



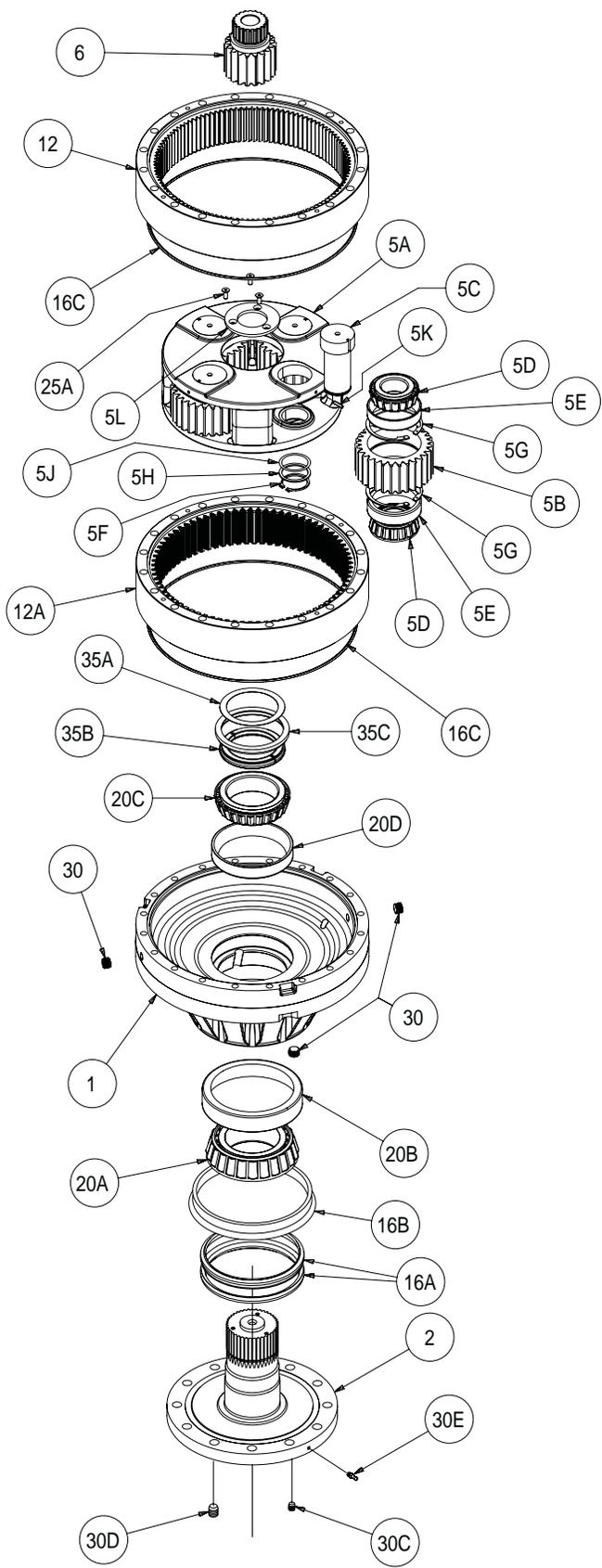
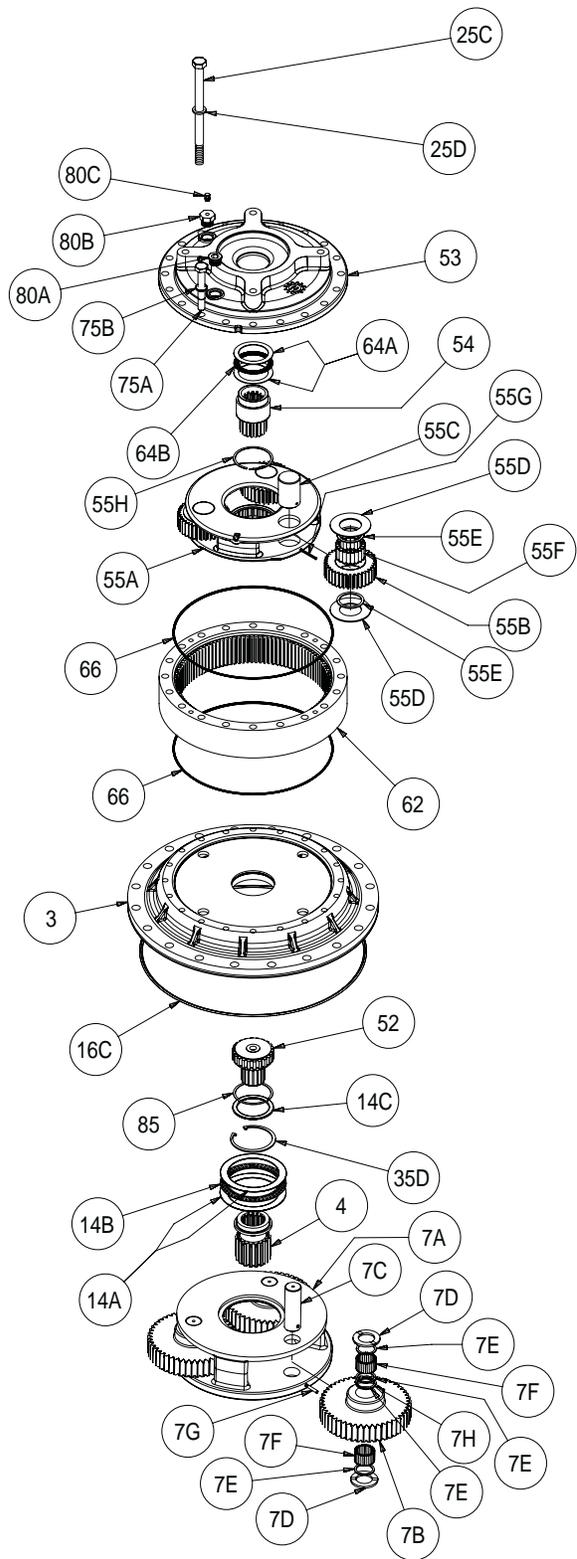
## MODEL 1400 TRIPLE PLANETARY SPINDLE DRIVE SERVICE MANUAL



**WARNING:** While working on this equipment, use safe lifting procedures, wear adequate clothing and wear hearing, eye and respiratory protection.

THIS SERVICE MANUAL IS EFFECTIVE:  
S/N: 74362 TO CURRENT  
DATE: 10/01/2007 TO CURRENT  
VERSION: SM1400LS3-AA

**NOTE:** Individual customer specifications (mounting case, output shaft, brake assembly, etc.) may vary from exploded drawing and standard part numbers shown. If applicable, refer to customer drawing for details.



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**Effective date 07/01/2007**  
**Effective serial # 74362**

CORE UNIT:

|                                 |      | 1400LS-26  | 1400LS-41  | 2-STAGE+3-STAGE CORE            |             |             |
|---------------------------------|------|--|--|---------------------------------|-------------|-------------|
| <b>MODEL 1400 SPINDLE DRIVE</b> |      | <b>26.48:1</b><br><b>4.96:1</b><br><b>5.33:1</b> | <b>41.41:1</b><br><b>7.76:1</b><br><b>5.33:1</b> | <b>EITHER RATIO + 3RD STAGE</b> |             |             |
| Item #                          | QTY. | Description                                      | Part Number                                      | Part Number                     | Part Number |             |
| 1                               | 1    | BASE   | CODE A - FLANGED                                 | 60-004-3044                     | SEE 2-STAGE |             |
|                                 |      |  | CODE A - FLANGED W/ BRG GREASE ZERK              | 60-004-3044Z                    | SEE 2-STAGE |             |
|                                 |      |  | CODE F - FLANGELESS                              | 60-004-3138                     | SEE 2-STAGE |             |
|                                 |      |  | CODE F - FLANGELESS W/ BRG GREASE ZERK           | 60-004-3138Z                    | SEE 2-STAGE |             |
|                                 |      |  | CODE CA or CF - CUSTOM                           | (CUSTOM P/N)                    | SEE 2-STAGE |             |
| 2                               | 1    | SPINDLE  | CODE S1 - 12X 1-1/8 UNF ON 15.00 B.C.            | 60-004-4052L                    | SEE 2-STAGE |             |
|                                 |      |  | CODE C1 - CUSTOM                                 | (CUSTOM P/N)                    | SEE 2-STAGE |             |
| 3                               | 1    | COVER #1   | CODE D - SAE 'D' (4 BOLT)                        | 60-004-1074                     | 60-004-1934 |             |
|                                 |      |  | CODE E - SAE 'E' (4 BOLT)                        | 60-004-1564                     |             |             |
| 4                               | 1    | INPUT GEAR #1                                    | CODE 9 (13T, 8/16 SPLINE)                        | 60-004-1122                     | 60-004-1142 | ---         |
|                                 |      |  | CODE 5 (15T, 8/16 SPLINE)                        | PNNYA                           | 60-004-1552 | ---         |
|                                 |      |  | CODE 8 (16T, 8/16 SPLINE)                        | 60-004-1402                     | 60-004-1492 | SEE 2-STAGE |
| 5                               | 1    | <b>SEC CARR ASSY-5.33:1(1400)</b>                | <b>60-005-2133</b>                               |                                 | SEE 2-STAGE |             |
| 5A                              | 1    | CARRIER SEC; 4-PLANET                            | 60-004-1774                                      | SEE 2-STAGE                     |             |             |
| 5B                              | 4    | PLANET GEAR; SEC                                 | 60-004-1232                                      | SEE 2-STAGE                     |             |             |
| 5C                              | 4    | PLANET SHAFT; SEC                                | 60-004-1262                                      | SEE 2-STAGE                     |             |             |
| 5D                              | 8    | CONE; SEC. PLNT                                  | 01-102-0210                                      | SEE 2-STAGE                     |             |             |
| 5E                              | 8    | CUP; SEC.PLNT                                    |  | SEE 2-STAGE                     |             |             |
| 5F                              | 4    | RETAINING RING; PLANET SHAFT                     | 01-160-0490                                      | SEE 2-STAGE                     |             |             |
| 5G                              | 8    | RETAINING RING; PLANET BORE                      | 01-160-0500                                      | SEE 2-STAGE                     |             |             |
| 5H                              | 8    | WASHER; SEC                                      | 60-004-1291                                      | SEE 2-STAGE                     |             |             |
| 5J                              | 8    | SHIM; SEC. PLNT                                  | 60-004-1321                                      | SEE 2-STAGE                     |             |             |
| 5K                              | 4    | ROLL PIN; 1/4 x 1 3/8                            | 01-153-0150                                      | SEE 2-STAGE                     |             |             |
| 5L                              | 1    | PLATE; SEC CARRIER RETAINER                      | 60-004-1352                                      | SEE 2-STAGE                     |             |             |
| 6                               | 1    | SUN GEAR -SECONDARY                              | 60-004-1792                                      | SEE 2-STAGE                     |             |             |
| 7                               | 1    | <b>PRIMARY CARRIER ASSY-1400</b>                 | <b>60-005-2113</b>                               | <b>60-005-2123</b>              | SEE 2-STAGE |             |
| 7A                              | 1    | CARRIER; PRIMARY                                 | 60-004-1372                                      | 60-004-1722                     | SEE 2-STAGE |             |
| 7B                              | 3    | PLANET GEAR; PRIMARY                             | 60-004-1862                                      | 60-004-1872                     | SEE 2-STAGE |             |
| 7C                              | 3    | PLANET SHAFT; PRIMARY                            | 60-004-1272                                      | SEE 2-STAGE                     |             |             |
| 7D                              | 6    | THRUST WASHER; PRIMARY PLANET                    | 60-004-1881                                      | SEE 2-STAGE                     |             |             |
| 7E                              | 12   | SPACER WASHER; PRI ROLLER; 4 PER SHAFT           | 60-004-1891                                      | SEE 2-STAGE                     |             |             |
| 7F                              | 168  | LOOSE ROLLER; 2 X 28 PER SHAFT                   | 01-106-0050                                      | SEE 2-STAGE                     |             |             |
| 7G                              | 3    | ROLL PIN; 1/4 x 1 3/8                            | 01-153-0150                                      | SEE 2-STAGE                     |             |             |
| 7H                              | 3    | RETAINING RING; PLANET BORE                      | 01-160-0750                                      | SEE 2-STAGE                     |             |             |
| 12A                             | 1    | RING GEAR; SEC.                                  | 60-004-1243                                      | SEE 2-STAGE                     |             |             |
| 12B                             | 1    | RING GEAR; SIMPLE PRI                            | 60-004-1193                                      | SEE 2-STAGE                     |             |             |
| 14A                             | 2    | THRUST RACE; PRI CARR                            | 01-112-0350                                      | SEE 2-STAGE                     |             |             |
| 14B                             | 1    | THRUST BRG; PRI CARR                             | 01-112-0340                                      | SEE 2-STAGE                     |             |             |
| 14C                             | 1    | THRUST RACE; INPUT GEAR                          | 01-112-0060                                      | SEE 2-STAGE                     |             |             |
| 16A                             | 1    | SEAL; METAL FACE                                 | 01-406-0010                                      | SEE 2-STAGE                     |             |             |
| 16B                             | 1    | SEAL-RUBBER/FACE                                 | 01-406-0020                                      | SEE 2-STAGE                     |             |             |
| 16C                             | 3    | O-RING; RING GEAR                                | 01-402-0660                                      | SEE 2-STAGE                     |             |             |
| 20A                             | 1    | BRG CONE; OUTER                                  | 01-102-0190                                      | SEE 2-STAGE                     |             |             |

| Model 1400 Shaft/Spindle Drive Ratio breakdown |      |      |      |      |
|--|------|------|------|------|
| Unit   | 104  | 155  | 201  | 314  |
| Stg I  | 3.95 | 5.87 | 7.59 | 7.59 |
| Stg II   | 4.96 | 4.96 | 4.96 | 7.76 |
| Stg III  | 5.33 | 5.33 | 5.33 | 5.33 |

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|   |             |             |             |             |
|---|-------------|-------------|-------------|-------------|
| <b>Model 1400 Shaft/Spindle Drive Ratio breakdown</b> |             |             |             |             |
| <b>Unit</b>   | <b>104</b>  | <b>155</b>  | <b>201</b>  | <b>314</b>  |
| <b>Stg I</b>  | <b>3.95</b> | <b>5.87</b> | <b>7.59</b> | <b>7.59</b> |
| <b>Stg II</b>   | <b>4.96</b> | <b>4.96</b> | <b>4.96</b> | <b>7.76</b> |
| <b>Stg III</b>  | <b>5.33</b> | <b>5.33</b> | <b>5.33</b> | <b>5.33</b> |

|                              |          |   |                                  |                    |                    |                    |
|------------------------------|----------|---|----------------------------------|--------------------|--------------------|--------------------|
| 20B                          | 1        | BRG CUP; OUTER                                  |                                  | 01-103-0190        | SEE 2-STAGE        |                    |
| 20C                          | 1        | BRG CONE; INNER                                 |                                  | 01-102-0230        | SEE 2-STAGE        |                    |
| 20D                          | 1        | BRG CUP; INNER                                  |                                  | 01-103-0230        | SEE 2-STAGE        |                    |
| 25A                          | 3        | FLAT HD SOC C.S.; SEC CARR RET. (3/8-24X1 GR-8) |                                  | 01-150-1590        | SEE 2-STAGE        |                    |
| 25C                          | 20       | HHCS (3/4-10 x 10.5 GRD 8)                      |                                  | 01-150-1580        | SEE 2-STAGE        |                    |
| 25D                          | 20       | HARDWASHER; 3/4; 1.25 O.D.                      |                                  | 01-166-0350        | SEE 2-STAGE        |                    |
| 30A                          | 4/6      | PIPE PLUG (3/4 NPT MAGNETIC)                    |                                  | 01-207-0100        | SEE 2-STAGE        |                    |
| 30B                          | 1        | GR. FIT; STR. 1/8 NPT (O.D. of spindle flange)  |                                  | 01-215-0010        | SEE 2-STAGE        |                    |
| 30C                          | 1        | PIPE PLUG; 1/8 NPT (face of spindle flange)     |                                  | 01-207-0030        | SEE 2-STAGE        |                    |
| 30D                          | 1        | PIPE PLUG; 1/4 NPT (face of spindle shaft)      |                                  | 01-207-0020        | SEE 2-STAGE        |                    |
| 30E                          | (1)      | GR. FIT; STR.; 1/4 NPT ('Z' OPTION)             |                                  | (01-215-0040)      | SEE 2-STAGE        |                    |
| 35A                          | 2        | SHIM; OUTPUT SHAFT                              |                                  | 60-004-1311        | SEE 2-STAGE        |                    |
| 35B                          | 1        | SPLIT RING (L-SEGMENT)                          |                                  | 60-004-1482        | SEE 2-STAGE        |                    |
| 35C                          | 1        | LOCK RING                                       |                                  | 60-004-1472        | SEE 2-STAGE        |                    |
| 35D                          | 1        | RETAINING RING; INPUT HOI #5008-400             |                                  | 01-160-0510        | SEE 2-STAGE        |                    |
| <b>MODEL 440 THIRD STAGE</b> |          |   | <b>CORE UNIT:</b>                | <b>1400-440-4</b>  | <b>1400-440-5</b>  | <b>1400-440-7</b>  |
|                              |          |   | <b>3RD-STAGE RATIO:</b>          | <b>3.95</b>        | <b>5.87</b>        | <b>7.59</b>        |
| 52                           | 1        | SPLINED ADAPTOR SHAFT                           |                                  | 60-004-1902        |                    |                    |
| 53                           | 1        | COVER #2  | SAE 'C' 2 BOLT AND 4 BOLT        | 42-004-2012        |                    |                    |
|                              |          |   | SAE 'D' 4 BOLT                   | 42-004-2022        |                    |                    |
|                              |          |   | SAE 'E' 4 BOLT                   | 42-004-2032        |                    |                    |
| 54A                          | 1        | INPUT GEAR                                      | INPUT GEAR 13 TOOTH, 8/16        | 42-004-1152        | 42-004-1162        | 42-004-1172        |
| 54B                          | (1)      |   | FOR 14 TOOTH, 12/24, USE ADAPTER | 98-005-1141        |                    |                    |
| <b>55</b>                    | <b>1</b> | <b>CARRIER ASSY - THIRD STAGE</b>               |                                  | <b>42-005-0101</b> | <b>42-005-0111</b> | <b>42-005-0121</b> |
| 55A                          | 1        | CARRIER - 3RD STAGE                             |                                  | 42-004-1062        | 42-004-1072        | 42-004-1282        |
| 55B                          | 3        | PLANET GEAR - 3RD STAGE                         |                                  | 42-004-1102        | 42-004-1112        | 42-004-1272        |
| 55C                          | 3        | PLANET SHAFT - 3RD STAGE                        |                                  | 42-004-1342        |                    |                    |
| 55D                          | 6        | THRUST WASHER - 3RD STAGE PLANET                |                                  | 42-004-1362        |                    |                    |
| 55E                          | 6        | SPACER WASHER - 3RD STAGE ROLLER                |                                  | 42-004-1352        |                    |                    |
| 55F                          | 60       | LOOSE ROLLER; 20 PER SHAFT                      |                                  | 01-106-0040        |                    |                    |
| 55G                          | 3        | ROLL PIN; 3/16 X 1-3/4                          |                                  | 01-153-0220        |                    |                    |
| 55H                          | 1        | RETAINING RING - ADAPTOR SHAFT                  |                                  | 01-160-0690        |                    |                    |
| 62                           | 1        | RING GEAR - PRIMARY                             |                                  | 42-004-1042        |                    |                    |
| 64A                          | 2        | THRUST WASHER                                   |                                  | 01-112-0400        |                    |                    |
| 64B                          | 1        | THRUST BEARING                                  |                                  | 01-112-0410        |                    |                    |
| 66                           | 2        | O-RING - RING GEAR                              |                                  | 01-402-0840        |                    |                    |
| 75A                          | 20       | HEX HEAD CAPSCREW 5/8-11 X 4.5 GR 8             |                                  | 01-150-0870        |                    |                    |
| 75B                          | 20       | LOCKWASHER 5/8                                  |                                  | 01-166-0040        |                    |                    |
| 80                           | 2        | PLUG - COVER #2                                 |                                  | 01-208-0030        |                    |                    |
| 85                           | 1        | RETAINING RING - ADAPTOR SHAFT                  |                                  | 01-160-0690        |                    |                    |

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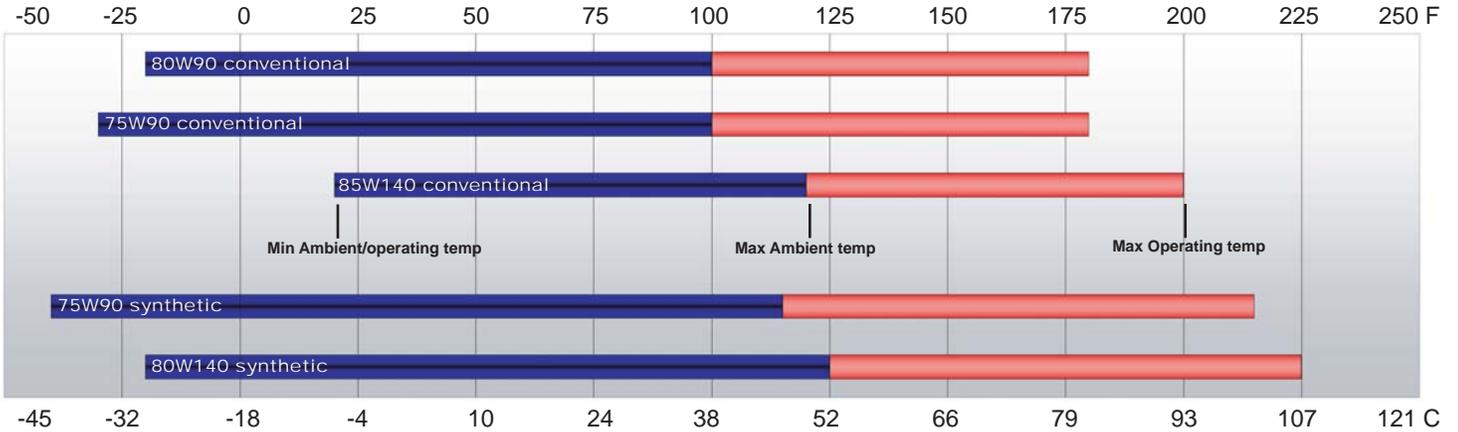
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# LUBRICATION & MAINTENANCE

Using the chart below, determine an appropriate lubricant viscosity. Use only EP (extreme pressure) or API GL-5 designated lubricants. Change the lubricant after the first 50 hours of operation and at 500 hour intervals thereafter. The gear drive should be partially disassembled to inspect gears and bearings at 1000 hour intervals.

## Recommended ambient and operating temperatures for conventional and synthetic gear lubricants



Note: Ambient temperature is the air temperature measured in the immediate vicinity of the gearbox. A Gearbox exposed to the direct rays of the sun or other radiant heat sources will operate at higher temperatures and therefore must be given special consideration. The max operating temp must not be exceeded under any circumstances, regardless of ambient temperature.

## ESKRIDGE MODEL 1400 OIL CAPACITIES

| Operating Position   | Oil Capacity |              |                    | Oil Level  |
|--|--------------|--------------|--------------------|--|
|  | Single stage | Double stage | Triple stage       |  |
|  Horizontal Shaft             | -            | -            | 18 qts / 17 Liters | To horizontal centerline of gear drive  |
|  Vertical Shaft (Pinion Up)   | -            | -            | 27 qts / 25 Liters | To side port on gear drive base         |
|  Vertical Shaft (Pinion Down) | -            | -            | 31 qts / 29 Liters | To midway on upper/primary gear set     |

## ESKRIDGE PART NUMBER INTERPRETATION

Note: All standard Eskridge Geardrives are issued a descriptive part number which includes information regarding the Model, means of shaft retention, base style, shaft style, input mounting, input shaft size, overall ratio and various available options. For a detailed breakdown of this information, please refer to Eskridge product specification sheets found at: <http://www.eskridgeinc.com/geardrives/gearprodspecs.html>

# Unit Teardown

- 1) Scribe a diagonal line across the outside of the unit from the top cover (53) to the adapter cover (3), and to the base (1) before disassembly to aid in the proper positioning of pieces during reassembly.
- 2) Remove drain plugs (30A) and drain oil from unit. The oil will drain out more quickly and completely if warm.
- 3) Remove the twenty 5/8-11 capscrews (75B) securing the top cover (53) to the unit.
- 4) Remove the top cover (53), input thrust washer(s), bearing(s) (64A, 64B), and Stage I input gear (54). Inspect cover o-ring (66); discard if damaged or deformed.
- 5) Lift the stage I planet carrier assembly (55) including shaft adapter (52) from the unit.
- 6) Remove Stage I ring gear (62), inspect o-ring (66) and replace if damaged or deformed.
- 7) Remove the twenty 3/4-10 capscrews (25C) and lockwashers (25D) securing the ring adapter cover (3).
- 8) Remove the ring adapter cover (3), thrust race (14C), Stage II sun gear (4) and thrust washers (14A, 14B) from unit. Inspect cover o-ring (16C); discard if damaged or deformed.
- 9) Lift the stage II planet carrier assembly (7) from the unit.
- 10) Remove the Stage III sun gear (6).
- 11) Remove the three 3/8-24 flat head capscrews (25A) securing the carrier retaining plate (5L) to the output spindle (2).
- 12) Remove remaining ring gears (12B, 12A) and Stage III carrier assembly (5). Inspect gear to gear and gear to base O-ring(s) (16C), discard and replace any damaged or deformed O-rings.
- 13) The unit is now disassembled into groups of parts. The area(s) requiring repair should be identified by thorough inspection of the individual components after they have been cleaned and dried.

## Carrier Assembly Teardown

**Rotate planet gears (55B Stg I, 7B Stg II, 5B, Stg III) to check for abnormal noise or roughness in bearings. If further inspection or replacement is required, proceed as follows.**

- 1) Drive roll pins (55G Stg I, 7C Stg II) completely into the planet shafts or remove planet shaft retaining rings (5F Stg III)
- 2) Slide planet shafts (55C Stg I, 7C Stg II, 5C Stg III) out of carrier (55A Stg I, 7A Stg II, 5A Stg III).
- 3) Remove planet gears, washers (55D Stg I, 7D Stg II) and bearings (55E Stg I, 7F Stg II, 5D & 5E Stg III) from carrier.
- 4) Inspect the planet gear, bearing bore and planet shaft (55C Stg I, 7C Stg II, 5C Stg III) and bearings. Check for spalling, bruising or other damage and replace components as necessary. *Note: When using loose (uncaged) roller bearings, all rollers in the corresponding planet gear should be replaced if any in the set are found to be defective*

- 5) Remove roll pins (55C Stg I, 7C Stg II) from planet shafts (7C) using a 3/16" (Stg I) or 1/4" (Stg II) pin punch.

## Carrier Reassembly

- 1) Loose roller installation; if using bearing assemblies, replace bearings as needed and proceed to step 2:
  - a) Set planet washer (55D Stg I, 7D Stg II) on work table with planet gear (55B Stg I, 7B Stg II) on top of it. Center planet washer to planet gear as closely as possible.
  - b) Center planet shaft (55C Stg I, 7C Stg II) in planet gear bearing bore.
  - c) If used, place spacer washer (55E Stg I, 7E Stg II) onto planet shaft (refer to exploded view to confirm spacer positions).
  - d) Begin placing rollers (55F Stg I, 7F Stg II) around shaft (55C Stg I, 7C Stg II). There should be clearance for last roller to slide in. Be sure to install sixteen (Stg I) or twenty (Stg II) rollers in each bearing row.  
  
(If using multiple rows of rollers, repeat steps C and D as necessary. Once complete, refer to exploded view to confirm that any spacer washers (55E Stg I, 7E Stg II) are appropriately positioned.)
  - e) Place a washer (55D Stg I, 7D Stg II) over gear and onto shaft.
  - f) Carefully slide assembly off of table, holding planet washers against planet gear.
  - g) Slide planet shaft out of the assembly and slip assembly into carrier.
  - h) Align planet gear & bearing assembly inside carrier and install planet shaft through entire assembly.
- 2) Planet shafts (55C Stg I, 7C Stg II, 5C Stg III) should be installed with chamfered end of roll pin hole (Stg I, II) or slot (Stg III) towards outside diameter of carrier.
- 3) Drive roll pin into the carrier hole (Stg I & II) and into planet shaft or replace planet shaft retaining rings (Stg III) to retain parts. Repeat for remaining planet gears.

## Base Subassembly Teardown

- 1) Remove the output shaft lock ring (35C) using a heel bar or puller; if using a heel bar, be sure not to pry against the cage of the inner spindle bearing (20C). Remove the split ring segments (35B) and shims (35A).  
  
**Caution: Since the shaft is no longer positively retained, care should be taken to avoid injury. Care should also be taken not to damage it while pressing through base.**
- 2) Place base (1) exterior side down, on a plate or table. Press output shaft out bottom of base by applying a load to internal end of spindle (2) until it passes through inner spindle bearing cone (20C).
- 3) A gear puller may be used to remove the outer bearing cone (20A) from the spindle (2). If reusing old bearing cone, do not pull on or damage roller cage.

**Note: Press bearing cone onto output spindle by pressing on inner race only. DO NOT press on roller cage, as it may damage the bearing assembly.**

- 4) Inspect inner and outer bearing cups **(20D & 20B)**. If cups are damaged they must be replaced, drive them out using a brass drift and utilizing the bearing knock-out notches in the base **(1)**

### Base Reassembly

- 1) Clean all foreign material from magnetic oil plugs located in base **(1)**.
- 2) Place base exterior side up on work table.
- 3) Apply a layer of lithium or general purpose bearing grease to the roller contact surface of outer bearing cup **(20B)**.
- 4) Press outer bearing cone **(20A)** onto the spindle **(2)** until it seats against the shoulder.
- 5) Wipe the face of each half of the metal face seal **(16A)** using a lint-free wipe. No particles of any kind are permissible on the sealing surfaces. (Even a hair is sufficient to hold the seal surfaces apart and cause a leak.) Apply a thin film of oil on the entire seal face of one or both seals using a clean finger or lint-free applicator. Oil must not contact any surfaces other than the sealing faces. (See Pages 7-9 for seal inspection and service procedures.)
- 6) Place the spindle **(2)** with the outer bearing cone into the base.
- 7) Flip shaft/base assembly, and apply lithium or general purpose bearing grease to roller contact surface of the inner cup **(20D)**, then press inner bearing cone **(20C)** onto shaft until it seats against inner bearing cup.
- 8) Proper spindle bearing preload will result in a rolling torque which varies between 200 to 300 in-lb. The bearing preload should be tailored to your application; a low-speed application may require a high pre-load, while high-speed applications usually benefit from low pre-load. Adding shims **(35A)** will increase the pre-load on the bearing set. Determine your pre-load requirement and install shims to obtain this pre-load.
- 9) Install the Load-N-Lock™ halves **(35B)** over the shims and into the corresponding spindle groove. Then, install the lock ring **(35C)** over the segments **(35B)**.

**All subassembly service or repairs should be complete at this time. Continue to Unit Assembly to complete buildup of unit.**

## Unit Reassembly

- 1) Install the Stage III carrier assembly onto the output spindle **(2)**; align the splines of the carrier **(5A)** with the output spindle splines and slide the carrier onto the output spindle.
- 2) Install carrier retaining plate **(5L)** & secure using provided 3/8-24 Flathead capscrews **(25A)**. If using retaining compound to assist in screw retention, apply only a small amount to internal threads. Use of excess thread retaining compound may cause screws to be irremovable once the compound has cured.
- 3) Lubricate o-rings **(16C)** and install on the ring gear **(12B Stg III)**,

**12A Stg III)** pilots.

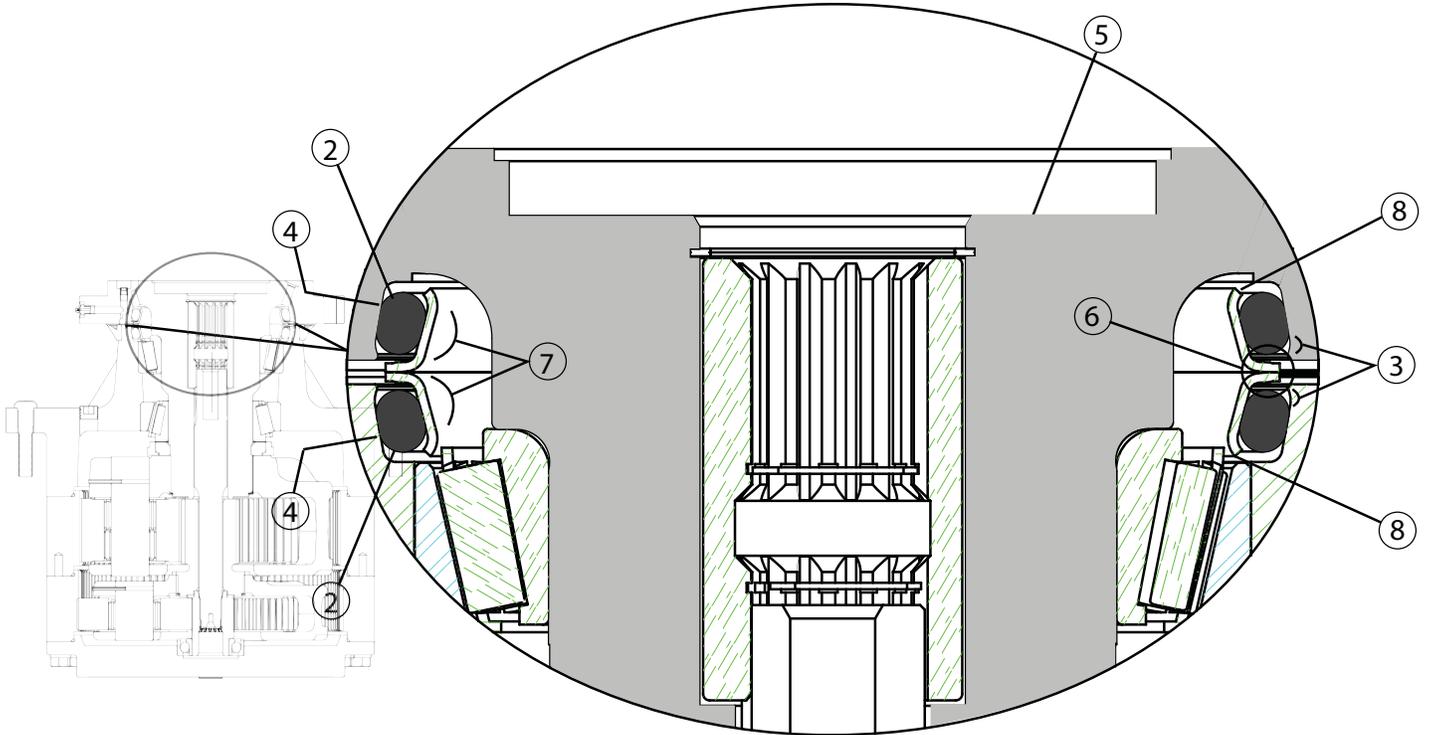
**Caution: Use lifting device to prevent injury when handling ring gears and other heavy components.**

- 4) Align gear teeth of Stage III ring gear **(12A)** with planet gears **(5B)** and place on base, then align mounting holes of ring gear with holes in base. Use the scribed line made during disassembly for reference.
- 5) With lubricated o-ring on pilot, place Stage II ring gear **(12)** on base. Align mounting holes of ring gear with holes in base, using the scribed line made during disassembly for reference.
- 6) Install the Stage III sun gear **(6)**, then the Stage II carrier assembly **(7)** aligning gear teeth of ring gear with those of the planet gears
- 7) Install Stage II sun gear **(4)**, and stage II carrier thrust-washers **(14A, 14B)**.
- 8) Install o-ring **(16C)** to ring adapter cover **(3)** and install adapter cover to Stage II ring gear, aligning mounting holes of cover with those in ring gears. Use the scribed line made during disassembly for reference.
- 9) Install, and torque the twenty 3/4-10 capscrews **(25C)** w/ lockwashers **(25D)** to retain adapter cover **(3)**. The torque for the capscrews is 380 ft.-lbs. dry or 280 ft.-lbs. lubricated
- 10) Install o-ring on Stage I ring gear **(62)** and install ring gear to adapter cover, aligning mounting holes of ring with those in the adapter cover **(3)**. Use the scribed line made during disassembly for reference.
- 11) Install the Stage I carrier assembly **(55)** with adapter shaft **(52)** into the Stage I ring gear **(62)**.
- 12) Install the input gear **(54)** and thrust bearing set **(64A, 64B)** Refer to exploded view for details..
- 13) Noting the scribed line made during disassembly, (with lubricated o-ring in place) align and install the top cover **(53)**.
- 14) Install and torque the twenty 5/8-11 hex-head cap-screws **(75A)** with lockwashers **(75B)**, retaining the top cover **(53)**. The torque for the cap-screws: 220 ft-lb dry, 170 ft-lb if the fasteners are lubricated.
- 15) Using a splined shaft to drive the input gear **(54)** ensure that the unit spins freely.
- 16) Fill the unit to the proper level, as specified, with recommended gear oil (refer to chart, page 4) after unit is sealed with brake and/or motor.

**The gear drive is now ready to use.**

# Seal Assembly for Duo-Cone Seals

Installation Instructions courtesy Caterpillar, Inc.



Cross Section View of Installed Seal

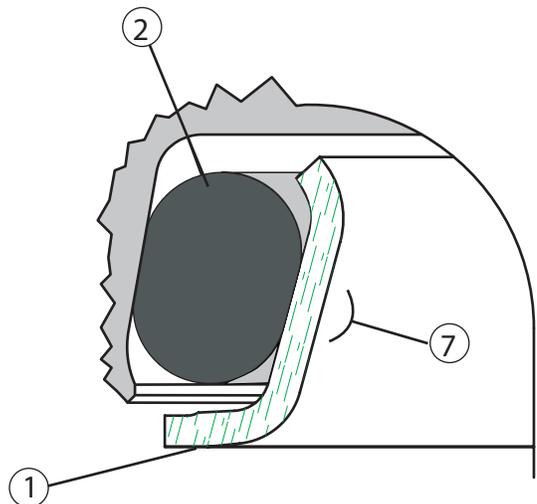
## Seal Assembly Contents:

(2) Metal Seal Rings

(2) Rubber Toric Rings

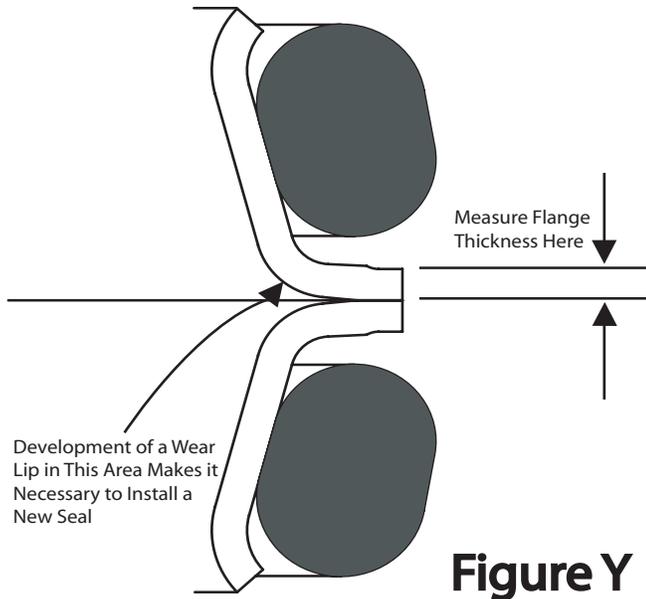
## Terminology:

- |                                    |                                  |
|------------------------------------|----------------------------------|
| 1 - Seal Ring                      | 6 - Seal Ring Face               |
| 2 - Rubber Toric                   | 7 - Seal Ring Ramp               |
| 3 - Housing Retainer Lip           | 8 - Seal Ring Retaining Lip      |
| 4 - Housing Ramp                   | 9 - Installation Tool (Optional) |
| 5 - Seal Ring Housing (Base/Shaft) |                                  |



## Inspection of Worn Seals

Seals wear in an axial, rather than radial, direction (as depicted in Figure Y). The total thickness of the flange is usable wear material on the formed seal rings and good seal performance can generally be expected until the flange is completely worn away. Remaining service life can be estimated by measuring the ring flange thickness, and using the chart below. Minimum flange thickness required for reusability is 0.05" (1.27 mm).



**Figure Y**

The measured parameter used to check the remaining seal life is flange thickness, at the outer edge (once any wear lip is removed). The measurement must be made carefully because the shoulder is only 0.06" (1.52 mm) from the edge of the flange.

Estimates of expected seal life are difficult, because there are many differences in machine applications, job conditions, maintenance and other factors that affect seal service life.

| Formed Seal Wear Chart   |                        |
|--------------------------|------------------------|
| Flange Thickness in (mm) | Seal Wear Percent Worn |
| 0.075 (1.91)             | 0                      |
| 0.062 (1.59)             | 25                     |
| 0.050 (1.27)             | 50                     |
| 0.038 (0.95)             | 75                     |
| 0.025 (0.64)             | 100                    |
| 0.012 (0.32)             | 125                    |
| 0.000 (0.00)             | 150                    |

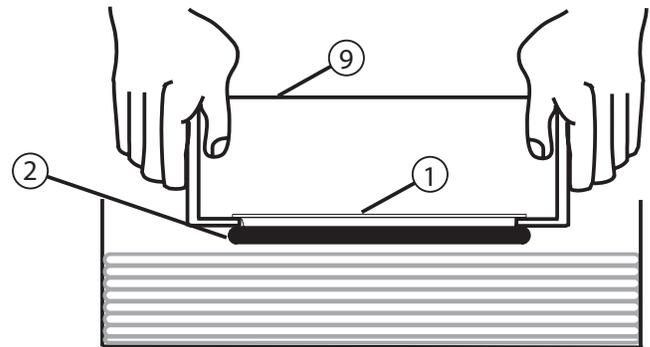
## Mishandling Of Seals

Mishandling of seals during assembly can cause immediate leaks or premature failure. Failure can occur due to cutting or tearing of the elastomeric load ring, breakage of the sealing ring, contamination of the sealing face with dirt or lint, etc. When assembling metal face seals, please carefully observe assembly instructions.

## Housing Preparation

The housing components (3, 4) that contact the rubber toric rings must be free from foreign material (oil, grease, dirt, metal chips dust or lint particles, etc.) before installing the seal. This should be done with a lint-free wipe and a non-petroleum based solvent.

- 1) Remove any foreign material from the rubber torics (2), ramps (7) and lips (8) of both seal rings. This should also be done with a lint-free wipe and non-petroleum based solvent.
- 2) Dry with a clean wipe.
- 3) Place the rubber toric (2) on the metal seal ring (6) at the bottom of the seal ring ramp (7) and against the retaining lip (8) (see illustration on previous page). Make sure the rubber toric is straight on the seal ring and not twisted. Be careful not to nick or cut the torics during this assembly, as this can cause leaks.
- 4) Put the installation tool (9) onto the metal seal ring (6) and rubber toric (2). Lightly dampen the lower half of the rubber toric with the appropriate assembly lubricant. Techniques to dampen the toric include wiping with a lint-free towel, lubricating using a clean foam brush, or dipping into a container lined with towels saturated in the assembly lubricant (as shown).



## Approved Assembly Lubricants\*

Isopropyl Alcohol

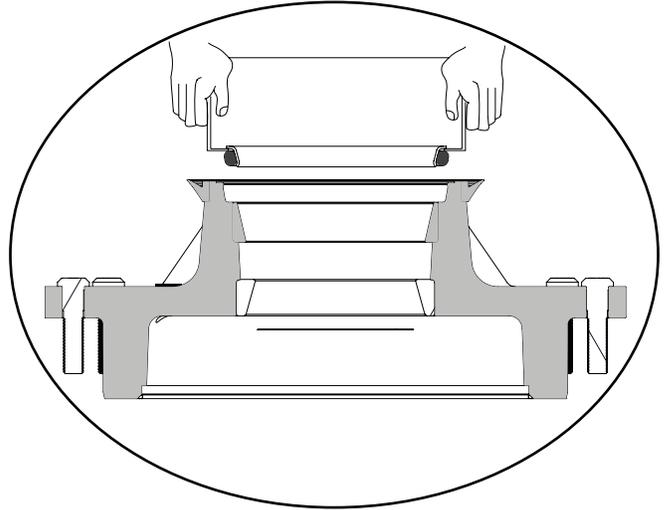
Houghto-Grind 60 CT

Quaker® Solvo Clean 68-RAH

\*Do not use Stanosol or any other liquid that leaves an oil film or does not evaporate quickly.

## Installation Process

- 1) With the lower half of the rubber toric still wet, use the installation tool (9) to position the seal ring (1) and the rubber toric (2) squarely against the housing retainer lip (3) (as shown).
- 2) For smaller diameter seals, use sudden and even pressure to push the rubber toric under the retaining lip of the housing. For larger diameter seals, which will not press in with sudden and even pressure, it is acceptable to work the toric past the retaining lip by starting on one side and tapping the opposite side of the installation tool with a rubber mallet until it is engaged past the retaining lip of the housing.
- 3) Check the assembled height (A) (see below) in at least four places, 90° apart, using either a caliper, tool makers' ruler or any other calibrated measuring device. The difference in height around the ring must not be more than 0.04" (1 mm). If small adjustments are necessary, do not push or pull directly on the seal ring. Use the installation tool (9) to push down and your fingers to pull up uniformly on the rubber toric and seal ring.

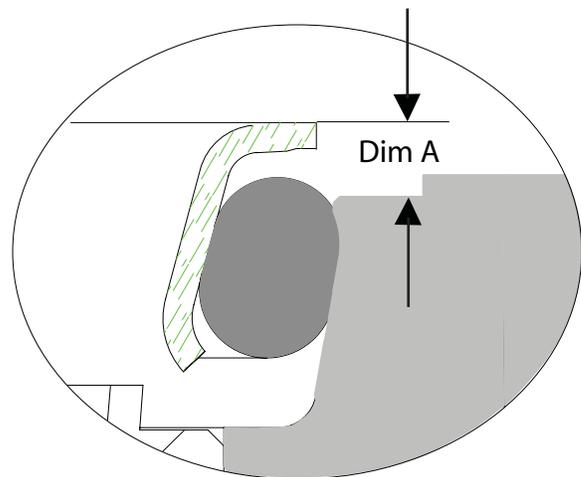


**NOTE: The rubber toric can twist if it is not completely wet during installation or if there are burrs or fins on the retaining lip of the housing. Twists, misalignments and bulges of the toric will result in seal failure. If correct installation is not apparent, remove seal from the housing and repeat the process.**

**The rubber toric must never slip on the ramps of either the seal ring or the housing. To prevent slippage, allow adequate evaporation time for the lubricant before proceeding with further assembly. Once correctly in place, the rubber toric must roll on the ramp only.**

- 4) Wipe each seal ring face (6) using a lint-free wipe. No particles of any kind are permissible on the sealing surfaces. (Even a hair is sufficient to hold the seal surfaces apart and cause a leak.)
- 5) Apply a thin film of oil on the entire seal face (6) of one or both seals using a clean finger or lint-free applicator. Oil must not contact surfaces other than the sealing faces.

**NOTE: Mishandling of seals during assembly can cause immediate leaks or premature failure. Failure can occur due to curing or tearing of the elastomeric load ring, breakage of the sealing ring, contamination of the sealing face with dirt or lint, etc. When assembling metal face seals, please carefully observe assembly instructions.**



## Final Assembly

While completing the final assembly of the unit, make sure that both housings are in correct alignment and are concentric. Slowly bring the two housings together. High impact can scratch or break the seal components.

If the rubber toric slips at any location, it will twist, causing the seal rings to cock. Any wobbling motion of the seal is an indication of cocked seals and can cause dirt to enter by pumping mud past the torics.