

# ***Tulsa Winch***

DESIGN SERIES 001

## **RUFNEK 20 AND MODEL 23 SERVICE MANUAL**

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## WARNING

### **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/>



#### **DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



#### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



#### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

#### **NOTICE**

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-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 can be equipped with two (2) forms of dynamic braking. The worm brake is one method and is adjustable for pay-out load control. 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 that is not field adjustable.

The same method should be used to check this brake.

## **Operation:**

- All winch controls must be well marked for function to avoid confusion.
- Insure that the PTO is disengaged when the winch is not in use.
- 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.

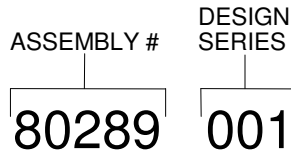
# **GENERAL INFORMATION**

## **INTRODUCTION AND THEORY OF OPERATION**

The Tulsa worm gear winch is operated by turning the input of the worm using a hydraulic motor or PTO driven sprocket and chain. The winch utilizes the adjustable, spring applied, multiple disc oil brake that activates only during pay-out to provide maximum efficiency during pay-in. The torque is transferred from the gearbox through the drum shaft which is keyed to a mechanically actuated sliding clutch that when engaged transfers the torque to the drum.

## **ASSEMBLY NUMBER EXPLANATION**

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



## **WINCH BREAK-IN**

Winches, like any other kind of machinery, require a “break-in” to perform well and to maximize their life. The following guidelines should be used in the break-in of Tulsa Winches.

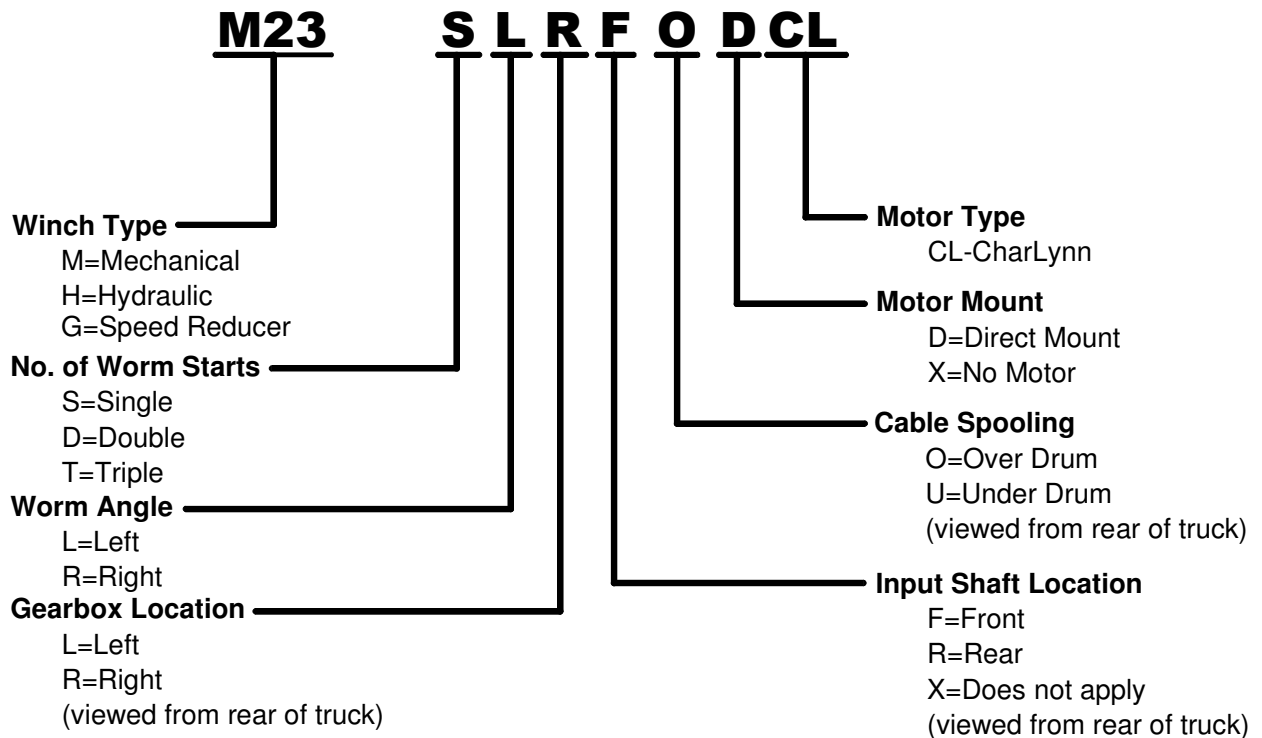
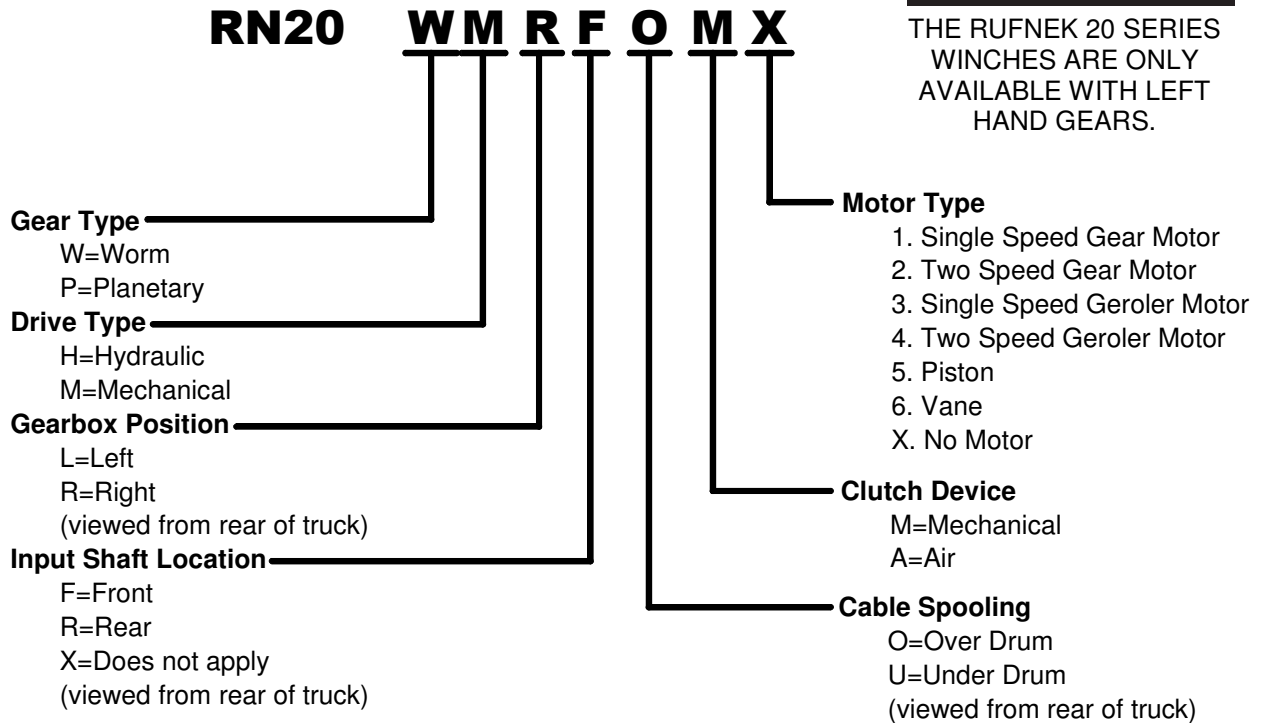
Use extreme care when first spooling cable onto the winch. DO NOT run the winch at high speeds when performing this operation. Make sure that the cable is payed-out in a straight line (to prevent kinks) and SLOWLY pay-in the winch to install the cable.

DO NOT exceed one half rated load or one half rated line speed for the first thirty minutes of operation. This will insure that the worm and gear have an opportunity to wear in properly. Periodically, check the gearbox for temperature rises and allow the winch to cool down between pulls. Worm gear winches are designed and intended for intermittent duty application only; using them in extremely long pulls may generate excessive heat and shorten the life of the winch.

# MODEL CODES

## NOTICE

THE RUFNEK 20 SERIES WINCHES ARE ONLY AVAILABLE WITH LEFT HAND GEARS.



# MAINTENANCE

Tulsa Winch worm gear winches require regular maintenance to ensure safe and reliable operation. Regular oil changes with the correct oil for the ambient temperature conditions and an annual inspection of the wear components are strongly recommended.

## Maintenance Scheduling

The owner is to ensure proper inspection intervals, in compliance with the API RP 2D Section 4, ANSI B30.5, 5-2.3, or ANSI B30.7, 7-2.1, and will review winch usage categories on a periodic basis. A qualified inspector should perform all maintenance and inspections.

USE (HRS PER MONTH)	API RP 2D RECOMMENDED INSPECTION SCHEDULE
0-10	PRE-USE, ANNUAL
11-50	PRE-USE, QUARTERLY
51+	PRE-USE, MONTHLY

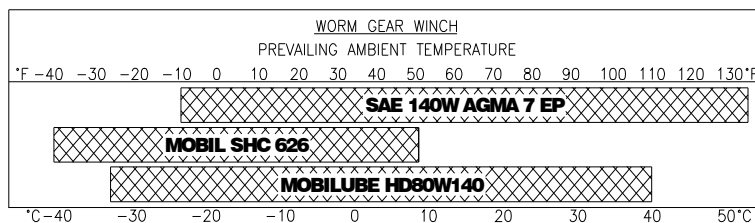
## Oil Maintenance

The oil in the gear and brake section should be changed every **1000 hrs** or **6 months** of normal usage.

- Tulsa Winch recommends that the oil level in the gearbox be checked and adjusted as part of the pre-use inspection. If the oil level drops frequently or oil leakage is detected during an inspection, maintenance should be performed to correct any problems.

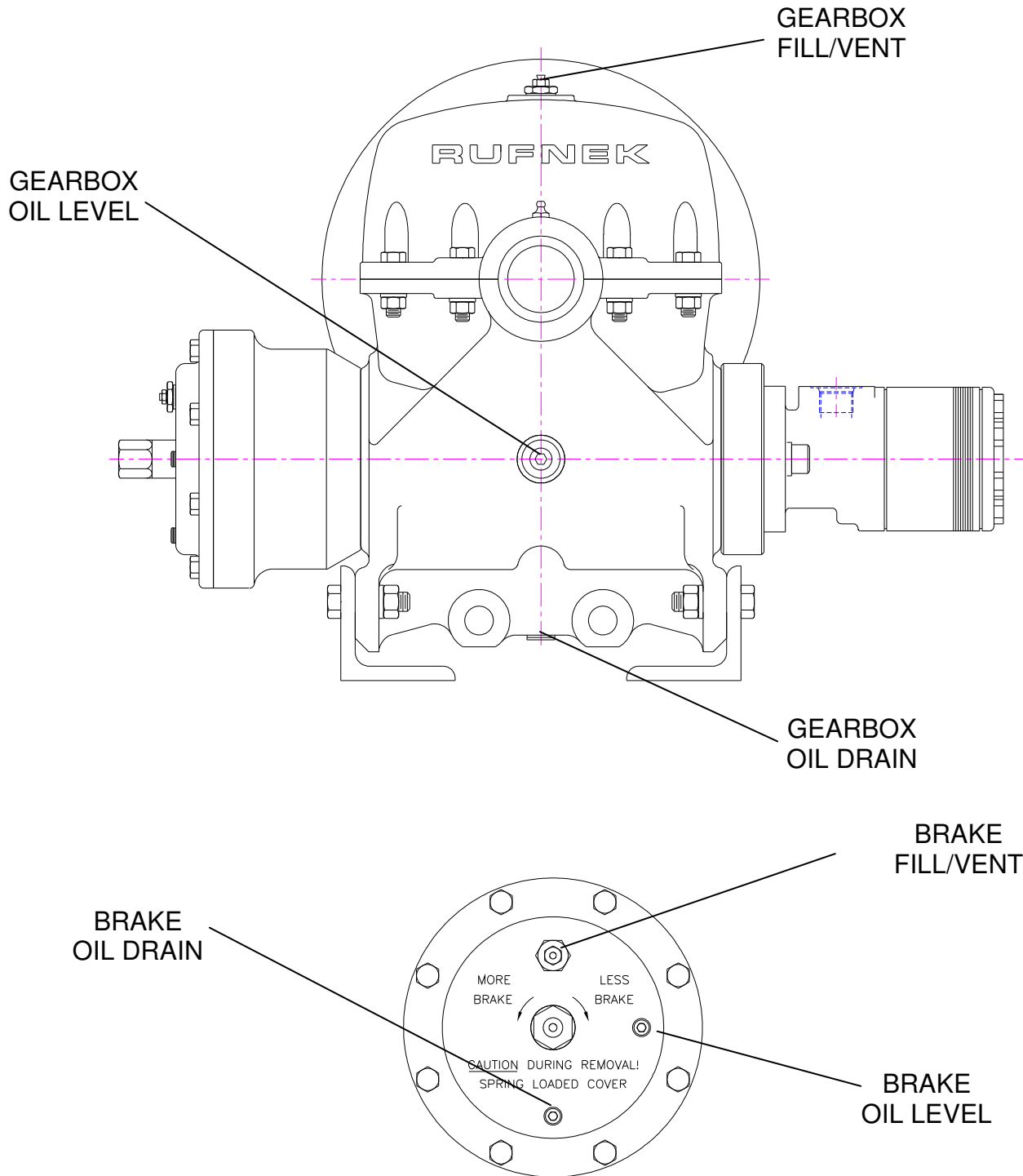
### **GEARBOX OIL CAPACITY = 3 QTS**

- Gearbox oil level inspection is achieved by removing the oil level inspection plug and visually inspecting the oil level. Minimum oil level is to the bottom of the threads of the inspection hole. Refer to the chart below for the recommended oil type and grade for your application.



*All oils must meet MIL-PRF2105E standards. Substitution from a reputable manufacturer is allowed as long as type and grade are maintained.*

# OIL LEVELS

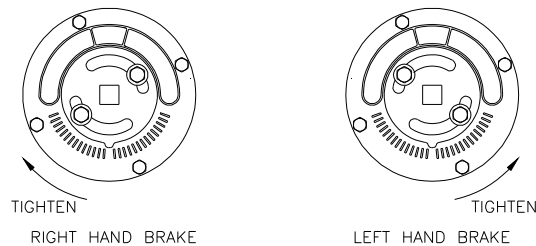


## BRAKE ADJUSTMENT

In general, worm brakes on Tulsa winches should be set to hold the load you are currently working with. Excessive brake torque will result in excessive heat generation and brake wear. The best way to insure proper brake adjustment is to pull the cable tight against the load and stop to ensure the brake holds. If it doesn't, tighten the brake slightly and try it again. If the brake doesn't respond to adjustment the brake must be serviced.

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### ADJUSTABLE SHOE BRAKE

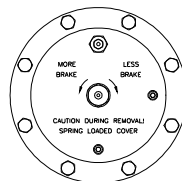


To tighten the brake, loosen the two capscrews in the slotted holes and rotate the brake in the direction shown. If the brake needs to be reversed, remove those same two capscrews; rotate the cam 60 degrees in the loosening direction, and reinstall the capscrews in the new set of holes which have just been revealed. After adjustment, be sure to re-tighten the cam capscrews securely.

If the input to the winch is accessible and a torque wrench can be put on it, the brake can be set with a torque wrench. The Model 23 brake is shipped from the factory pre-set at 50 Ft.-Lbs.

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### ADJUSTABLE MULTIPLE DISC OIL BRAKE RN20W



This style of brake can be adjusted by turning the hex adjuster counter-clockwise to increase brake and clockwise to decrease brake. The direction of braking for all multiple disc brakes can be changed by removing the cam clutch, turning it over, and re-installing it. For detailed service instructions, contact your Tulsa Winch distributor or the factory.

If the input to the winch is accessible and a torque wrench can be adapted to it, the brake can be set with a torque wrench. The RN20W brake is shipped from the factory pre-set at 50 Ft.-Lbs.



# DISASSEMBLY

## RUFNEK 20 BRAKE DISASSEMBLY

1. Remove the bottom drain plug (24) to drain oil from brake.
2. Loosen the spring tension inside the brake by rotating the adjusting nut (95) clockwise until it stops.

### ⚠ CAUTION

**Extreme care should be taken when removing the brake cover. The cover is spring loaded against the cover screws.**

3. Evenly remove the capscrews (14) from the brake cover (97).
4. Remove the spring (101). Remove the brake driver (100) along with the brake components (91, 98, 103, 104, and 105).

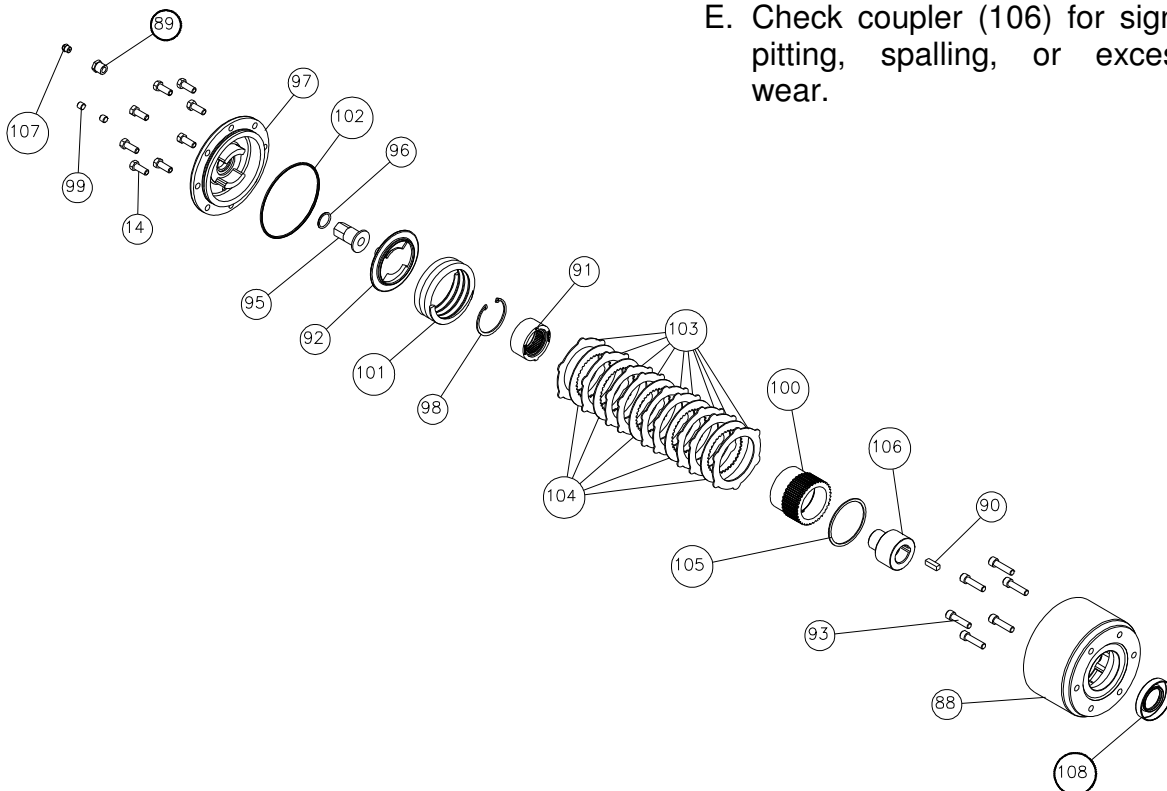
5. Inspect parts as follows, replace if necessary:

- A. Inspect the friction discs (104) for uneven or excessive wear. Friction discs should measure no less than .055-in thick.
- B. Inspect the the stator plates (103) for warpage or excessive wear.
- C. Inspect the spring (101) for damage or discoloration.
- D. Cam clutch (91) should be free of debris and have all cams intact.

### NOTICE

**If replacing the cam clutch (91), take note of the direction it locks up for reassembly.**

- E. Check coupler (106) for signs of pitting, spalling, or excessive wear.

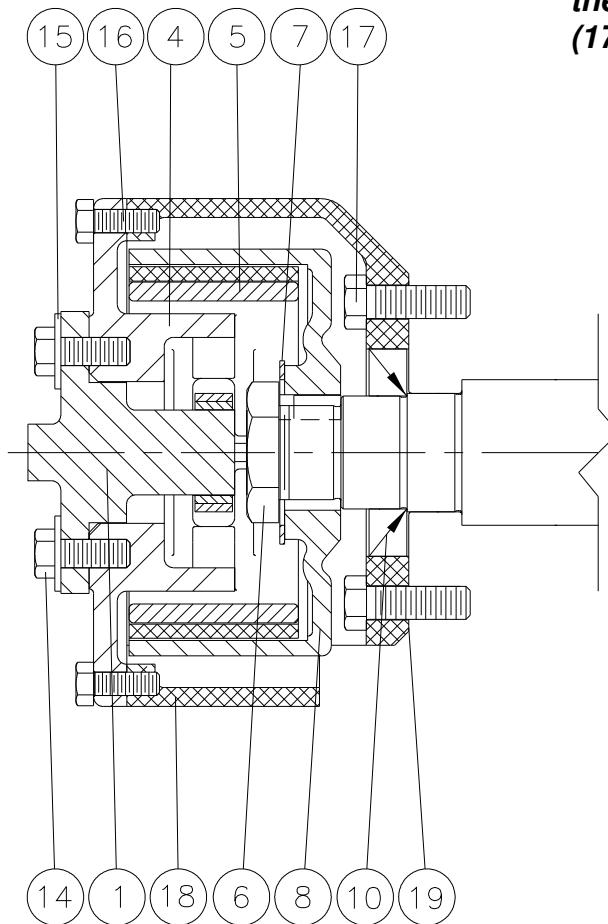


## MODEL 23 BRAKE DISASSEMBLY

1. Loosen the capscrews (14).
2. Remove the capscrews (16) from the cover (4).
3. Remove the cover (4) from the brake housing (18).
4. Remove the brake shoes (5).
5. Remove the nut (6) and washer (7).
6. Use the two threaded holes in the brake drum (8) and a gear puller to remove the brake drum.
7. Inspect parts as follows, replace if necessary:
  - A. Inspect the brake shoes (5) for wear. If the shoe linings are worn flush with the rivet heads, they must be replaced.
  - B. Inspect the brake drum (8) for severe wear or scoring.
  - C. Check the inside lower part of the brake housing (18) for the presence of oil. Replace the seal (10) if oil is present.

### NOTICE

***If replacing the seal (10), first drain the oil from the gearbox then remove the capscrews (17) and brake housing (18).***



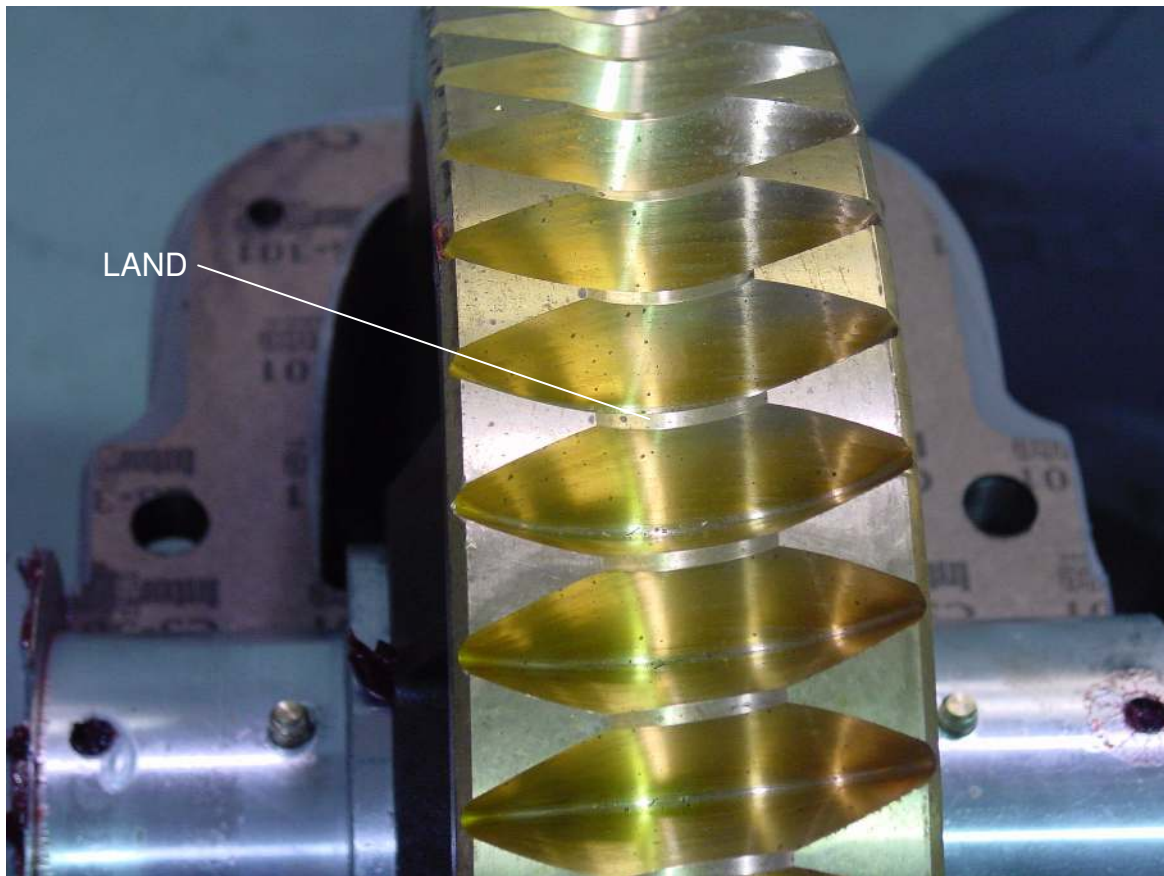
## CLUTCH AND DRUM DISASSEMBLY

1. Remove the rod (73) by removing the cotter keys (72).
2. Remove the arms (62) by removing the capscrews (59), nuts (28), and washers (27) holding the arm in place.
3. Remove the line shafts (61) by loosening the set screws in the collars (77) and the setscrews (74) in the arms (71) & (60).
4. Remove the capscrews (29), nuts (25), and washers (26) attaching the end bracket (57) to the frames (22 & 23).
5. Remove the end bracket (57), yoke assembly (items 27, 28, 32, 56, 75, 78, and 79) or clutch position indicator assembly (109), and sliding clutch (55).
6. Remove the keys (50) and thrust washers (54) from the output shaft (49).
7. Remove the brake band assembly by loosening the nuts on the rod (67) to remove tension on the spring (70). Then, remove the cotter key (65) & pin (63) attaching clevis (64) to control arm (60). Finally, remove the capscrews (66), washers (27), and nut (28) attaching the brake band to the frame.
8. Slide the drum (52) off the output shaft (49) using an overhead hoist.
9. Inspect parts as follows, replace if necessary:
  - A. Inspect the bushing (58) in the end bracket (57) for excessive wear.
  - B. Inspect the keys (50), sliding clutch (55), and thrust washer (54) for damage. See page 22 for clutch inspection.
  - C. Inspect the brake band (80) and verify that the band and lining is at least .225-in thick.
  - D. Inspect the drum bushings (48) for any wear or damage.
  - E. Inspect the line shafts & linkage for excessive wear or damage.

## GEARBOX DISASSEMBLY

1. Supporting the end of the output shaft (49) with a hoist, remove the cover (33) by removing capscrews (31 and 32), nuts (12 and 28), and washers (13 and 27).
2. Use the hoist to lift the output shaft (49), bushings (21), keys (45), roll pin (46), and gear (assembled items 12, 13, 35, 43, and 44) out of the housing (36). Remove the bushings (21) from the output shaft (49).
3. Remove the gear (35) from the carrier (43) by removing the twelve capscrews (44), nuts (12), and washers (13). Remove the carrier (43) by removing the roll pin (46). Finally, remove the keys (45).
4. Remove the worm (37) from the housing (36) by removing either the motor (81) and motor adapter (85), or just the end cap (39), depending on the type of drive. From the brake end, push the worm (37) out of the housing (36). If the brake has not been removed, see brake disassembly on page 9 or 10.
5. Inspect parts as follows, replace if necessary:
  - A. Inspect the carrier (43) for damage.
  - B. Inspect the gear (35) for excessive wear. See Pg.12 this manual for detailed instructions.
  - C. Inspect the keys (45) and bushings (21) for damage.
  - D. Inspect the worm (37) for excessive wear or signs of heat checking or cracks.
  - E. Inspect the bearings (11) and seals (10) for excessive wear or damage.

## GEAR INSPECTION INSTRUCTIONS



Check gear wear by removing the cover and visually inspecting the bronze gear. If the gear is worn such that there is no visible land on the throat of the gear between the gear flanks as shown in picture above the gear should be replaced.

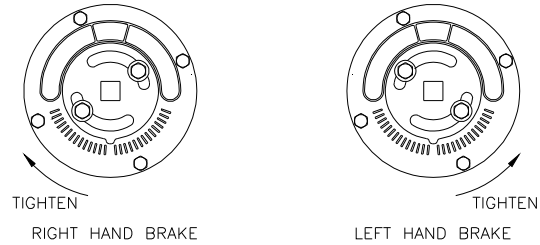
# ASSEMBLY

## GEARBOX ASSEMBLY

1. Press the bearings (11) onto the worm (37) then install the worm and bearings into the housing (36).
2. **For winches driven by a hydraulic motor:**  
Press a new oil seal (87) into the motor adapter (85). Attach the motor adapter (85) to the housing (36) with six capscrews (83), using the gasket (19). Install the motor (81) with two capscrews (82) and washers (86).  
**For winches driven by a PTO sprocket and chain:**  
Press a new oil seal (10) into the end cap (39). Attach the end cap (39) to the housing (36) with six capscrews (17) using the gasket (19).
3. Install the keys (45) into the output shaft (49).
4. Bolt the gear (35) to the carrier (43) using eighteen capscrews (44), nuts (12), and washers (13).
5. Install the assembled gear onto the shaft (49). Press the roll pin (46) into the carrier (43). Slide the bushings (21) on to both ends of the output shaft (49).
6. Install the output shaft assembly into the housing (36).
7. Attach the cover (33) to the housing (36), using capscrews (31 & 32), nuts (12 & 28), and washers (13 & 27), using gaskets (34).
8. Fill the gearbox and brake with the proper oil. Refer to maintenance section of this manual for oil type and amount.

## MODEL 23 BRAKE ASSEMBLY

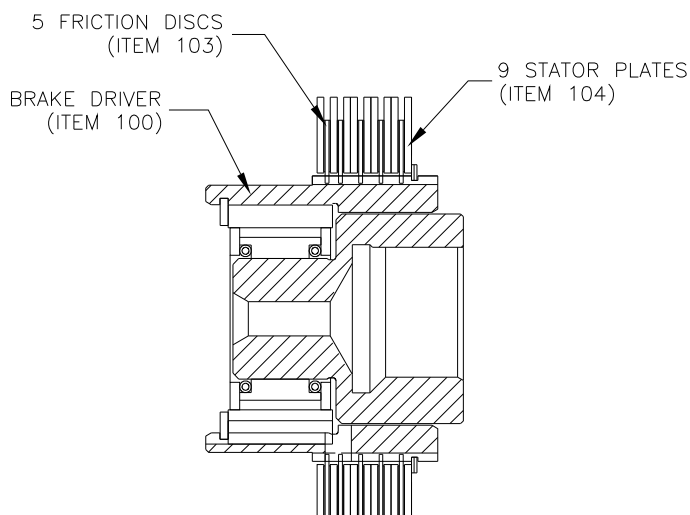
1. Press the oil seal (10) into the brake housing (18). Install the gasket (19), and attach the brake housing (18) to the gearbox with six capscrews (17).
2. Install the brake drum (8) and key (9) onto the worm shaft (37). Secure the brake drum with the nut (6) using lock washer (7). Bend two tabs of the washer (7) over the flats of the nut (6).
3. If removed, reattach the cam (1) to the brake cover (4) in the orientation needed for your application using two capscrews (14) and washers (15).



4. Install the brake cover (4), cam (1), and brake shoes (5) into the brake housing (18).
5. Secure the brake cover (4) using four capscrews (16).
6. Adjust the brake using the procedure on page 8 of this manual.

## RUFNEK 20 BRAKE ASSEMBLY

1. Press the oil seal (108) into the brake housing (88). Install the gasket (19), and attach the brake housing to the gearbox with six capscrews (93).
2. Install the key (90) and coupler (106) onto the worm. Next, install the clutch/driver assembly (Items 91, 98, 100, and 105), onto the coupler (106).



3. With the retaining ring (105) on the clutch driver (100). Install the stator plates (103) and friction discs (104), as shown below.
4. Install the spring (101).
5. Install the spring (101), next install the adjusting nut assembly (assembled items 92, 95, and 96) into the brake cover (97) and attach the brake cover to the housing (88), securing it evenly with eight capscrews (14).
6. Install the drain plug (99) into the bottom of the brake cover (97).
7. Fill gearbox and brake with proper oil. Refer to winch maintenance section of this manual for oil type and amounts.
8. Adjust the brake using the procedure on page 8 of this manual.

## CLUTCH AND DRUM ASSEMBLY

1. Install the bushings (48) into drum (52) and clutch (53). Install the drum (52) onto the output shaft (49).
2. Install the thrust washer (54). Tap the keys (50) into the output shaft (49).
3. Install the sliding clutch (55) and end bracket assembly onto the output shaft (49), lining up the yoke with the grooves in the sliding clutch (55). Attach the end bracket to the frame using four capscrews (29), washers (26), and nuts (25).

### CLUTCH POSITION INDICATOR ADJUSTMENT (FOR RUFNEK WINCHES ONLY)

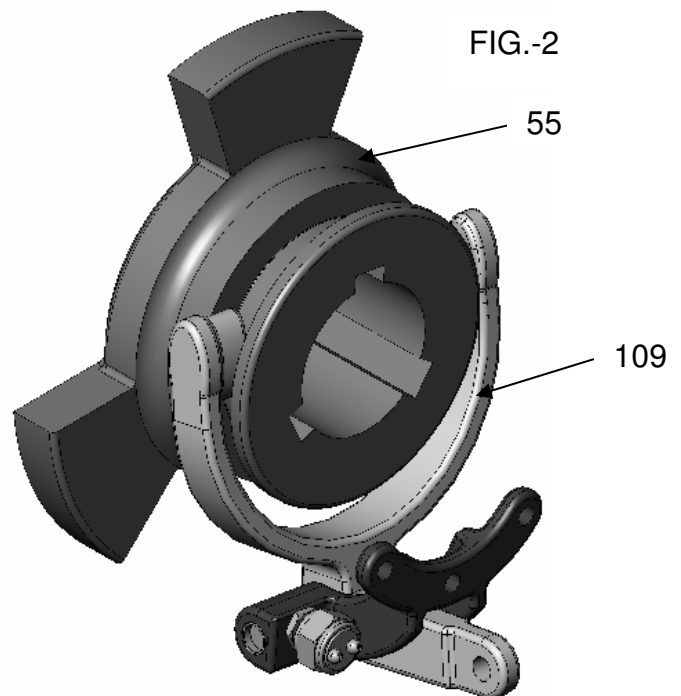
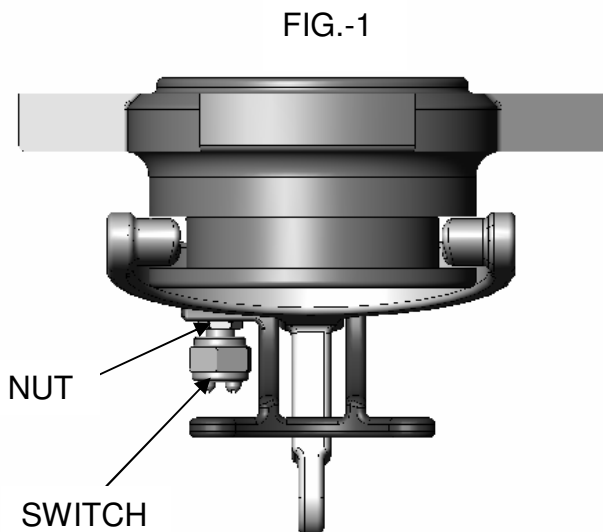
Make sure that the sliding clutch (55) is fully engaged and that the yoke assembly (109) is not binding on the drum clutch. The lugs of the yoke MUST be centered in the groove with the clutch fully engaged in order for the clutch position indicator to be properly adjusted (See FIG-1)

The switch is a normally-open electrical switch that is actuated by disengaging the clutch which closes the circuit.

With the clutch fully engaged, adjust the switch in until the warning device is activated, then back-out 1/4 turn to deactivate the warning device.

Tighten the jam nut against the clutch bracket to secure the adjustment.

Test the switch by fully engaging, then disengaging, the clutch. The warning device should activate while disengaging the clutch pivoting no more than 3°.





# TROUBLESHOOTING

FAILURE	PROBABLE CAUSE
Clutch handle won't latch	<ul style="list-style-type: none"> <li>a) Clutch jaws aren't aligned. Align the jaws by rotating drum.</li> <li>b) Damaged yoke or linkage. Replace the yoke or clutch</li> </ul>
Oil leaks from housing	<ul style="list-style-type: none"> <li>a) Seal damaged or worn. Replace the seal(s).</li> <li>b) Too much gearbox oil. Drain excess oil.</li> <li>c) Gasket could be worn. Replace the gasket.</li> </ul>
Load drifts	<ul style="list-style-type: none"> <li>a) The brake is out of adjustment or worn. Adjust brake until load doesn't drift. Replace the parts as required.</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>
Hydraulic fluid leaks from vent in the gearbox	<ul style="list-style-type: none"> <li>a) Damaged motor shaft seal. Replace the seal.</li> </ul>
Winch won't pick up heavy loads.	<ul style="list-style-type: none"> <li>a) Too much cable on the drum. Use the snatch block or remove some cable from the drum.</li> <li>b) System pressure too low. Increase the hydraulic system pressure.</li> <li>c) Winch not broke-in. Run winch at half of rated load for several pulls.</li> </ul>

# BILL OF MATERIAL

BOM DATED SEPTEMBER 2005

SEQ	QTY	P/N	DESCRIPTION
1	1	23875	CAM
2	--	--	OMIT
3	--	--	OMIT
4	1	3568	CAM PLATE
5	2	1733	BRAKE SHOE
6	1	20114	NUT
7	1	20115	WASHER
8	1	29503	BRAKE DRUM
9	1	20279	KEY
10	2	20232	OIL SEAL
11	2	20302	BEARING
12	13	20267	NUT
13	14	20518	WASHER
14	2	20522	CAPSCREW
15	2	20617	WASHER
16	4	28578	CAPSCREW
17	12	20289	CAPSCREW
18	1	23874	BRAKE HOUSING
19	2	20117	GASKET
20	2	20517	PIN
21	2	20754	BUSHING
22	1	20771	LEFT FRAME
23	1	20772	RIGHT FRAME
24	3	20286	PLUG
25	8	20295	NUT
26	8	20558	WASHER
27	13	20526	WASHER
28	13	20271	NUT
29	8	20406	CAPSCREW
30	5	21128	GREASE ZERK
31	4	20268	CAPSCREW
32	7	20325	CAPSCREW
33	1	40771	COVER (M23)
33a	1	44028	COVER (RUFNEK)
34	2	20181	GASKET
35a	1	20749	RIGHT HAND GEAR (M23)
35c	1	20750	GEAR (RUFNEK)
36	1	20332	HOUSING
37a	1	20086	RIGHT HAND MECHANICAL WORM (M23)
37b	1	20240	LEFT HAND MECHANICAL WORM (M23)

## BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
37c	1	40591	LEFT HAND HYDRAULIC WORM (M23)
37d	1	44060	MECHANICAL WORM (RUFNEK)
37e	1	44062	HYDRAULIC WORM (RUFNEK)
38	5	20105	KEY
39	1	20080	END CAP
40	1	20092	WASHER
41	1	20278	CAPSCREW
42	1	26799	BREATHER
43	1	22437	CARRIER
44	8	21059	CAPSCREW
45	2	20182	KEY
46	1	20717	PIN
47	5	20521	NUT
48	2	20756	BUSHING
49	1	25491	SHAFT
50	2	20101	KEY
51	1	21154	U BOLT
52	1	20991	DRUM
53	1	20993	CLUTCH
54	2	20774	WASHER
55	1	21058	CLUTCH
56	1	20129	BRACKET
57	1	20330	END BRACKET
58	1	20757	BUSHING
59	4	20276	CAPSCREW
60	1	20074	CONTROL ARM
61	2	20108	SHAFT
62	2	20000	CONTROL ARM
63	1	939243	PIN
64	1	20054	CLEVIS
65	1	20514	COTTER PIN
66	2	20270	CAPSCREW
67	1	20112	ROD
68	--	--	OMIT
69	--	--	OMIT
70	1	20958	SPRING
71	1	20001	CONTROL ARM
72	2	20474	COTTER PIN
73a	1	20111	RIGHT HAND ROD
73b	1	20113	LEFT HAND ROD
74	2	20737	SET SCREW
75	1	20078	YOKE
76	4	20193	SET SCREW

## BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
77	4	20110	COLLAR
78	1	20116	PIN
79	2	24724	SNAP RING
80	1	1739	BRAKE BAND
81	1	40342	MOTOR (RUFNEK 20)
82	2	13529	CAPSCREW
83	6	25654	CAPSCREW
84	1	40147	GASKET
85	1	40595	MOTOR ADAPTER
86	2	41000	WASHER
87	1	41272	OIL SEAL
88	1	43962	BRAKE HOUSING
89	1	12208	BUSHING
90	1	25519	KEY
91	1	33565	CAM CLUTCH
92	1	43960	SPRING PLATE
93	6	24475	CAPSCREW
94	--	--	OMIT
95	1	41406	ADJUSTING NUT
96	1	41411	O-RING
97	1	43958	BRAKE COVER
98	1	29084	RETAINING RING
99	2	21684	PLUG
100	1	44149	BRAKE DRIVER
101	1	33559	SPRING
102	1	17344	O-RING
103	9	44141	STATOR PLATE
104	5	33564	FRICTION DISC
105	1	44145	RETAINING RING
106	1	44142	BRAKE COUPLER
107	2	13050	BREATHER
108	1	20232	OIL SEAL
109	1	4361	YOKE ASSEMBLY W/ POSITION INDICATOR

# 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)	Torque *(Ft-Lbs)	Torque *(Ft-Lbs)	Torque *(Ft-Lbs)	Torque *(Ft-Lbs)	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

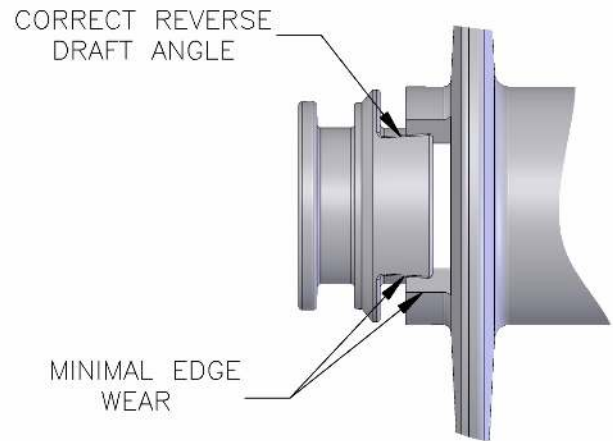
D = NOMINAL BOLT SIZE (IN.)

\* ALL TORQUE VALUE TOLERANCES ARE ± 5%

# CLUTCH INSPECTION

## GOOD

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



### **WARNING**

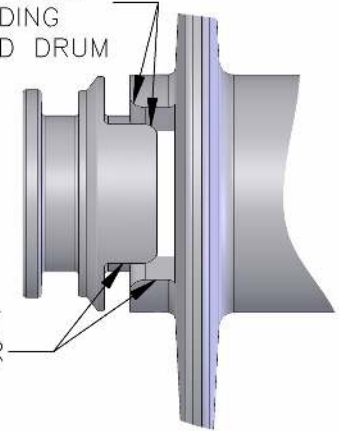
THE REVERSE DRAFT ENSURES THE CLUTCH STAYS ENGAGED DURING PAY-IN.

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

## BAD

EXCESSIVE EDGE WEAR ON BOTH THE SLIDING CLUTCH AND DRUM

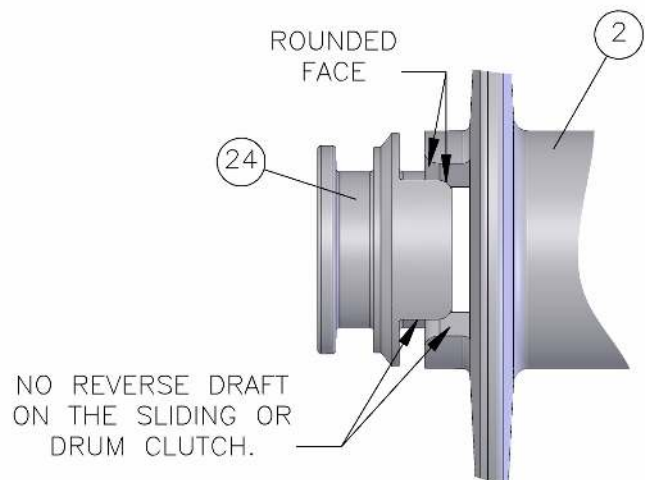
NO REVERSE DRAFT ON THE SLIDING OR DRUM CLUTCH.



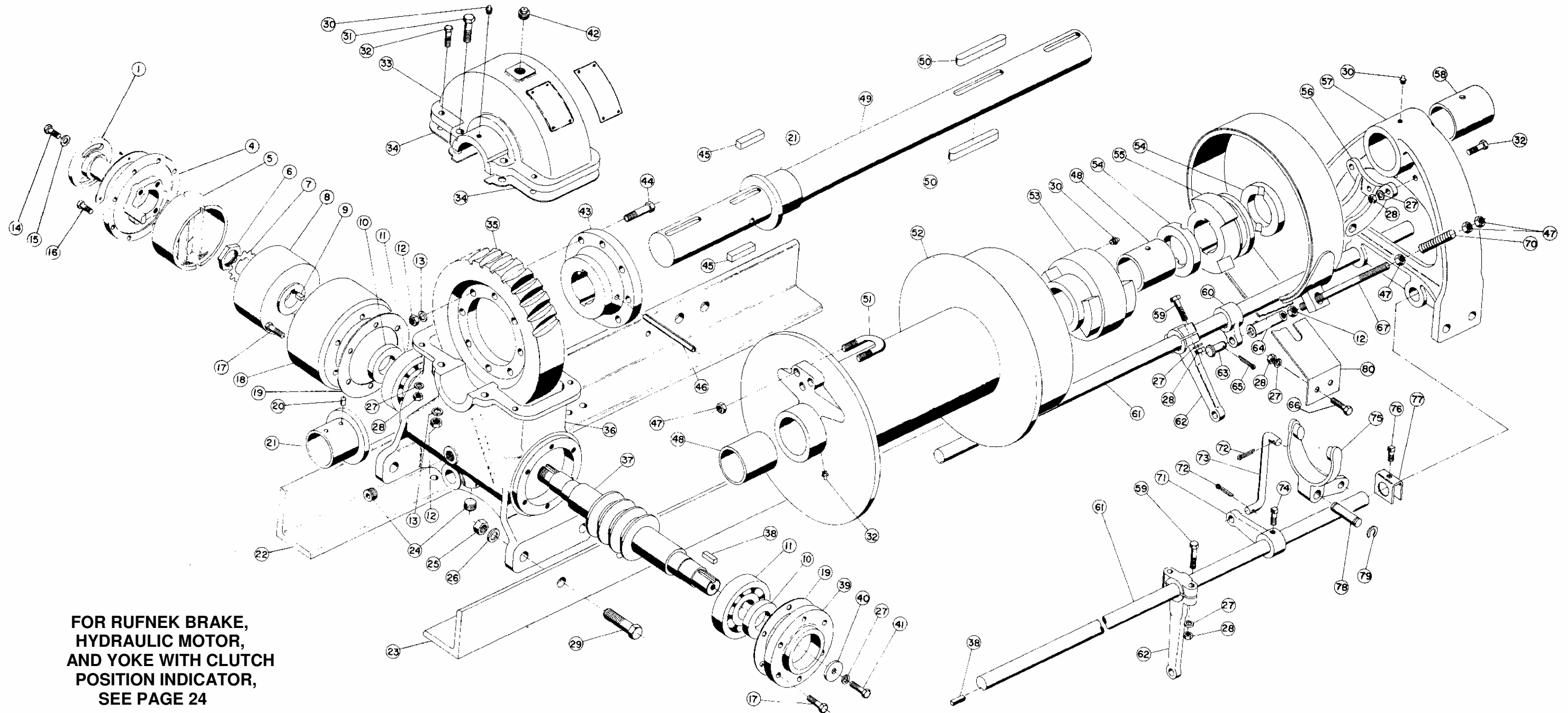
## CLUTCH REPLACEMENT CRITERIA

### **NOTICE**

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.



# ISOMETRIC DRAWING



FOR RUFNEK BRAKE,  
HYDRAULIC MOTOR,  
AND YOKE WITH CLUTCH  
POSITION INDICATOR,  
SEE PAGE 24

**RUFNEK BRAKE, HYDRAULIC MOTOR, & CLUTCH POSITION INDICATOR**

