal	Size	Dry	Plated	Lubricated	Dry	Plated	Lubricated
		SAE Grade 5 Torque *(Ft-Lbs)	SAE Grade 5 Torque *(Ft-Lbs)	SAE Grade 5 Torque *(Ft-Lbs)	SAE Grade 8 Torque *(Ft-Lbs)	SAE Grade 8 Torque *(Ft-Lbs)	SAE Grade 8 Torque *(Ft-Lbs)
1/4	20	8	6	5	12	9	7
1/4	28	10	7	6	14	10	8
5/16	18	17	13	10	25	18	15
5/16	24	19	14	11	27	20	16
3/8	16	31	23	19	44	33	26
3/8	24	35	26	21	49	37	30
7/16	14	49	37	30	70	53	42
7/16	20	55	41	33	78	58	47
1/2	13	76	57	45	106	80	64
1/2	20	85	64	51	120	90	72
9/16	12	109	82	65	153	115	92
9/16	18	122	91	73	172	129	103
5/8	11	150	113	90	212	159	127
5/8	18	170	128	102	240	180	144
3/4	10	266	200	160	376	282	226
3/4	16	297	223	178	420	315	252
7/8	9	430	322	258	606	454	364
7/8	14	474	355	284	668	501	401
1	8	644	483	386	909	682	545
1	14	721	541	433	1019	764	611
1-1/8	7	794	596	475	1288	966	772
1-1/8	12	890	668	534	1444	1083	866
1-1/4	7	1120	840	672	1817	1363	1090
1-1/4	12	1241	930	745	2012	1509	1207

T = BOLT TORQUE (LB. FT.)

$$T = (KWD) / 12$$

K = TORQUE COEFFICIENT (K = 0.20 DRY    K = 0.15 PLATED    K = 0.12 LUBRICATED)

W = PRELOAD TENSION

D = NOMINAL BOLT SIZE (IN.)

\* ALL TORQUE VALUE TOLERANCES ARE ± 5%

# RUFNEK 80 ISOMETRIC DRAWING

