



Tulsa Winch

3541RL SERVICE MANUAL

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MODEL CODE
3541RL A L O C DWE

BASIC MODEL _____

A OR **B** DRUM WIDTH _____

LEFT/**R**IGHT MOUNT _____

SPOOL **O**VER/**U**NDER DRUM _____

CLOSE COUPLED _____

MOTOR OPTION _____

!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. Do not use EP type gear lubes in the brake section of this winch. EP lubes may prevent the clutch from locking up, causing a load to fall, and resulting in property damage, personal injury, or death.
8. 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.

INTRODUCTION AND THEORY OF OPERATION

The 3541RL series planetary winch is designed to use a roller-vane gerotor motor, driving through a multiple disc brake, spring assisted air operated clutch and two 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.

MAINTENANCE

Tulsa 3541RL 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 three steps.

1. A daily inspection to insure that there are no oil leaks present, that all mounting bolts and other fasteners are tight, and that the wire rope is in good condition.
2. Periodic servicing of the winch includes changing the oil in both the gearboxes 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. 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 on 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.

Tulsa 3541RL series of winches are shipped from the factory with SAE 90 EP gear lube in the gearboxes and automatic transmission fluid in the brake section. This oil should be satisfactory for operation in ambient temperatures from -10°F to +110°F. If your work calls for operation in temperatures outside this range, contact Tulsa Winch for recommendations.

Gearbox oil in gear section is drained by removing the fill and drain plugs (items 79) located on the gearbox cover (item 61). Gearbox oil in the drum section is drained by removing the plug (item 45) located on the barrel of the drum (item 1). Examine the used oil for signs of significant metal deposits and then dispose of it in a proper manner. Reinstall the plugs and fill the gearboxes with the proper amount of new SAE 90 EP gear lube through the fill hole. Make sure the breather (item 78) is operational and replace if necessary.

Drain the brake section by removing the drain plug (item 32) and breather (item 31) in the brake cover (item 28). Inspect the oil for signs of metallic particles and/or burning and re-install the drain plug. Fill brake section with automatic transmission fluid, or hydraulic oil.

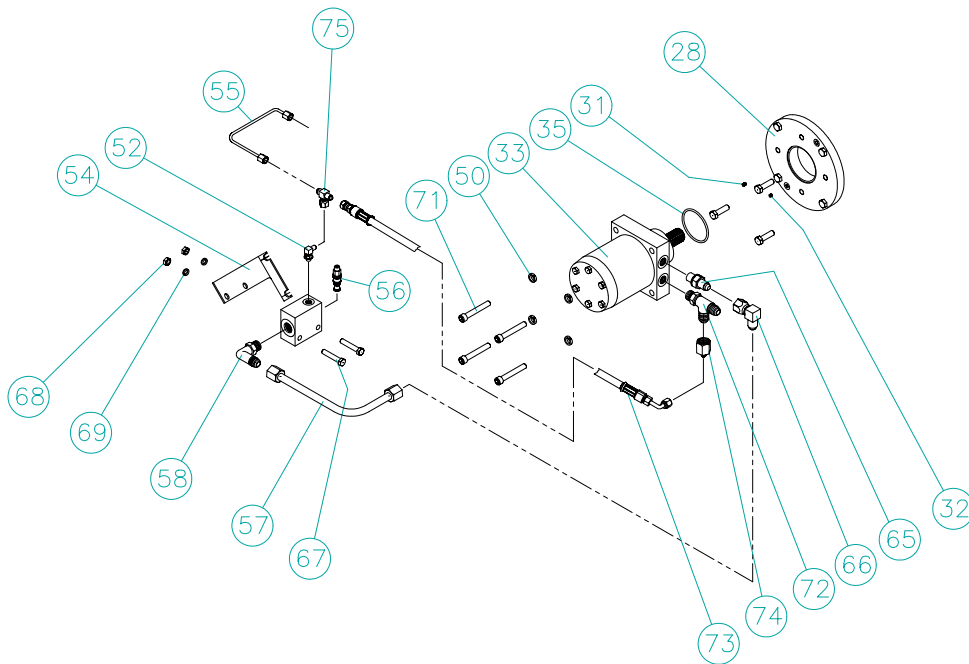
OIL CAPACITIES

	QTY	TYPE
GEAR LUBE (DRUM SECTION)	3/4 qt.	EP 90
BRAKE OIL	1/2-1 pt.	ATF
GEAR LUBE (GEAR SECTION)	1-1/2 qts.	EP 90

GENERAL DISASSEMBLY

A. MOTOR SECTION DISASSEMBLY

1. Drain the oil from the brake assembly by removing the plug (item 32) from brake cover (item 28).
2. Remove all tubing and hoses attached to motor. (*Note the location of tubing, hoses and fittings for re-assembly*).
3. Remove the capscrews (item 71) holding motor in place.
4. Grasp the motor and remove from winch.
5. Inspect o-ring (item 35), replace if necessary.
6. Motors are not serviceable in the field. Return them to an authorized dealer for service.

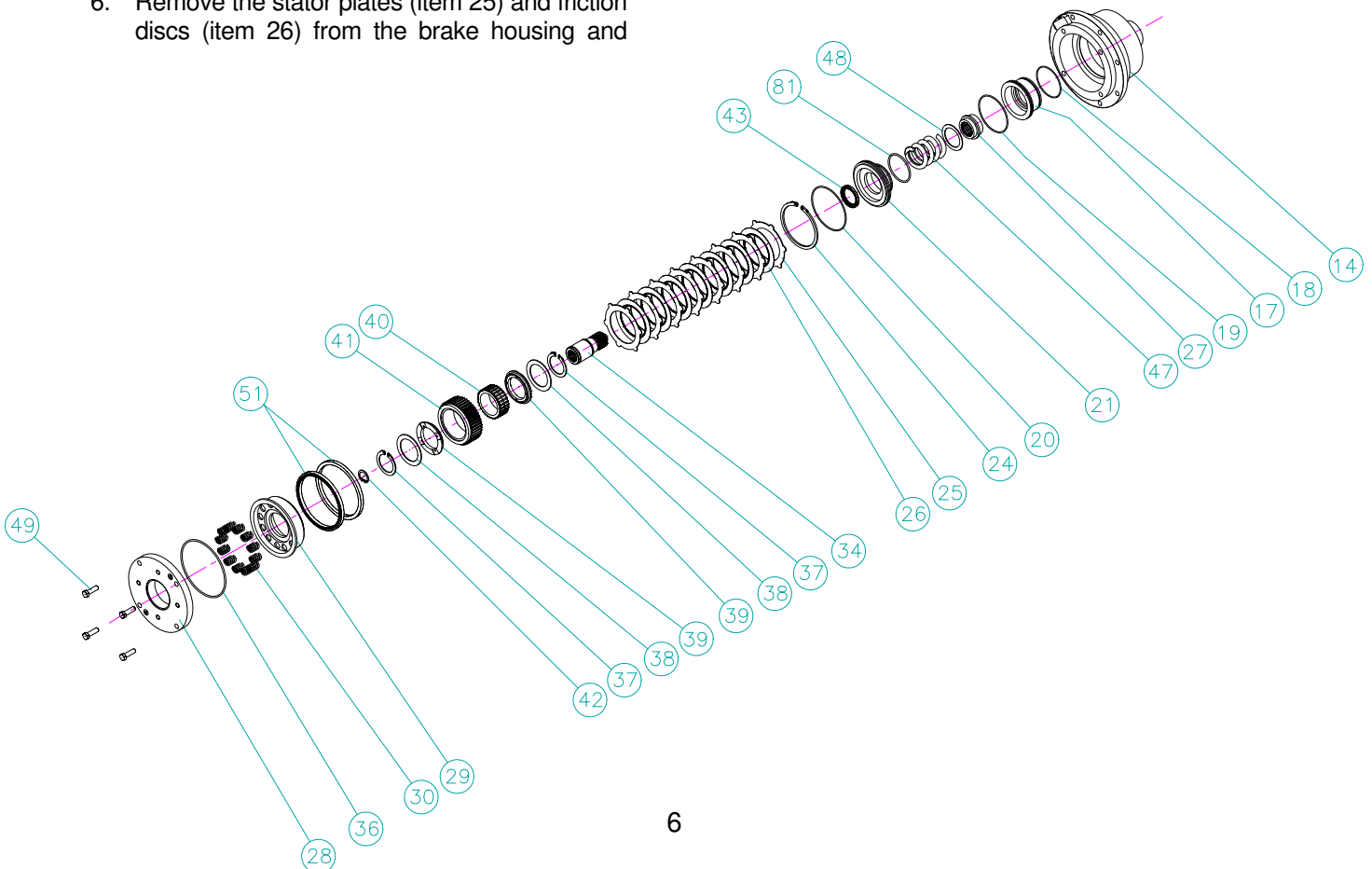


B. BRAKE SECTION DISASSEMBLY

1. Evenly remove the four capscrews (item 49) that hold the brake cover in place. Spring pressure will raise the cover up as the capscrews are loosened. Carefully remove the cover (item 28) from the brake housing (item 14). Inspect the o-ring (item 36) for damage and replace if necessary.
2. Remove the springs (item 30) from the piston (item 29) and check the free height. Each spring should measure at least 1.250 inches with no force on them.
3. Remove the brake piston (item 29) by installing two pieces of 3/8"-16NC all thread run in evenly until the piston is clear of the housing. An alternate way of removing the piston is to use a portable hydraulic power unit or air to gently pressurize the brake cavity to remove the piston from the brake housing (item 14).
4. If one or both the square seals (item 51) remain in the bore of the brake housing, remove them. Inspect the seals for damage and replace if necessary.
5. Grasp the brake driver/clutch assembly (assembled items 34,37,38,39,40,41 & 42) and remove it from the brake housing.
6. Remove the stator plates (item 25) and friction discs (item 26) from the brake housing and

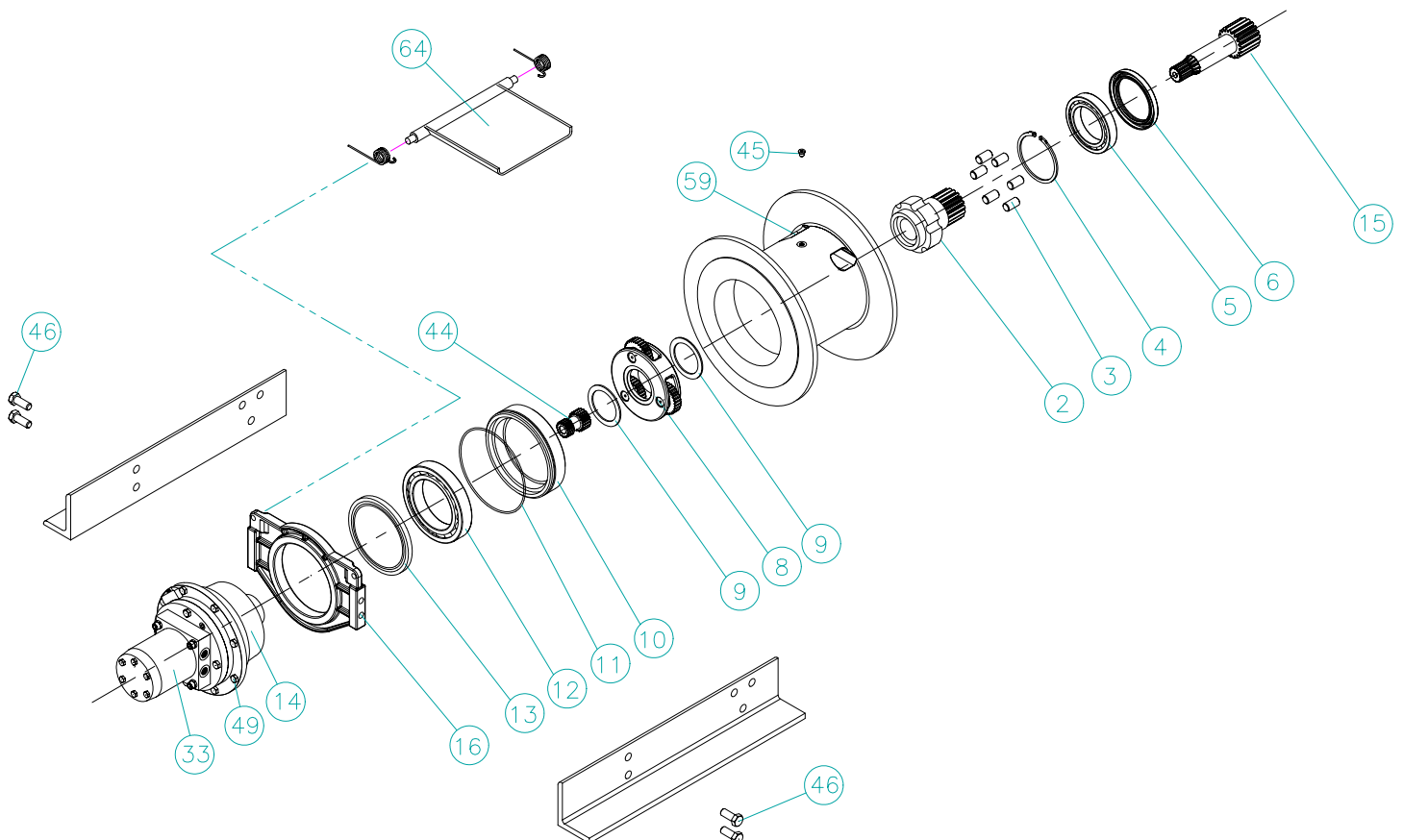
check them for excessive wear. Replace if necessary. Be sure to check the top stator plate for scoring caused by the removal of the piston and polish if necessary. Friction discs should measure no less than .055-in. thick and stator plates should measure no less than .068-in thick.

7. To dis-assemble the brake driver/clutch assembly, remove the retaining ring (item 37) from either end of the driver. Then remove the race (item 38) and bushing (item 39). Slide the brake driver (item 41) off the drive coupling. *(Note: Notice the direction of lock-up on the clutch for re-assembly. Inspect the driver coupling and brake driver for wear. Replace if necessary.)*
8. Remove the retaining ring (item 24), then remove the middle piston (item 21). Inspect the seal (item 43) and o-rings (items 20 & 81) for damage and replace if necessary.
9. Remove the clutch spring (item 47) and thrust washer (item 48) from brake housing.
10. Grasp the sliding clutch (item 27) and remove from the brake housing.
11. Remove inner piston (item 17) from brake housing. Inspect the o-rings (items 18 & 19) for damage and replace if necessary.



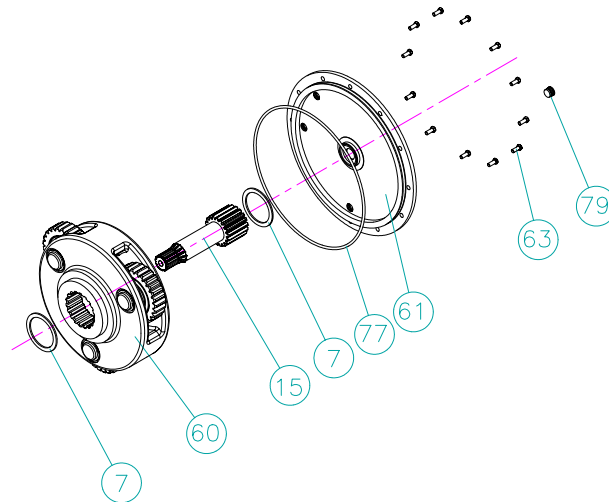
C. DRUM & INPUT GEAR SET DISASSEMBLY

1. Remove all tubing and hoses attached to motor (item 33) and brake housing (item 14). (Note the location of tubing, hoses and fittings for re-assembly).
2. Drain oil from drum section by removing plug (item 45) located on the barrel of the drum.
3. Then remove the motor and brake assembly by removing 8 capscrews (item 49).
4. Grasp the motor and remove the motor & brake assembly from winch.
5. Examine the journal on the brake housing where the seal (item 13) rides. If severely worn, replace the brake housing (item 14). *Refer to brake section disassembly section for brake housing replacement.*
6. Grasp the input sun gear (item 44) and remove from gear set (item 8).
7. Using two crows foot pry bars, hook the bearing carrier (item 10) in the I.D. of the bearing (item 12) and pull out of drum. Inspect the seal (item 13), o-ring (item 11) and bearing (item 12) for damage or wear, replace if necessary.
8. Next remove the input gear set (item 8) with thrust washers (item 9) from drum. Inspect gear set for wear and repair as needed. (See gear set disassembly section for disassembly and assembly procedures).
9. To remove drum the side plate (item 16) must be removed by removing capscrews (item 46) attaching frames to sideplate. Remove side plate.
10. Remove drum by hoisting the drum straight up off of output sun gear (item 15).
11. Use caution removing drum with cable packer option (item 64). Cable packer is spring loaded.
12. Inspect seal (item 6), bearing (item 5) and shaft (item 2) located in drum for damage or wear. Remove and replace if necessary.



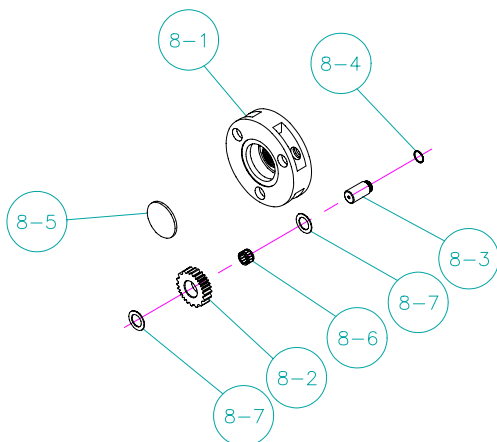
D. OUTPUT GEAR SECTION DISASSEMBLY

1. With winch positioned horizontally drain the oil by removing the plug (item 79) at the bottom of the gear cover. To disassemble the output gear end you must start with the outer cover. Remove the capscrews (item 63) and cover (item 61).
2. Inspect the o-ring (item 77) and the outer race (item 7), replace if necessary.
3. Remove output sun gear (item 15), output gear set (item 60), and the inner race (item 7) and inspect for Wear. Replace if necessary.

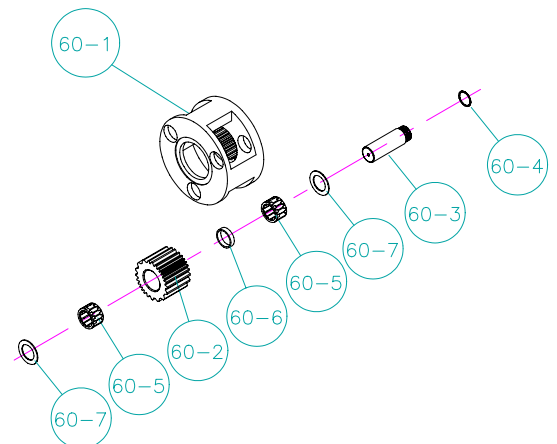


E. PLANET SET DISASSEMBLY AND ASSEMBLY.

1. Remove the retaining rings from the planet pins.
2. Remove the pins from the carrier by carefully tapping them out.
3. Remove the planet gears, thrust washers and bearings from the carriers.
4. Inspect the pins, bearings, and gear bores for evidence of wear and replace if necessary.
5. Before assembly, be sure to insert the round thrust plate into the input carrier.
6. To re-assemble, be careful to line up the planet pins with the thrust washers and bearings. Press the knurled part of the pin into the carrier. If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.
7. Replace retaining rings.



INPUT GEAR SET (8)

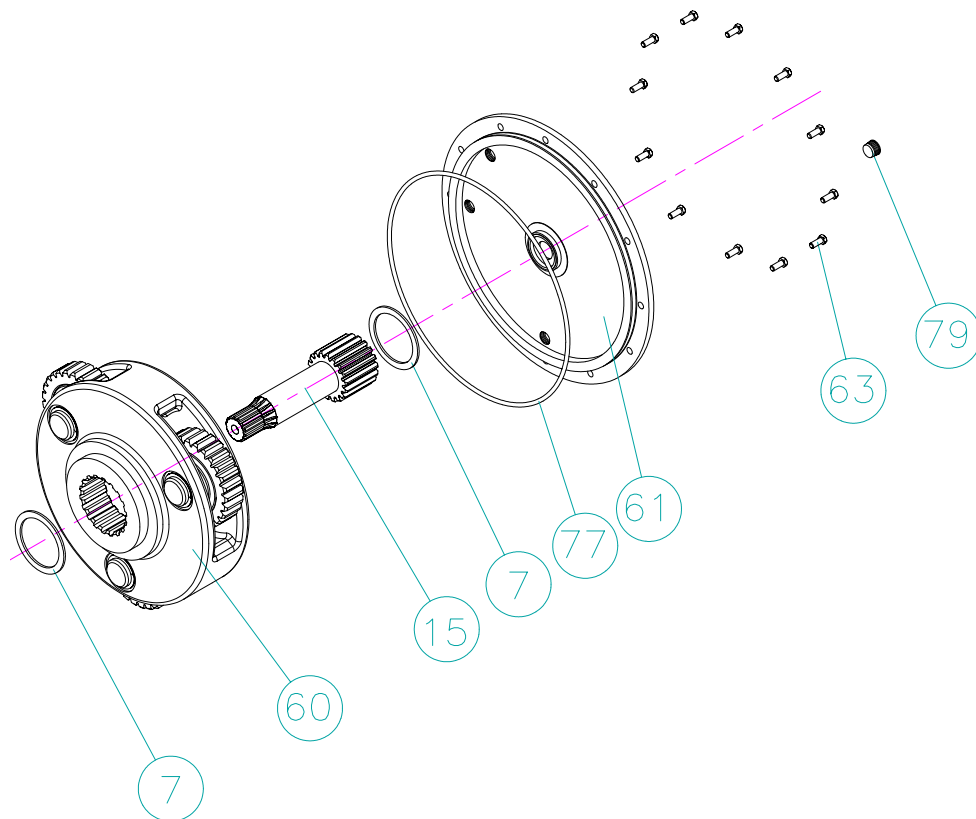


OUTPUT GEAR SET (60)

GENERAL ASSEMBLY

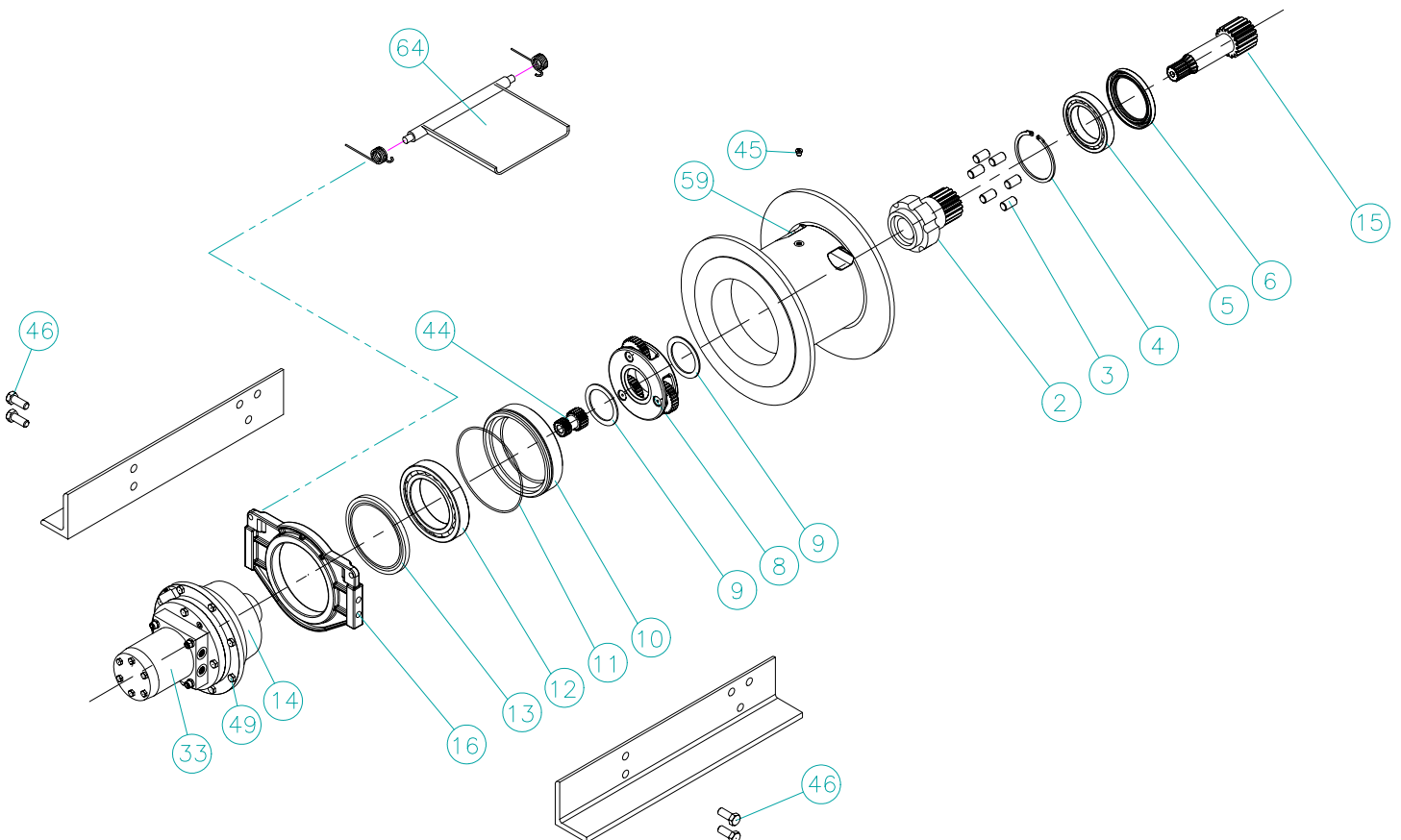
F. OUTPUT GEAR SECTION ASSEMBLY

1. Lubricate and insert inner race (item 7) into recess located in gear housing (item 80)
2. Insert output gear set (item 15) into gear housing.
3. Install output sun gear (item 15) into output gear set.
4. lubricate and install outer race (item 7) into recess located on output gear set.
5. Install cover (item 61) by installing capscrews (item 63).
6. Fill gear section to fill/level hole in cover with proper type of lubricant.



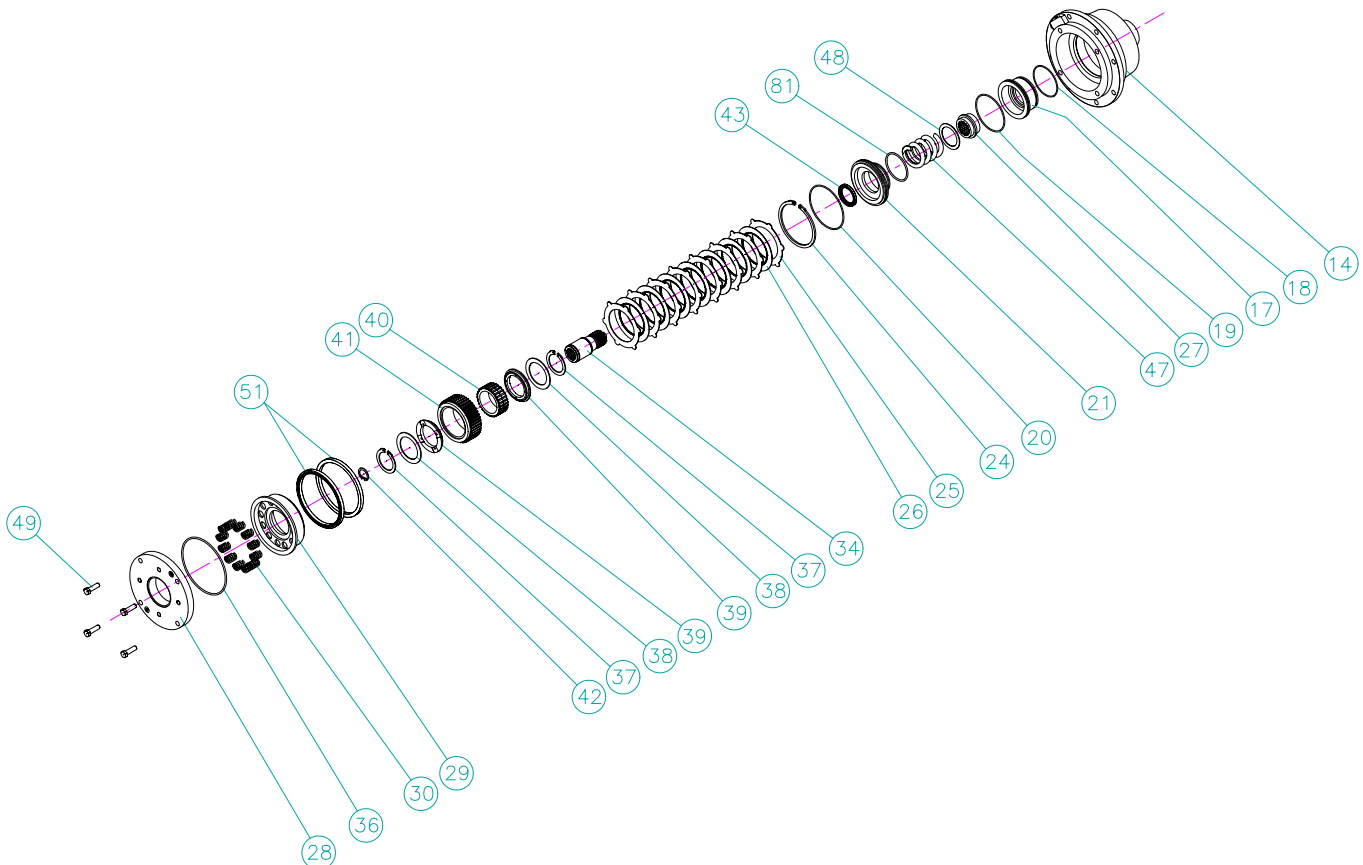
G. DRUM & INPUT GEAR SET ASSEMBLY

1. Thoroughly clean all parts. Replace those which show wear. Lubricate all oil seals and o-rings before assembly.
2. After inspecting drum, shaft, bearing and seal for damage or wear, Install drum (item 1) over output sun gear, making sure that the splines on shaft (item 2) properly engage output gear set (item 60).
3. If applicable install cable packer.
4. Install side plate (item 16) by attaching sideplate to frames with capscrews (item 46).
Note: Do not tighten capscrews (item 46) until brake housing (item 14) is attached to side plate (item 16).
5. Lubricate and Insert thrust washer (item 9) into drum and center over output sun gear (item 15) on top of shaft (item 2).
6. Insert input gear set (item 8) into drum, making sure that it engages the output sun gear (item 15).
7. Lubricate and Insert thrust washer (item 9) into drum and locate in recess on input gear set (item 8).
8. Install the bearing carrier (item 10) with seal side facing up into drum.
9. Insert the input sun gear (item 44) into input gear set (item 8).
10. Place the brake assembly into the winch and install 8 capscrews (item 49). Tighten capscrews evenly to 100-110 ft. lb torque. Make sure that the level and vent plugs in the cover are properly oriented.
11. Tighten capscrews (item 46) holding frames (items 22 & 23) to sideplate (item 16).
12. Attach all tubing and hoses to motor (item 33) and brake housing (item 14).
13. Position winch horizontally and fill drum section with proper amount and type of lubricant.



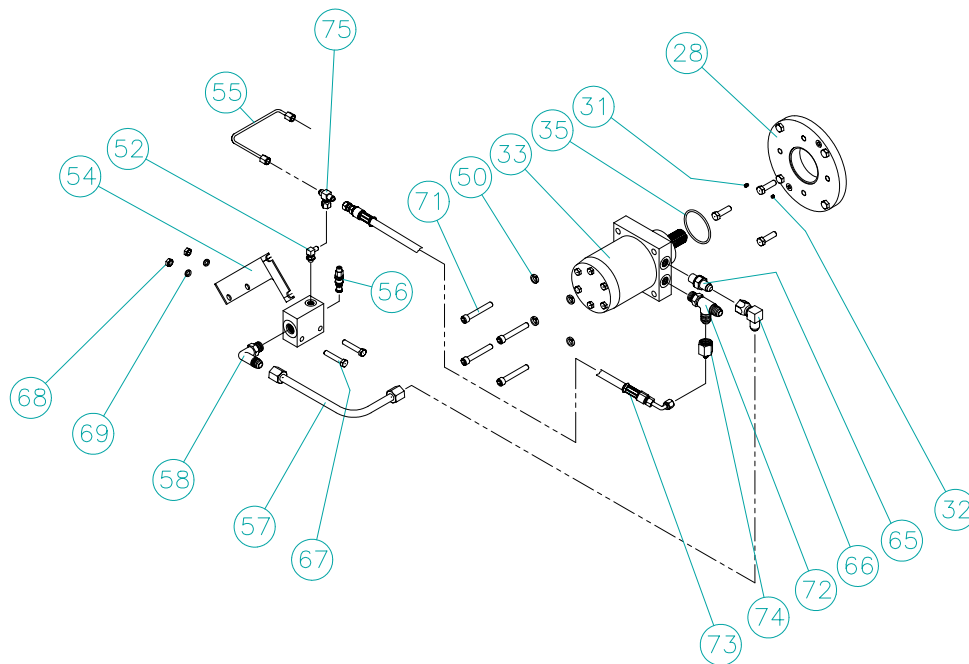
H. BRAKE SECTION ASSEMBLY

1. Lubricate and install inner piston (item 17) into brake housing (item 14).
2. Insert sliding clutch (item 27) into bore of inner piston (item 17) with long side down.
3. Install thrust washer (item 48), then clutch spring (item 47).
4. Insert the middle piston (item 21). While holding down on piston (item 21) install retaining ring (item 24).
5. Insert the brake driver/clutch assembly, making sure that it engages the sliding clutch (item 27).
6. Install the stator plates (item 25) and friction discs (item 26) starting with a stator plate and alternating between friction discs and stator plates. There is one more stator plate than friction discs so you should end with a stator plate. Note: Soak friction discs in hydraulic oil before installation.
7. Inspect each new seal (item 51) to make sure it has an o-ring in the groove of the seal. Install one seal into the bore of the brake housing (item 14) with the o-ring side toward the brake pack. Place the other seal onto the brake piston (item 29) with the o-ring side toward the flange of the piston.
8. Lubricate and install piston into the brake housing and gently tap down until seated.
9. Install the springs (item 30) into the spring pockets. If working in a horizontal position, coat the bottom of each spring with chassis lube to keep it in position.
10. Install the brake cover (item 28) onto the brake housing and tighten capscrews (item 49) evenly, alternating between opposite capscrews. Make sure ports are oriented in proper position.
11. Check the brake release with a portable hydraulic pump. Full release should be obtained at 320-340 psi. Also, check the brake for proper operation by applying 280 psi to the brake port and adapting a torque wrench to the input shaft. The torque in the payout direction should be 95-115 ft-lbs.
12. Check the air operated clutch by applying 100 psi. air to "Clutch In" and "Clutch Out" ports. Check for leaks and proper working of clutch.



I. MOTOR SECTION ASSEMBLY

1. Insert motor (item 33) into brake cover (item 28) making sure that ports are oriented correctly. Install capscrews (item 71) with lockwashers (item 50).
2. Attach all tubing and hoses.
3. Fill brake section with proper amount of ATF fluid.



TROUBLE SHOOTING

1. **PROBLEM:**

Winch won't hold load.

SOLUTION:

- a. Excessive back pressure in the system. Check the system for restrictions and reduce the backpressure.
- b. Brake discs are worn out. Replace brake discs.
- c. Winch clutch is slipping. Inspect the clutch and driver for wear and replace worn parts.

2. **PROBLEM:**

Winch will not raise the load it should.

SOLUTION:

- a. Relief valve setting may be too low to allow proper lifting. Increase relief valve pressure setting. *(Note: do not exceed recommended system pressures).*
- b. Load being lifted may be more than the winch's rating. Reduce the load or re-rig to increase mechanical advantage.

3. **PROBLEM:**

Oil leaks from the vent on the motor side of the winch.

SOLUTION:

- a. The motor shaft seal may have failed. Replace this seal and reduce backpressure if that caused the shaft seal to fail.
- b. Brake piston seals may have failed. Service the brake section and replace worn parts.

3541RL BILL OF MATERIAL

ITEM NO.	PART NO.	QTY.	DESCRIPTION
1	42814	1	DRUM
2	42812	1	SHAFT
3	42827	6	PIN
4	30567	1	RETAINING RING
5	30385	1	BEARING, BALL
6	42828	1	SEAL, OIL
7	42839	2	RACE
8	4217	1	INPUT GEAR SET
9	41722	2	RACE
10	42203	1	CARRIER BEARING
11	939452	1	O-RING
12	29967	1	BALL BEARING
13	42202	1	OIL SEAL
14	42661	1	BRAKE HOUSING
15	42803	1	OUTPUT SUN GEAR
16	42663	1	SIDE PLATE
17	42924	1	AIR PISTON
18	42201	1	O-RING
19	31455	1	O-RING
20	34003	1	O-RING
21	42943	1	AIR PISTON
22	42842	1	FRAME, L.H.
23	42843	1	FRAME, R.H.
24	30600	1	RETAINING RING
25	42148	8	STATOR PLATE
26	32765	7	FRICTION DISC
27	42220	1	SLIDING CLUTCH
28	42593	1	BRAKE COVER
29	42229	1	BRAKE PISTON
30	42230	12	BRAKE SPRING
31	13050	1	BREATHER
32	21684	1	PLUG
33	43117	1	MOTOR, HYDRAULIC
34	42206	1	INPUT DRIVER
35	32566	1	O-RING
36	33094	1	O-RING
37	26980	2	RETAINING RING
38	41723	2	RACE
39	41743	2	BUSHING
40	41759	1	CLUTCH
41	41740	1	BRAKE DRIVER
42	29043	1	RETAINING RING
43	42217	1	OIL SEAL
44	42238	1	INPUT SUN GEAR
45	41719	1	PLUG, O-RING
46	42239	10	CAPSCREW
47	42241	1	SPRING, CLUTCH
48	33260	1	THRUST WASHER
49	28060	12	CAPSCREW
50	41000	4	LOCKWASHER
51	41721	2	OIL SEAL
52	32868	1	ADAPTER, 90 DEG.
53	41838	1	ADAPTER, STRAIGHT
54	42594	1	MOUNTING BRACKET
55	42595	1	TUBING
56	41603	1	COUNTERBALANCE VALVE
57	42596	1	TUBING
58	42597	1	ADAPTER, 90 DEG.
59	42534	1	CABLE THIMBLE
60	4215	1	OUTPUT GEAR SET
61	42820	1	COVER
62	23521	1	PLUG
63	20522	12	CAPSCREW
64	4218	1	CABLE PACKER

65	42599	1	ADAPTER, STRAIGHT
66	42600	1	ADAPTER, SWIVEL 90 DEG.
67	40146	2	CAPSCREW
68	21723	2	NUT
69	21106	2	WASHER
70	42283	1	CAPLUG
71	42517	4	CAPSCREW
72	42618	1	ADAPTER, TEE
73	42494	1	HOSE ASSEMBLY
74	42620	1	ADAPTER, REDUCER
75	42033	1	TEE, SWIVEL NUT
76	41668	1	CAPLUG
77	42841	1	O-RING
78	4101	1	BUSHING & BREATHER
79	32220	2	PLUG
80	42802	1	GEAR HOUSING
81	41641	1	O-RING

3541RL SUB-ASSEMBLY BILL OF MATERIAL

SA-4217, INPUT GEAR SET (ITEM 8)			
ITEM	DESCRIPTION	QTY.	PART NO.
8-1	INPUT CARRIER	1	42838
8-2	INPUT PLANET GEAR	3	42245
8-3	PLANET PIN	3	41760
8-4	RETAINING RING	3	41715
8-5	PLATE	1	41769
8-6	BEARING	3	30484
8-7	RACE	6	28771

SA-4215, OUTPUT GEAR SET (ITEM 60)			
ITEM	DESCRIPTION	QTY.	PART NO.
60-1	OUTPUT CARRIER	1	42805
60-2	PLANET GEAR	3	42806
60-3	PLANET PIN	3	41747
60-4	RETAINING RING	3	41716
60-5	BEARING	6	41717
60-6	SPACER	3	41739
60-7	RACE	6	939249

SA-4218, CABLE PACKER (ITEM 64)			
ITEM	DESCRIPTION	QTY.	PART NO.
64-1	SPRING, L.H.	1	42344
64-2	CABLE PACKER	1	42840
64-3	SPRING, R.H.	1	42343



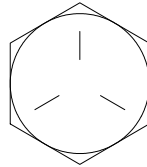
VISCOSITY CHART



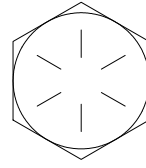
Tulsa Winch

TORQUE SPECIFICATIONS CHART

(HEX HEAD CAP SCREWS)

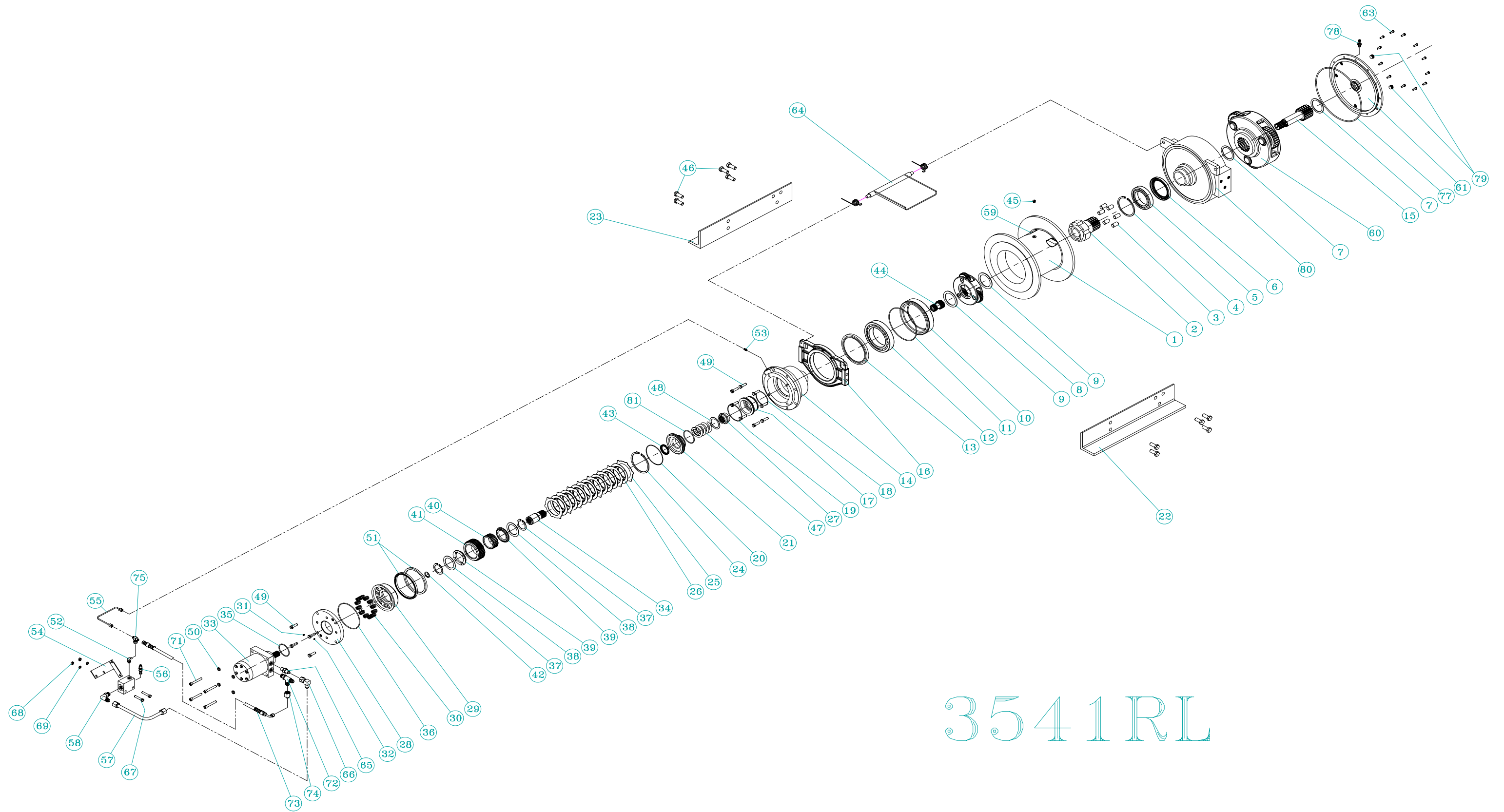


Grade 5



Grade 8

Nominal Dia.	Threads Per Inch	Ft. Lbs.	Ft. Lbs.
3/8	16	36 - 42	42 - 48
	24	41 - 47	48 - 54
7/16	14	54 - 62	63 - 71
	20	65 - 73	76 - 84
1/2	13	80 - 90	100 - 110
	20	100 - 110	120 - 130
9/16	12	105 - 115	125 - 135
	18	125 - 135	150 - 160
5/8	11	170 - 180	200 - 210
	18	195 - 205	230 - 240
3/4	10	285 - 295	330 - 340
	16	340 - 350	400 - 410
7/8	9	495 - 505	580 - 595
	14	580 - 595	685 - 700
1	8	685 - 700	805 - 820
	14	825 - 840	965 - 980
1-1/8	7	1045 - 1060	1500 - 1525
	12	1240 - 1260	1680 - 1705



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