



# ***Tulsa Winch***

DESIGN SERIES 004



## **RUFNEK 100**

## **SERVICE MANUAL**

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# INTRODUCTION AND THEORY OF OPERATION

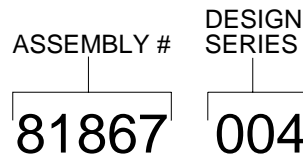
The Rufnek series planetary winch is designed to use a high-speed gear motor, driving through a multiple disc brake, through three planet sets to the cable drum.

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.

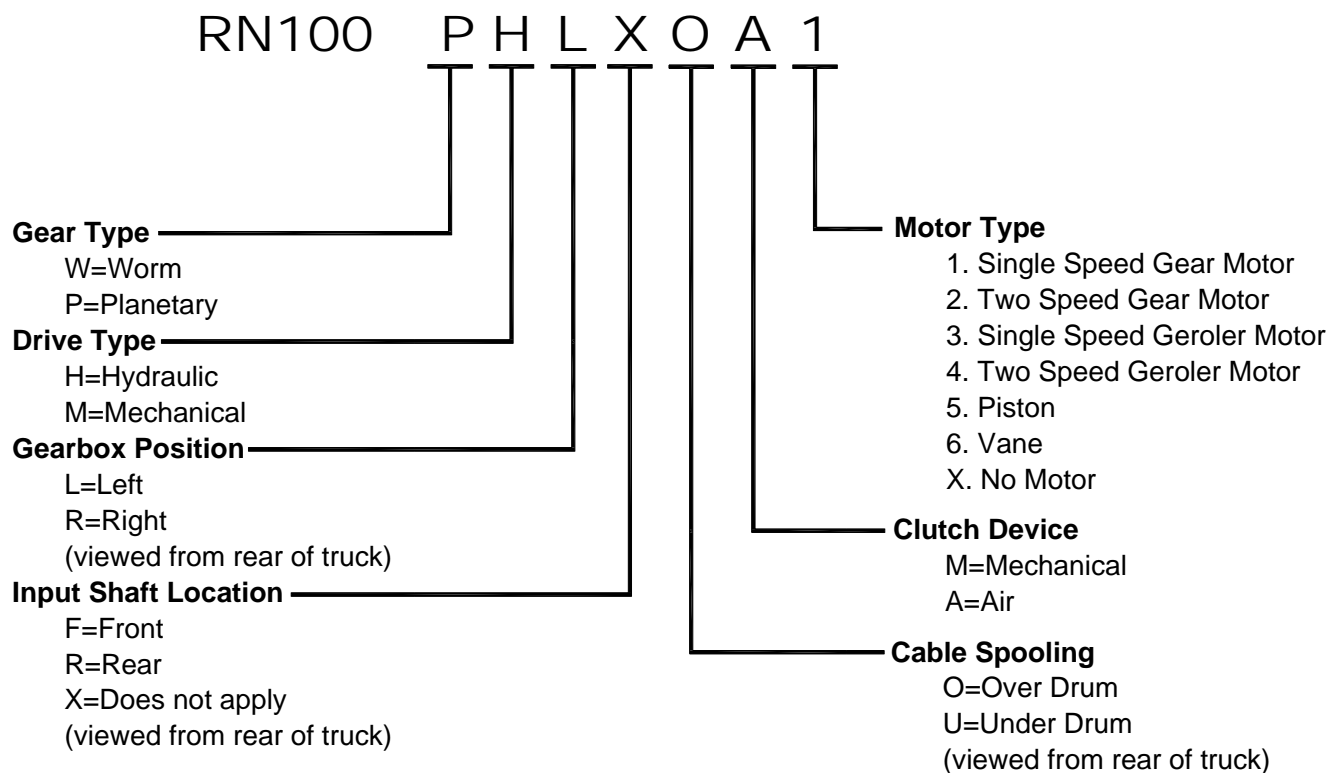
The brake and brake valve receives its signal any time the winch is in pay out. With the brake fully open at about 340 PSI the brake valve will open and dynamically control the lowering of the load.

## ASSEMBLY NUMBER EXPLANATION

This manual is for design series 004. In the case of a major design change implementation, a new design specification number will be issued for the winch. A new manual will also be created for that specific design series.



## WINCH MODEL CODE








***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/>

 <b>DANGER</b>	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.
<b>NOTICE</b>	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.

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.

## **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-twq.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 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. 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 (18 & 85) located at bottom of gear housing (10) & bottom of brake cover (3), then remove the fill plugs (39 & 81) located at the top of the gear housing (10) & the top of the brake cover (3). Inspect the oil for signs of metallic particles and/or burning and dispose of in a proper manner. Then re-install the drain plugs.

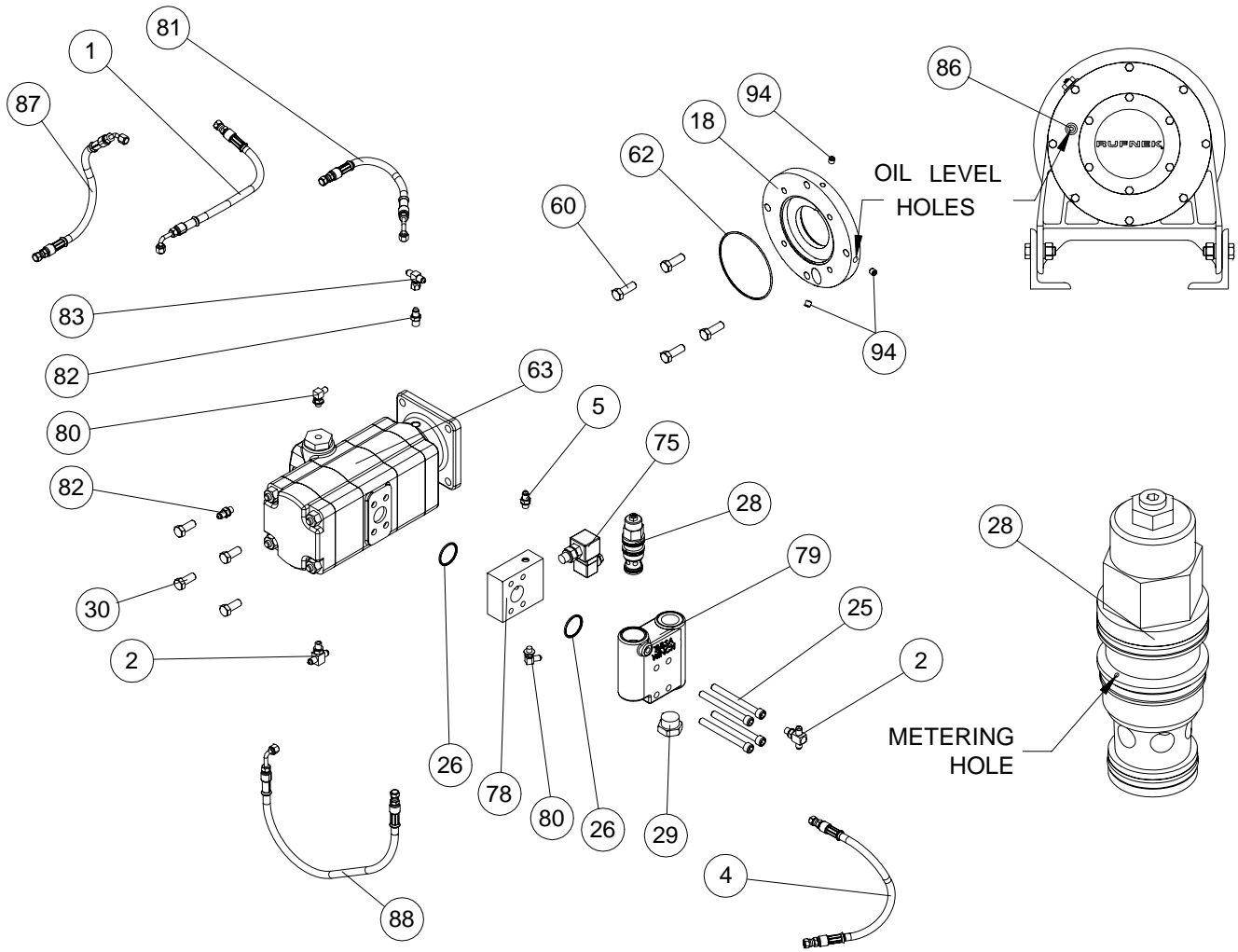
Fill the brake end with Mobilube SHC SAE 75W-90 (1/2 quart), then fill the gear end with of Mobilube SHC SAE 75W-90 oil (17-1/2 quarts) and replace both of the fill plugs.

OIL CAPACITY = 18 QUARTS

# GENERAL DISASSEMBLY

## A. MOTOR DISASSEMBLY

1. Drain the oil from the brake assembly by removing the plug (94) from the brake cover (18).
2. Remove hoses (1, 4, 81, 87, & 88).
3. Remove the counterbalance block (79) and the manifold block (78) from the motor by removing the four capscrews (25).
4. Remove the motor (63) from the winch by removing four capscrews (30).
5. Remove the counterbalance valve (28) from the counterbalance block (79) 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 (26) & (62) for damage.



## B. BRAKE SECTION DISASSEMBLY

1. Evenly remove the four cap screws (60) that hold the brake cover (18) in place. Spring pressure will raise the cover up as the cap screws are loosened. Carefully remove the cover (18) from the brake housing (16). Inspect the o-ring (61) for damage.
2. Remove the springs (59) from the piston (54) and check the free height. Each spring should measure at least 1.240 inches with no force on them.
3. Remove the piston (54) by installing two pieces of 3/8"-16NC all thread into the two

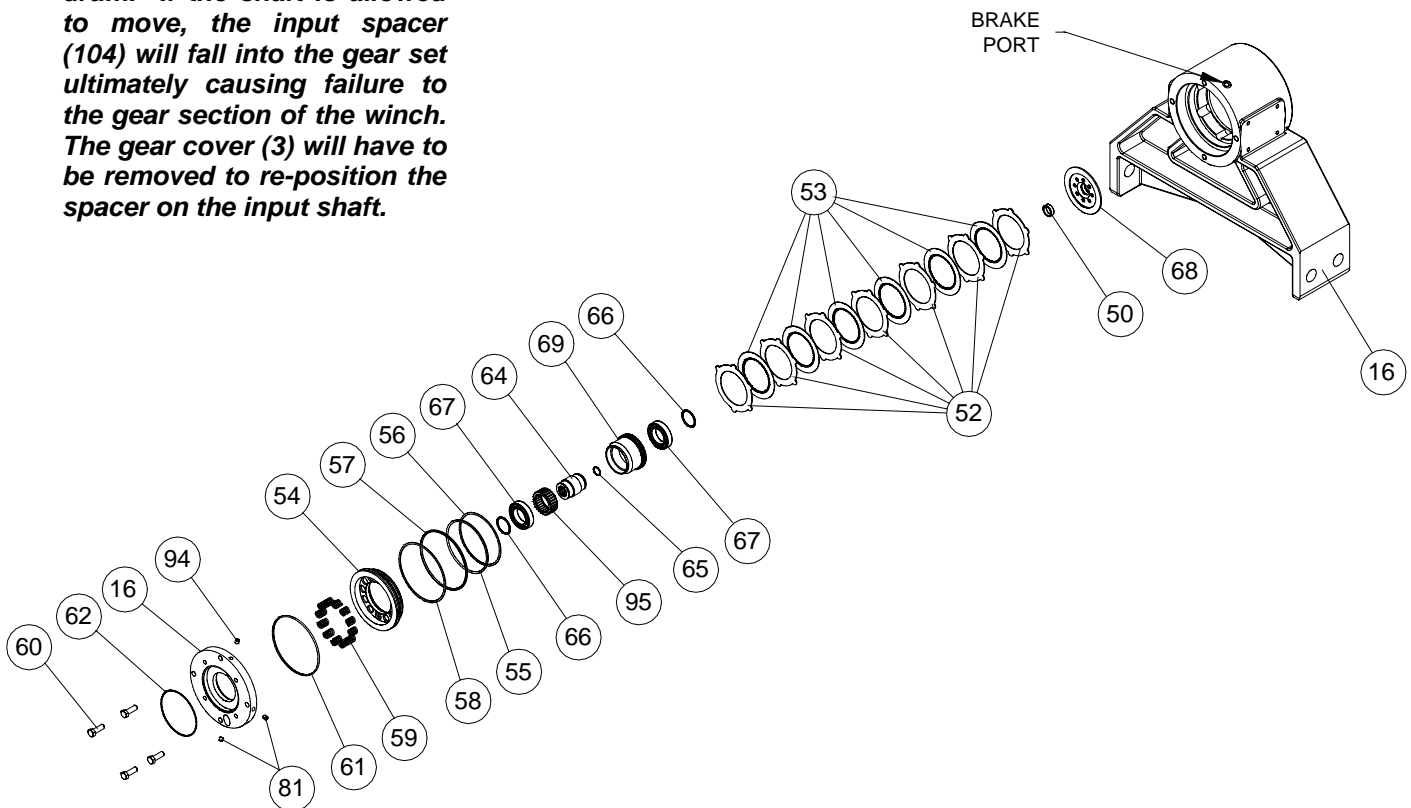
holes in the top of the piston and run in evenly until the piston is clear of the housing. An alternate way of removing the piston is to use shop air to slowly pressurize the brake port to remove the piston from the brake housing (16).

4. Inspect o-rings (55, 57) and back up rings (56, 58) on the piston. Grasp the brake driver/clutch assembly (assembled items 64, 65, 66, 67, 69) and remove it from the brake housing.

(Continued on page 8)

### CAUTION

***If a complete tear down is not necessary, make sure the input shaft (21) does not move during removal of the drum. If the shaft is allowed to move, the input spacer (104) will fall into the gear set ultimately causing failure to the gear section of the winch. The gear cover (3) will have to be removed to re-position the spacer on the input shaft.***



## BRAKE SECTION DISASSEMBLY CONTINUED

5. Remove the stator plates (52) and friction discs (53) 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 .055-in. thick and stator plates should measure no less than .068-in thick.
6. To disassemble the brake driver/clutch assembly, remove the retaining ring (66) from either end of the driver. Then, remove the brake driver (69) and bearing (67) from the input driver. Next, remove the sprag clutch (95). Finally, remove the retaining ring (66) from the other end of the driver.

Then, remove the second bearing (67) from the input driver.



### WARNING

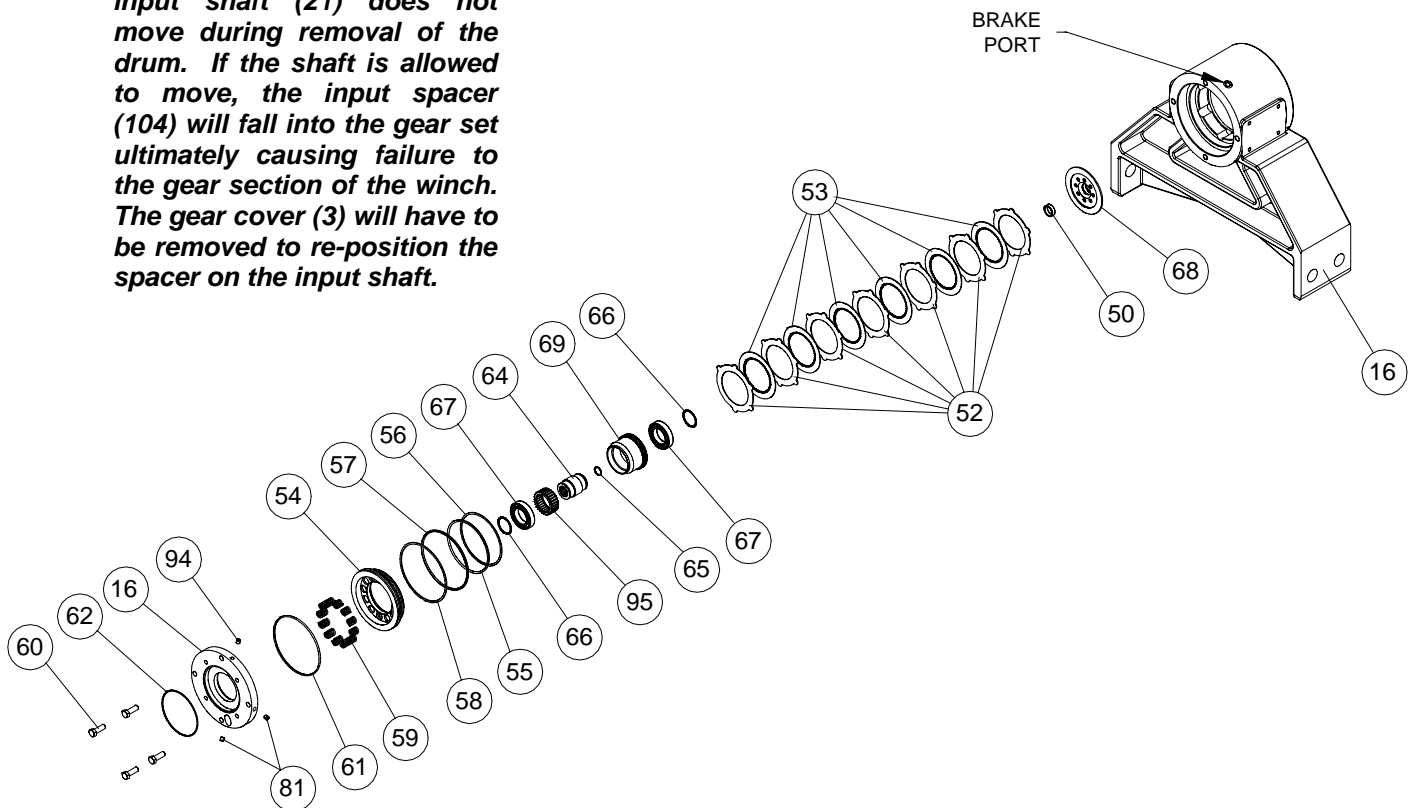
**Notice the direction of lock-up on the clutch for re-assembly.**

7. Remove the bearing housing (68) and inspect the bearing (50).
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.



### CAUTION

*If a complete tear down is not necessary, make sure the input shaft (21) does not move during removal of the drum. If the shaft is allowed to move, the input spacer (104) will fall into the gear set ultimately causing failure to the gear section of the winch. The gear cover (3) will have to be removed to re-position the spacer on the input shaft.*





## C. DRUM SECTION DISASSEMBLY

1. To remove the drum, first disconnect the cable from the U-bolt (43) and lay aside. If removing the drum from the motor end with the motor and brake disassembled, first remove the cotter keys (108) and clevis pins (99) connecting the yoke (17) to the bracket (110) & air cylinder (15).

### NOTICE

**You may need to remove the air lines, 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 cap screws (70) and the nuts and washers (71, 72) on the bottom of the brake housing (16). Disconnect the airline running from the air cylinder (15) to the brake housing (16). Remove the brake housing by sliding it off of the output shaft (20). At this time you will need to remove two cap screws (70), nuts and washers (71, 72) from the frames (73 or 74). Do not remove air cylinder (76) yet. Disconnect the air line from the backside of the brake housing (16) that goes to the brake band air

cylinder. You can now remove the brake band assembly (77). Note which frame the mounting bolts are on for re-assembly. Inspect and replace, if needed.

3. Remove the outer thrust collar (48) by loosening three set screws (89).
4. Remove the yoke (17), sliding clutch (13), and coupler (12). Remove the three keys (47) and the inner thrust collar (46). Remove the drum using a hoist. Inspect the bushings (9) in both ends of the drum.

### NOTICE

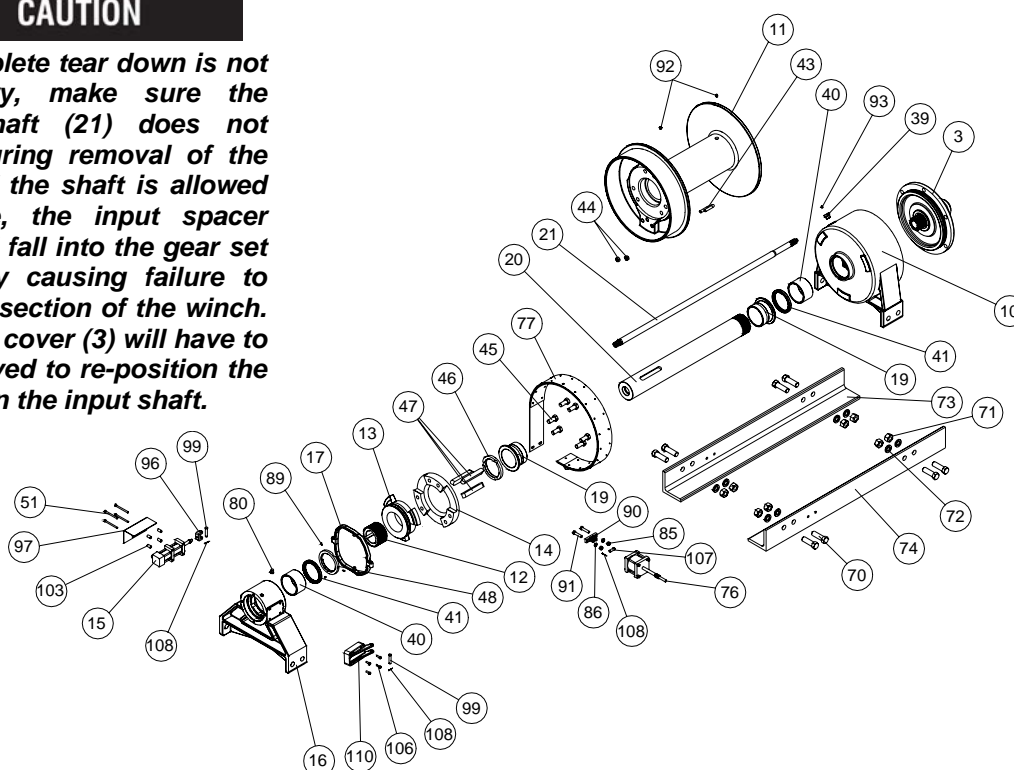
**You should also inspect the bushing and seal (40, 41) that are located in the end of the brake housing.**

5. If necessary, replace the drum clutch (14) at this time by removing six capscrews (45). If you replace the clutch, make sure to torque the capscrews to the specified torque upon re-assembly. (See torque specifications chart on page 28 of this manual.)



### CAUTION

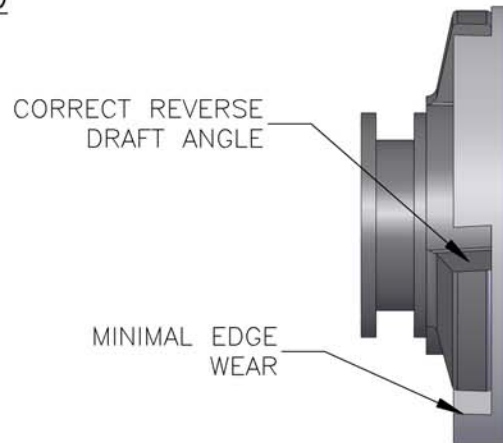
***If a complete tear down is not necessary, make sure the input shaft (21) does not move during removal of the drum. If the shaft is allowed to move, the input spacer (104) will fall into the gear set ultimately causing failure to the gear section of the winch. The gear cover (3) will have to be removed to re-position the spacer on the input shaft.***



## CLUTCH INSPECTION

### GOOD

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



### **NOTICE**

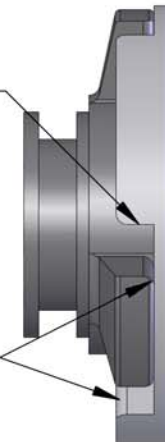
THE REVERSE DRAFT ENSURES THE CLUTCH STAYS ENGAGED DURING PAY-IN.

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

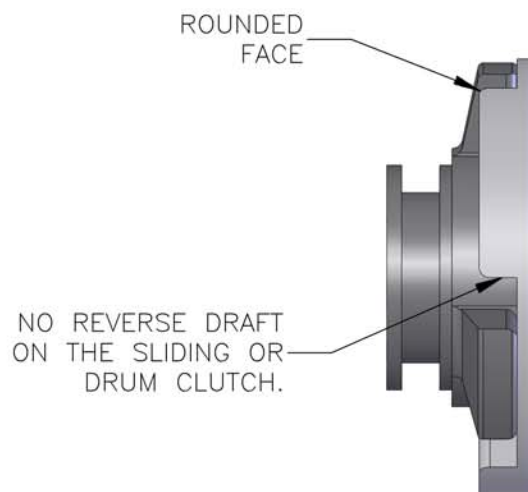


## CLUTCH REPLACEMENT CRITERIA



### **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.



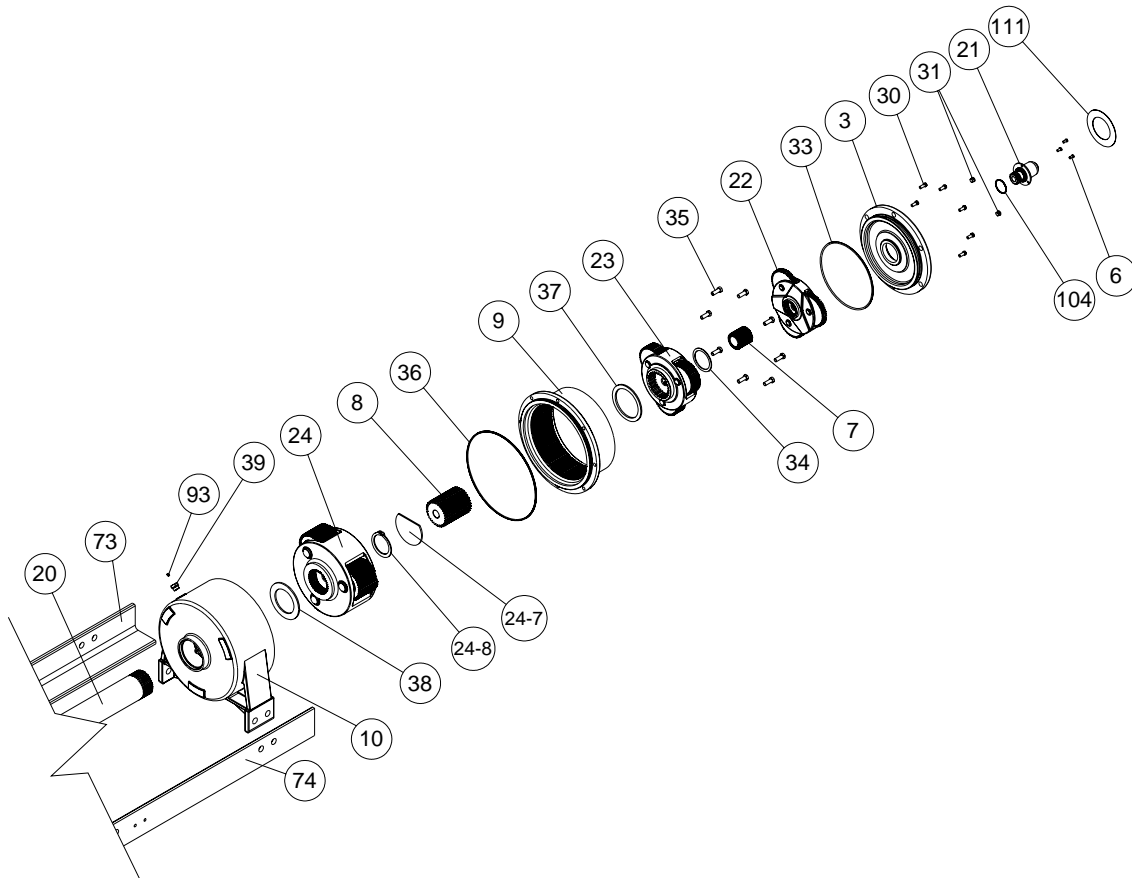
## D. GEAR SECTION DISASSEMBLY

1. Drain the oil by removing the plug (86) located on the bottom of the end cover (3).
2. To disassemble the gear section, remove the Intelliguard™ sensor (21) from the end cover (3) by removing three capscrews (6). Inspect the gear teeth on the Intelliguard™ (21) for wear. The Intelliguard™ system is not serviceable in the field. Return to an authorized dealer for service.
3. Remove the end cover (3) by removing the six capscrews (30).
4. Inspect the o-rings (33 & 104) for wear and replace if necessary.
5. Remove the input gear set (22) and thrust washers (34 & 37). Inspect and replace if necessary.
6. Remove secondary gear set (23) and sun gear (7). Inspect and replace if necessary.
7. Remove the secondary gear housing (9) by removing eight cap screws (35). Inspect the o-ring (36) and replace if necessary.
8. Remove the sun gear (8).
9. Rotate the thrust plate (24-7) into alignment with the snap ring (24-8). Remove the snap ring from the groove on the output shaft (20).
10. Remove the output gear set (24) and thrust washer (38). Inspect and replace if necessary.



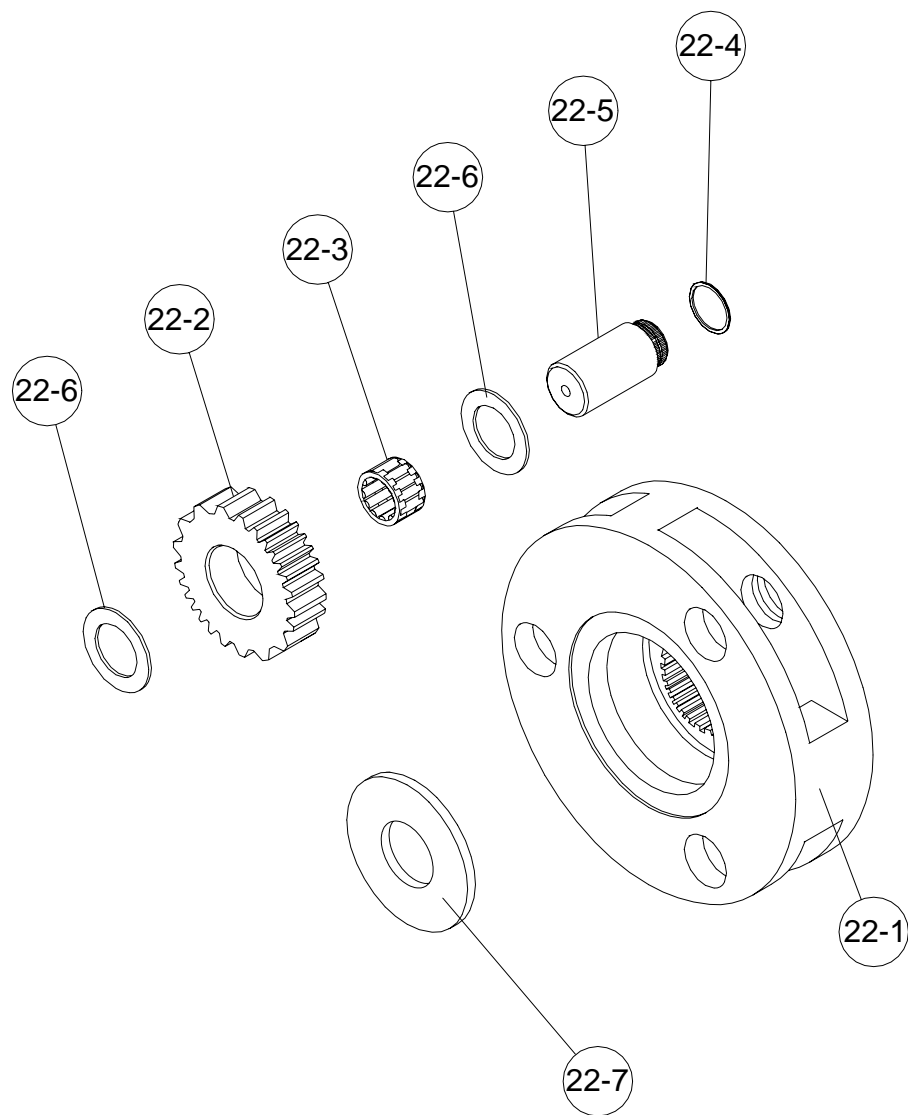
### WARNING

**The housing is very heavy.  
Use caution when removing it.**



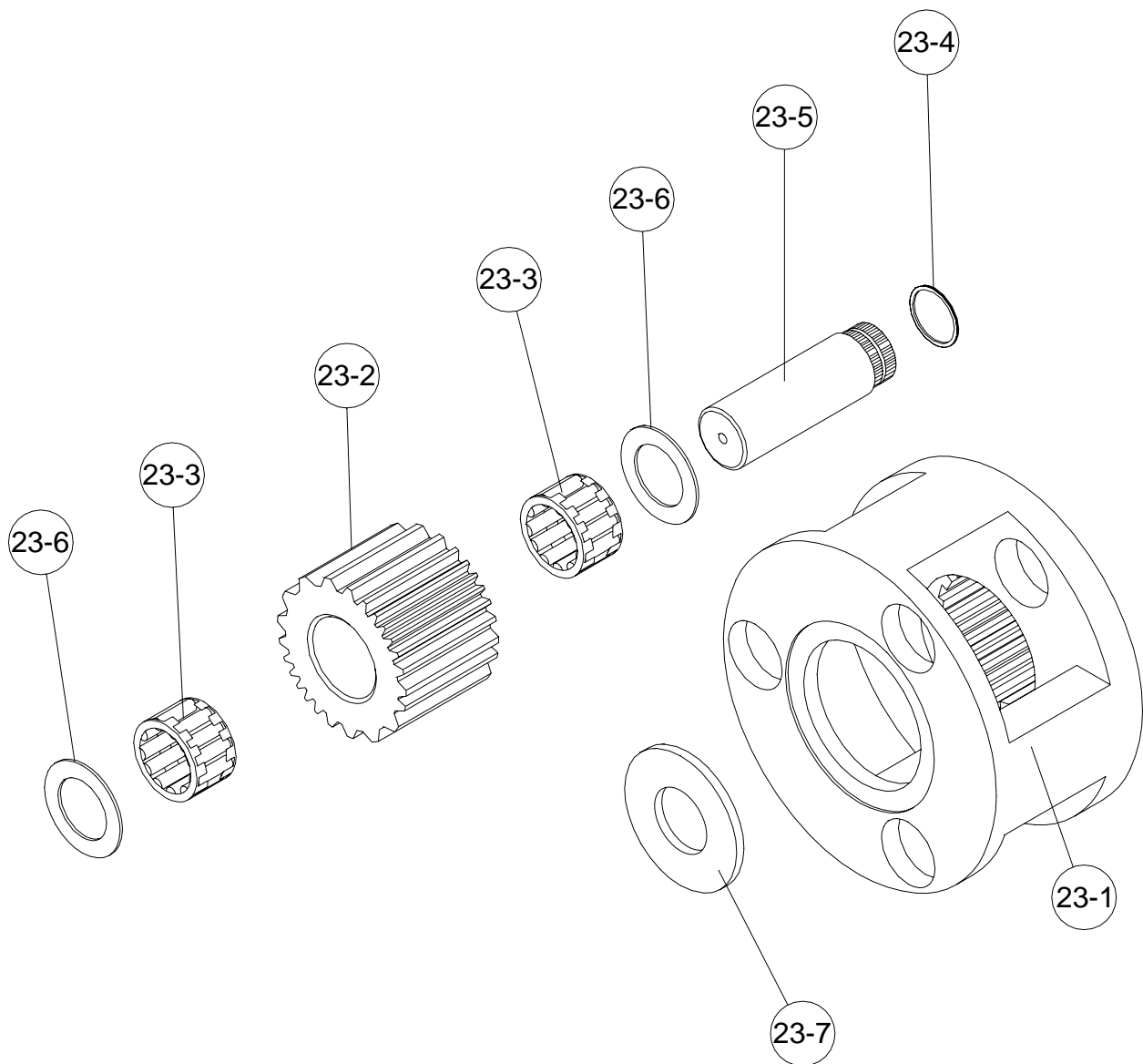
## E. INPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (22-4) from the planet pins (22-5).
2. Remove the pins (22-5) from the carrier (22-1) by carefully tapping them out.
3. Remove the planet gears (22-2), thrust washers (22-6) and bearings (22-3) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



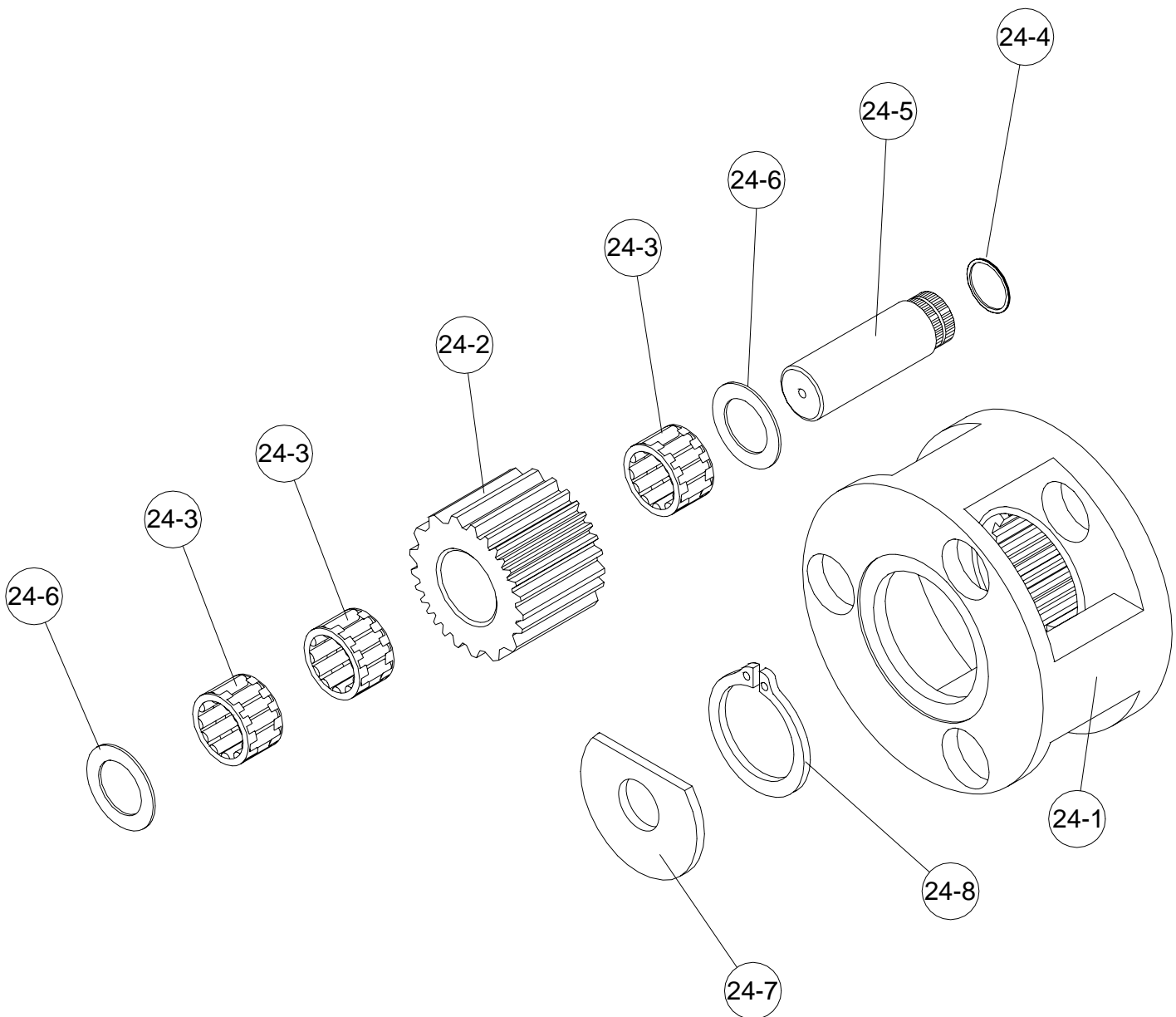
## F. SECONDARY PLANET SET DISASSEMBLY

1. Remove the retaining rings (23-4) from the planet pins (23-5).
2. Remove the pins (23-5) from the carrier (23-1) by carefully tapping them out.
3. Remove the planet gears (23-2), thrust washers (23-6) and bearings (23-3) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



## G. OUTPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (24-4) from the planet pins (24-5).
2. Remove the pins (24-5) from the carrier (24-1) by carefully tapping them out
3. Remove the planet gears (24-2), thrust washers (24-6), and bearings (24-3) from the carrier.
4. Remove the thrust plate (24-7) and the retaining ring (24-8) from the carrier.
5. Inspect the parts for wear or damage and replace if necessary.



# GENERAL ASSEMBLY

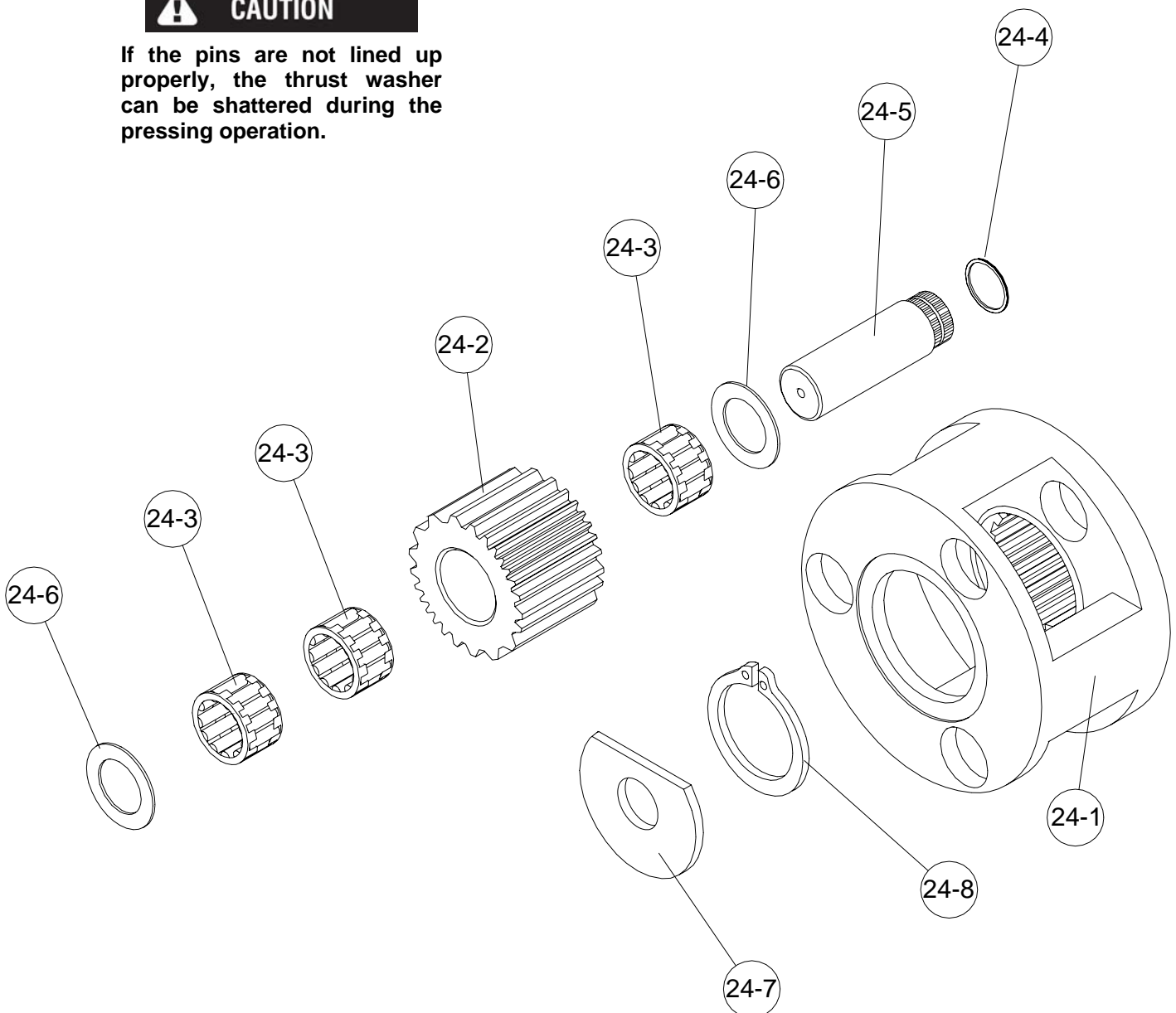
## H. OUTPUT PLANET SET ASSEMBLY

1. Insert the retaining ring (24-8) and the thrust plate (24-7) into the carrier (24-1) along with the gears (24-2), bearings (24-3), and thrust washers (24-6).
2. Being careful to line up the thrust washers (24-6) and bearings (24-3) with the planet pins (24-5), press the pins into the carrier.
3. Replace the retaining rings (24-4).



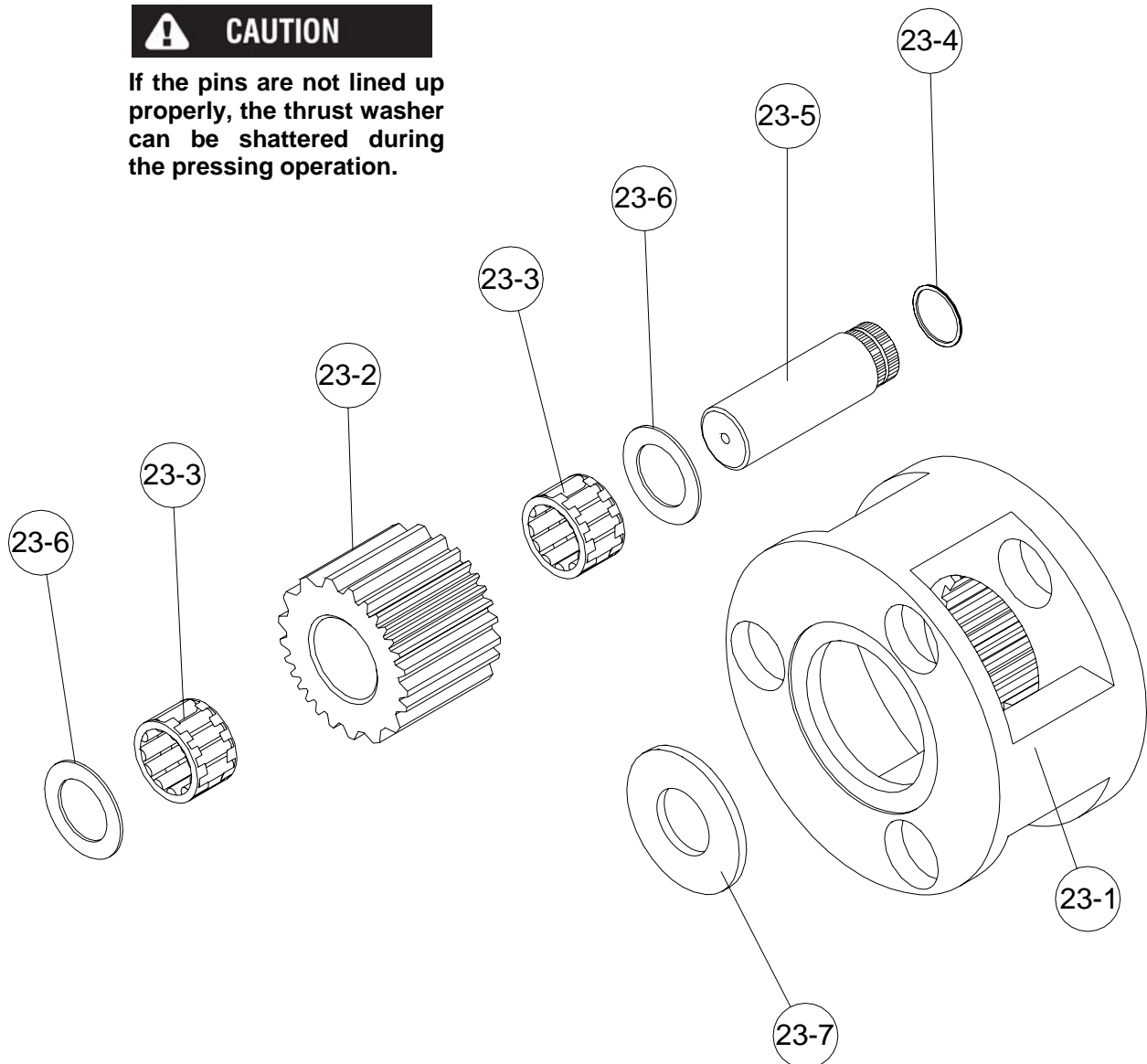
### CAUTION

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



## I. SECONDARY PLANET SET ASSEMBLY

1. Insert the thrust plate (23-6) into the carrier (23-1) along with the gears (23-2), bearings (23-3), and thrust washers (23-6).
2. Being careful to line up the thrust washers (23-6) and bearings (23-3) with the planet pins (23-5), press the pins into the carrier.
3. Replace the retaining rings (23-4).



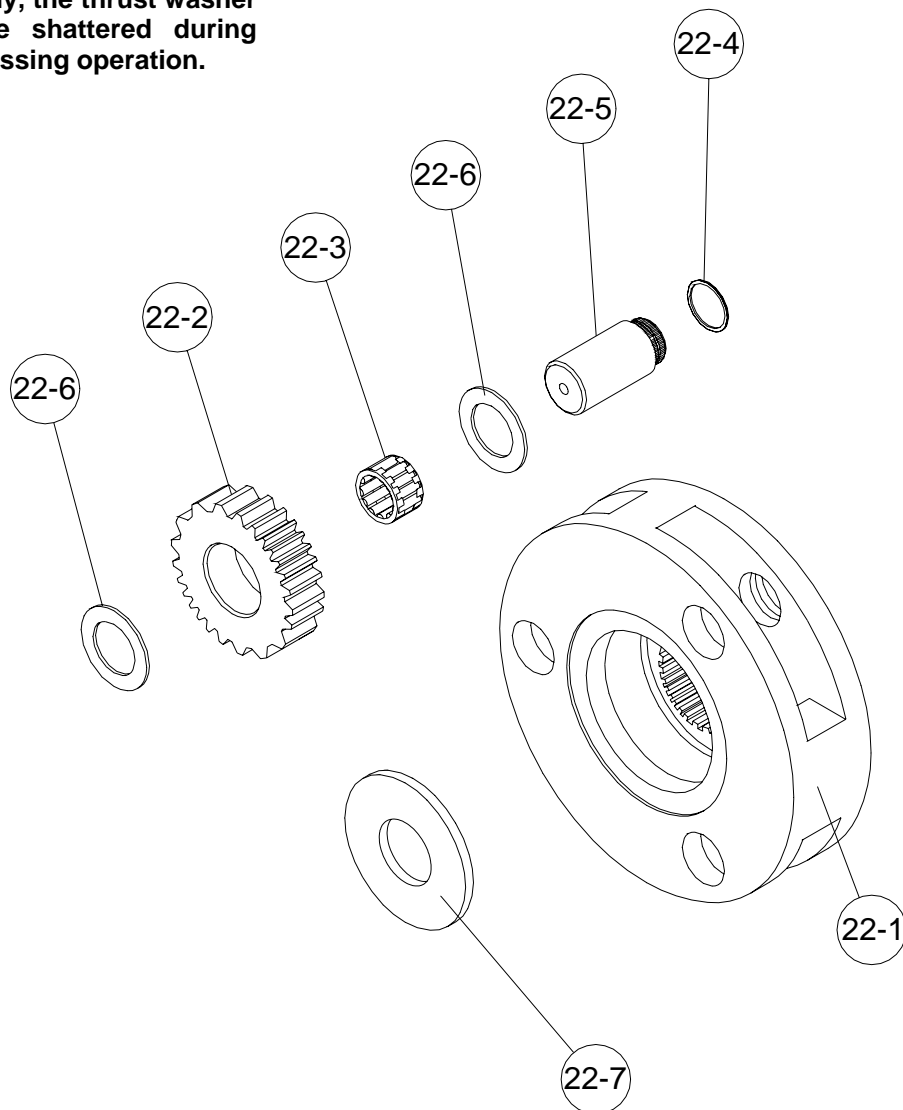


## J. INPUT PLANET SET ASSEMBLY

1. Insert the thrust plate (22-7) into the carrier (22-1) along with the gears (22-2), bearings (22-3), and thrust washers (22-6).
2. Being careful to line up the thrust washers (22-6) and bearings (22-3) with the planet pins (22-5), press the pins into the carrier.
3. Replace the retaining rings (22-4).

### CAUTION

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



## K. GEAR END ASSEMBLY

1. Bolt the gear housing (10) loosely into both frames (73, 74). Slide the output shaft (20) halfway into the gear housing (10).
2. When reassembling apply grease to parts such as thrust washers, o-rings, and seals. Slide the thrust washer (38) onto the output shaft (20). Next install the output gear set (24). Rotate the thrust plate (24-7) in position and install the retaining ring (24-8) onto the shaft. Push the gear set and shaft back into the housing until it stops against the thrust washer (38).
5. Install the secondary sun gear (7). Making sure it's against the washer in the secondary gear set (23).
6. Install the thrust washer (34) onto the input gear set (22). Insert the input gear set (22) into the gear housing (10), making sure it is against the thrust washer. Put the outer thrust washer (34) in place and slide the input shaft (21) all the way through the output shaft (20). Let the input shaft protrude out on the gear end so that all of the spline is showing. Make sure the correct end is towards the gear end. It will not work if it is backwards.

### NOTICE

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

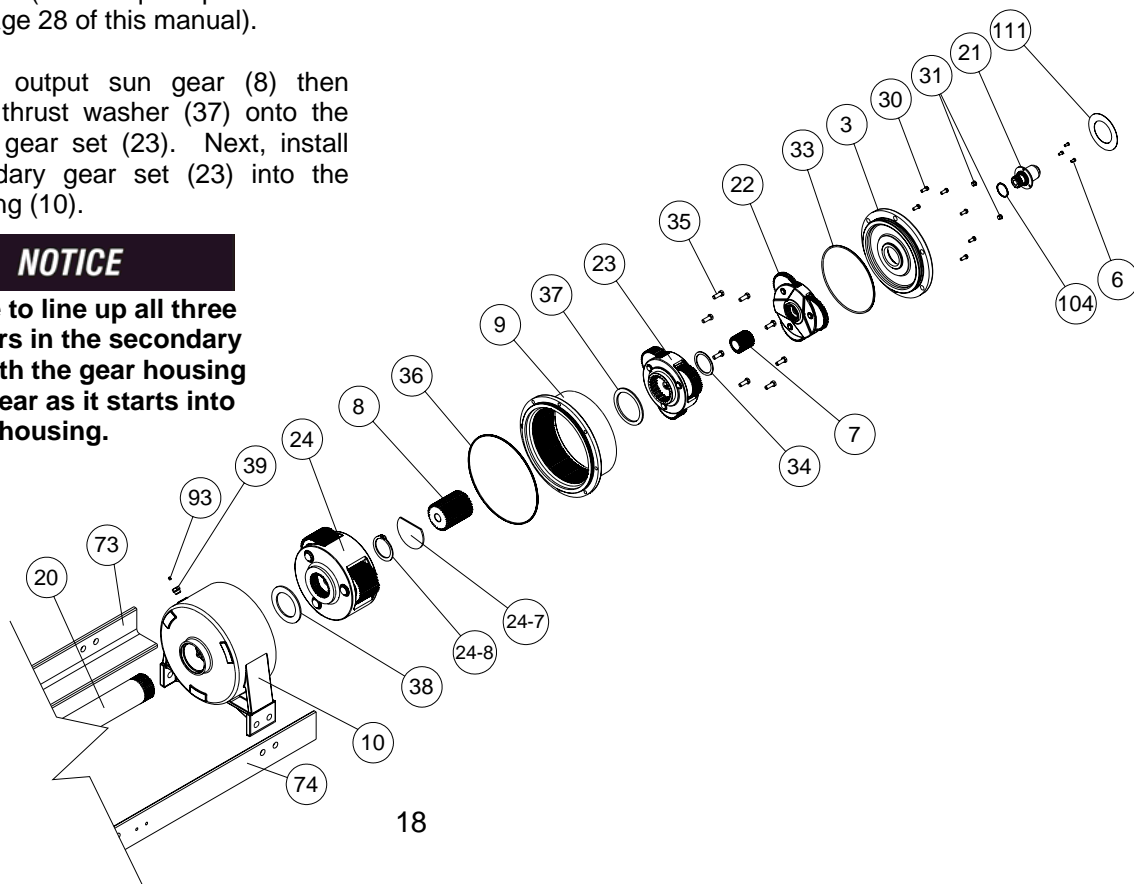
3. Install the secondary gear housing (9) onto the gear housing (10) making sure not to damage the o-ring (36). Use eight capscrews (35) and torque them to specification (see torque specifications chart on page 28 of this manual).
4. Install the output sun gear (8) then install the thrust washer (37) onto the secondary gear set (23). Next, install the secondary gear set (23) into the gear housing (10).

### NOTICE

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

### NOTICE

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



## L. DRUM SECTION ASSEMBLY

1. After inspecting and replacing the necessary parts, such as the drum bushings (19), install the drum (11) onto the output shaft (20). 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 (77) along with the bracket (90), capscrews (91), nuts (85), and washers (86).

### NOTICE

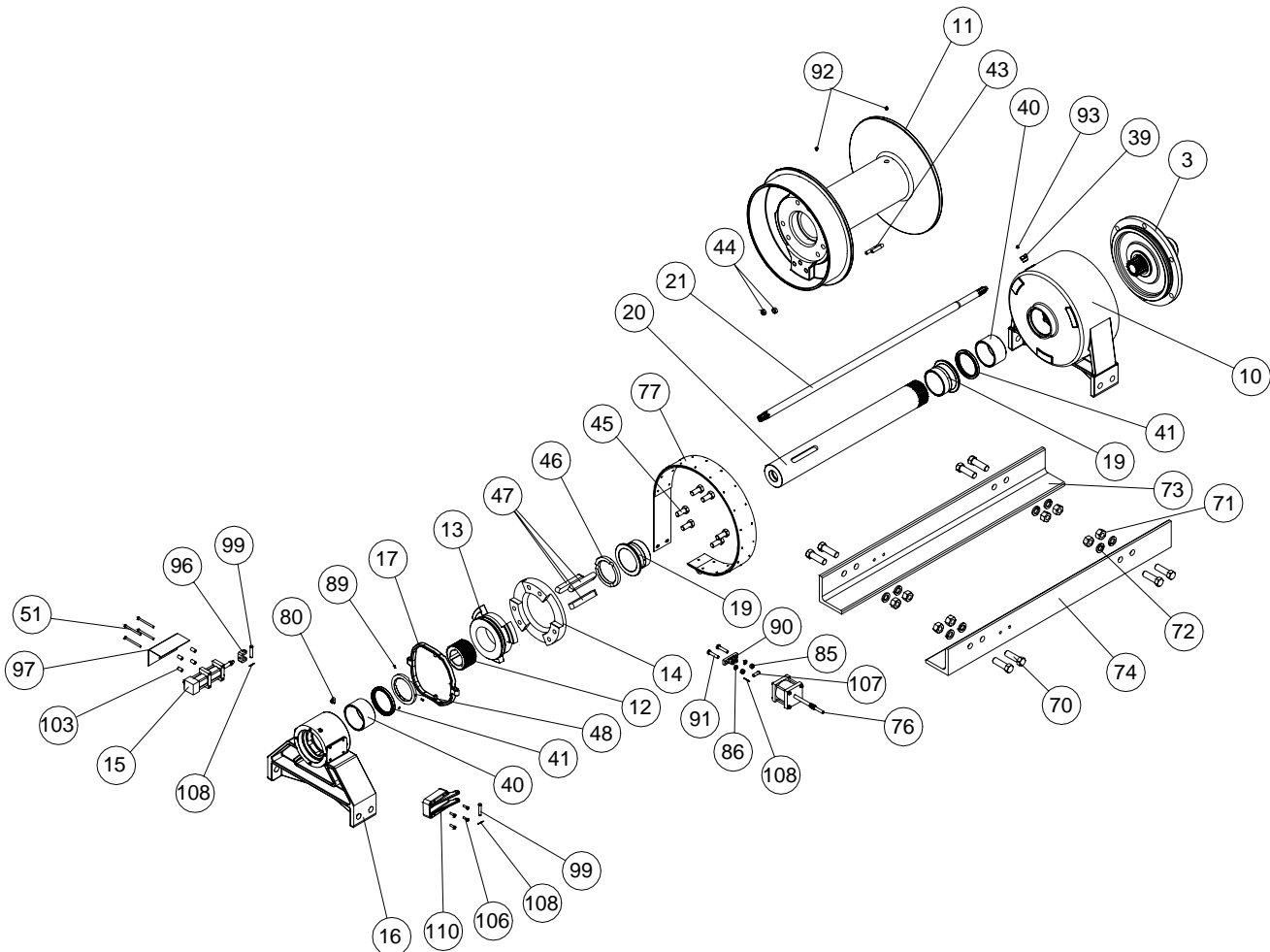
**You may need to lower the drum to align the holes in the brake band with the holes in the frame.**

2. Install the brake band air cylinder (76), making sure the rod of the air cylinder is going through the bracket on the brake band (77). Secure it to the bracket (90) with the clevis pin (107) and cotter key (108).

Tighten the adjusting nut on the air cylinder shaft until there is not space between the drum (11) and the brake band (77). Then, tighten the jam nut to secure the adjusting nut.

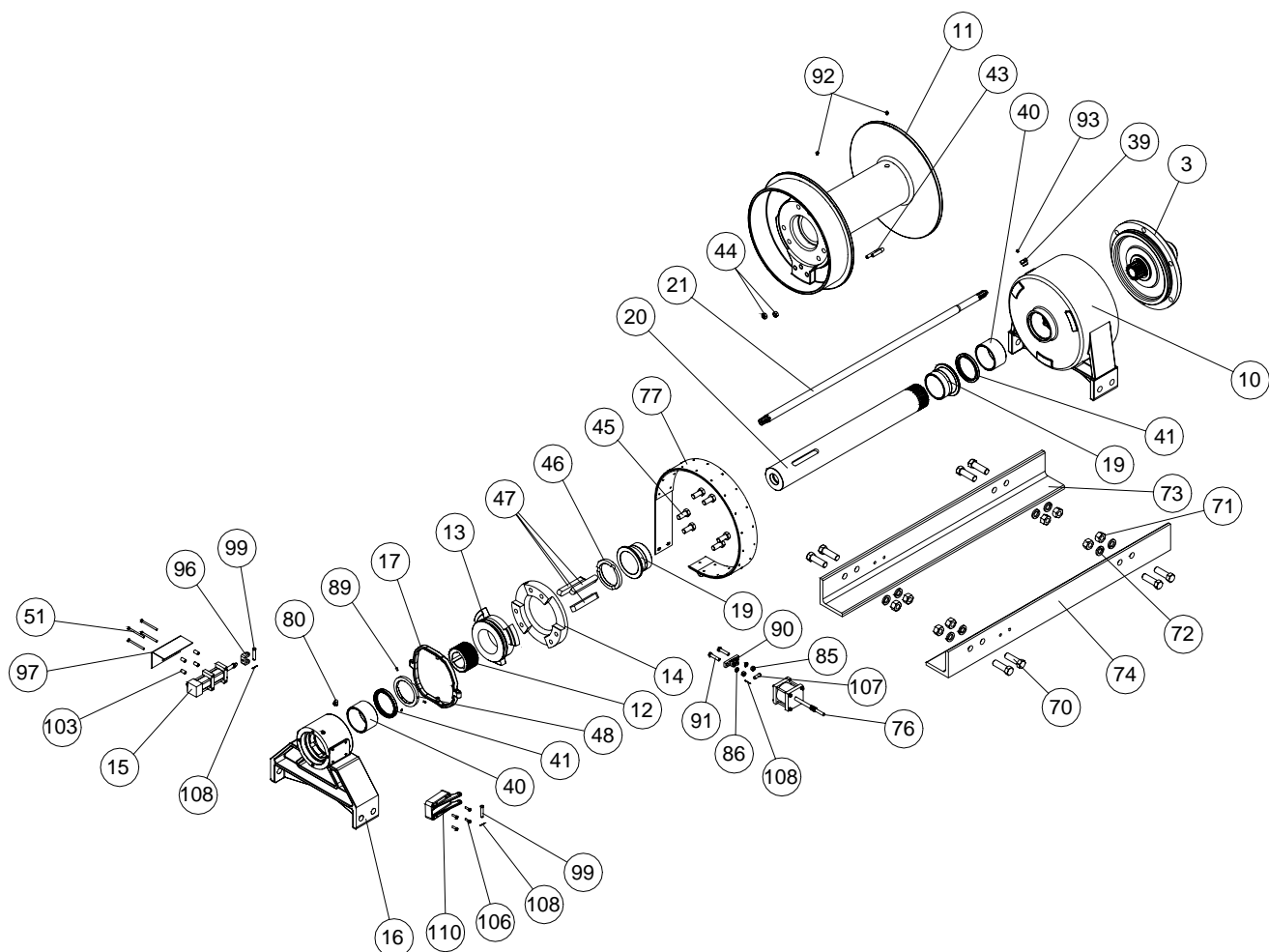
3. Install the inner thrust collar (46), making sure the half-moon slots are lined up with the key slots in the output shaft (20). Tap the three keys (47) into their slots in the output shaft.
4. If necessary, install the new drum clutch (14) using six capscrews (45). Torque to specified torque (see page 28 of this manual). Next, align the coupler (12) with the keys (47) and slide it onto the output shaft (20). Install the sliding clutch (13) and yoke (17) onto the coupler (12).

(Continued on Page 20)

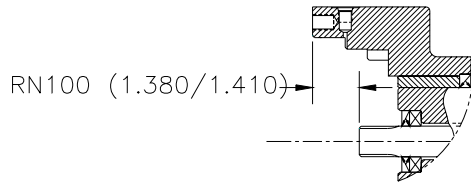


## DRUM SECTION ASSEMBLY CONTINUED

5. Install the outer thrust collar (48), aligning the half moon slots with the keys (47). Tightly hold the thrust collar against the keys and lock down the three set screws (89).
6. Slide the brake housing (10) onto the output shaft.
7. Bolt the brake housing (10) loosely into both frames (73, 74). Lower the drum so the 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 (13) so you can turn the drum freely and tighten all bolts through the frames to the proper torque specification (see page 28 of this manual).
9. Turn the drum to make sure it is not binding.
10. If necessary, install the air cylinder (15) and the air cylinder cover (97) to the brake housing with four capscrews (51) and spacers (103).
11. Install the bracket (110) to the brake housing using four capscrews (106).
12. Attach the yoke (17) by installing clevis pins (99) into the bracket (110) and clevis (96). Install the cotter keys (108) into the clevis pins (99) 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 (96) and air cylinder jam nut accordingly.



## M. BRAKE SECTION ASSEMBLY



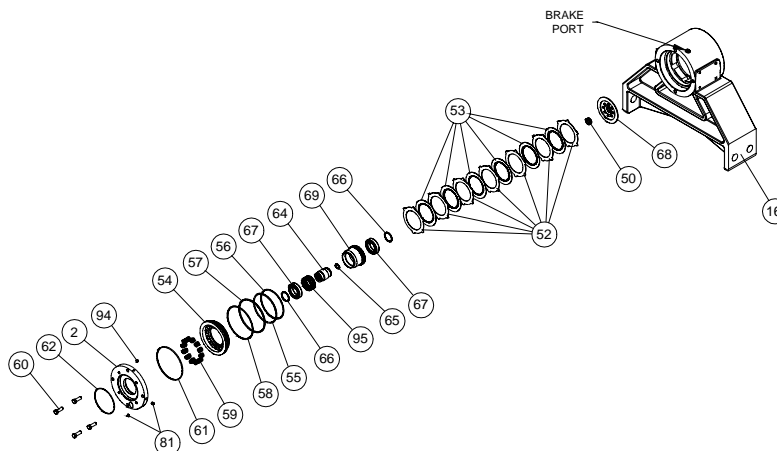
### CAUTION

***If a complete tear down is not necessary, make sure the input shaft (21) does not move during removal of the drum. If the shaft is allowed to move, the input spacer (104) will fall into the gear set ultimately causing failure to the gear section of the winch. The gear cover (3) will have to be removed to re-position the spacer on the input shaft.***

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 the face of the brake housing to the end of the shaft as shown above.
3. If needed, add shims (113, 114) inside input driver (64) on motor side to achieve dimension shown above.
4. Install the bearing housing assembly that contains parts 50 and 68 into the brake housing.
5. Install the driver/clutch assembly onto the input shaft (21).
6. Install the stator plates (52) and friction discs (53) starting with a stator plate and alternating between friction discs and stator plates until seven stator plates and six friction discs are used.
7. Install the piston (54) into the brake housing (16) and gently tap it down until it is seated making sure not to damage the o-rings (55, 57) or back-up rings (56, 58).
8. Install the springs (59) into the spring pockets. If working in a horizontal position, coat the bottom of each spring with chassis lube to keep it in position.
9. Install the cover (60) onto the brake housing (16) using four cap screws (62). Draw the cover down evenly, alternating between opposite hex bolts. Make sure that the cover is aligned properly with the brake housing to orient the motor correctly.
10. Check the brake release with a portable hydraulic pump. Full release should be obtained at 340psi, plus or minus 20psi. Also, check the brake for proper operation by applying 107psi to the brake port and adapting a torque wrench to the input shaft. The torque in the payout should be 142 to 162 ft-lbs.

### NOTICE

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



## N. MOTOR ASSEMBLY

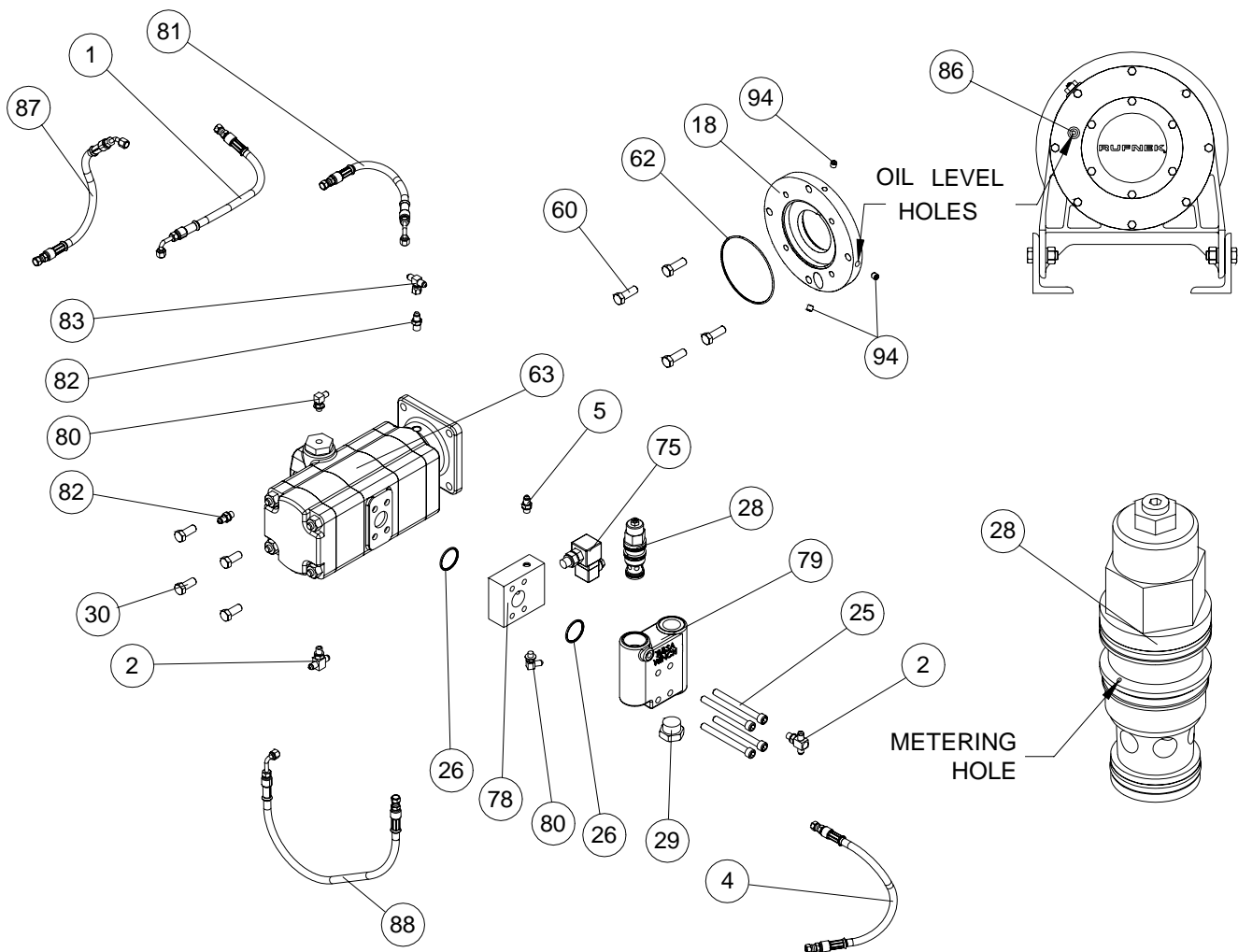
1. Install the o-ring (62) onto the motor (63) and install the motor using four capscrews (30). Tighten the capscrews to the proper torque specification (see page 28 of this manual).

### 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 (75).
3. Install the counter-balance valve (28) into the counterbalance block (79).

4. Install the o-ring (26) into the manifold block (78) and counterbalance block (79). Install the manifold block (78) and counter-balance block (79) using four capscrews (25).
5. Install hoses (1, 4, 81, 87, and 88).
6. Remove the oil level plugs (86 & 94) from the brake cover (18) and gearbox cover (3). 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
Winch won't hold load.	<ul style="list-style-type: none"> <li>a) Excessive backpressure 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>
Winch will not raise the load it should.	<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>
Oil leaks from vent located on the top of the gearbox.	<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 to fail.</li> <li>b) Brake piston seals may have failed. Service the brake section and replace worn parts.</li> </ul>
Winch runs too slow	<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>
Cable drum won't free spool	<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 100 BILL OF MATERIAL

81867004-BOM-AUGUST 2005

ITEM	QTY	P/N	DESCRIPTION
1	1	42031	HOSE ASSEMBLY
2	2	42438	STRAIGHT THREAD BRANCH TREE
3	1	44750	END COVER
4	1	42030	HOSE ASSEMBLY
5	2	41838	STRAIGHT ADAPTER
6	3	32477	CAPSCREW
7	1	42913	SECONDARY SUN GEAR
8	1	42914	OUTPUT SUN GEAR
9	1	42915	PRIMARY GEAR HOUSING
10	1	42916	GEAR HOUSING
11	1	42917	DRUM
12	1	42918	COUPLER
13	1	44576	SLIDING CLUTCH
14	1	43769	DRUM CLUTCH
15	1	44340	AIR CYLINDER
16	1	42922	BRAKE HOUSING
17	1	43882	CLUTCH YOKE
18	1	43419	BRAKE COVER
19	2	42868	BUSHING
20	1	42869	OUTPUT SHAFT
21	1	4480	INTELLIGUARD SYSTEM
22	1	4250	INPUT GEAR SET
22-1	1	43183	INPUT CARRIER
22-2	3	42877	PLANET GEAR
22-3	3	30484	NEEDLE BEARING
22-4	3	41715	RETAINING RING
22-5	3	41760	PLANET PIN
22-6	6	27221	THRUST RACE
22-7	1	42954	THRUST PLATE
23	1	4229	SECONDARY GEAR SET
23-1	1	42926	SECONDARY CARRIER
23-2	3	42876	SECONDARY PLANET GEAR
23-3	6	41717	BEARING
23-4	3	41716	RETAINING RING
23-5	3	42951	PLANET PIN
23-6	6	939249	THRUST RACE
23-7	1	42957	THRUST PLATE
24	1	4230	OUTPUT GEAR SET
24-1	1	42927	OUTPUT CARRIER
24-2	3	42878	OUTPUT PLANET GEAR
24-3	9	939247	NEEDLE BEARING
24-4	3	41901	RETAINING RING
24-5	3	42952	PLANET PIN
24-6	6	27219	THRUST RACE



## RUFNEK 100 BILL OF MATERIAL CONTINUED

24-7		1		42957		THRUST PLATE
24-8		1		43699		RETAINING RING
25		4		43372		CAPSCREW
26		2		32182		O-RING
27		-		-		OMIT
28		1		41867		COUNTERBALANCE VALVE
29		1		32411		HEX PLUG
30		12		20524		CAPSCREW
31		2		41719		O-RING PLUG
32		1		42137		CAPLUG
33		1		28947		O-RING
34		2		42934		THRUST WASHER
35		8		28212		CAPSCREW
36		1		32368		O-RING
37		1		42935		THRUST WASHER
38		1		42936		THRUST WASHER
39		1		42978		SPECIAL O-RING PLUG
40		2		42930		BUSHING
41		2		44690		OIL SEAL
42		-		-		OMIT
43		1		42937		U-BOLT
44		2		21214		NUT
45		6		21644		CAPSCREW
46		1		42938		THRUST COLLAR
47		3		42939		KEY
48		1		43696		THRUST COLLAR
49		-		-		OMIT
50		1		42932		BALL BEARING
51		4		43880		CAPSCREW
52		7		42148		STATOR PLATE
53		6		32765		FRICTION DISC
54		1		42942		BRAKE PISTON
55		1		42335		O-RING
56		1		42336		BACK-UP RING
57		1		32186		O-RING
58		1		42337		BACK-UP RING
59		12		42230		BRAKE SPRING
60		4		28060		CAPSCREW
61		1		33094		O-RING
62		1		34003		O-RING
63		1		43165		2 SPEED HYDRAULIC MOTOR
64		1		44337		INPUT DRIVER
65		1		29043		RETAINING RING
66		2		44323		RETAINING RING
67		2		29162		BEARING
68		1		44338		BEARING HOUSING

## RUFNEK 100 BILL OF MATERIAL CONTINUED

69		1		44335		BRAKE DRIVER
70		8		20650		CAPSCREW
71		8		20653		NUT
72		8		20652		LOCKWASHER
73		1		44048		RIGHT HAND FRAME
74		1		44049		LEFT HAND FRAME
75		1		43367		CARTRIDGE VALVE
76		1		42929		BRAKE BAND AIR CYLINDER
77		1		4343		BRAKE BAND ASSEMBLY
78		1		43368		MANIFOLD BLOCK
79		1		42029		COUNTERBALANCE BLOCK
80		3		42089		90° ADAPTER
81		1		42494		HOSE ASSEMBLY
82		1		42033		SWIVEL TEE
83		1		40280		FITTING
84		1		32145		CAPLUG
85		2		20521		NUT
86		2		20518		LOCKWASHER
87		1		42495		HOSE ASSEMBLY
88		1		43459		HOSE ASSEMBLY
89		3		21653		SET SCREW
90		1		42955		MOUNTING BRACKET
91		2		29472		CAPSCREW
92		2		21128		GREASE ZERK FITTING
93		1		13050		BREATHER
94		3		21684		PIPE PLUG
95		1		41759		CLUTCH
96		1		43828		CLEVIS
97		1		43891		AIR CYLINDER COVER
98		1		43941		AIR SHIFT KIT
99		2		43827		CLEVIS PIN
100		-		-		OMIT
101		-		-		OMIT
102		-		-		OMIT
103		4		43078		SPACER
104		1		31543		O-RING
105		-		-		OMIT
106		4		29614		CAPSCREW
107		1		939243		CLEVIS PIN
108		3		20514		COTTER PIN
109		-		-		OMIT
110		1		43877		CLUTCH BRACKET
111		-		-		OMIT
112		-		-		OMIT
113		3		994188		(SHIM)
114		2		33324		(SHIM)

# VISCOSITY CHART



**Tulsa Winch**

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		
	600				
3000	500				140
2500	400	460	7		
2000					
	300	320	6		
1500					
	200	220	5	50	90
1000	175				
900					
800	150	150	4	40	
700					
600	125				
500	100	100	3	30	85W
400	80				
	70				
300	60	68	2		80W
	50				
200	40	46	1	20W-20	
150	30	32	0		75W
100	20	22		10W	
	15	15		5W	
				0W	
	10	10			
		7			
50	5	5			
		3			
		2			

# TORQUE SPECIFICATIONS CHART

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

T = BOLT TORQUE (LB. FT.)

$T = (KWD) / 12$

K = TORQUE COEFFICIENT (K = 0.20 DRY

K = 0.15 PLATED

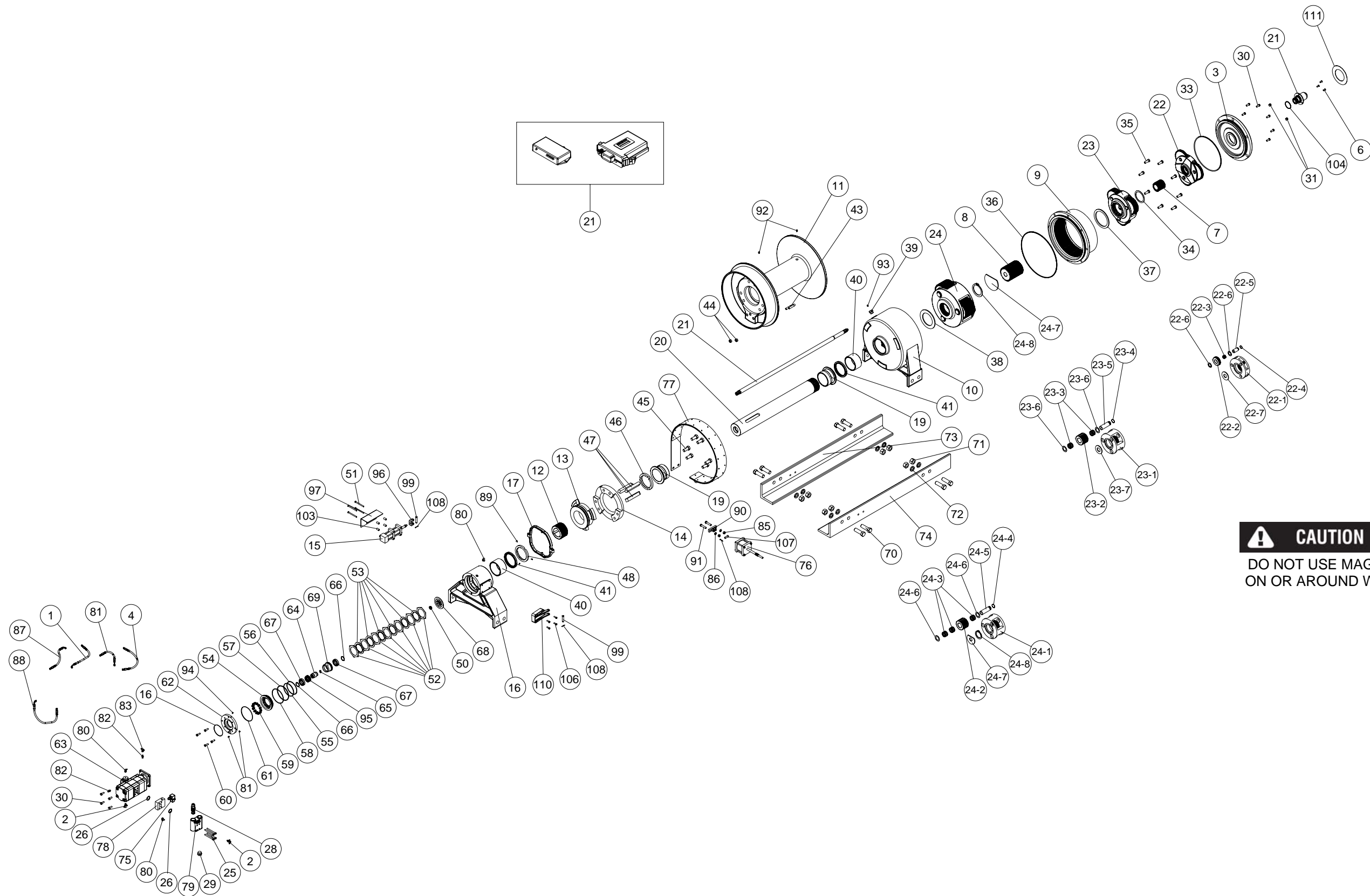
K = 0.12 LUBRICATED)

W = PRELOAD TENSION

D = NOMINAL BOLT SIZE (IN.)

\* ALL TORQUE VALUE TOLERANCES ARE  $\pm 5\%$

# RUFNEK 100 ISOMETRIC DRAWING



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