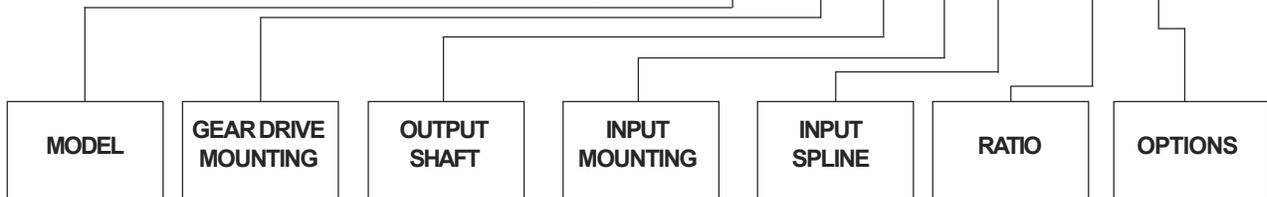


**Part Number Example: 28L B D1 A 4 - 16 Z**



## **28LB/28LP PLANETARY GEAR DRIVES SERVICE & REPAIR MANUAL**

THIS SERVICE MANUAL IS EFFECTIVE  
FROM: ..... S/N 16401, JULY 1993  
TO: ..... CURRENT  
REF: ..... SM28LB28LPD2-BD

# 28LB/28LP Service Manual

## Single & Double Planetary Gear Drive

This manual will assist in disassembly and assembly of the above model planetary gear drives. Item numbers, indicated in parentheses throughout this manual, refer to the exploded parts breakdown drawing. Individual customer specifications (mounting case, output shaft, brake assembly, etc.) may vary from exploded drawing and standard part numbers shown. If applicable, refer to individual customer drawing for details.

For any spare or replacement parts, contact your distributor or equipment manufacturer. Always try to have the gear drive unit part number, serial number and date code on the serial tag available when you call. This information may be necessary for verification of any component part numbers. Component part numbers and/or manufacturing lot numbers may be stamped on individual parts. This information may also be helpful in identifying replacement components.

### Lubrication and Maintenance

**Change the oil after the first 50 hours of operation.** Oil should be changed at 500 hour intervals thereafter. Use a GL-5 grade EP 80/90 gear oil (EP = "Extreme Pressure"). The gear drive should be partially disassembled to inspect gears and bearings at 1,000 hour intervals.

If your unit was specified "output shaft up" or with a "-Z" after the part number, a grease zerk was provided in the base housing. For output shaft-up operation, the output bearing will not run in oil and must be grease lubricated. Use a lithium base or general purpose bearing grease sparingly every 50 hours or at regular maintenance intervals. Over-greasing the output bearing in tends to fill the housing with grease and thicken the oil.

| OPERATING POSITION | STAGE  | OIL CAPACITY            | OIL LEVEL                              |
|--------------------|--------|-------------------------|--|
| Horizontal Shaft   | Single | 1.0 pints (0.5 liters)  | To horizontal centerline of gear drive |
| Horizontal Shaft   | Double | 1.25 pints (0.6 liters) | To horizontal centerline of gear drive |
| Vertical Shaft     | Single | 1.75 pints (0.9 liters) | To midway on upper/primary gearset     |
| Vertical Shaft     | Double | 2.25 pints (1.1 liters) | To midway on upper/primary gearset     |

|   |   |
|---|---|
|  | <p><b>WARNING:</b> While working on this equipment, use safe lifting procedures, wear adequate clothing and wear hearing, eye and respiratory protection.</p> |
|---|---|

### Contents

|  |              |
|--|--------------|
| <b>Unit Disassembly Procedure .....</b>              | <b>3</b>     |
| <b>Output Shaft Subassembly .....</b>                | <b>3</b>     |
| <b>*Primary Planetary Subassembly .....</b>          | <b>3</b>     |
| <b>Secondary Planetary Subassembly .....</b>         | <b>4</b>     |
| <b>Case Subassembly .....</b>                        | <b>4</b>     |
| <b>Unit Assembly Procedure .....</b>                 | <b>4</b>     |
| <b>28LB Single Stage Exploded View Drawing .....</b> | <b>6</b>     |
| <b>28LB Double Stage Exploded View Drawing .....</b> | <b>7</b>     |
| <b>28LP Single Stage Exploded View Drawing .....</b> | <b>8</b>     |
| <b>28LP Double Stage Exploded View Drawing .....</b> | <b>9</b>     |
| <b>WARRANTY.....</b>                                 | <b>10-11</b> |

## Unit Disassembly Procedure

(Refer to drawings on pages 6-7)

Steps marked with an asterisk(\*) apply only to the double stage model, which has a primary planet carrier. All parts should be carefully inspected as they are removed from unit. Scribe across mounting case (1) and cover (2) joint on outside of gear drive to ensure proper orientation of oil fill and drain plugs, motor mounting, etc., as unit is reassembled.

- 1) Remove hydraulic motor and Eskridge brake from gear drive. Drain oil.
- 2) Remove the six 5/16" hex cap screws (22) and 5/16 lockwashers (26), which retain cover (2) to mounting case (1).
- 3) Lift cover (2) off of unit and remove input gear (11), input thrust washer (21), and \*thrust bearing (33).
- \*4) Primary ring gear (31) and planetary assembly is now ready for removal (includes items 5, 7, 13, 16, 20 & 24). Secondary sun gear (10) is splined to primary carrier (5) and may come out when removing planetary assembly. If not, remove sun gear.
- 5) The secondary planetary assembly (includes items 4, 6, 12, 14, 15, 19, 23) is splined to the output shaft (3). It may now be lifted, by hand, from output shaft spline.
- 6) Place unit on a press table with the output shaft (3) Unit protruding downward through a hole in the table. Unit should be supported only by mounting case (1). The only thing retaining output shaft (3) is the retaining ring (25). Remove retaining ring from output shaft, followed by support washer (8) and bearing shims (9).

**CAUTION: The output shaft is no longer being retained. Take precautions if moving unit. Shaft may fall out.**

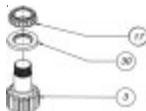
- 7) With output shaft down through centerhole in press table and unit supported by case, press shaft out by applying press load to top end of shaft (internal end) until it passes through inner bearing cone (17). Outer bearing cone (17) will come out of unit attached to shaft.

**CAUTION: Care should be taken not to injure feet or damage output shaft during this procedure. Once shaft has been pressed through inner shaft bearing, it will drop from unit.**

The unit is now disassembled into groups of parts and/or subassemblies. The are requiring repair or service should be identified by thorough inspection of the parts after they have been washed in solvent. If repair is necessary, refer to the individual repair section.

## Output Shaft Subassembly

(Items 3, 17 & 30)



\*Applies only to Double Stage gear drive models.

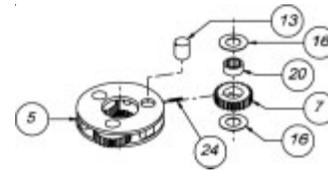
## Output Shaft Subassembly (cont.)

- 1) If outer bearing cone (17) needs replacing, it will need to be pressed off of output shaft (3). Also inspect inner bearing cone (17), which can be found in mounting case seated inside the inner bearing cup (18). In some instances, outer bearing cone (17) may need to be removed if shaft seal (30) is to be replaced. If outside diameter of output shaft (external end opposite bearing) is smaller than inside diameter of seal, then shaft seal may be replaced without removing bearing cone.
- 2) Lubricate inner lip of new shaft seal (30) and turn so that open side of seal is up. Slide seal onto output shaft until it fits snug over shaft seal diameter.
- 3) With small end of bearing cone pointed upward, place outer bearing cone (17) onto the internal end of the output shaft (3). Press until bearing is seated tightly against shoulder. If the original bearing was removed only to replace shaft seal, it may be reused.

**NOTE: Press only on inner race of bearing cone. DO NOT press on outer roller cage of bearing or it will damage bearing.**

## \*Primary Planetary Subassembly

(Items 5, 7, 13, 16, 20 & 24)



\*Rotate primary planet gears (7) to check for any abnormal noises or roughness in the primary planet bearings (20). At the same time, inspect planet gears for any damage or worn teeth. If replacement or further inspection is required, proceed as follows.

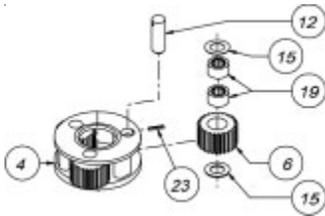
- \*1) Drive the spring pins (or roll pins) (24) completely into the planet shafts (13) using a pin punch. Press planet shafts out of carrier (5).
- \*2) Remove planet gears (7) and primary planet washers (16) from carrier (5).
- \*3) If any of the primary planet bearings (20) need replacing, press them out of planet gears.
- \*4) Check primary planet shafts (13) for any abnormal wear, especially ones in which bearings needed to be replaced. If any abnormal wear is found, replace planet shaft.
- \*5) Using a punch, drive roll pins out of planet shafts.
- \*6) If required, press new primary planet bearings (20) into planet gears.
- \*7) With a primary planet washer (16) on both sides of planet gear and bearing (20) installed, slide gear into carrier (5). Insert primary planet shaft (13) through the

carrier, planet gear, and washers. During planet shaft installation, align roll pin hole in planet shaft, to the roll pin hole in outside diameter of carrier.

**\*NOTE: Inserting a 1/8" diameter punch in the roll pin hole of planet shaft will help in the alignment of holes between planet shaft and carrier during step #7.**

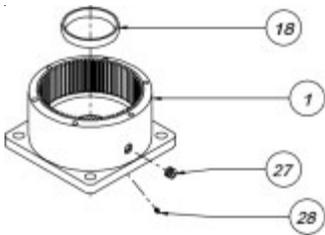
- \*8) Once holes are properly aligned, drive a roll pin (24) through primary carrier and into planet shaft to retain parts. Use a drift to drive roll pin flush to carrier and to prevent striking planet gear teeth.
- \*9) Repeat the same process for remaining gears.

## Secondary Planetary Subassembly (Items 4, 6, 12, 15, 19 & 23)



Follow same procedures as that for the Primary Planetary Subassembly, except substitute item numbers as indicated: Secondary carrier (4), secondary planet gear (6), secondary planet shaft (12), secondary planet washer (15), secondary planet bearing (19), secondary roll pin (23).

## Case Subassembly (Items 1, 18, 27 & 28)



- 1) Inspect inner and outer bearing cups (18). If cups are damaged, the cups **and** case (1) may need replacement. Contact Eskridge, inc. if you have questions.
- 2) Clean all foreign material from magnetic oil plug (27) located in side of mounting case (1). Add a small amount of pipe thread compound to pipe plug before installing back into case.

All subassembly service or repairs should be complete at this time. Continue on through Unit Assembly Procedure to complete unit buildup.

## Unit Assembly Procedure

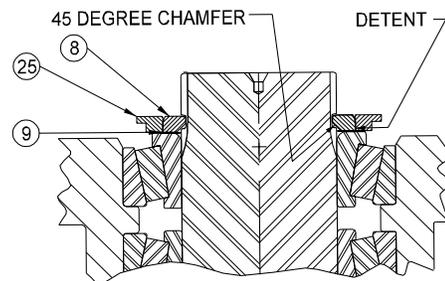
- 1) Start with case assembly (1). Turn case upside down on the press table. Case pilot diameter should be

pointing upward with outer bearing cup (18) exposed. Apply a layer of lithium bearing grease to outer bearing cup surface.

- 2) Invert the output shaft assembly (3) (**retaining ring groove down**) and carefully lower into the case (1) until the shaft's outer bearing cone (17) is seated against the outer bearing cup (18).
- 3) Press shaft seal (30) into case until it is flush with bottom of pilot diameter. Use a press fixture, if possible, to eliminate distorting seal. If press fixture is not available, a hammer and flat-ended drift may be used by tapping outer edge of seal lightly and alternating sides.
- 4) Stand unit assembly upright on output shaft (3).

**CAUTION: The only thing retaining output shaft and case together at this point is the tightness in fit of the shaft seal. Securely and cautiously turn unit upright, not allowing case and shaft to separate.**

- 5) While holding output shaft (3) with one hand, rotate case (1) to be certain it turns freely and smoothly. The slight resistance felt, if any, is due to shaft seal load (drag) on output shaft.
- 6) Apply a layer of lithium grease to inner bearing cup (18) and surface.
- 7) Install inner bearing cone (17) (**small end down**) over internal end of output shaft. Press bearing down slowly until it is just seated against inner bearing cup (18). With a slight press load still applied, rotate case (1) by hand to ensure that the roller bearings are rotating evenly and smoothly. Slide bearing shims (9) over output shaft and down onto inner bearing cone (17). The same number (quantity) of shims which were removed from unit during Disassembly Procedure should be returned.



- 8) Lubricate Load-N-Lock™ lock ring (25) and split ring segments (8). Press split ring segments (45° chamfer side down) into the groove in shaft (4) directly on top of shims (9) (see detail). This can be done with a soft drift punch & hammer or a C-clamp or adjustable pliers across both segments of split ring. Drive lock ring (25) over outside of split ring segments until the detent engages between split and lock rings. The lock ring should then be seated against the shims. This may require a firm blow with a soft mallet.

**NOTE: Proper positioning of Load-N-Lock™ split ring (8) and lock ring (25) is critical to proper assembly of unit. Do**

**\*Applies only to Double Stage gear drive models.**

**not use steel hammer or hydraulic press to install split or lock ring or damage may result.**

**NOTE: Quantity of shims (9) may vary from unit to unit. Always use the same quantity of shims when reassembling.**

- 9) Place thrust bearing (32) on internal end of the shaft. Install secondary carrier (4) assembly into unit. Carrier assembly should be installed with hub side down (24 tooth spline). Rotate carrier assembly back and forth to mesh secondary planet gear teeth (6) with case (1) teeth. Once teeth mesh, let secondary carrier slide down until it makes contact with the output shaft spline. The carrier splined hub (4) should spline onto output shaft (3). Carrier hub will rest on top of retaining ring (25) when splines are fully engaged. Install carrier thrust washer (14).
- \*10) Install sun gear (10) in secondary carrier. Install primary carrier assembly in unit so that its splined hub meshes with sun gear (10).
- 11) Install input gear (11) in unit. Refer to exploded view drawing for proper orientation.
- \*12) Place thrust bearing (33) over input gear (11).
- 13) Place input thrust washer (21) over input gear (11).
- \*14) Grease a new o-ring (29) and install in bottom (internal stepped) end of ring gear (31). Refer back to scribe marks made across external join prior to Disassembly Procedure. Line up scribe marks between cover and case (1) so that orientation of motor mount holes and oil plugs are back to their original positions. Place ring gear over primary carrier onto top of case (1) so that it meshes with planet gears (7).
- 15) Fill unit with proper level (see page 2) of a GL-5 grade EP 80/90 gear oil. Proper oil level will measure to middle of primary planet gears (7).
- 16) Grease a new o-ring (29) and install into bottom of cover (2). Refer back to scribe marks made across external joint prior to Disassembly Procedure. Line up scribe marks between cover and case (1) so that orientation of motor mount holes and oil plugs are back to their original positions.

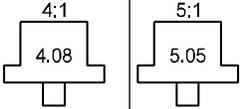
**NOTE: Be certain o-ring (29) stays seated in cover during step 12.**

- 17) Install all six of the 5/16 lockwashers (26) and the 5/16 hex capscrews (22) and torque them to 20 ft-lbs.

**THE GEARBOX IS NOW READY FOR USE.**

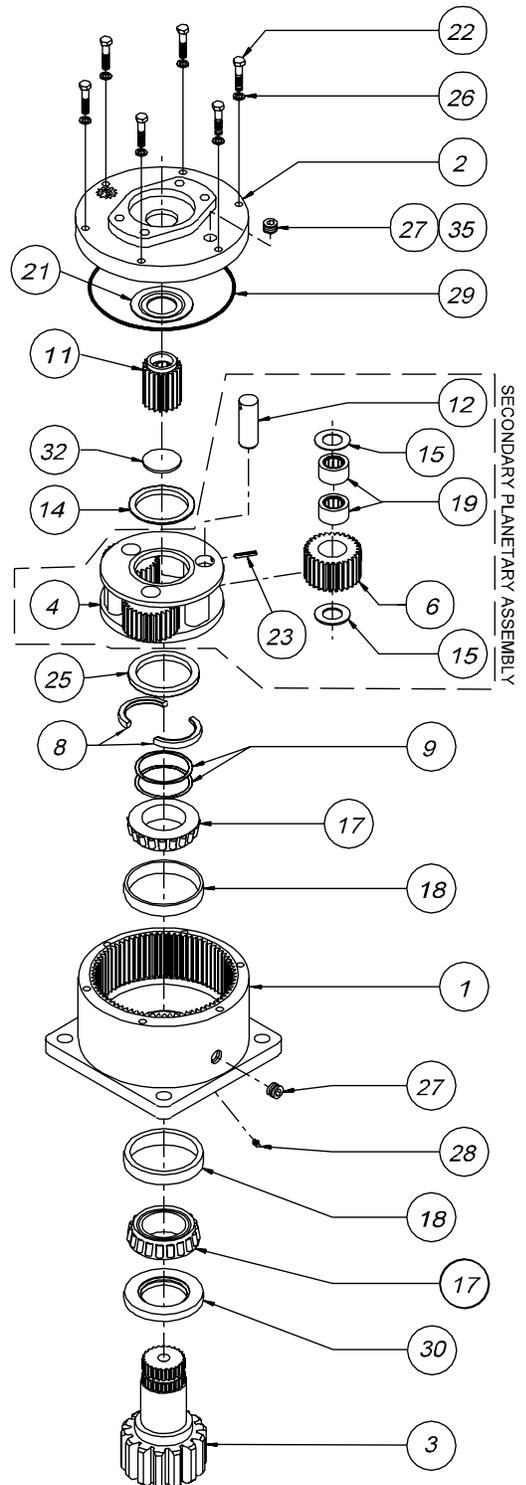
**\*Applies only to Double Stage gear drive models.**

# 28LB Single Stage Exploded View Drawing

|  |              |       |  | EQUIPPED WITH PATENTED "LOAD-N-LOCK"®<br>SHAFT RETENTION SYSTEM.<br>(U.S. PATENT NO. 5746517). |                                       |
|---|--------------|-------|--|--|---------------------------------------|
| SINGLE PLANETARY  |              |       | EFFECTIVE FROM: S/N 16401 07-01-93 TO: (CURRENT) |  |                                       |
|  |              | RATIO |  |  |                                       |
| PART NUMBER   | PART NUMBER  | QTY.  | ITEM   | C O D E  | DESCRIPTION                           |
| ←   | 28-004-3504  | 1     | 1  |  | B28 CASE-SQUARE- (NO ZERK)            |
| ←   | 28-004-3504Z |       |  |  | B28 CASE-SQUARE- W/ZERK (28)          |
| ←   | -            |       |  |  | C28 CASE-CUST.MTG PER CUSTOMER SPECS. |
| ←   | 85-004-1513  | 1     | 2  | A  | COVER-SAE 'A'                         |
| ←   | 85-004-1503  |       |  | B  | COVER-SAE 'B' 2-BOLT                  |
| ←   | 28-004-1013  |       |  | C  | COVER-SAE 'C' 4-BOLT                  |
| ←   | 20-004-4022L | 1     | 3  | D1   | 2"DIA SHAFT-3/8" KEYWAY               |
| ←   | 20-004-4032L |       |  | D2   | SHAFT 23T, 12/24 D.P. SPLINE          |
| ←   | 20-004-4042L |       |  | D3   | 2" DIA.SHAFT-1/2"KEYWAY               |
| ←   | 28-004-4202L |       |  | D4   | 2.25"D.SHAFT-1/2"KEYWAY               |
| ←   | -            |       |  | C1   | SHAFT-CUSTOM PER CUSTOMER SPECS.      |
| ←   | 50-004-1062  | 1     | 4  |  | CARRIER-SECONDARY                     |
| ←   | 85-004-1051  | 3     | 6  |  | PLANET GEAR-SEC.                      |
| ←   | -            | -     | 7  |  | PLANET GEAR-PRI.                      |
| ←   | 20-004-1362  | 1     | 8  |  | SPLIT RING (MATCHING HALVES)          |
| ←   | 20-004-1091  | *     | 9  |  | SHIM                                  |
| ←   | 85-004-1552  | 1     | 11   | 1  | INPUT GEAR 21T,20/40 D.P.SPLINE       |
| ←   | 85-004-1382  |       |  | 2  | INPUT GEAR 13T,16/32 D.P.SPLINE       |
| ←   | 85-004-1272  |       |  | 3  | INPUT GEAR SAE 1"-6B SPLINE           |
| ←   | 85-004-1292  |       |  | 4  | INPUT GEAR 14T,12/24 D.P.SPLINE       |
| ←   | 85-004-1562  |       |  | 5  | INPUT GEAR 15T,16/32 D.P.SPLINE       |
| ←   | 85-004-1592  |       |  | 6  | INPUT GEAR 1"DIA X .25" KEY           |
| ←   | 71-004-0121  | 3     | 12   |  | PLANET SHAFT-SECONDARY                |
| ←   | 50-004-1011  | 1     | 14   |  | THRUST WASHER-SEC.CUP                 |
| ←   | 85-004-1181  | 6     | 15   |  | THRUST WASHER-(SEC.PLANET GEAR)       |
| ←   | 01-102-0160  | 2     | 17   |  | BEARING CONE                          |
| ←   | 01-103-0160  | 2     | 18   |  | BEARING CUP                           |
| ←   | 01-105-0010  | 6     | 19   |  | BEARING-SEC.PLANET                    |
| ←   | 50-004-1091  | 1     | 21   |  | THRUST WASHER-INPUT                   |
| ←   | 01-150-1400  | 6     | 22   |  | HEX CAPSCREW 5/16-18 X 1.5 GR8        |
| ←   | 01-153-0210  | 3     | 23   |  | ROLLPIN-SECONDARY 3/16 X 7/8          |
| ←   | 20-004-1372  | 1     | 25   |  | LOCK RING                             |
| ←   | 01-166-0110  | 6     | 26   |  | LOCKWASHER 5/16 MED                   |
| ←   | 01-207-0070  | 2     | 27   |  | PIPE PLUG-MAG. 3/8 NPT-SOC HD         |
| ←   | 01-215-0050  | (1)   | 28   |  | GREASE FITTING (OPTIONAL)             |
| ←   | 01-402-0560  | 1     | 29   |  | O-RING 167 MM X 3 MM                  |
| ←   | 01-405-0550  | 1     | 30   |  | SEAL-SHAFT                            |
| ←   | 28-004-1021  | 1     | 32   |  | THRUST BEARING                        |
| ←   | 01-216-0070  | (1)   | 35   |  | AIR VENT 3/8 NPT (OPTIONAL)           |
| ←   | -            | -     | -  |  | -                                     |

NOTE \* BEARING PRELOAD DETERMINES QUANTITY OF SHIMS.

SEAL KIT; P/N 20-016-0501; INCLUDES ITEMS 29 AND 30.



ECN 2197  
X28LBD1-BB DATE: 04-15-04

# ESKRIDGE MODEL 28LB

EQUIPPED WITH PATENTED "LOAD-N-LOCK"®  
SHAFT RETENTION SYSTEM.  
(U.S. PATENT NO. 5746517).

## DOUBLE PLANETARY

EFFECTIVE  
FROM: S/N 16401 07-01-93  
TO: (CURRENT)

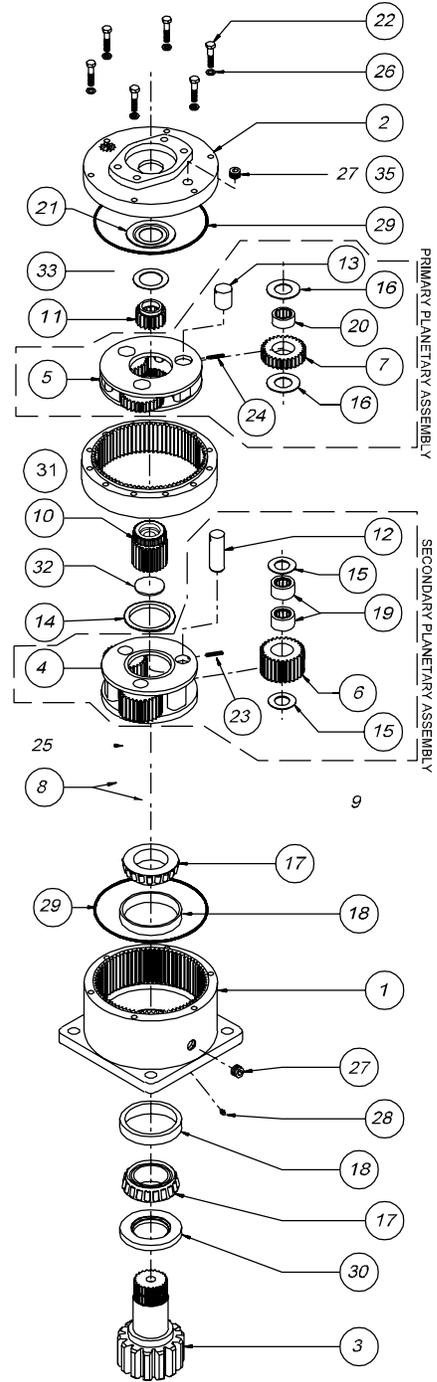
| RATIO | 16.65:1<br>4.08<br>4.08 | 20.62:1<br>5.05<br>4.08 | 20.62:1<br>4.08<br>5.05<br>INVERTED | 25.53:1<br>5.05<br>5.05 |
|-------|-------------------------|-------------------------|-------------------------------------|-------------------------|
|       |                         |                         |                                     |                         |

| ITEM | QTY. | PART NUMBER  | PART NUMBER  | PART NUMBER  | PART NUMBER  |
|------|------|--------------|--------------|--------------|--------------|
|      |      | 28-004-3504  | 28-004-3504  | 28-004-3504  | 28-004-3504  |
|      |      | 28-004-3504Z | 28-004-3504Z | 28-004-3504Z | 28-004-3504Z |
|      |      | -            | -            | -            | -            |
| A    |      | 85-004-1513  | 85-004-1513  | 85-004-1513  | 85-004-1513  |
| B    |      | 85-004-1503  | 85-004-1503  | 85-004-1503  | 85-004-1503  |
| C    |      | 28-004-1013  | 28-004-1013  | 28-004-1013  | 28-004-1013  |
| D1   |      | 20-004-4022L | 20-004-4022L | 20-004-4022L | 20-004-4022L |
| D2   |      | 20-004-4032L | 20-004-4032L | 20-004-4032L | 20-004-4032L |
| D3   |      | 20-004-4042L | 20-004-4042L | 20-004-4042L | 20-004-4042L |
| D4   |      | 20-004-4202L | 20-004-4202L | 20-004-4202L | 20-004-4202L |
| C1   |      | -            | -            | -            | -            |
|      |      | 50-004-1062  | 50-004-1062  | 50-004-1052  | 50-004-1052  |
|      |      | 50-004-1082  | 50-004-1072  | 50-004-1082  | 50-004-1072  |
|      |      | 85-004-1051  | 85-004-1051  | 85-004-1041  | 85-004-1041  |
|      |      | 85-004-1031  | 85-004-1021  | 85-004-1031  | 85-004-1021  |
|      |      | 20-004-1362  | 20-004-1362  | 20-004-1362  | 20-004-1362  |
|      |      | 20-004-1091  | 20-004-1091  | 20-004-1091  | 20-004-1091  |
|      |      | 85-004-1412  | 85-004-1092  | 85-004-1072  | 85-004-1072  |
| 1    |      | 85-004-1402  |              | 85-004-1402  | N/A          |
| 2    |      | 85-004-1102  | 85-004-1062  |              | 85-004-1062  |
| 3    |      | 85-004-1122  | 85-004-1122  |              | 85-004-1122  |
| 4    |      | 85-004-1533  |              | 85-004-1533  | N/A          |
| 5    |      | 85-004-1542  | 85-004-1422  |              | 85-004-1422  |
| 6    |      | 85-004-1582  |              | 85-004-1582  | N/A          |
|      |      | 71-004-0121  | 71-004-0121  | 71-004-0121  | 71-004-0121  |
|      |      | 81-004-0071  | 81-004-0071  | 81-004-0071  | 81-004-0071  |
|      |      | 50-004-1011  | 50-004-1011  | 50-004-1011  | 50-004-1011  |
|      |      | 85-004-1181  | 85-004-1181  | 85-004-1181  | 85-004-1181  |
|      |      | 85-004-1581  | 85-004-1581  | 85-004-1581  | 85-004-1581  |
|      |      | 01-102-0160  | 01-102-0160  | 01-102-0160  | 01-102-0160  |
|      |      | 01-103-0160  | 01-103-0160  | 01-103-0160  | 01-103-0160  |
|      |      | 01-105-0010  | 01-105-0010  | 01-105-0010  | 01-105-0010  |
|      |      | 01-105-0410  | 01-105-0410  | 01-105-0410  | 01-105-0410  |
|      |      | 50-004-1091  | 50-004-1091  | 50-004-1091  | 50-004-1091  |
|      |      | 01-150-1490  | 01-150-1490  | 01-150-1490  | 01-150-1490  |
|      |      | 01-153-0210  | 01-153-0210  | 01-153-0210  | 01-153-0210  |
|      |      | 01-153-0080  | 01-153-0080  | 01-153-0080  | 01-153-0080  |
|      |      | 20-004-1372  | 20-004-1372  | 20-004-1372  | 20-004-1372  |
|      |      | 01-166-0110  | 01-166-0110  | 01-166-0110  | 01-166-0110  |
|      |      | 01-207-0070  | 01-207-0070  | 01-207-0070  | 01-207-0070  |
|      | (1)  | 01-215-0050  | 01-215-0050  | 01-215-0050  | 01-215-0050  |
|      |      | 01-402-0560  | 01-402-0560  | 01-402-0560  | 01-402-0560  |
|      |      | 01-405-0550  | 01-405-0550  | 01-405-0550  | 01-405-0550  |
|      |      | 85-004-1313  | 85-004-1313  | 85-004-1313  | 85-004-1313  |
|      |      | 28-004-1021  | 28-004-1021  | 28-004-1021  | 28-004-1021  |
|      |      | 01-112-0230  | 01-112-0230  | 01-112-0230  | 01-112-0230  |
|      | (1)  | 01-216-0070  | 01-216-0070  | 01-216-0070  | 01-216-0070  |

NOTE \* BEARING PRELOAD DETERMINES QUANTITY OF SHIMS.

SEAL KIT; P/N 20-016-0501; INCLUDES ITEMS 29 AND 30.

▷ INVERTED RATIOS REQUIRED WITH INPUT CODES 1, 4, & 6.

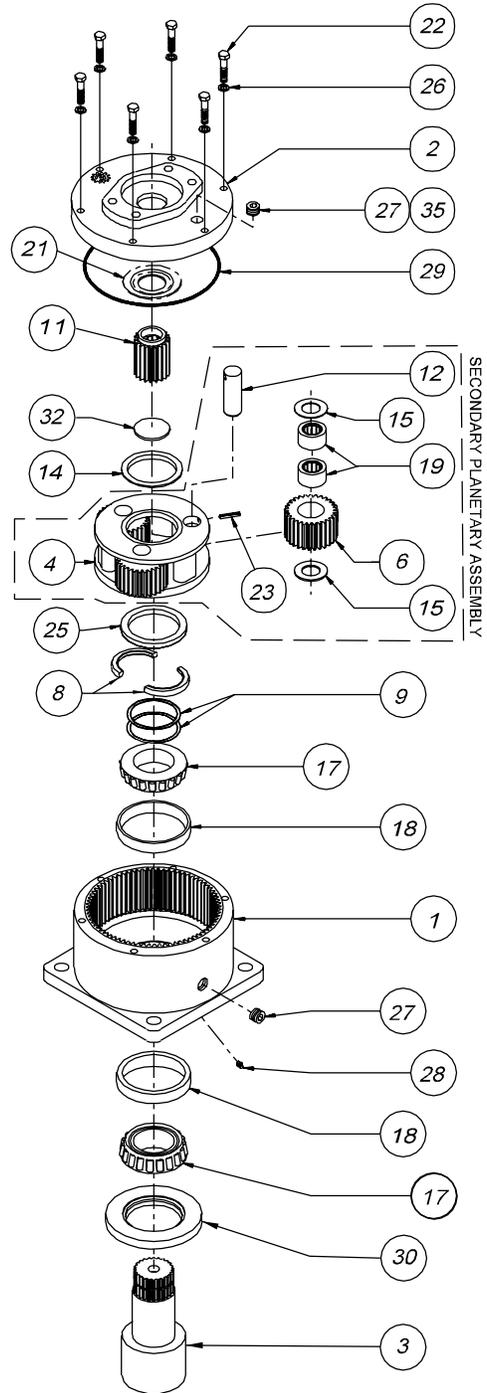


# 28LP Single Stage Exploded View Drawing

| PART NUMBER |  | PART NUMBER  | QTY.        | ITEM | C O D E | DESCRIPTION                            |
|-------------|--|--------------|-------------|------|---------|--|
| ←           |  | 28-004-3504  | 1           | 1    |         | B28 CASE-SQUARE- (NO ZERK)             |
| ←           |  | 28-004-3504Z |             |      |         | B28 CASE-SQUARE- W/ZERK (28)           |
| ←           |  | -            |             |      |         | C28 CASE-CUST.MTG PER CUSTOMER SPECS.  |
| ←           |  | 85-004-1513  | 1           | 2    | A       | COVER-SAE 'A'                          |
| ←           |  | 85-004-1503  |             |      | B       | COVER-SAE 'B' 2-BOLT                   |
| ←           |  | 28-004-1013  |             |      | C       | COVER-SAE 'C' 4-BOLT                   |
| ←           |  | 20-004-4122L | 1           | 3    | F1      | SHAFT - 1.5" DIA. X 3/8 KEY - INTERNAL |
| ←           |  | 20-004-4112L |             |      | F2      | SHAFT - 2" DIA. X 1/2 KEY - INTERNAL   |
| ←           |  | -            |             |      | C1      | SHAFT-CUSTOM PER CUSTOMER SPECS.       |
| ←           |  | 50-004-1062  | 1           | 4    |         | CARRIER-SECONDARY                      |
| ←           |  | 85-004-1051  | 3           | 6    |         | PLANET GEAR-SEC.                       |
| ←           |  | -            | -           | 7    |         | PLANET GEAR-PRI.                       |
| ←           |  | 20-004-1362  | 1           | 8    |         | SPLIT RING (MATCHING HALVES)           |
| ←           |  | 20-004-1091  | *           | 9    |         | SHIM                                   |
| ←           |  | 85-004-1552  | N/A         | 1    |         | INPUT GEAR 21T,20/40 D.P.SPLINE        |
| ←           |  | 85-004-1382  | 85-004-1392 | 2    |         | INPUT GEAR 13T,16/32 D.P.SPLINE        |
| ←           |  | 85-004-1272  | 85-004-1262 | 3    |         | INPUT GEAR SAE 1"-6B SPLINE            |
| ←           |  | 85-004-1292  | N/A         | 4    |         | INPUT GEAR 14T,12/24 D.P.SPLINE        |
| ←           |  | 85-004-1562  | 85-004-1572 | 5    |         | INPUT GEAR 15T,16/32 D.P.SPLINE        |
| ←           |  | 85-004-1592  | N/A         | 6    |         | INPUT GEAR 1"DIA X .25" KEY            |
| ←           |  | 71-004-0121  | 3           | 12   |         | PLANET SHAFT-SECONDARY                 |
| ←           |  | 50-004-1011  | 1           | 14   |         | THRUST WASHER-SEC.CUP                  |
| ←           |  | 85-004-1181  | 6           | 15   |         | THRUST WASHER-(SEC.PLANET GEAR)        |
| ←           |  | 01-102-0160  | 2           | 17   |         | BEARING CONE                           |
| ←           |  | 01-103-0160  | 2           | 18   |         | BEARING CUP                            |
| ←           |  | 01-105-0010  | 6           | 19   |         | BEARING-SEC.PLANET                     |
| ←           |  | 50-004-1091  | 1           | 21   |         | THRUST WASHER-INPUT                    |
| ←           |  | 01-150-1400  | 6           | 22   |         | HEX CAPSCREW 5/16-18 X 1.5 GR8         |
| ←           |  | 01-153-0210  | 3           | 23   |         | ROLLPIN-SECONDARY 3/16 X 7/8           |
| ←           |  | 20-004-1372  | 1           | 25   |         | LOCK RING                              |
| ←           |  | 01-166-0110  | 6           | 26   |         | LOCKWASHER 5/16 MED                    |
| ←           |  | 01-207-0070  | 2           | 27   |         | PIPE PLUG-MAG. 3/8 NPT-SOC HD          |
| ←           |  | 01-215-0050  | (1)         | 28   |         | GREASE FITTING (OPTIONAL)              |
| ←           |  | 01-402-0560  | 1           | 29   |         | O-RING 167 MM X 3 MM                   |
| ←           |  | 01-405-0610  | 1           | 30   |         | SEAL-SHAFT                             |
| ←           |  | 28-004-1021  | 1           | 32   |         | THRUST BEARING                         |
| ←           |  | 01-216-0070  | (1)         | 35   |         | AIR VENT 3/8 NPT (OPTIONAL)            |
| ←           |  | -            | -           | -    |         | -                                      |

NOTE \* BEARING PRELOAD DETERMINES QUANTITY OF SHIMS.

SEAL KIT; P/N 20-016-0501; INCLUDES ITEMS 29 AND 30.



ECN 2197  
X28LPD1-6B DATE: 04-15-04

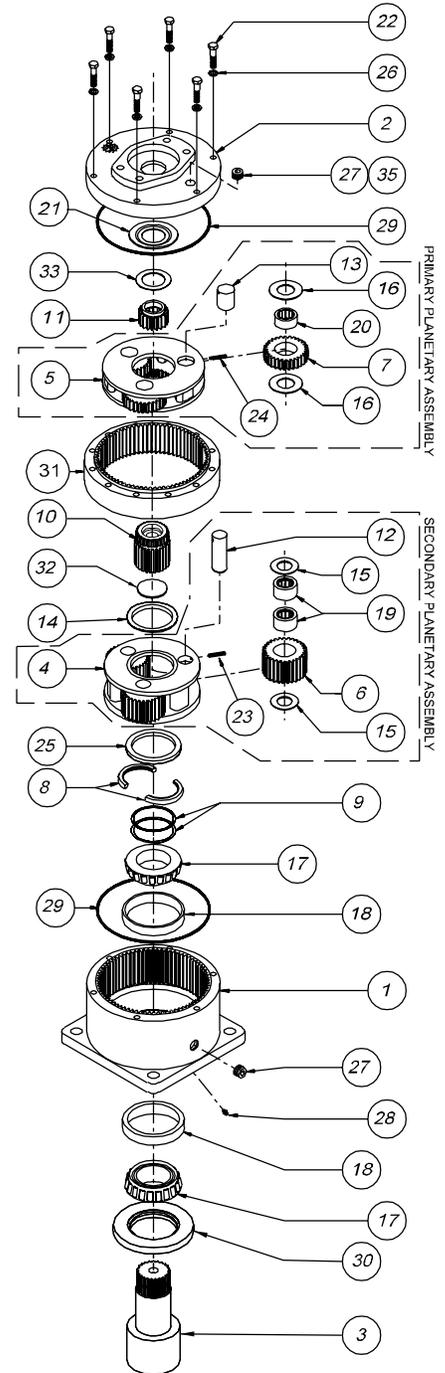
# 28LP Double Stage Exploded View Drawing

|  |  | DOUBLE PLANETARY |                         |                         |                                     |                         |              |
|--|--|------------------|-------------------------|-------------------------|-------------------------------------|-------------------------|--------------|
| EQUIPPED WITH PATENTED "LOAD-N-LOCK"®<br>SHAFT RETENTION SYSTEM.<br>(U.S. PATENT NO. 5746517).<br><br>EFFECTIVE<br>FROM: S/N 16401 07-01-93<br>TO: (CURRENT) |  | RATIO            | 16.65:1<br>4.08<br>4.08 | 20.62:1<br>5.05<br>4.08 | 20.62:1<br>4.08<br>5.05<br>INVERTED | 25.53:1<br>5.05<br>5.05 |              |
| DOC  | DESCRIPTION                            | ITEM             | QTY.                    | PART NUMBER             | PART NUMBER                         | PART NUMBER             | PART NUMBER  |
|  | B28 CASE-SQUARE- (NO ZERK)             |                  |                         | 28-004-3504             | 28-004-3504                         | 28-004-3504             | 28-004-3504  |
|  | B28 CASE-SQUARE- W/ZERK (28)           | 1                | 1                       | 28-004-3504Z            | 28-004-3504Z                        | 28-004-3504Z            | 28-004-3504Z |
|  | C28 CASE-CUST.MTC PER CUSTOMER SPECS.  |                  |                         | -                       | -                                   | -                       | -            |
| A  | COVER-SAE 'A'                          |                  |                         | 85-004-1513             | 85-004-1513                         | 85-004-1513             | 85-004-1513  |
| B  | COVER-SAE 'B' 2-BOLT                   | 2                | 1                       | 85-004-1503             | 85-004-1503                         | 85-004-1503             | 85-004-1503  |
| C  | COVER-SAE 'C' 4-BOLT                   |                  |                         | 28-004-1013             | 28-004-1013                         | 28-004-1013             | 28-004-1013  |
| F1   | SHAFT - 1.5" DIA. X 3/8 KEY - INTERNAL |                  |                         | 20-004-4122L            | 20-004-4122L                        | 20-004-4122L            | 20-004-4122L |
| F2   | SHAFT - 2" DIA. X 1/2 KEY - INTERNAL   | 3                | 1                       | 20-004-4112L            | 20-004-4112L                        | 20-004-4112L            | 20-004-4112L |
| C1   | SHAFT-CUSTOM PER CUSTOMER SPECS.       |                  |                         | -                       | -                                   | -                       | -            |
|  | CARRIER-SECONDARY                      | 4                | 1                       | 50-004-1062             | 50-004-1062                         | 50-004-1062             | 50-004-1062  |
|  | CARRIER-PRIMARY                        | 5                | 1                       | 50-004-1082             | 50-004-1072                         | 50-004-1082             | 50-004-1072  |
|  | PLANET GEAR-SEC.                       | 6                | 3                       | 85-004-1051             | 85-004-1051                         | 85-004-1041             | 85-004-1041  |
|  | PLANET GEAR-PRI.                       | 7                | 3                       | 85-004-1031             | 85-004-1021                         | 85-004-1031             | 85-004-1021  |
|  | SPLIT RING (MATCHING HALVES)           | 8                | 1                       | 20-004-1362             | 20-004-1362                         | 20-004-1362             | 20-004-1362  |
|  | SHIM                                   | 9                | *                       | 20-004-1091             | 20-004-1091                         | 20-004-1091             | 20-004-1091  |
|  | SUN GEAR-SECONDARY                     | 10               | 1                       | 85-004-1412             | 85-004-1092                         | 85-004-1072             | 85-004-1072  |
| 1  | INPUT GEAR 21T 20/40 D.P.SPLINE        |                  |                         | 85-004-1402             |                                     | 85-004-1402             | N/A          |
| 2  | INPUT GEAR 13T 16/32 D.P.SPLINE        |                  |                         | 85-004-1102             | 85-004-1062                         |                         | 85-004-1062  |
| 3  | INPUT GEAR SAE 1" 5B SPLINE            |                  |                         | 85-004-1122             | 85-004-1122                         |                         | 85-004-1122  |
| 4  | INPUT GEAR 14T, 12/24 D.P.SPLINE       |                  |                         | 85-004-1533             |                                     | 85-004-1533             | N/A          |
| 5  | INPUT GEAR 15T 16/32 D.P.SPLINE        |                  |                         | 85-004-1542             | 85-004-1422                         |                         | 85-004-1422  |
| 6  | INPUT GEAR 1" DIA X .25" KEY           |                  |                         | 85-004-1582             |                                     | 85-004-1582             | N/A          |
|  | PLANET SHAFT-SECONDARY                 | 12               | 3                       | 71-004-0121             | 71-004-0121                         | 71-004-0121             | 71-004-0121  |
|  | PLANET SHAFT- PRIMARY                  | 13               | 3                       | 81-004-0071             | 81-004-0071                         | 81-004-0071             | 81-004-0071  |
|  | THRUST WASHER-SEC.CUP                  | 14               | 1                       | 50-004-1011             | 50-004-1011                         | 50-004-1011             | 50-004-1011  |
|  | THRUST WASHER-(SEC.PLANET GEAR)        | 15               | 6                       | 85-004-1181             | 85-004-1181                         | 85-004-1181             | 85-004-1181  |
|  | THRUST WASHER-(SECONDARY PLANET GEAR)  | 16               | 6                       | 85-004-1561             | 85-004-1561                         | 85-004-1561             | 85-004-1561  |
|  | BEARING CONE                           | 17               | 2                       | 01-102-0160             | 01-102-0160                         | 01-102-0160             | 01-102-0160  |
|  | BEARING CUP                            | 18               | 2                       | 01-103-0160             | 01-103-0160                         | 01-103-0160             | 01-103-0160  |
|  | BEARING-SEC.PLANET                     | 19               | 6                       | 01-105-0010             | 01-105-0010                         | 01-105-0010             | 01-105-0010  |
|  | BEARING-PRI.PLANET                     | 20               | 3                       | 01-105-0410             | 01-105-0410                         | 01-105-0410             | 01-105-0410  |
|  | THRUST WASHER-INPUT                    | 21               | 1                       | 50-004-1091             | 50-004-1091                         | 50-004-1091             | 50-004-1091  |
|  | HEX CAPSCREW 5/16-18 X 1.5 GR8         | 22               | 6                       | 01-150-1490             | 01-150-1490                         | 01-150-1490             | 01-150-1490  |
|  | ROLLPIN-SECONDARY 3/16 X 7/8           | 23               | 3                       | 01-153-0210             | 01-153-0210                         | 01-153-0210             | 01-153-0210  |
|  | ROLLPIN-PRIMARY 1/8 X 1                | 24               | 3                       | 01-153-0080             | 01-153-0080                         | 01-153-0080             | 01-153-0080  |
|  | LOCK RING                              | 25               | 1                       | 20-004-1372             | 20-004-1372                         | 20-004-1372             | 20-004-1372  |
|  | LOCKWASHER 5/16 MED                    | 26               | 6                       | 01-166-0110             | 01-166-0110                         | 01-166-0110             | 01-166-0110  |
|  | PIPE PLUG-MAG. 3/8 NPT-SOC HD          | 27               | 2                       | 01-207-0070             | 01-207-0070                         | 01-207-0070             | 01-207-0070  |
|  | GREASE FITTING (OPTIONAL)              | 28               | (1)                     | 01-215-0050             | 01-215-0050                         | 01-215-0050             | 01-215-0050  |
|  | O-RING 167 MM X 3 MM                   | 29               | 2                       | 01-402-0560             | 01-402-0560                         | 01-402-0560             | 01-402-0560  |
|  | SEAL-SHAFT                             | 30               | 1                       | 01-405-0610             | 01-405-0610                         | 01-405-0610             | 01-405-0610  |
|  | RING GEAR                              | 31               | 1                       | 85-004-1313             | 85-004-1313                         | 85-004-1313             | 85-004-1313  |
|  | THRUST BEARING                         | 32               | 1                       | 28-004-1021             | 28-004-1021                         | 28-004-1021             | 28-004-1021  |
|  | THRUST BEARING                         | 33               | 1                       | 01-112-0230             | 01-112-0230                         | 01-112-0230             | 01-112-0230  |
|  | AIR VENT 3/8 NPT (OPTIONAL)            | 35               | (1)                     | 01-216-0070             | 01-216-0070                         | 01-216-0070             | 01-216-0070  |
| -  |  | -                | -                       | -                       | -                                   | -                       | -            |

NOTE \* BEARING PRELOAD DETERMINES QUANTITY OF SHIMS.

SEAL KIT; P/N 20-016-0501; INCLUDES ITEMS 29 AND 30.

▷ INVERTED RATIOS REQUIRED WITH INPUT CODES 1,4,&6.



ECN 2197  
X28LPD2-BB DATE: 04-15-04

**ESKRIDGE FINISHED PRODUCT  
LIMITED WARRANTY**

**1.1 Scope of Warranty Coverage.** Upon the terms and subject to the conditions set forth in this limited warranty:

(a) ESKRIDGE (referred to herein as “**ESKRIDGE**” or the “**Manufacturer**”) warrants to each initial end user customer (a “**Purchaser**”) of a new finished product together with any accessories manufactured and sold directly from ESKRIDGE (the “**Product**”) that the Product shall be free from defects in material and workmanship, under normal working and service conditions, for a period of eighteen (18) months from the date the Product is shipped from ESKRIDGE. (the “**Warranty Term**”). A Purchaser shall be eligible for an additional eighteen (18) months of coverage in addition to the Warranty Term (also referred to as the “**Standard (+) PLUS benefit**”) only if the Purchaser (i) complies with Section 1.2(a) and (ii) registers the Product during the Warranty Term at [myproduct.eskridgeinc.com](http://myproduct.eskridgeinc.com).

(b) Notwithstanding the foregoing, this warranty does not cover components damaged by accident, abuse, misuse, neglect, untrained operators, collision, overloading, modification, disassembly, rework, misapplication, improper installation, lack of lubrication or maintenance, or improper service. This warranty does not cover the paint or material finish, removal or reinstallation of the Product, or normal wear and tear and loss of functionality due to aging of the Product (which may include but is not limited to bearings, bushings, seals, O-rings, gaskets, brake material, motor brushes, electrical cables and more).

**1.2 Eligibility of Warranty Coverage.**

(a) A Purchaser shall be eligible for warranty coverage under this Limited Warranty during the Warranty Term only if:

(i) Prior to placing a Product in service, and throughout use of the Product during the Warranty Term, the Purchaser provides (or causes to be provided) proper storage such that foreign objects (e.g. rain or debris) cannot enter any Product through entry ports which are normally closed during operation.; and

(ii) The Purchaser maintains, or causes to be maintained, the Product according to commercially reasonable standards and utilizes the Product for the purposes for which it was created; and

(iii) No repairs or alterations have been made by any party other than ESKRIDGE, including Purchaser, unless otherwise authorized in writing by ESKRIDGE.

**1.3 Transferability of Warranty.**

(a) This warranty is transferable only from the Purchaser to the first subsequent transferee (the “**Transferee**”) of the Product from Purchaser upon (i) written notification to ESKRIDGE and (ii) registration of the transfer, both within 30 days of such Product transfer.

(b) Upon satisfaction of transfer requirements set forth in Section 1.3(a), the Transferee shall succeed to all the rights and obligations of the Purchaser set forth in this Limited Warranty.

**1.4 Certain Limitations on Scope of Warranty Service.**

(a) Any obligation of ESKRIDGE under this warranty, statutory or otherwise, is limited to the repair of the Product, at its factory or Authorized Service Centers. Notwithstanding the foregoing, if field service or repair is performed by ESKRIDGE at the request of the Purchaser and no defect is found with material or workmanship of the Product, the Purchaser shall compensate ESKRIDGE for its time and expenses within thirty (30) days of delivery of an invoice relating to the same. If repair is determined by ESKRIDGE in its sole, absolute and uncontrolled discretion to be impossible or impractical, then ESKRIDGE may satisfy this warranty by replacing the Product. ESKRIDGE will not provide any cash payment or credits for defective materials or workmanship.

(b) Purchaser shall be responsible for any and all freight charges for any Product receiving warranty service under this limited warranty. Any travel time, transportation charges, freight charges, or similar costs incurred by ESKRIDGE in connection with the replacement or repair of defective parts, shall, be the responsibility of the Purchaser. If applicable, ESKRIDGE shall invoice Purchaser for the total amount of such charges within sixty (60) days of fulfilling its duties under this warranty, payable within thirty (30) days of delivery of such invoice. In no event shall ESKRIDGE be liable for bills for service, labor or other expenses that have been incurred by the Purchaser without approval or prior authorization by ESKRIDGE for inspection, maintenance, or repair of the Product.

(c) If a Product is found to be operable upon inspection, the Product, at Purchaser's election, may be either (1) returned to the Purchaser with a service charge from ESKRIDGE for inspection, cleaning, and routine replacement of all rubber components and any other parts that show wear; or (2) ESKRIDGE can dispose of the product safely.

1.5 **Limitations of Liability.** ESKRIDGE shall in no event be liable for punitive, special or consequential damages relating to the Product or this Warranty. ESKRIDGE makes no warranty in respect to third-party accessories, upgrades, or additions to the Product.

1.6 **Improving Product.** ESKRIDGE reserves the right to improve the Product through changes in design or materials as it may deem desirable or necessary without being obligated to incorporate, upgrade, or otherwise modify previously manufactured products.

1.7 **Limitations of Warranty.**

(a) THE WARRANTY SET FORTH ABOVE IS THE ONLY EXPRESS WARRANTY. ESKRIDGE HEREBY DISCLAIMS AND EXCLUDES ANY OTHER EXPRESS, IMPLIED, OR STATUTORY WARRANTIES, ARISING BY OPERATION OF LAW, COURSE OF DEALING, COURSE OF PERFORMANCE, USAGE, OF TRADE, OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND INTELLECTUAL PROPERTY RIGHTS OF A THIRD PARTY.

(b) ANY IMPLIED WARRANTY WHICH BY LAW MAY NOT BE EXCLUDED IS LIMITED IN DURATION TO ONE (1) YEAR FROM THE DATE OF ORIGINAL RETAIL PURCHASE OF THE PRODUCT.

(c) This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

(d) This warranty is valid only in the U.S.A. and Canada. For warranty outside the U.S.A. and Canada contact your nearest Eskridge Distributor.

1.8 **No Modifications to Warranty.** No ESKRIDGE dealer, distributor, agent or employee is authorized to make any modification, extension or addition to this warranty.

1.9 **How to Apply for Warranty Coverage.**

All claims are handled by contacting your nearest Eskridge Distributor. For questions, please contact customer support: [eskcustomersupport@ramseyindustries.com](mailto:eskcustomersupport@ramseyindustries.com).

Visit [Dealer Locator - Eskridge](#) for Eskridge Distributor locations and contact information.

Additional warranty, service support, product information, and parts information can be found on [www.eskridgeinc.com](http://www.eskridgeinc.com).