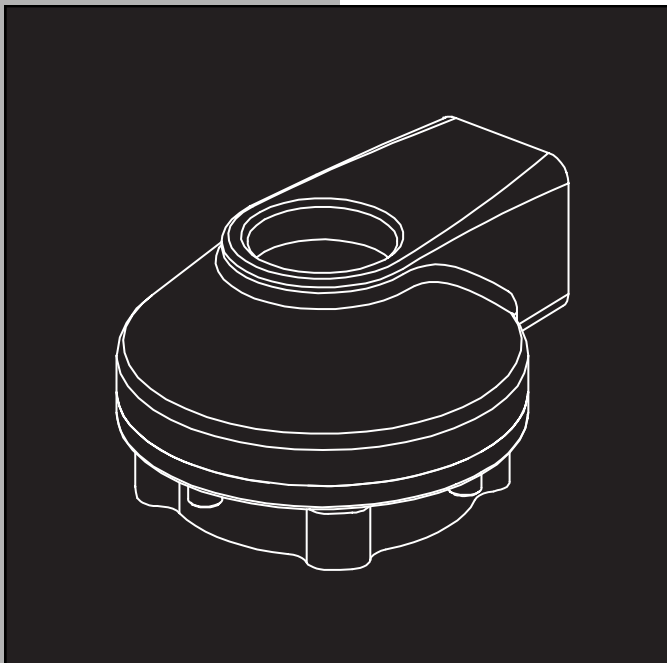


# *Limitorque Actuation Systems*

320-11000

Rev. E

May 2003



***Limitorque***<sup>®</sup>  
*B320 Series*  
*Installation and Maintenance*

**B320 Series Installation & Maintenance Manual**

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# 1 Introduction

## 1.1 Purpose

This Installation and Maintenance Manual explains how to install and maintain the B320 bevel gear operator. Information on installation, disassembly, lubrication, and spare parts is provided.

## 1.2 User Safety

Safety notices in this manual detail precautions the user must take to reduce the risk of personal injury and damage to the equipment. The user must read and be familiar with these instructions before attempting installation, operation, or maintenance. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, void of the warranty, or operational difficulty.

Safety notices are presented in this manual in three forms:

**▲ WARNING: Refers to personal safety. Alerts the user to potential danger. Failure to follow warning notices could result in personal injury or death.**

**CAUTION: Directs the user's attention to general precautions that, if not followed, could result in personal injury and/or equipment damage.**

**NOTE:** Highlights information critical to the user's understanding of the gear operator's installation and operation.

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# 2

## Product Capabilities and Features

**Designed to make operation of multi-turn valves easier** The B320 gear operator makes manual operation of multi-turn valves easier and makes converting to a motorized service easier.

**Built for reliable valve control—whether manual or motorized** The B320 offers torque ranges up to 8,000 ft-lb (10,856 N m) and thrust capacities to 325,000 lb. (1,445 kN) for any applications demanding superior strength and accuracy.

**Easily adaptable for other applications** The B320 is designed to be configured to each customer's needs:

- optional handwheel available for manual actuation
- add a spur gear attachment for greater mechanical advantage
- couple with an electric actuator from Limitorque for an economical, motorized, multi-turn package.

### 2.1 Initial Inspection and Storage Instructions

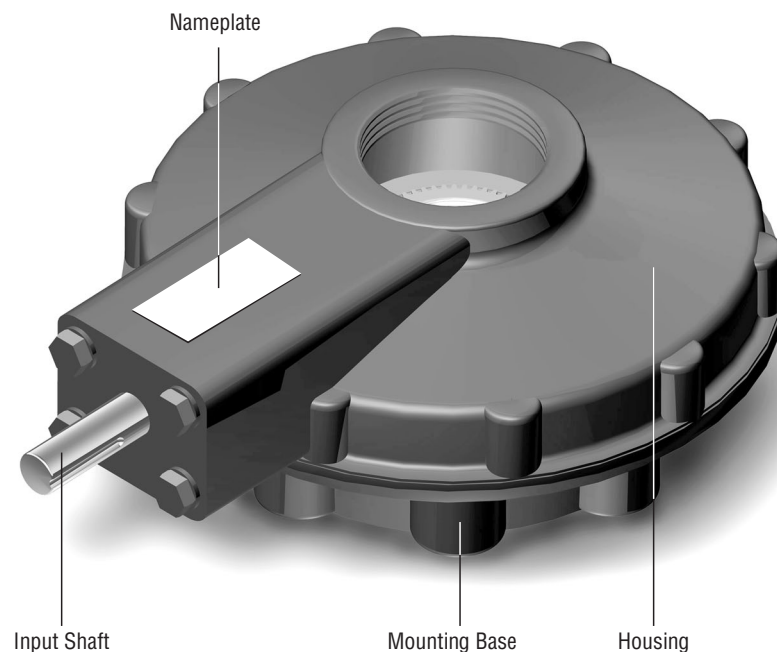
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**▲ WARNING:** Read this Installation and Maintenance Manual carefully and completely before attempting to store the gear operator.

---

### 2.2 Product Identification

Figure 2.1 – B320 Bevel Gear Operator



## 2.3 Inspection and Recording

Upon receipt of the gear operator, inspect the condition of the equipment and record nameplate information.

1. Carefully remove gear operator from shipping carton or skid. Thoroughly examine the equipment for any physical damage that may have occurred during shipment. If damaged, immediately report the damage to the transport company.
2. A nameplate is attached to each gear operator with the following information:
  - Operator Size
  - Limitorque Order Number
  - Ratio
  - Serial Number

Record this information for future reference, for ordering parts or obtaining further information.

Figure 2.2 – B320 Nameplate



## 2.4 Storage Procedure

**NOTE:** The following is the recommended storage procedure to retain maximum product integrity during storage. Failure to comply with recommended procedure will void the warranty.

### Storage (less than 1 year)

Operators should be stored in a clean, dry, protected warehouse and should be stored on wooden skids to protect the machined mounting flange. If the operators must be stored outside, they must be covered in polyethylene protection with silica gel crystals to absorb moisture. Input shafts should be rotated every three months to mix lubricant.

# 3

## Operator Weights

The approximate weights of the gear operators, with and without spur gear attachments, are provided below:

*Table 3.1 – Operator Weights*

| Operator | Without SGA |     | With SGA |     |
|----------|-------------|-----|----------|-----|
|          | lb.         | kg  | lb.      | kg  |
| B320-10  | 45          | 21  | 75       | 34  |
| B320-20  | 51          | 23  | 80       | 36  |
| B320-30  | 57          | 26  | 86       | 39  |
| B320-40  | 68          | 31  | 97       | 44  |
| B320-50  | 143         | 65  | 198      | 90  |
| B320-70  | 254         | 115 | 309      | 140 |
| B320-80  | 418         | 190 | 474      | 215 |
| B320-90  | 745         | 339 | 875      | 398 |

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# 4 Installation Instructions

## 4.1 Safety Precautions

- 
- ▲ **WARNING:** Read this Installation Manual carefully and completely before attempting to install, operate, or troubleshoot the Limitorque gear operator.
  - ▲ **WARNING:** Do not attempt to install or remove the bevel gear operator on a valve in a pressurized line.
  - ▲ **WARNING:** Do not attempt to energize an electric actuator fitted to the bevel gear operator without first checking the limit switch setting and correct motor rotation.
  - ▲ **WARNING:** Do not use a cheater on the handwheel.
- 

## 4.2 Safety Practices

The following check points should be performed to maintain safe operation of the B320 gear operator:

- Set up a periodic operating schedule on infrequently used valves.
- Ensure that the limit and/or torque switches on any electric actuator fitted to the bevel gear operator are correctly and appropriately adjusted.

## 4.3 Installation

The B320 series of gear operators has been designed to transmit torque as well as thrust. The gear operator can be supplied with a threaded stem nut, keyed stem nut, or a blank stem nut.

### 4.3.1 Installing an Operator with a Threaded Stem Nut

1. Position operator above the valve stem.
2. Rotate the operator handwheel or wrench nut several turns until there is positive engagement between the valve stem and the operator stem nut.
3. Rotate the handwheel to lower the operator onto the valve until contact has been made with the valve flange.
4. Bolt the gear operator securely to the valve mounting flange.

#### 4.3.2 Installing an Operator with a Blank Stem Nut (B320-10 through -90, one-piece)

1. Remove the thrust ring from the base of the operator.

---

**CAUTION: Care must be taken to ensure that the 'O' ring seals located on the ring are not damaged.**

---

2. Remove the stem nut assembly consisting of a bronze nut and two needle roller bearings with washers.
3. Remove bearings and washers. Place them in a clean and dry area until reassembly.
4. Machine the stem nut to suit the valve stem.

---

**CAUTION: Care should be taken to ensure that the clamping devices used during machining do not damage surfaces of the stem nut.**

---

5. Reassemble the operator, reversing steps 1, 2, and 3.
  - a. Install bearings and washers onto the bronze stem nut.
  - b. Install the assembly into the thrust base.
  - c. Bolt the thrust base assembly to the main housing.

---

**CAUTION: Ensure that no dirt or foreign material enters the operator.**

---

6. Using the specified lubricant, grease the thrust base assembly through the grease fitting. See **Section 5 Lubrication, and Figure 6.1, 6.2, 6.3, 6.4 and 6.5 for grease fitting location.**
7. Mount the operator on the valve as detailed in **Section 4.3.1, Installing an Operator with a Threaded Stem Nut.**

#### 4.3.3 Installing an Operator with a Blank Stem Nut (B320-90, two-piece)

1. Remove the key from the bottom of the operator. The key is located between the **Thrust Drive Sleeve** (piece #117) and the **Stem Nut** (piece #392). The key is tapped (1/4-20) to provide for removal.
2. Remove the **Stem Nut** by rotating in the proper direction (the **Stem Nut** is threaded into the **Thrust Drive Sleeve** (piece #394). A slot is provided on the end of the **Stem Nut** to aid in its removal.
3. Thread the **Stem Nut** to suit the valve stem.

---

**CAUTION: Do not clamp the splined area of the stem nut during the tapping operation.**

---

4. Reassemble the operator, reversing steps 1 and 2. **Stem Nuts** should be positioned flush with the **Thrust Drive Sleeve** but can be recessed inward approximately 1/4 inch, if so desired. **Stem Nuts** can also be positioned to extend below the **Thrust Drive Sleeve** approximately 1/4 inch without jeopardizing the thrust rating of the operator. All **Stem Nuts** are threaded on the outside diameter using eight threads per inch.
5. Mount the operator on the valve as detailed in **Section 4.3.1, Installing an Operator with a Threaded Stem Nut.**

# 5

## Lubrication

### Lubrication

The B320 bevel gear operators have a sealed gear case, factory-lubricated with grease. No seal can remain absolutely tight at all times. Therefore, it is not unusual to find a very small amount of weeping around shaft seals—especially during long periods of idleness such as storage. Using grease minimizes this condition as much as possible. If a small amount is weeping at start-up, remove it with a clean cloth. Once the equipment is operating on a regular basis, the weeping should stop.

#### 5.1 Lubrication Inspection

Inspect the B320 bevel gear operators for correct lubrication prior to operating—particularly following a storage period. We recommend the operators be checked during an overhaul program.

#### 5.2 Factory Lubricant

The B320 series operator gear case is factory-lubricated with EP-00 calcium complex base grease, suitable for temperatures from -20°F (-29°C) to 250°F (121°C).

---

**CAUTION: Do not mix lubricants of dissimilar bases.**

---

*Table 5.1 – Lubricant Quantities*

| Operator | Without SGA |     | With SGA |     |
|----------|-------------|-----|----------|-----|
|          | lb.         | kg  | lb.      | kg  |
| B320-10  | 0.7         | 0.3 | 1.2      | 0.6 |
| B320-20  | 0.7         | 0.3 | 1.2      | 0.6 |
| B320-30  | 1.2         | 0.6 | 1.7      | 0.8 |
| B320-40  | 1.2         | 0.6 | 1.7      | 0.8 |
| B320-50  | 2.2         | 1.0 | 2.7      | 1.2 |
| B320-70  | 4.0         | 1.8 | 4.5      | 2.0 |
| B320-80  | 4.0         | 1.8 | 4.5      | 2.0 |
| B320-90  | 4.2         | 1.9 | 6.7      | 3.1 |

### 5.3 Minimum Lubricant Qualities Required

The standard lubricants used by Limitorque have been proven to be extremely reliable over years of service. Lubricant substitute may be used; however, **Limitorque does require the following lubricant qualities as a minimum.**

The lubricant must

- contain an “EP” additive.
- be suitable for the temperature range intended.
- be water- and heat-resistant and non-separating.
- not create more than 8% swell in Buna N or Viton.
- not contain any grit, abrasive, or fillers.
- be slump-prefer NLGI-0 grade.
- not be corrosive to steel gears, balls, or roller bearings.
- have a dropping point above 316°F for temperature ranges of -20°F to 150°F (-28°C to 65°C).

# 6

## Disassembly and Reassembly

No special tools are required for assembly/disassembly of the B320 series bevel gear operators.

---

**▲ WARNING:** Valve must be in fully opened position with no pressure in the line to perform work on the gear operator.

---



---

**CAUTION:** During assembly, all removed components should be cleaned and placed in an area free of dirt, water, or other foreign material.

---



---

**CAUTION:** Care should be taken in removing the bevel gear load bearings. The load bearings are a series of hardened ground balls.

---

The table below indicates the number of ball bearings utilized by each B320 size:

*Table 6.1 – Quantity of Ball Bearings*

| Operator | Quantity |
|----------|----------|
| B320-10  | 42       |
| B320-20  | 42       |
| B320-30  | 57       |
| B320-40  | 57       |
| B320-50  | 53       |
| B320-70  | 74       |
| B320-80  | 80       |
| B320-90  | 66       |

## 6.1 Disassembly and Reassembly of B320-10 through -80

### 6.1.1 Disassembly

(Piece numbers refer to **Figures 6.1, 6.2, 6.3, and 6.4**).

1. Remove **Thrust Ring** (piece #5). Pull out **Stem Nut** (piece #4), **Washers** (piece #7) and **Bearings** (piece #6).
2. Remove **Endcover** (piece #20).
3. Slide out **Bevel Pinion Shaft/Bearing Subassembly** (piece #21, 22, and 23) together with **Shims** (piece #25).
4. Remove **Housing** (piece #1) from **Base** (piece #2).
5. Remove **Bevel Gear** (piece #3) and **Ball Bearings** (piece #8).

**NOTE:** Please note the number and position of each shim.

### 6.1.2 Reassembly

(Piece numbers refer to **Figures 6.1, 6.2, 6.3, and 6.4**).

1. Install **Ball Bearings** (piece #8) and **Bevel Gear** (piece #3) on **Base** (piece #2).
2. Attach **Housing** (piece #1) to **Base** (piece #2).
3. Slide in **Bevel Pinion Shaft/Bearing Subassembly** (piece #21, 22, and 23) together with **Shims** (piece #25).
4. Attach **Endcover** (piece #20).
5. Insert **Thrust Washer** (piece #7), **Needle Bearing** (piece #6) and another **Thrust Washer** (piece #7).
6. Insert **Stem Nut** (piece #4)
7. Insert **Thrust Washer** (piece #7), **Needle Bearing** (piece #6) and another **Thrust Washer** (piece #7).
8. Attach **Thrust Ring** (piece #5).

**NOTE:** Gasket compound is to be used on all metal/metal faces.

Figure 6.1 – B320-10 and 20 Parts Diagram

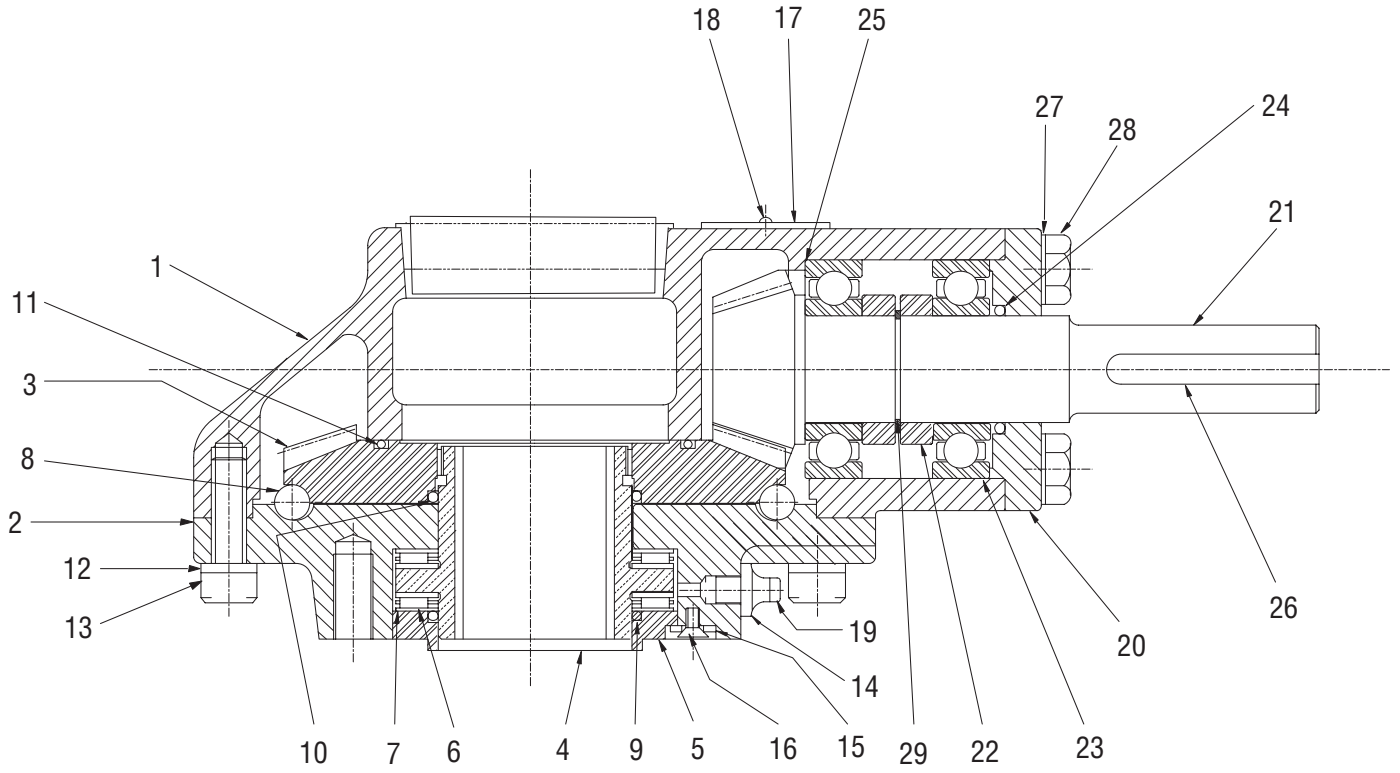


Figure 6.2 – B320-30 and -40 Parts Diagram

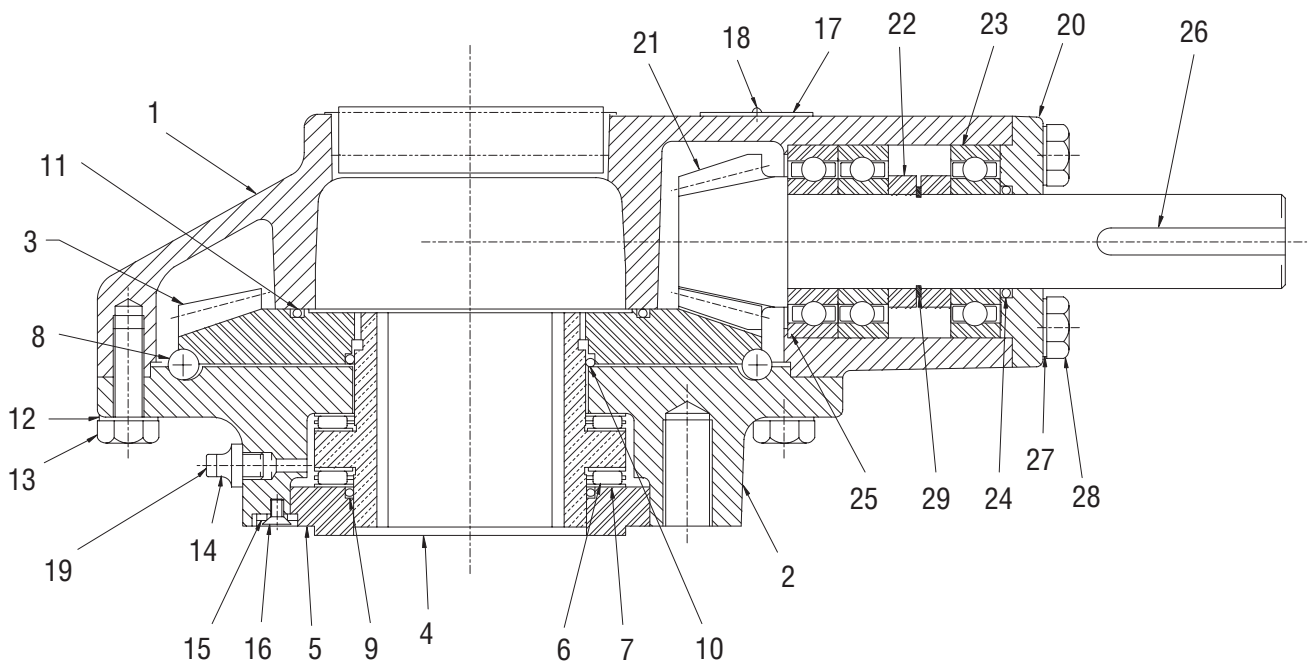


Figure 6.3 – B320-50 and -70 Parts Diagram

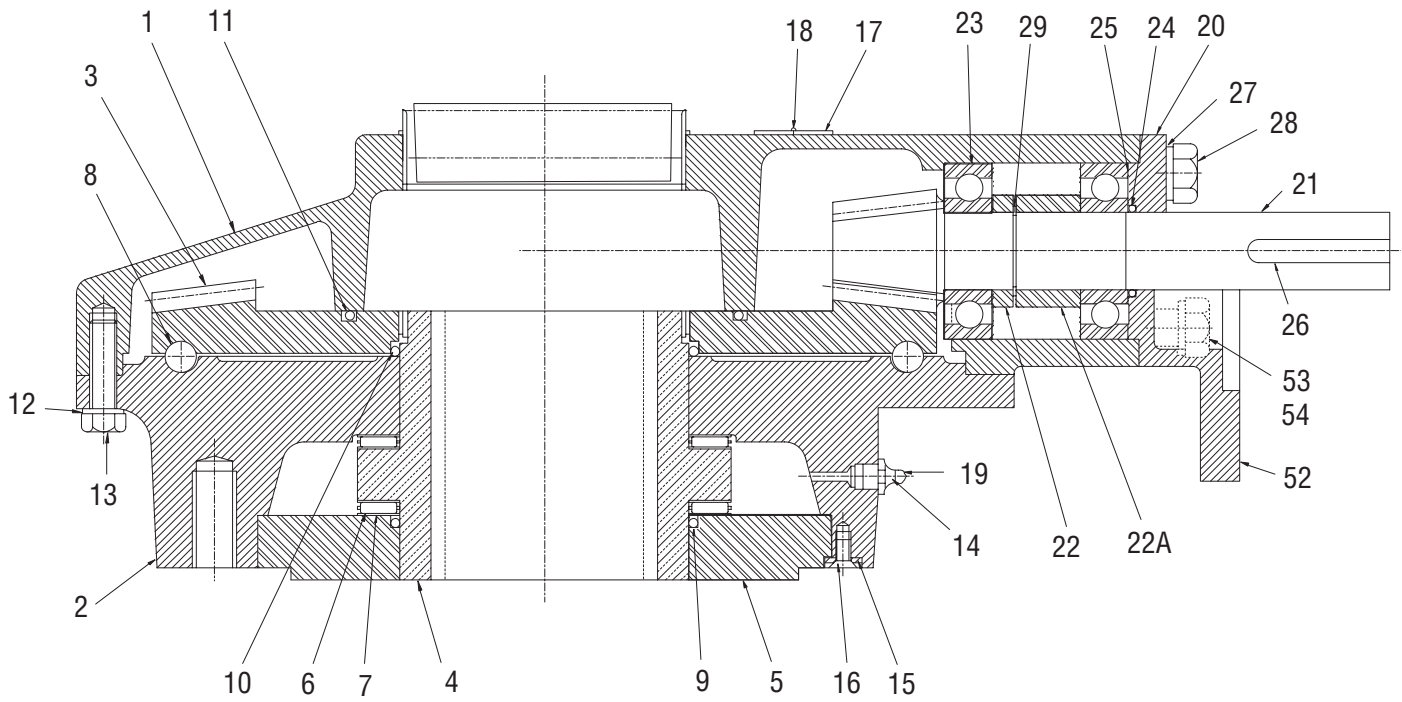


Figure 6.4 – B320-80 Parts Diagram

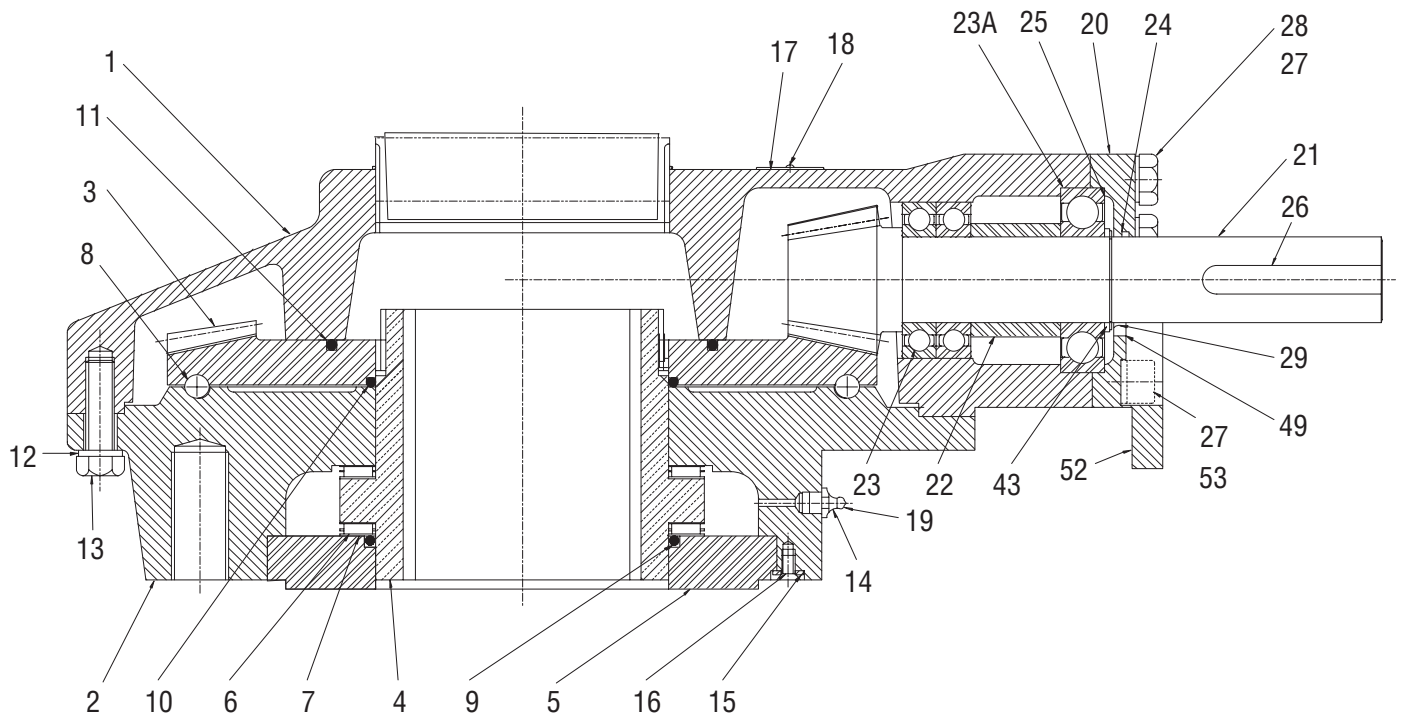


Table 6.2– Common Parts List

| Piece         | Quantity | Description             |
|---------------|----------|-------------------------|
| 1             | 1        | Housing                 |
| 2             | 1        | Base                    |
| 3             | 1        | Bevel Gear              |
| 4             | 1        | Stem Nut                |
| 5             | 1        | Thrust Ring             |
| 6             | 2        | Needle Bearing          |
| 7             | 4        | Thrust Washer           |
| 8             | A/R      | Ball Bearings           |
| 9             | 1        | 'O' Ring                |
| 10            | 1        | 'O' Ring                |
| 11            | 1        | 'O' Ring                |
| 12            | A/R      | Lockwasher              |
| 13            | A/R      | Hex Head Cap Screw      |
| 14            | 1        | Grease Fitting          |
| 15            | 1        | Plain Washer            |
| 16            | 1        | Flat Head Mach. Screw   |
| 17            | 1        | Nameplate               |
| 18            | 2        | Drive Screw             |
| 19            | 1        | Grease Fitting Cap      |
| 20            | 1        | Endcover                |
| 21            | 1        | Bevel Pinion            |
| 22 (B320-20)  | 2        | Spacer                  |
| 23 (B320-20)  | 2        | Ball Bearing            |
| 22 (B320-40)  | 2        | Spacer                  |
| 23 (B320-40)  | 3        | Ball Bearing            |
| 22 (B320-50)  | 2        | Spacer                  |
| 23 (B320-50)  | 2        | Ball Bearing            |
| 22 (B320-70)  | 1        | Spacer                  |
| 22A (B320-70) | 1        | Spacer                  |
| 23 (B320-70)  | 2        | Spacer                  |
| 22 (B320-80)  | 1        | Spacer                  |
| 23 (B320-80)  | 2        | Ball Bearing            |
| 23A (B320-80) | 1        | Ball Bearing            |
| 24            | 1        | 'O' Ring                |
| 25            | A/R      | Shim                    |
| 26            | 1        | Key                     |
| 27            | 4        | Lockwasher              |
| 28            | 4        | Hex Head Cap Screw      |
| 29            | 1        | Circlip                 |
| 43 (B320-80)  | 1        | Washer                  |
| 52            | 1        | Motorized Adapter       |
| 53            | 1        | Lockwasher              |
| 54            | 1        | Hex Head Cap Screw      |
| 56 (B320-50)  | 1        | Spacer Ring (not shown) |

**NOTE:** A/R—as required

## 6.2 Disassembly and Reassembly of B320-90

### 6.2.1 Disassembly

Piece numbers refer to **Figure 6.5**.

1. Remove **Thrust Plate** (piece #118) followed by **Stem Nut** (piece #392, two-piece) and **Drive Sleeve** (piece #117, 2-piece; piece #394, one-piece) and **Roller Bearings** (piece #115 and 116).
2. Remove **Bevel Cap** (piece #94) and withdraw **Bevel Pinion/Bearing Subassembly** (piece #95, #103 and #104).
3. Remove **Bevel Housing** (piece #91) from **Thrust Housing** (piece #114).
4. Remove **Bevel Gear/Torque Drive Sleeve** subassembly (piece #93 and 96) and **Ball Bearings** (piece #102).

### 6.2.2 Reassembly

Piece numbers refer to **Figure 6.5**.

1. Install **Ball Bearings** (piece #102) and **Bevel Gear/Torque Drive Sleeve** subassembly (piece #93 and 96).
2. Attach **Bevel Housing** (piece #91) to **Thrust Base** (piece #114).
3. Attach **Bevel Cap** (piece #94) and **Bevel Pinion/Bearing Subassembly** (piece #95, #103 and #104).
4. Install **Roller Bearings** (piece #115 and 116) and **Stem Nut** (piece #392, two-piece) and **Drive Sleeve** (piece #117, two-piece; piece #394, one-piece), followed by **Thrust Plate** (piece #118).

Figure 6.5 – B320-90 Parts Diagram

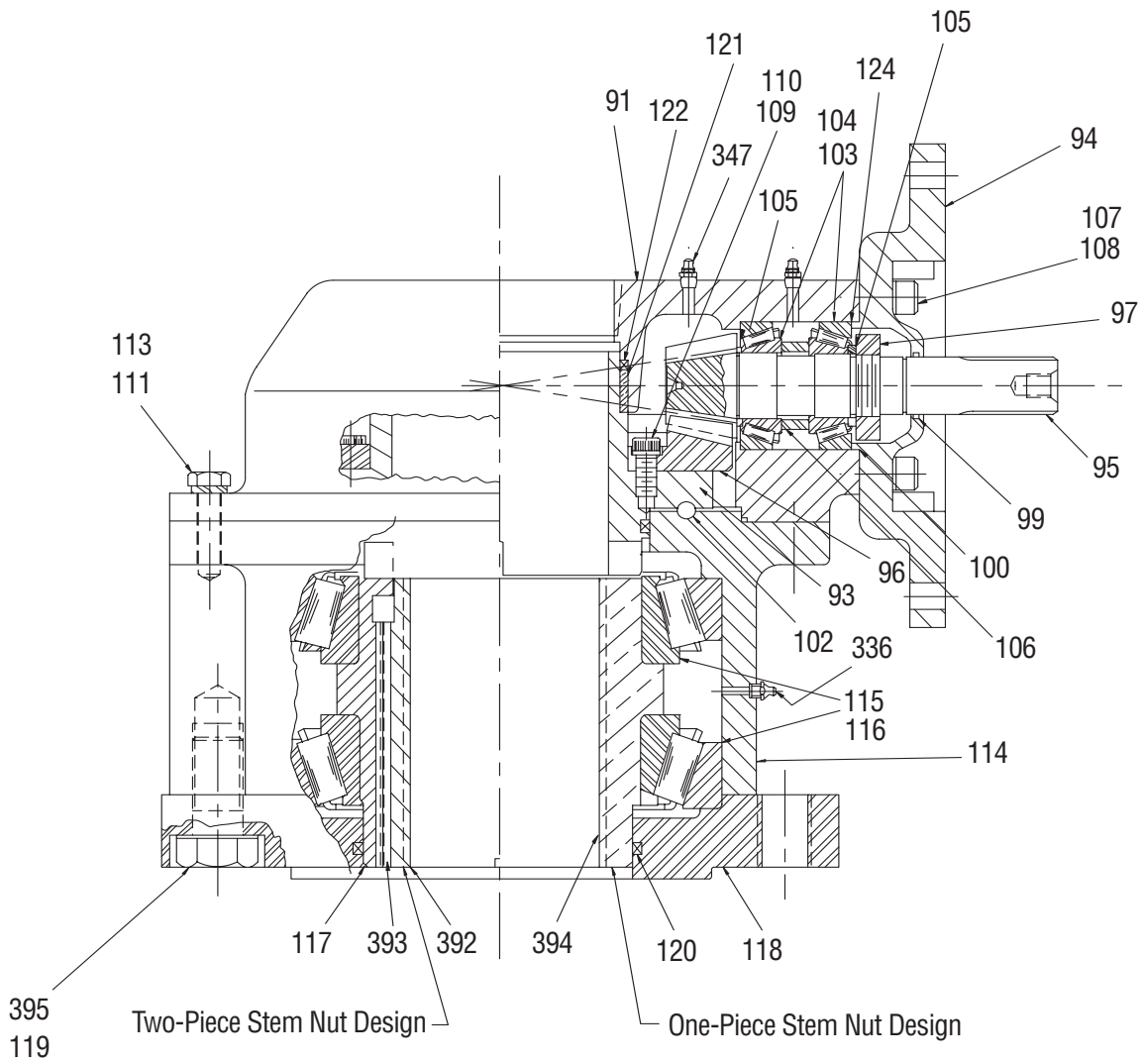


Table 6.3 – B320-90 Parts List

| Piece | Quantity | Description                |
|-------|----------|----------------------------|
| 91    | 1        | Bevel Housing              |
| 93    | 1        | Torque Drive Sleeve        |
| 94    | 1        | Bevel Cap                  |
| 95    | 1        | Input Shaft/Pinion         |
| 96    | 1        | Bevel Gear                 |
| 97    | 1        | Threaded Collar            |
| 99    | 1        | Quad Ring                  |
| 100   | 1        | 'O' Ring                   |
| 102   | 66       | Ball Bearing               |
| 103   | 2        | Roller Bearing Cone        |
| 104   | 2        | Roller Bearing Cup         |
| 105   | 2        | Spacer-Pinion              |
| 106   | 1        | Spacer-Input Bearing       |
| 107   | 6        | Hex Head Cap Screw         |
| 108   | 6        | Lockwasher                 |
| 109   | 12       | Soc Head Cap Screw         |
| 110   | 12       | Lockwasher                 |
| 111   | 6        | Hex Head Cap Screw         |
| 113   | 6        | Lockwasher                 |
| 114   | 1        | Thrust Housing             |
| 115   | 2        | Roller Bearing Cone        |
| 116   | 2        | Roller Bearing Cup         |
| 117   | 1        | Thrust Drive Sleeve (2-pc) |
| 118   | 1        | Thrust Plate               |
| 119   | 8        | Hex Head Cap Screw         |
| 120   | 1        | Quad Ring                  |
| 121   | 1        | Bushing                    |
| 122   | 1        | Quad Ring                  |
| 336   | 1        | Grease Fitting             |
| 347   | 1        | Grease Fitting             |
| 392   | 1        | Stem Nut                   |
| 393   | 1        | Key                        |
| 394   | 1        | Thrust Drive Sleeve (1-pc) |
| 395   | 1        | Lockwasher                 |

## 6.3 Disassembly and Reassembly of Spur Gear Attachments

### 6.3.1 Disassembly of 3:1 Spur Gear Attachment for B320-10 through -40

Piece numbers refer to **Figure 6.6** and **Table 6.4**.

1. Remove **Hex Head Cap Screws**(piece #34) and **Lockwashers** (piece #35).
2. Remove the **Spur Gear Cover** (piece #31) and **O-Ring** (piece #46), followed by the **Input Shaft and Pinion** (piece #37), **Idler Gear** (piece #38), and **Output Gear** (piece #40).
3. Remove the **Snap Ring** (piece #29).
4. Remove the **Hex Head Cap Screw** (piece #28) and **Lockwasher** (piece #27).
5. Remove the **Spur Gear Housing** (piece #30).
6. Continue disassembly as detailed in **Section 6.1. Disassembly and Reassembly – 320-10 through -80**.

### 6.3.2 Reassembly of 3:1 Spur Gear Attachment for B320-10 through -40

1. Install the **Spur Gear Housing** (piece #30), using the **Hex Head Cap Screw** (piece #28) and **Lockwashers** (piece #27).
2. Install the **Snap Ring** (piece #29).
3. Install the **Output Gear** (piece #40), **Idler Gear** (piece #38), and **Input Shaft and Pinion** (piece #37).
4. Install the **O-Ring** (piece #46) and **Spur Gear** (piece #31), using the **Hex Head Cap Screws** (piece #34) and **Lockwashers** (piece #35)

Figure 6.6 – 3:1 SGA Parts Diagram for B320-10 through -40

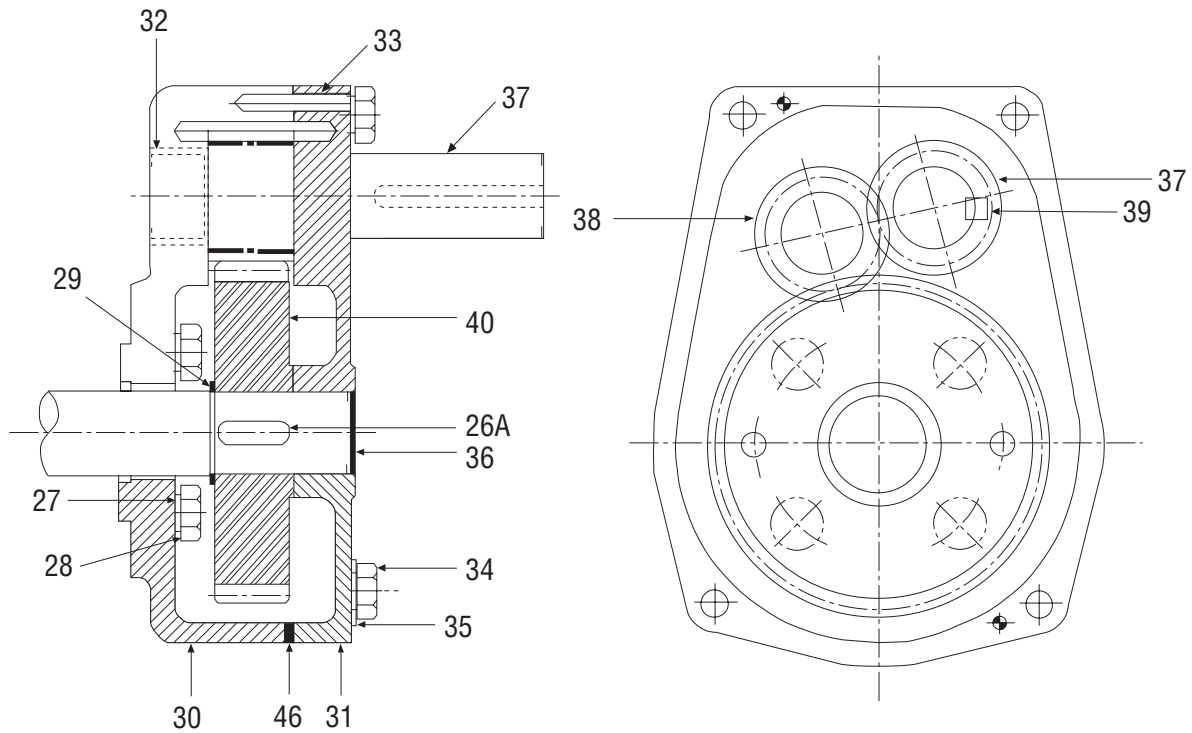


Table 6.4 – 3:1 SGA Parts List for B320-10 through -40

| Piece | Quantity | Description            |
|-------|----------|------------------------|
| 26A   | 1        | Key                    |
| 27    | 4        | Lockwasher             |
| 28    | 4        | Hex Head Cap Screw     |
| 29    | 1        | Snap Ring              |
| 30    | 1        | Spur Gear Housing      |
| 31    | 1        | Spur Gear Cover        |
| 32    | 5        | Bushing                |
| 33    | 2        | Dowel Pin              |
| 34    | 4        | Hex Head Cap Screw     |
| 35    | 4        | Lockwasher             |
| 36    | 2        | Expansion Plug         |
| 37    | 1        | Input Shaft and Pinion |
| 38    | 1        | Idler Gear             |
| 39    | 1        | Key                    |
| 40    | 1        | Output Gear            |
| 46    | 1        | 'O' Ring               |

### 6.3.3 **Disassembly of 6.3:1, 10.3:1, and 10.8:1 Spur Gear Attachments for B320-50, -70, and -80**

Piece numbers refer to **Figure 6.7** and **Table 6.5**.

1. Remove the **Hex Head Cap Screws** (piece #47) and **Lockwashers** (piece #35).
2. Remove the **End Cover** (piece #44) and **O-Ring** (piece #46), followed by the **Input Shaft and Pinion** (piece #37) and outer **Ball Bearing** (piece #45).
3. Remove the **Hex Head Cap Screw** (piece #34) and **Lockwasher** (piece #35).
4. Remove the **Spur Gear Cover** (piece #31), followed by the **Idler Shaft** subassembly (piece #48), inner **Ball Bearing** (piece #45), and **Final Gear** (piece #40).
5. Remove the **Socket Head Cap Screws** (piece #53) and **Lockwashers** (piece #54).
6. Remove the **Spur Gear Housing** (piece #30).
7. Continue disassembly as detailed in **Section 6.1, Disassembly and Reassembly of B320-10 through -80**.

### 6.3.4 **Reassembly of 6.3:1, 10.3:1, and 10.8:1 Spur Gear Attachments for B320-50, -70, and -80**

1. Install the **Spur Gear Housing** (piece #30), using the **Socket Head Cap Screws** (piece #53) and **Lockwashers** (piece #54).
2. Install the **Final Gear** (piece #40), inner **Ball Bearings** (piece #45), **Idler Shaft** subassembly (piece #48), and the **Spur Gear Cover** (piece #31).
3. Install the **Spur Gear Cover** (piece #31), using the **Hex Head Cap Screws** (piece #34) and **Lockwashers** (piece #35).
4. Install the outer **Ball Bearing** (piece #45) and **Input Shaft and Pinion** (piece #37).
5. Install the **O-Ring** (piece #46) and **End Cover** (piece #44), using the **Hex Head Cap Screws** (piece #47) and **Lockwashers** (piece #35).

Figure 6.7 – 6.3:1, 10.3:1, and 10.8:1 SGA Parts Diagram for B320-50 through 80

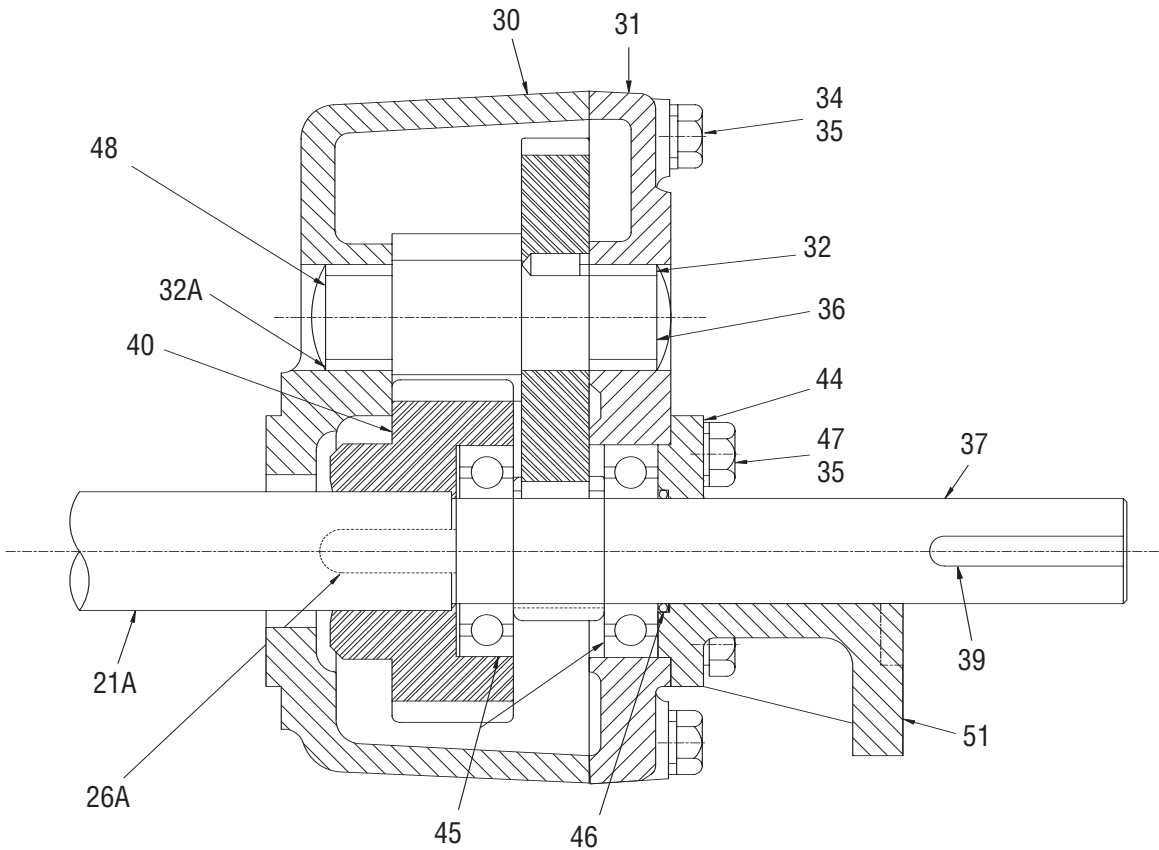


Table 6.5 – 6.3:1, 10.3:1, and 10.8:1 SGA Parts List for B320-50 through 80

| Piece | Quantity | Description                                  |
|-------|----------|--|
| 21A   | 1        | Spur Pinion                                  |
| 26A   | 2        | Key  |
| 30    | 1        | Spur Gear Housing                            |
| 31    | 1        | Spur Gear Cover                              |
| 32    | 1        | Bushing                                      |
| 32A   | 1        | Bushing                                      |
| 33    | 2        | Dowel Pin (not shown)                        |
| 34    | 8        | Hex Head Cap Screw                           |
| 35    | 12       | Lockwasher                                   |
| 36    | 2        | Plug   |
| 37    | 1        | Input Shaft & Pinion                         |
| 39    | 1        | Key  |
| 40    | 1        | Final Gear                                   |
| 44    | 1        | Endcover                                     |
| 45    | 2        | Ball Bearing                                 |
| 46    | 1        | 'O' Ring                                     |
| 47    | 4        | Hex Head Cap Screw                           |
| 48    | 1        | Idler Shaft Subassembly                      |
| 51    | 1        | Motorized Adapter (if required)              |
| 53    | 8        | Socket Head Cap Screw (internal, not shown)  |
| 54    | 8        | Lockwasher (Hi Collar) (internal, not shown) |

### 6.3.5 Disassembly of 5:1 Spur Gear Attachment for B320-90

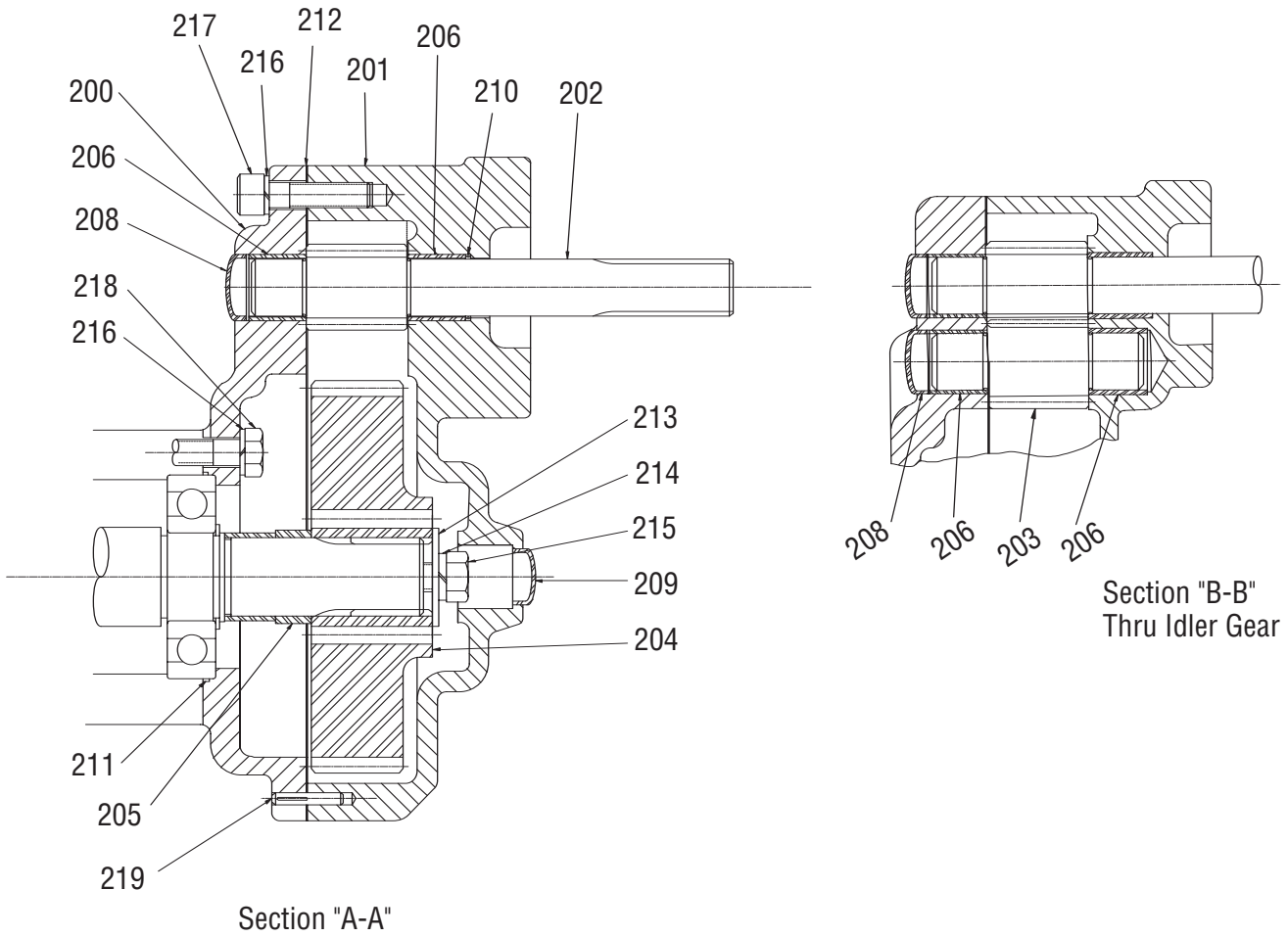
Piece numbers refer to **Figure 6.8** and **Table 6.6**.

1. Remove the **Socket Head Cap Screws** (piece #217) and **Lockwashers** (piece #216) to remove the **Housing** (piece #201).
2. Remove the **Housing** complete with the **Input Shaft and Pinion** (piece #202) and **Idler Gear** (piece #203).
3. Remove the **Hex Head Cap Screw** (piece #215), **Lockwasher** (piece #214), and **Flat Washer** (piece #213).
4. Remove the **Output Gear** (piece #204).
5. Remove the **Hex Head Cap Screw** (piece #218) and **Lockwasher** (piece #216).
6. Remove the **Adapter Plate** (piece #200) and **O-Ring** (piece #211).
7. Continue disassembly as detailed in **Section 6.1, Disassembly and Reassembly of B320-90**.

### 6.3.6 Reassembly of 5:1 Spur Gear Attachment for B320-90

1. Install the **O-Ring** (piece #211) and **Adapter Plate** (piece #200), using the **Hex Head Cap Screws** (piece #218) and **Lockwashers** (piece #216).
2. Install the **Output Gear** (piece #204).
3. Install the **Flat Washer** (piece #213), **Lockwasher** (piece #214), and **Hex Head Cap Screw** (piece #215).
4. Install the **Idler Gear** (piece #203) and the **Input Shaft and Pinion** (piece #202) into the **Housing** (piece #201).
5. Apply liquid gasket to the **Adapter Plate** flange and install the **Housing** assembly (piece #210, #202, and #203), using the **Socket Head Cap Screws** (piece #217) and **Lockwashers** (piece #216).

Figure 6.8 – 5:1 SGA Parts Diagram for B320-90



*Table 6.6 – 5:1 SGA Parts List for B320-90*

| Piece | Quantity | Description                |
|-------|----------|----------------------------|
| 200   | 1        | Adapter Plate              |
| 201   | 1        | Housing                    |
| 202   | 1        | Input Shaft and Pinion     |
| 203   | 1        | Idler Gear                 |
| 204   | 1        | Output Gear                |
| 205   | 1        | Spacer                     |
| 206   | 4        | Teflon Bearing             |
| 208   | 2        | Expansion Plug             |
| 209   | 1        | Expansion Plug             |
| 210   | 1        | Quad Ring                  |
| 211   | 1        | 'O' Ring                   |
| 212   | 1        | Gasket                     |
| 213   | 1        | Flat Washer                |
| 214   | 1        | Lockwasher                 |
| 215   | 1        | Hex Head Cap Screw         |
| 216   | 13       | Lockwasher                 |
| 217   | 7        | Socket Head Cap Screw      |
| 218   | 6        | Hex Head Cap Screw         |
| 219   | 2        | Dowel Pin                  |
| 347   | 1        | Grease Fitting (not shown) |

### 6.3.7 Disassembly of 17.5:1 Spur Gear Attachment for B320-90

Piece numbers refer to **Figure 6.9** and **Table 6.7**.

1. Remove **Socket Head Cap Screws** (piece #220) and **Lockwashers** (piece #221) to remove the **Housing Cover** (piece #201). The **Input Shaft and Pinion** (piece #202, 207, 208 ad 211) are removed with the **Housing Cover** (piece #201).

**NOTE:** If the Input Shaft is horizontal, exercise caution when removing the Housing Cover. Prepare to support the 2nd Set Input Shaft Assembly (piece# 204, #205, and #206)

2. Remove the **1st Set Output Gear** (piece #203), the **2nd Set Input Shaft** (piece #204), and the **2nd Set Input Gear** (piece #205).
3. Remove the **Socket Head Screw** (piece #218), **Lockwasher** (piece #217), and the **Flat Washer** (piece #216).
4. Remove the **2nd Set Output Gear** (piece #206).
5. Remove the **Hex Head Cap Screw** (piece #222) and **Lockwashers** (piece #223), and remove the **Housing** (piece #200) and **O-Ring** (piece #212).
6. Continue disassembly as detailed in **Section 6.2, Disassembly & Reassembly – B320-90**.

### 6.3.8 Reassembly of 17.5:1 Spur Gear Attachment for B320-90

1. Install **O-Ring** (piece #212) and **Housing** (piece #200) using the **Hex Head Cap Screws** (piece #222) and **Lockwashers** (piece #223).
2. Install the **2nd Set Output Gear** (piece #206).
3. Install the **Flat Washer** (piece #216), **Lockwasher** (piece #217), and **Socket Head Cap Screws** (piece #218).
4. Install the **2nd Set Input Gear** (piece #205), **2nd Set Input Shaft** (piece #204), and **1st Set Output Gear** (piece #203).
5. Apply liquid gasket to the flange surface of the **Housing** (piece #200), and install the **Housing Cover** (piece #201) using **Lockwashers** (piece #221) and **Socket Head Cap Screws** (piece #220).

Figure 6.9 - 17.5:1 SGA Parts Diagram for B320-90

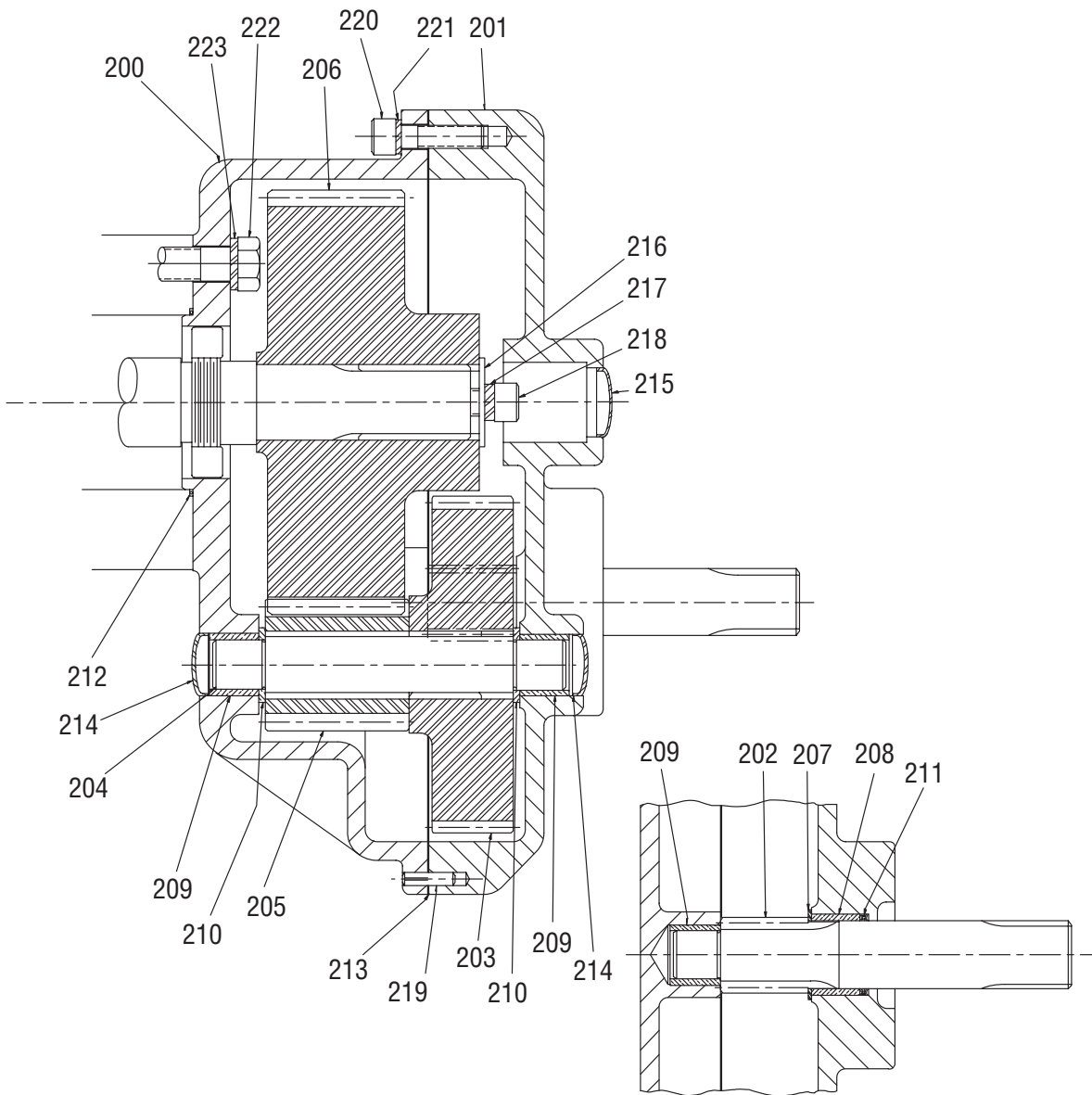


Table 6.7 – 17.5:1 SGA Parts List for B320-90

| Piece | Quantity | Description                |
|-------|----------|----------------------------|
| 200   | 1        | Housing                    |
| 201   | 1        | Housing Cover              |
| 202   | 1        | 1st Set Input Shaft/Pinion |
| 203   | 1        | 1st Set Output Gear        |
| 204   | 1        | 2nd Set Input Shaft        |
| 205   | 1        | 2nd Set Input Gear         |
| 206   | 1        | 2nd Set Output Gear        |
| 207   | 1        | Spacer                     |
| 208   | 1        | Bushing                    |
| 209   | 3        | Bushing                    |
| 210   | 2        | Thrust Washer              |
| 211   | 1        | Quad Ring                  |
| 212   | 1        | 'O' Ring                   |
| 213   | 1        | Gasket                     |
| 214   | 2        | Expansion Plug             |
| 215   | 1        | Expansion Plug             |
| 216   | 1        | Flatwasher                 |
| 217   | 1        | Lockwasher                 |
| 218   | 1        | Socket Head Cap Screw      |
| 219   | 2        | Dowel Pin                  |
| 220   | 8        | Socket Head Cap Screw      |
| 221   | 8        | Lockwasher                 |
| 222   | 6        | Hex Head Cap Screw         |
| 223   | 6        | Lockwasher                 |
| 347   | 1        | Grease Fitting (not shown) |

# 7

## How to Order Parts

To order parts or obtain further information for your Limitorque bevel gear operators, contact your local Limitorque distributor, sales office, or:

Limitorque  
5114 Woodall Road  
P.O. Box 11318  
Lynchburg, VA 24506-1318

Phone (434) 528-4400  
Fax (434) 845-9736  
<http://www.limitorque.com>

All inquiries or orders must be accompanied by the following information:

1. Operator size
2. Limitorque order number
3. Limitorque serial number



## **Australian Distributor for Limitorque**

Acrodyne Pty Ltd  
14/11 Havelock Road  
Bayswater, Victoria 3153  
Australia  
Phone 03-8727-7800  
Fax 03-9729-8699