



# Tulsa Winch

DESIGN SERIES 003



## RUFNEK 45 SERVICE MANUAL

<b>INTRODUCTION AND THEORY OF OPERATION .....</b>	<b>2</b>
<b>ASSEMBLY NUMBER EXPLANATION .....</b>	<b>2</b>
<b>WINCH MODEL CODES .....</b>	<b>2</b>
<b>!WARNING! .....</b>	<b>3</b>
<b>MAINTENANCE .....</b>	<b>5</b>
<b>GENERAL DISASSEMBLY .....</b>	<b>6</b>
A. MOTOR DISASSEMBLY .....	7
B. BRAKE SECTION DISASSEMBLY .....	7
C. DRUM SECTION DISASSEMBLY .....	8
D. GEAR SECTION DISASSEMBLY .....	10
E. INPUT PLANET SET DISASSEMBLY .....	11
F. OUTPUT PLANET SET DISASSEMBLY .....	12
<b>GENERAL ASSEMBLY .....</b>	<b>13</b>
G. OUTPUT PLANET SET ASSEMBLY .....	13
H. INPUT PLANET SET ASSEMBLY .....	14
I. GEAR END ASSEMBLY .....	15
J. DRUM SECTION ASSEMBLY .....	16
K. BRAKE SECTION ASSEMBLY .....	17
L. MOTOR ASSEMBLY .....	18
<b>TROUBLESHOOTING .....</b>	<b>19</b>
<b>RUFNEK 45 BILL OF MATERIAL .....</b>	<b>20</b>
<b>VISCOSITY CHART .....</b>	<b>23</b>
<b>TORQUE SPECIFICATIONS CHART .....</b>	<b>24</b>
<b>RUFNEK 45 ISOMETRIC DRAWING .....</b>	<b>25</b>

# INTRODUCTION AND THEORY OF OPERATION

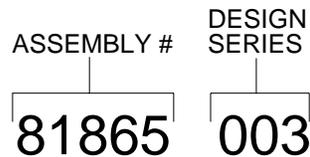
The Rufnek series planetary winch is designed to use a high-speed gear motor, driving through a multiple disc brake, through two planet sets to the cable drum.

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.

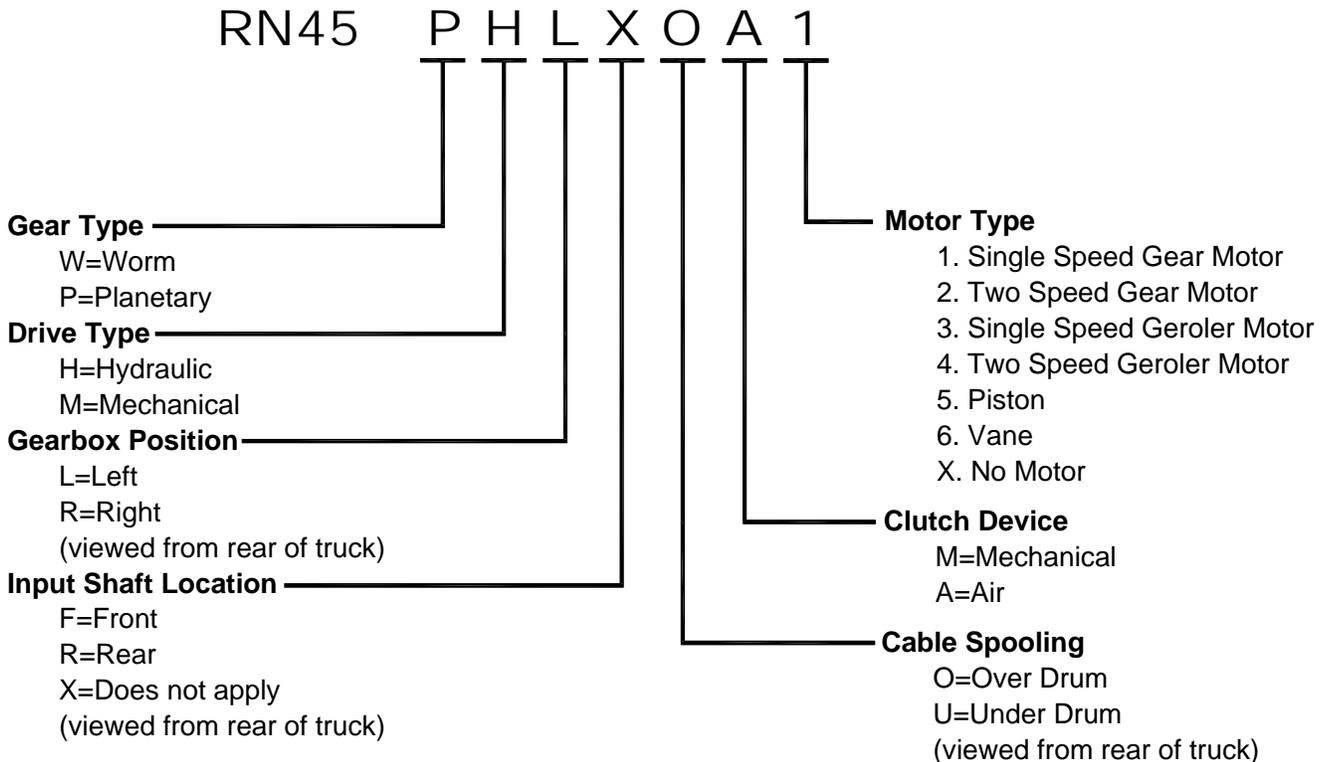
The brake and brake valve receives its signal any time the winch is in pay out. With the brake fully open at about 340 PSI the brake valve will open and dynamically control the lowering of the load.

# ASSEMBLY NUMBER EXPLANATION

This manual is for design series 003. 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





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

The safety of the winch operator and ground personnel should always be of great concern, and all necessary precautions to insure their safety must be taken. The primary mover and the winch must be operated with care and concern for the equipment and the environment and with a thorough knowledge of the equipment and its performance capabilities must be understood. These general safety guidelines are offered, however local rules and regulations or national standards may also apply. Recommended references are, but not limited to, ANSI B30, OSHA 1910, AWS D 14.3, and SAE J706.

Additional information can be found at <http://www.team-twg.com/TulsaWinch/>

	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.
	Indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property.

**Mounting:**

Winch mounting must be secure and able to withstand the applied loads.

- The stability of the mounting system must be approved by a qualified person.
- All welding should also be done by a qualified person.
- Winch mount must be flat so as not to induce binding.
- The flatness must not exceed 1/16 inch across the mounting surface of the winch itself.

Guards must be placed on all open drives in the case of mechanical winches. Insure that all hydraulic hoses, valves and fittings are rated to winch manufacturer's operating pressures.

Relief valves should be set to winch manufacturer's specifications. Insure that all PTO's and drivelines are sized appropriately for the winch manufactures speed and torque specifications.

## **Operator:**

Must read and understand the operating and service manual.

Both the **SERVICE MANUAL** and **OPERATING AND MAINTENANCE MANUAL** are available online at <http://www.team-twg.com/TulsaWinch/>

Must never lift or move people with this winch.

This winch is not designed or intended for any use that involves moving people.

Must stay clear of the load at all times.

Ground personnel should remain a safe distance from the load and winch cable at least 1 ½ times the length of cable measured from the winch to the load.

Must stay clear of the cable at all times.

A broken cable can cause serious injury or death.

Must avoid shock loads.

Shock loads can impose a strain on the winch that can be many times the design rating.

Must be aware of the fleet angle of the winch.

All loads should only be pulled with the load line perpendicular to the drum shaft, this is to avoid excessive stresses on the winch and will help prevent the cable from building on one side of the drum flange.

Must wear personnel protective equipment (PPE) if required.

Check the local, state and federal regulations for compliance.

Must insure that the drum clutch is fully engaged before hoisting.

A visual inspection of the drum clutch engagement is required before each winching operation.

Must rig all loads secure before winching.

Pull the load line taut and inspect the condition of load for stability.

Must inspect the drum brake if equipped.

The drum brake is not a load holding device it is design to prevent over spooling of the drum and causing bird nesting of the cable on the drum. Inspect the brake for wear of the lining and the actuation method.

Must inspect the load control brake.

These winches are equipped with two (2) forms of dynamic braking. The spring-applied/hydraulically-released multi-disc oil brake is one method. Before a load is handled the load should be pulled tight and stopped to check this brake. The second method is a hydraulic lowering control. The same method should be used to check this brake.

## **Operation:**

- All winch controls must be well marked for function to avoid confusion.
- All winch controls must be located to provide the operator with a clear view of the load.
- The clutch must be inspected daily for proper operation.
- The winch cable should be inspected daily for serviceability.
- A minimum of five wraps of tightly wound cable must remain on the drum.

# 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, 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 the oil 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. The drum bushings are lubed thru two grease zerks located on drum barrel.
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 (86 & 81) located at bottom of gear housing (60) & bottom of brake cover (2), then remove the fill plugs (74 & 81) located at the top of the gear housing (60) & 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 (1 pint) Mobilube SHC SAE 75W-90, then fill the gear end with (7 quarts) of Mobilube SHC SAE 75W-90 oil and replace both of the fill plugs.

OIL CAPACITY = 7 1/2 QUARTS



## B. BRAKE SECTION DISASSEMBLY

1. Evenly remove the four capscrews (3) that hold the brake cover (2) in place. Spring pressure will raise the cover up as the capscrews 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 1.084 inches with no force on them.
3. Remove the piston (5) by installing two pieces of 3/8"-16NC all thread into the two threaded holes in 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 port to remove the piston from the brake housing (20).
4. Inspect the o-rings (8, 10) and back up rings (9, 11) on the piston. Grasp the brake driver/clutch assembly (assembled items 14, 17, 18, 19, 52, 82), 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, and 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 0.055-in. thick and stator plates should measure no less than 0.068-in thick.

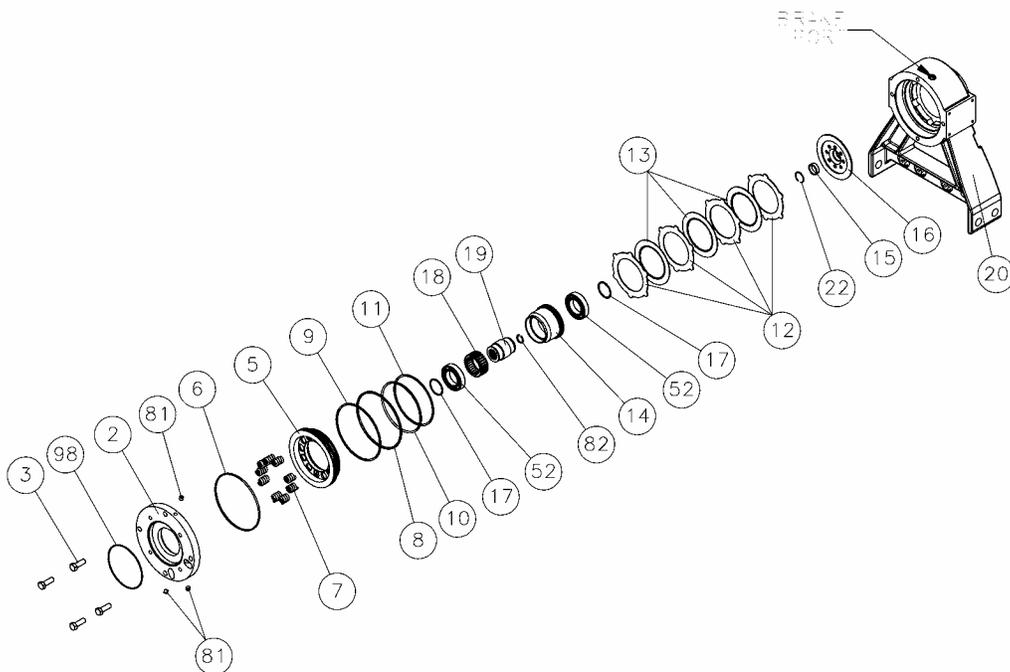
6. To disassemble the brake driver/clutch assembly, remove the retaining ring (17) from either end of the driver. Then, remove the brake driver (14) and bearing (52) from the input driver (19). Next, remove the sprag clutch (18). Finally, remove the retaining ring (17) from the other end of the driver, then remove the second bearing (52) from the input driver.

### WARNING

**Notice the direction of lock-up on the clutch for re-assembly.**

Inspect the input driver and brake driver for wear, and replace if necessary.

7. Remove the bearing housing (16) and inspect the needle bearing (15). If necessary, remove the retaining ring (22) and replace.
8. If the bushing or seal in the brake housing needs to be replaced, follow the drum section disassembly and reassembly sections of this manual prior to reassembly of the brake.



## C. DRUM SECTION DISASSEMBLY

1. To remove the drum, first disconnect the cable from the U-bolt (35) and lay aside. If removing the drum from the motor end with the motor and brake disassembled, first remove cotter keys (100) and clevis pins (93) connecting yoke (87) to bracket (101) & air cylinder (67).

### NOTICE

You may need to remove the airlines, so it's a good idea to mark them for re-assembly.

2. Support the weight of the drum with a hoist. Remove the four capscrews (61) along with the nuts and washers (62 & 63) 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 (40-9). At this time you will need to remove two capscrews (70), nuts and washers (72 & 71) from the frames (64 & 65). Do not remove air cylinder (68) yet. You can now remove the brake band assembly (66). Note

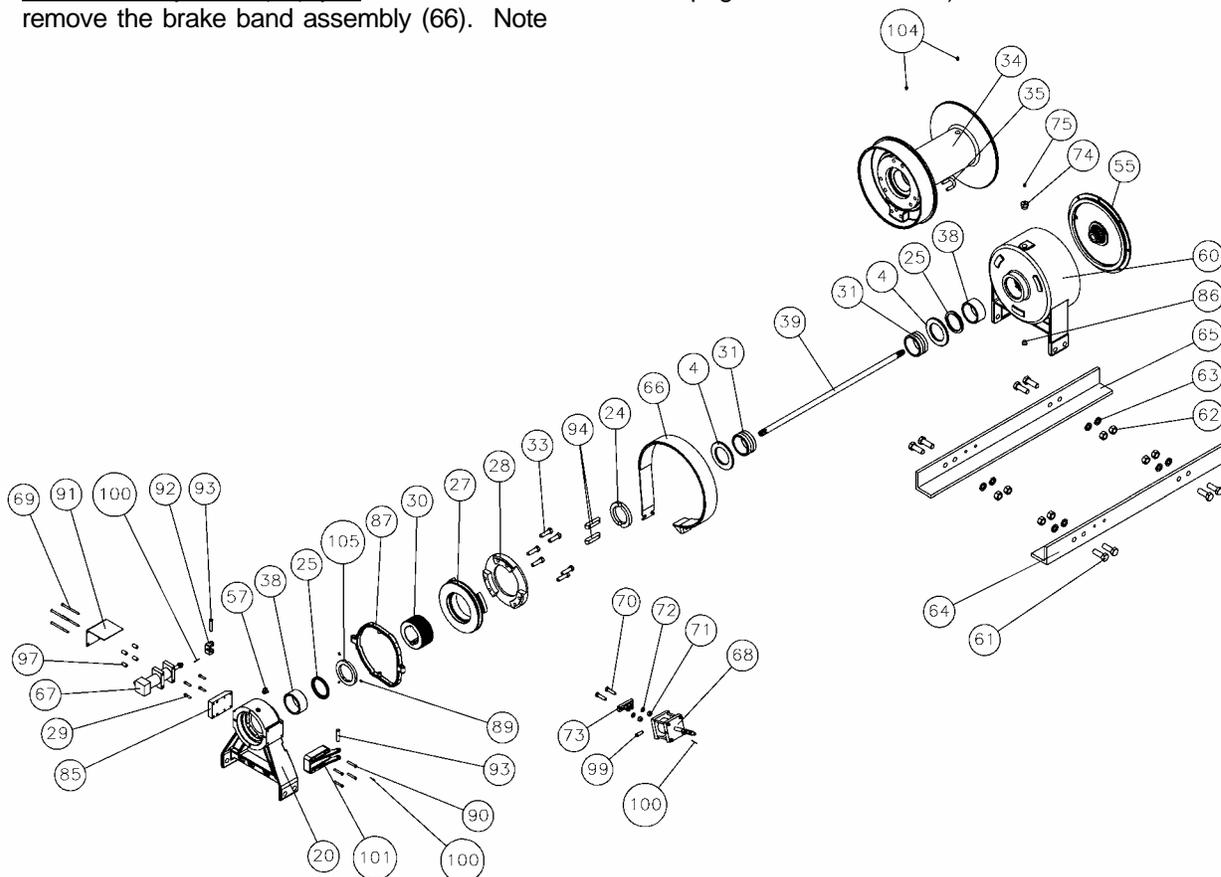
which frame the mounting bolts are on for re-assembly. Inspect and replace if needed.

3. Remove the outer thrust collar (105) by loosening three set screws (89).
4. Remove the yoke (87), sliding clutch (27), and coupler (30). Remove the two keys (94) from the shaft (40-9). Remove the drum using a hoist and inspect the bushings (31) & (4) at both ends of the drum.

### NOTICE

You should also inspect the bushing and seal (38, 25) that are located in the end of the brake housing.

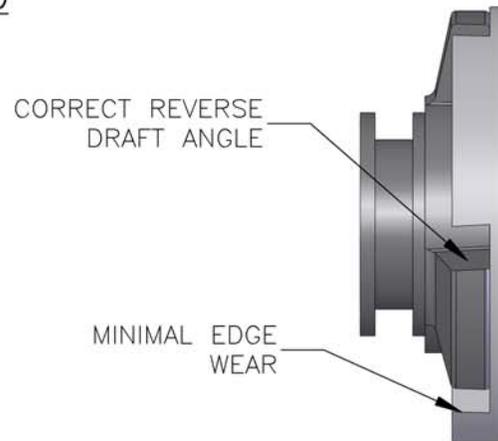
5. If necessary, replace the drum clutch (28) at this time by removing six capscrews (33). If you replace the clutch, make sure to torque the capscrews to the specified torque upon re-assembly. (See torque specifications chart on page 24 of this manual)



# CLUTCH INSPECTION

## GOOD

THIS PICTURE ILLUSTRATES A SLIDING & DRUM CLUTCH WITH THE PROPER REVERSE DRAFT AND MINIMUM EDGE WEAR



## **NOTICE**

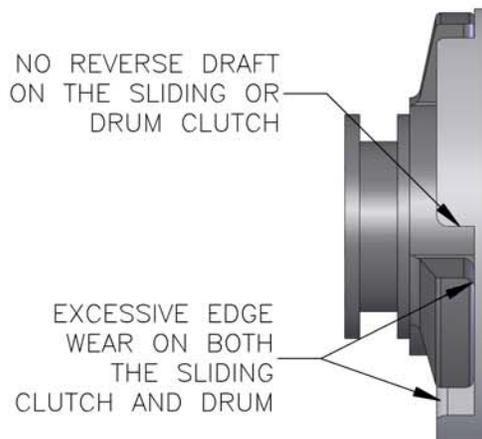
THE REVERSE DRAFT ENSURES THE CLUTCH STAYS ENGAGED DURING PAY-IN.

WITHOUT THE CORRECT DRAFT, THE CLUTCH COULD DIS-ENGAGE UNPREDICTIBLY.

## BAD

NO REVERSE DRAFT ON THE SLIDING OR DRUM CLUTCH

EXCESSIVE EDGE WEAR ON BOTH THE SLIDING CLUTCH AND DRUM

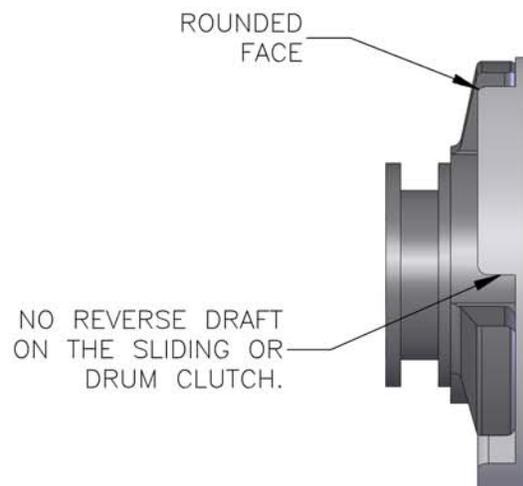


## CLUTCH REPLACEMENT CRITERIA



## **WARNING**

IF 1/4 OF THE SURFACE OF THE FACE ON THE SLIDING CLUTCH OR DRUM CLUTCH IS ROUNDED OR HAS NO REVERSE DRAFT THE SLIDING CLUTCH AND OR DRUM CLUTCH MUST BE REPLACED.

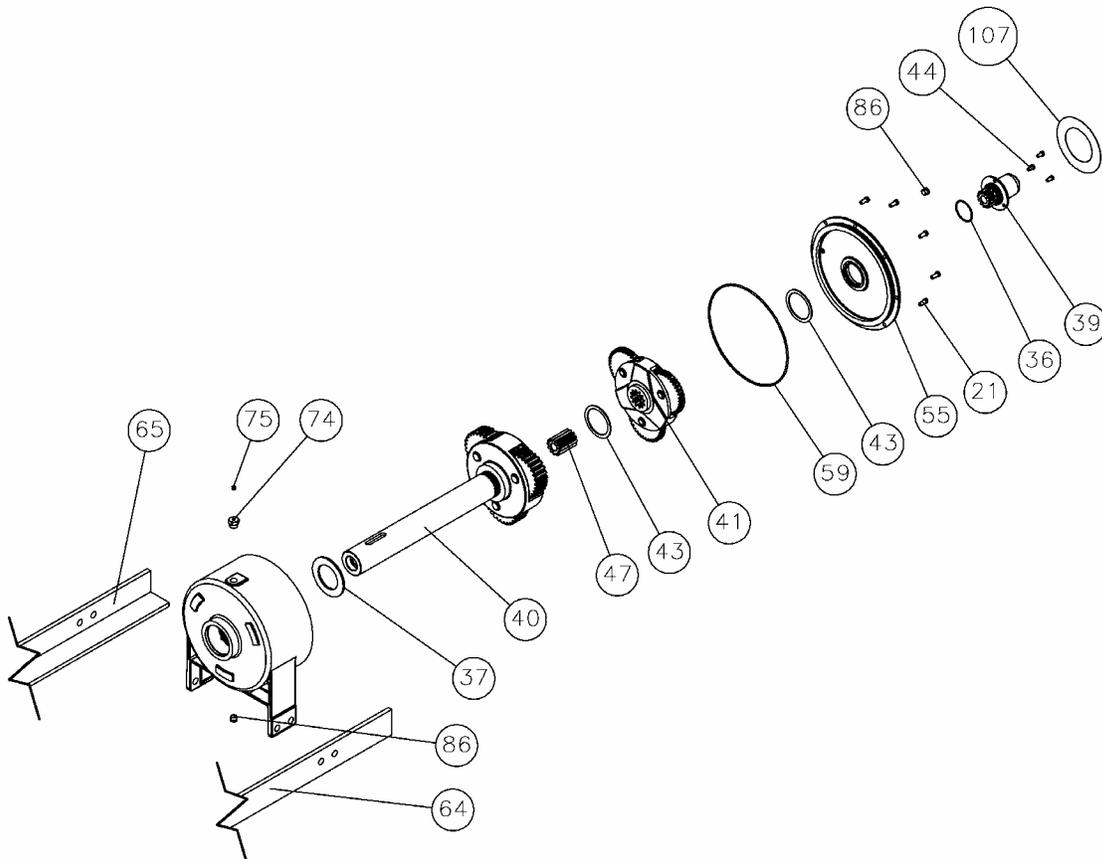


## D. GEAR SECTION DISASSEMBLY

### NOTICE

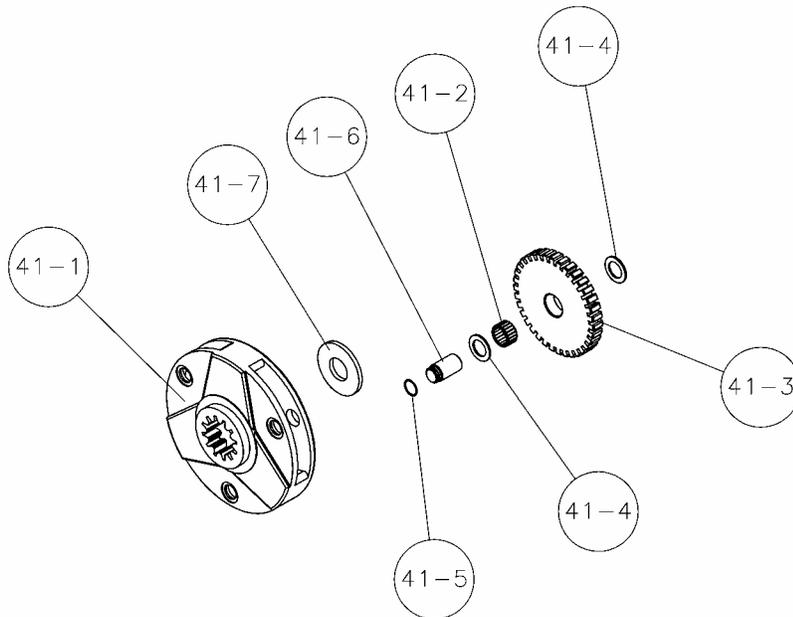
To remove the output gear set (40), the drum must first be removed, see **DRUM DISASSEMBLY** section on page 7 of this manual.

1. Drain the oil by removing the plug (86).
2. To disassemble the gear section, remove the Intelliguard™ sensor (39) from the outer cover (55) by removing three capscrews (44). Inspect the gear teeth on the Intelliguard™ (23) for wear. The Intelliguard™ system is not serviceable in the field. Return to an authorized dealer for service.
3. Remove the end cover (55) by removing eight capscrews (21).
4. Inspect the o-rings (36 & 59) for wear and replace if necessary.
5. Remove the input gear set (41) along with the inner and outer thrust washers (43). Inspect and replace if necessary.
6. Remove the output sun gear (47). Carefully remove the output gear set/output shaft assembly (40) from the gear housing (60).



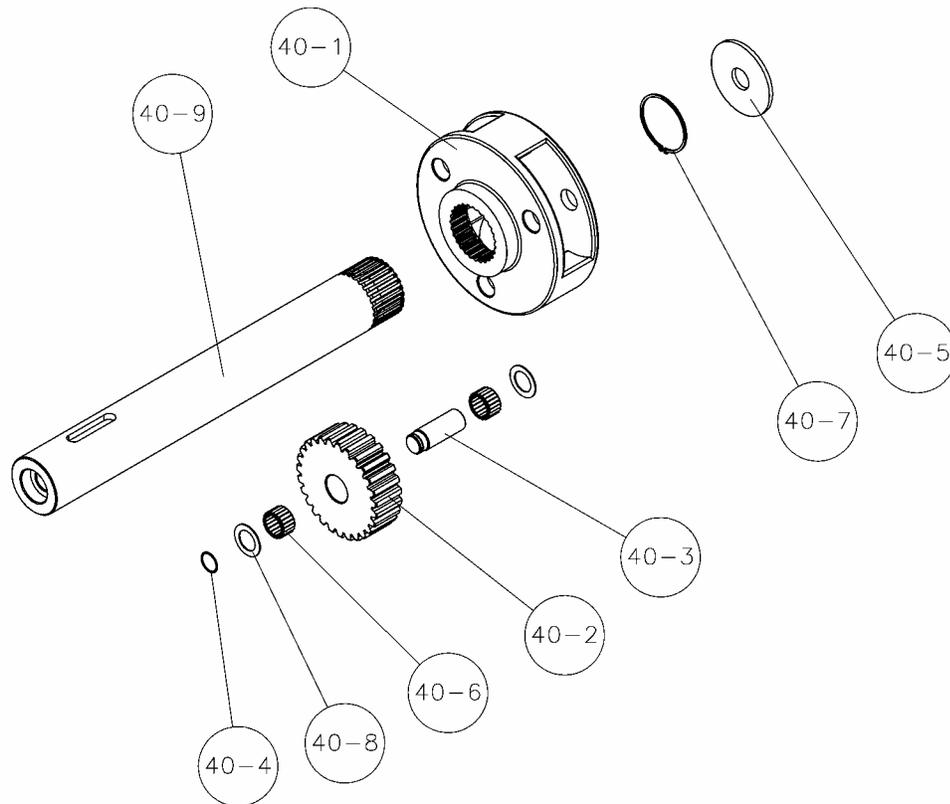
## E. INPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (41-5) from the planet pins (41-6). Remove the pins from the carrier (41-1) by carefully tapping them out.
2. Remove the planet gears (41-3), thrust washers (41-4) and bearings (41-2) from the carrier (41-1).
3. With planet gears out, remove the plate (41-7).
4. Inspect the parts for wear or damage and replace if necessary.



## F. OUTPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (40-4) from the planet pins (40-3).
2. Remove the pins (40-3) from the carrier (40-1) by carefully tapping them out.
3. Remove the planet gears (40-2), thrust washers (40-8), and bearings (40-6) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.
5. With planet gears out, remove the plate (40-5) and retaining ring (40-7). Remove the shaft (40-9) from the carrier (40-1). Inspect the parts for wear or damage and replace if necessary.



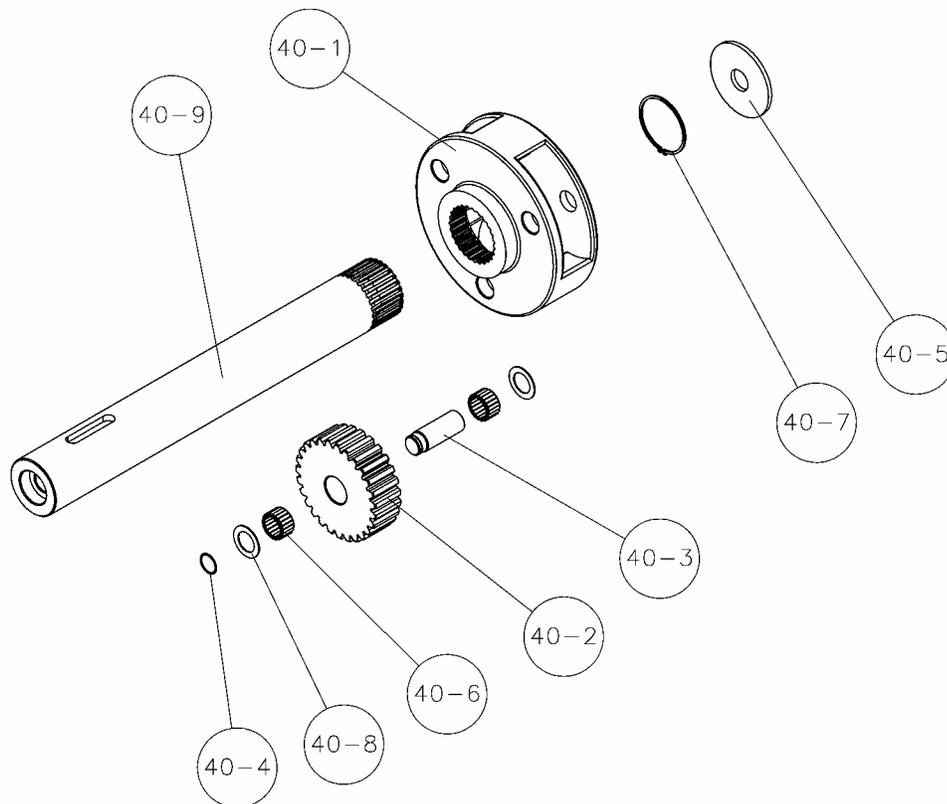
# GENERAL ASSEMBLY

## G. OUTPUT PLANET SET ASSEMBLY

1. Insert the output shaft (40-9) into the carrier (40-1) and install the retaining ring (40-7).
2. Next insert the thrust plate (40-5) into the carrier (40-1) along with the gears (40-2), bearings (40-6), and washers (40-8).
3. Being careful to line up the thrust washers (40-8) and bearings (40-6) with the planet pins (40-3), press the pin into the carrier (40-1).
4. Replace retaining rings (40-4).

### CAUTION

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

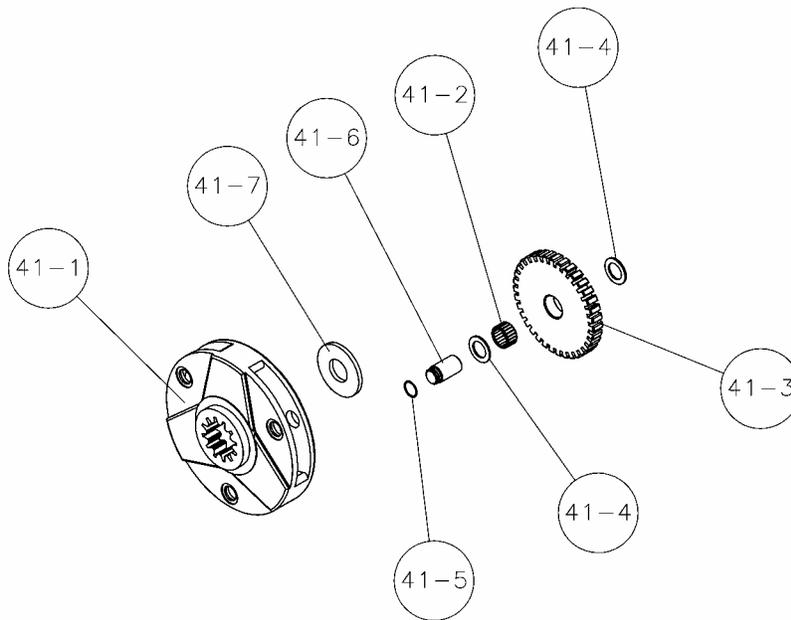


## H. INPUT PLANET SET ASSEMBLY

1. Insert the thrust plate (41-7) into the carrier (41-1) along with the gears (41-3), bearings (41-2), and washers (41-4).
2. Being careful to line up the thrust washers (41-4) and bearings (41-2) with the planet pins (41-6), press the pin into the carrier (41-1).
3. Replace the retaining rings (41-5).

### CAUTION

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



## I. GEAR END ASSEMBLY

1. Bolt the gear housing (60) loosely into both frames (64 , 65).
2. When reassembling, apply grease to parts such as thrust washers, o-rings, and seals. Slide the thrust washer (37) onto the output shaft (40-9). Next, install the output gear set (40) into the gear housing (60). Push the gear set into the housing until it stops against the thrust washer (37).

### NOTICE

**Make sure to line up the gear teeth in all three planet gears in the output gear set with the gear teeth in the housing.**

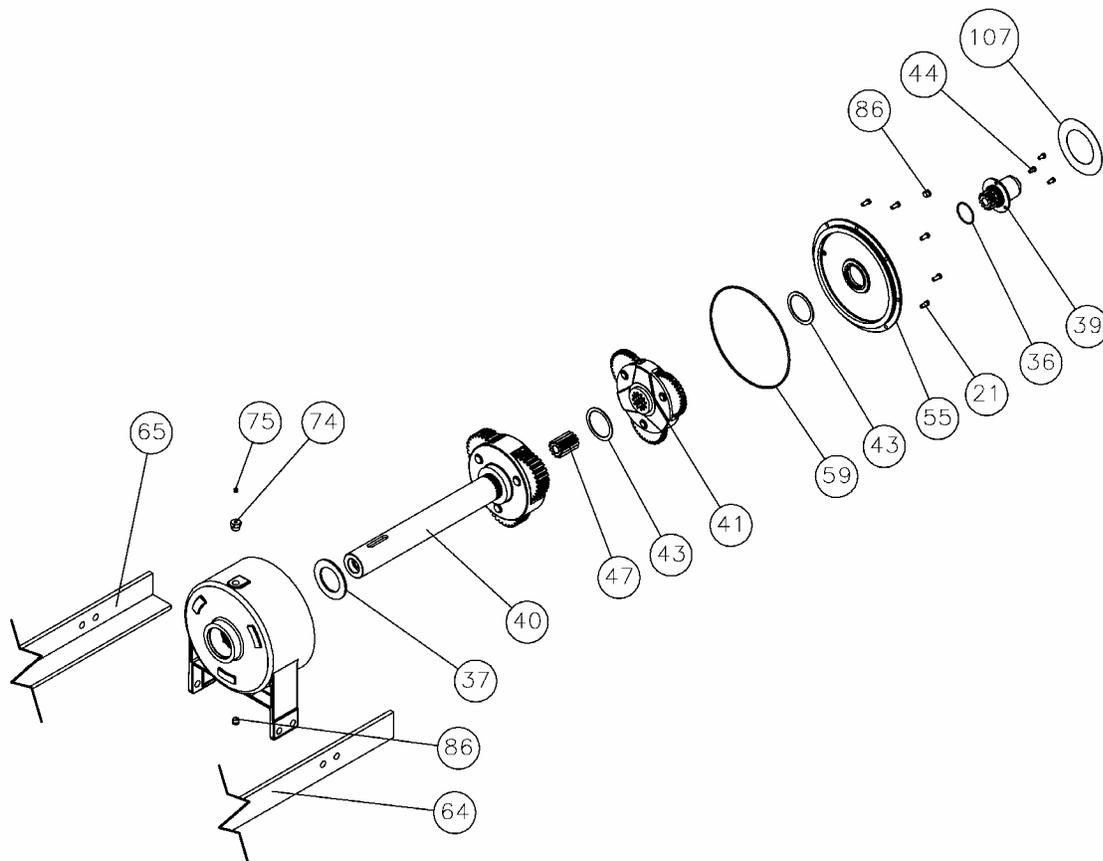
3. Install the output sun gear (47) into the output gear set (40).
4. Install the inner thrust washer (43) onto the input gear set (41). Insert the input gear set (41) into the gear housing making sure it is

against the output gear set (40) and engaged with the output sun gear (47). Put the outer thrust washer (43) in place and slide the input shaft (39) all the way through the output shaft (40-9). Let the input shaft protrude out on the gear end so that all of the spline is showing. Make sure the correct end of input shaft is towards the gear end.

5. Put the cover on and secure it with eight capscrews (21), being careful not to damage the o-ring (59). Install the the Intelliguard™ sensor (39) into the outer cover (55), again making sure not to damage the o-ring (36), add loctite and secure it with three capscrews (44).

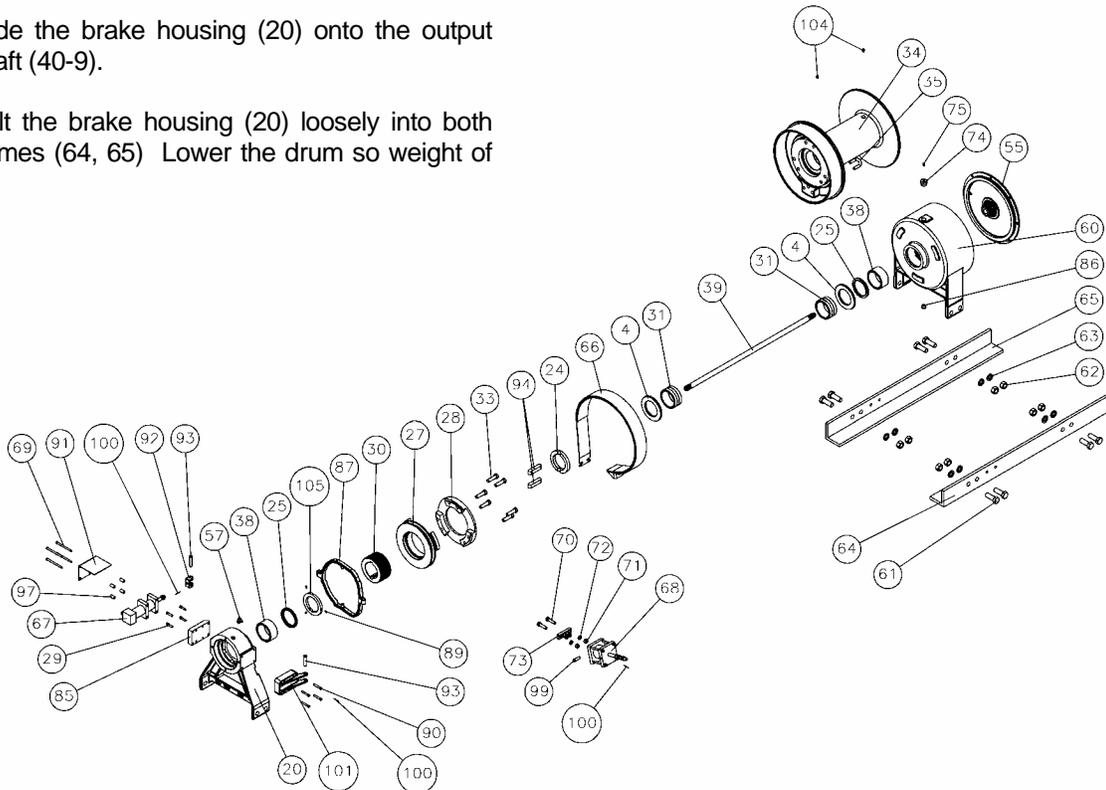
### NOTICE

**Make sure the input shaft engages the gear in the Intelliguard™ correctly.**

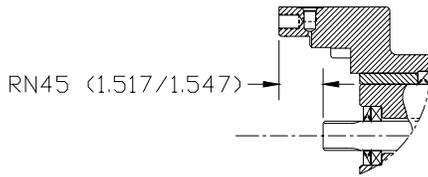


## J. DRUM SECTION ASSEMBLY

1. After inspecting and replacing the necessary parts, install the bushing (4) onto the output shaft (40-9).
2. Install the drum (34) onto the output shaft. 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) and install the capscrews (70), nut and washers (71 & 72). The brake band air cylinder (68) can be reattached later.
3. Install the bushing (4) onto the output shaft. Install the inner thrust collar (24) making sure the half-moon slots are lined up with the key slots in the output shaft. (40-9) Tap the two keys (94) into their slots in the output shaft.
4. If necessary, install the new drum clutch (28) using six capscrews (66). Torque to specified torque (see page 22 this manual). Next, align the coupler (30) with the keys (94) and slide onto the output shaft (40-9). Install the sliding clutch (27) onto the coupler (30).
5. Install the outer thrust collar (105), aligning the half moon slots with the keys (94). Tightly hold the thrust collar against the keys and lock down the three set screws (89).
6. Slide the brake housing (20) onto the output shaft (40-9).
7. Bolt the brake housing (20) loosely into both frames (64, 65) Lower the drum so weight of 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 22 this manual).
9. Turn the drum to make sure it is not binding.
10. If necessary, install the cylinder spacer using four capscrews (29). Next, install the air cylinder (67) and air cylinder cover (91) to the brake housing with the four capscrews (69) and spacers (97).
11. Install the bracket (101) to the brake housing using four capscrews (90).
12. Attach yoke (87) by installing clevis pins (93) into the bracket (101) and clevis (92). Install cotter keys (100) to clevis pins (93) to secure their positions. Connect shop air to the cylinder and apply air both directions. With the clutch fully engaged (air applied), there should be slight movement on the clutch plate in both directions. Adjust clevis (92) and air cylinder jam nut accordingly.



## K. BRAKE SECTION ASSEMBLY

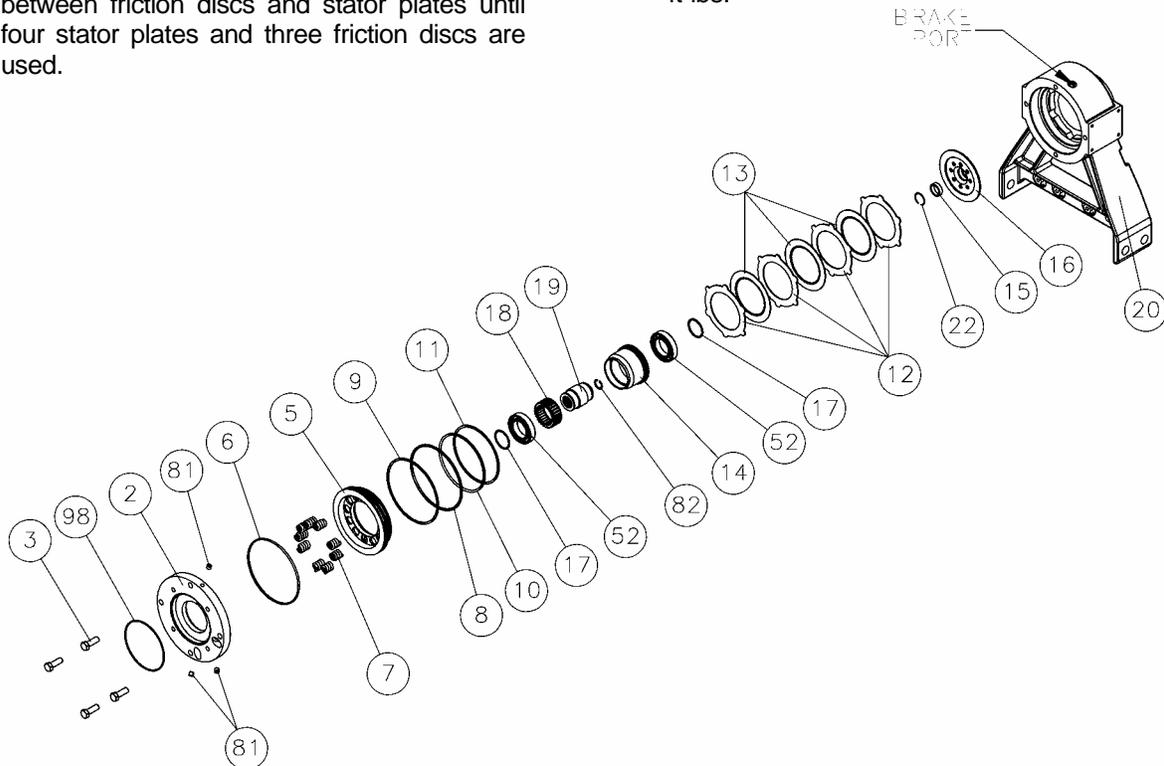


1. Re-assemble the driver/clutch assembly, making sure the clutch is installed properly, and checking to make sure the cam clutch is free turning in the pay in direction.
2. Measure the distance from face of the brake housing to the end of the shaft as shown above.
3. If needed, add shims part number 33324 and 994188 inside input driver (19) on motor side to achieve dimension shown above.
4. Install the bearing housing assembly that contains parts 16, 15, and 22 into the brake housing.
5. Install the driver/clutch assembly onto the input shaft (39).
6. Install the stator plates (12) and friction discs (13) starting with a stator plate and alternating between friction discs and stator plates until four stator plates and three friction discs are used.

### NOTICE

**Dip friction discs in lightweight Non-EP oil before installation.**

7. 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).
8. Install the springs (7) into the spring pockets. If working in a horizontal position, coat the bottom of each spring with grease to keep it in position.
9. Install the cover (2) onto the brake housing (20) using four capscrews (3). Draw the cover down evenly, alternating between opposite hex bolts, making sure that the cover is aligned properly with the brake housing to orient the motor as it should be.
10. Check the brake release with a portable hydraulic pump. Full release should be obtained at 400 psi, plus or minus 20psi. Also, check the brake for proper operation by applying 270 psi to the brake port and adapting a torque wrench to the input driver. The torque in the payout should be 95 to 115 ft-lbs.



## L. MOTOR ASSEMBLY

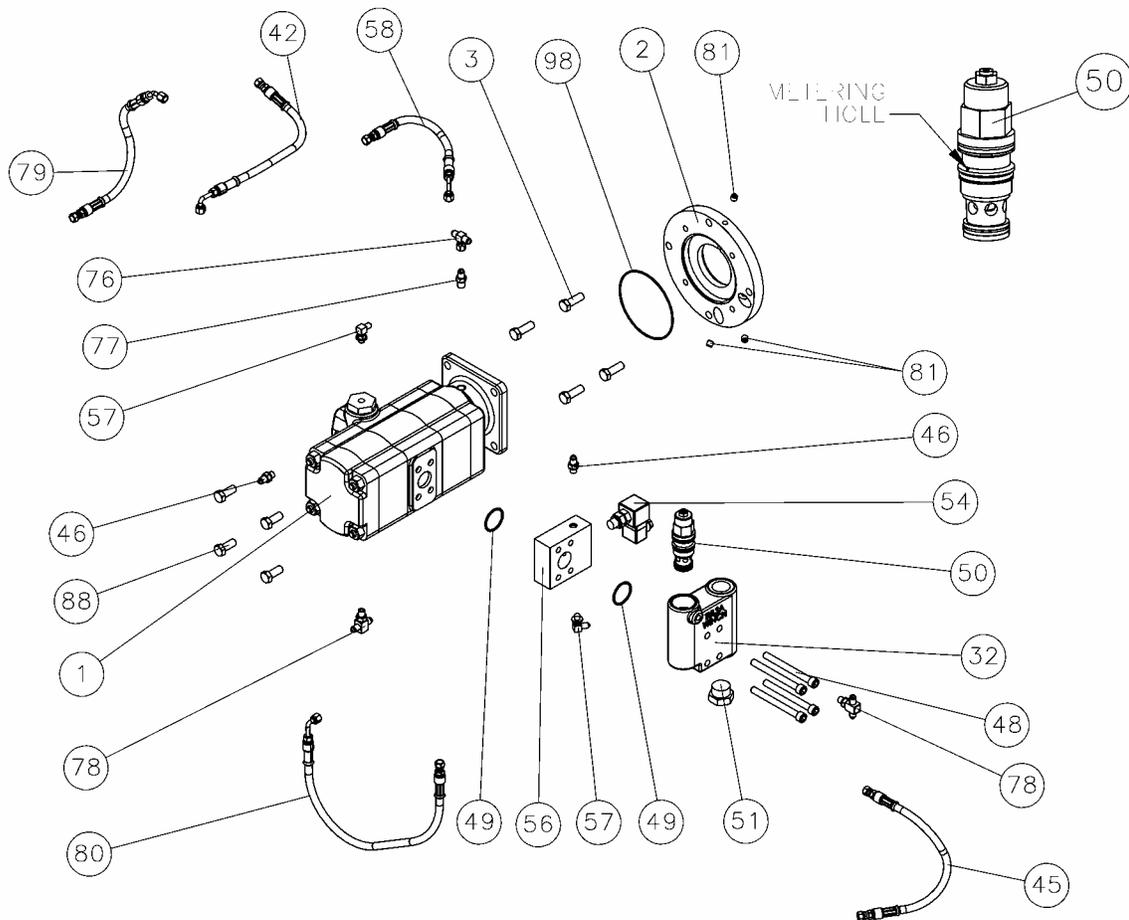
1. Install the o-ring (98) onto the motor (1). Attach the motor (1) to the brake cover (2) using four capscrews (88). Tighten the capscrews to the proper torque specification (see page 22 this manual).

### NOTICE

**Make sure you install the motor with the belly of it down and the case drain port up.**

2. If removed, install the cartridge valve (54).

3. Install the counterbalance valve (50) into the counter-balance block (32).
4. Install the o-rings (49) into the manifold block (56) and counterbalance block (32). Install the manifold block (56) and counterbalance block (32) using four capscrews (48).
5. Install hoses (42, 45, 58, 79, and 80).
6. Fill the brake and gearbox with the proper oil.



# 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>
<b>Winch runs too slow</b>	<ul style="list-style-type: none"> <li>a) Low flow rate. Check the flow rate and increase if necessary.</li> <li>b) Hydraulic motor worn out. Replace the motor.</li> </ul>
<b>Cable drum won't free spool</b>	<ul style="list-style-type: none"> <li>a) Winch not mounted squarely. Check mounting and confirm that the winch is mounted on a level surface.</li> <li>b) Clutch not disengaged. Disengage the clutch.</li> </ul>

# RUFNEK 45 BILL OF MATERIAL

81865003-BOM MAY 2006				
Item	Qty.	P/N	Description	
1	1	43399	HYDRAULIC MOTOR	
2	1	43925	BRAKE COVER	
3	4	28060	CAPSCREW	
4	2	43234	BUSHING	
5	1	42942	BRAKE PISTON	
6	1	33094	O-RING	
7	9	43938	BRAKE SPRING	
8	1	32186	O-RING	
9	1	42337	RING	
10	1	42335	O-RING	
11	1	42336	RING	
12	4	42148	STATOR PLATE	
13	3	32765	FRICTION DISC	
14	1	44332	BRAKE DRIVER	
15	1	40263	NEEDLE BEARING	
16	1	44333	BEARING HOUSING	
17	2	44323	RETAINING RING	
18	1	41759	CLUTCH	
19	1	44331	INPUT DRIVER	
20	1	43221	BRAKE HOUSING	
21	8	24905	CAPSCREW	
22	1	44322	RETAINING RING	
23	-	-	OMIT	
24	1	43255	THRUST COLLAR	
25	2	44688	OIL SEAL	
26	-	-	OMIT	
27	1	44572	CLUTCH, SLIDING	
28	1	43231	DRUM CLUTCH	
29	2	23754	CAPSCREW	
30	1	43413	COUPLER	
31	2	43233	BUSHING	
32	1	42029	COUNTERBALANCE BLOCK	
33	6	42048	CAPSCREW	
34	1	43223	DRUM	
35	1	21163	U-BOLT	
36	1	31543	O-RING	
37	1	43254	WASHER THRUST	
38	2	43729	BUSHING	
39	1	4477	INTELLIGUARD SYSTEM	
40	1	4256	OUTPUT GEARSET	
40-1	1	43247	OUTPUT CARRIER	

## RUFNEK 45 BILL OF MATERIAL CONTINUED

40-2	3	43248	OUTPUT PLANET GEAR
40-3	3	42951	PLANET PIN
40-4	3	41716	RETAINING RING
40-5	1	43025	GEARSET PLATE
40-6	6	41717	BEARING
40-7	1	43702	RETAINING RING
40-8	6	939249	RACE
40-9	1	43239	OUTPUT SHAFT
41	1	4255	INPUT GEARSET
41-1	1	43245	INPUT CARRIER
41-2	3	30484	NEEDLE BEARING
41-3	3	43246	INPUT PLANET GEAR
41-4	6	27221	THRUST RACE
41-5	3	41715	RETAINING RING
41-6	3	41760	PLANET PIN
41-7	1	42954	PLATE
42	1	42031	HOSE ASSY
43	2	42934	THRUST WASHER
44	3	32477	CAPSCREW
45	1	42030	HOSE ASSY
46	2	41838	STRAIGHT ADAPTER
47	1	43235	OUTPUT SUN GEAR
48	4	43372	CAPSCREW
49	2	32182	O-RING
50	1	41867	COUNTERBALANCE VALVE
51	1	32411	HEX PLUG
52	2	29162	BEARING
53	-	-	OMIT
54	1	43367	CARTRIDGE VALVE
55	1	44748	COVER
56	1	43368	MANIFOLD BLOCK
57	3	42089	ADAPTER
58	1	42494	HOSE ASSEMBLY
59	1	42841	O-RING
60	1	43219	GEAR HOUSING
61	8	30203	CAPSCREW
62	8	20318	NUT
63	8	20559	LOCKWASHER
64	1	43238	RIGHT FRAME
65	1	43237	LEFT FRAME
66	1	4275	BRAKE BAND ASSEMBLY
67	1	44339	CLUTCH AIR CYLINDER
68	1	43258	BRAKE BAND AIR CYLINDER
69	4	43875	CAPSCREW

## RUFNEK 45 BILL OF MATERIAL CONTINUED

70	2	20525	CAPSCREW
71	4	20521	NUT
72	6	20518	LOCKWASHER
73	1	42955	MOUNTING BRACKET
74	1	42978	O-RING PLUG
75	1	13050	BREATHER
76	1	42033	SWIVEL TEE
77	1	40280	FITTING
78	2	42438	STRAIGHT BRANCH TEE
79	1	42495	HOSE ASSEMBLY
80	1	43459	HOSE ASSEMBLY
81	3	21684	PIPE PLUG
82	1	27088	RETAINING RING
83	-	-	OMIT
84	1	43834	AIR SHIFT KIT
85	1	43889	CYLINDER SPACER
86	2	41719	O-RING PLUG
87	1	43882	CLUTCH YOKE
88	4	20524	CAPSCREW
89	3	21653	SET SCREW
90	4	29614	CAPSCREW
91	1	43890	AIR CYLINDER COVER
92	1	43828	CLEVIS
93	2	43827	PIN CLEVIS
94	2	43409	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	43877	CLUTCH BRACKET
102	-	-	OMIT
103	-	-	OMIT
104	2	21128	GREASE ZERK
105	1	43698	THRUST COLLAR
106	2	43428	CAPSCREW
107	1	44756	INTELLIGUARD™ LOGO PLATE
108	1	43929	U-BOLT
109	-	-	OMIT
110	-	-	OMIT
111	3	994188	THRUST RACE
112	2	33324	WASHER
113	-	-	OMIT

# VISCOSITY CHART



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



## TORQUE SPECIFICATIONS CHART

		Dry	Plated	Lubricated	Dry	Plated	Lubricated
		SAE Grade 5	SAE Grade 5	SAE Grade 5	SAE Grade 8	SAE Grade 8	SAE Grade 8
Nominal	Size	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.)

$T = (KWD) / 12$

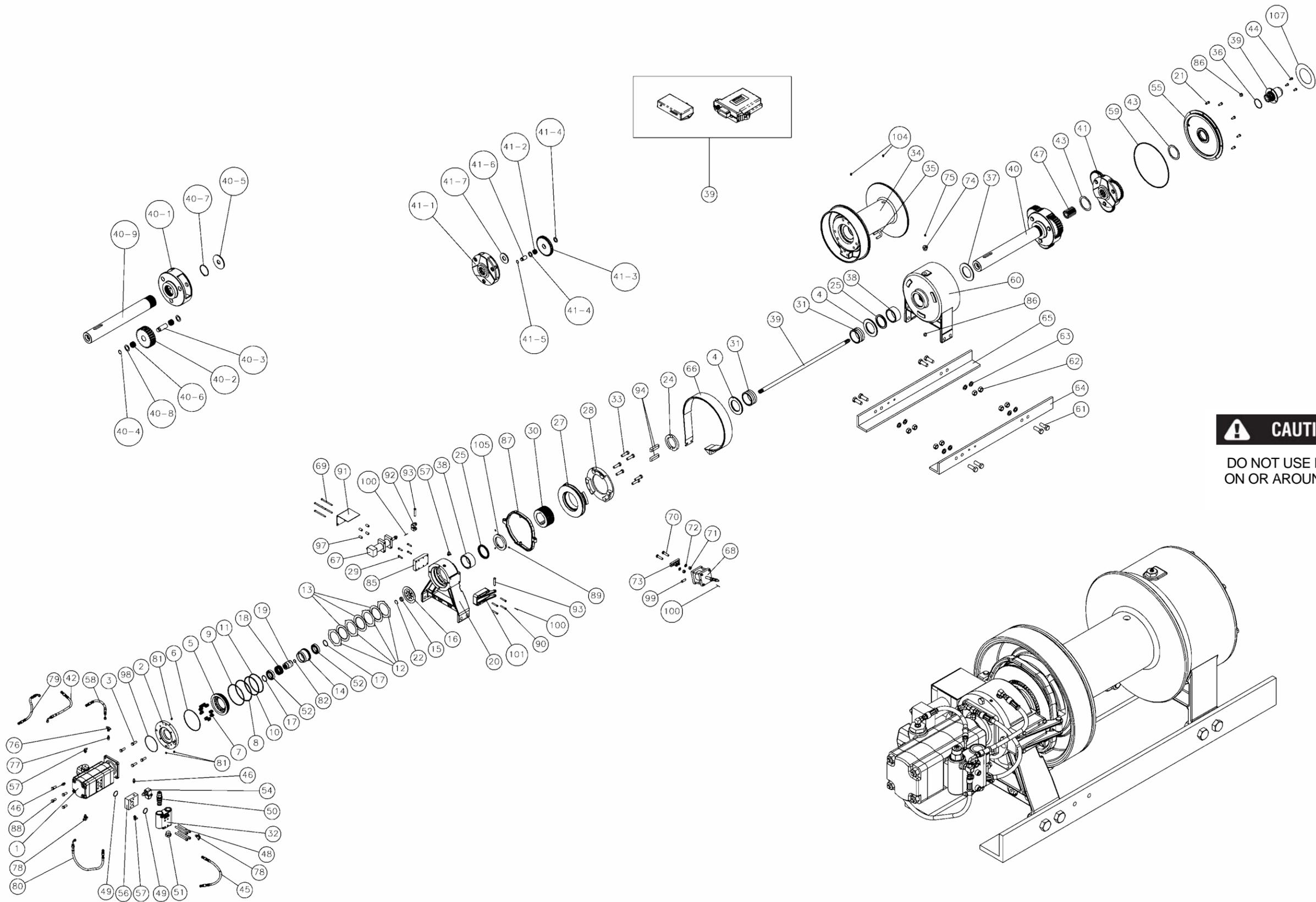
K = TORQUE COEFFICIENT (K = 0.20 DRY    K = 0.15 PLATED    K = 0.12 LUBRICATED)

W = PRELOAD TENSION

D = NOMINAL BOLT SIZE (IN.)

**\* ALL TORQUE VALUE TOLERANCES ARE ± 5%**

# RUFNEK 45 ISOMETRIC DRAWING



**CAUTION**  
DO NOT USE MAGNETS  
ON OR AROUND WINCH.