

Disassembly and Reassembly for WG Series Worm Gear Operator

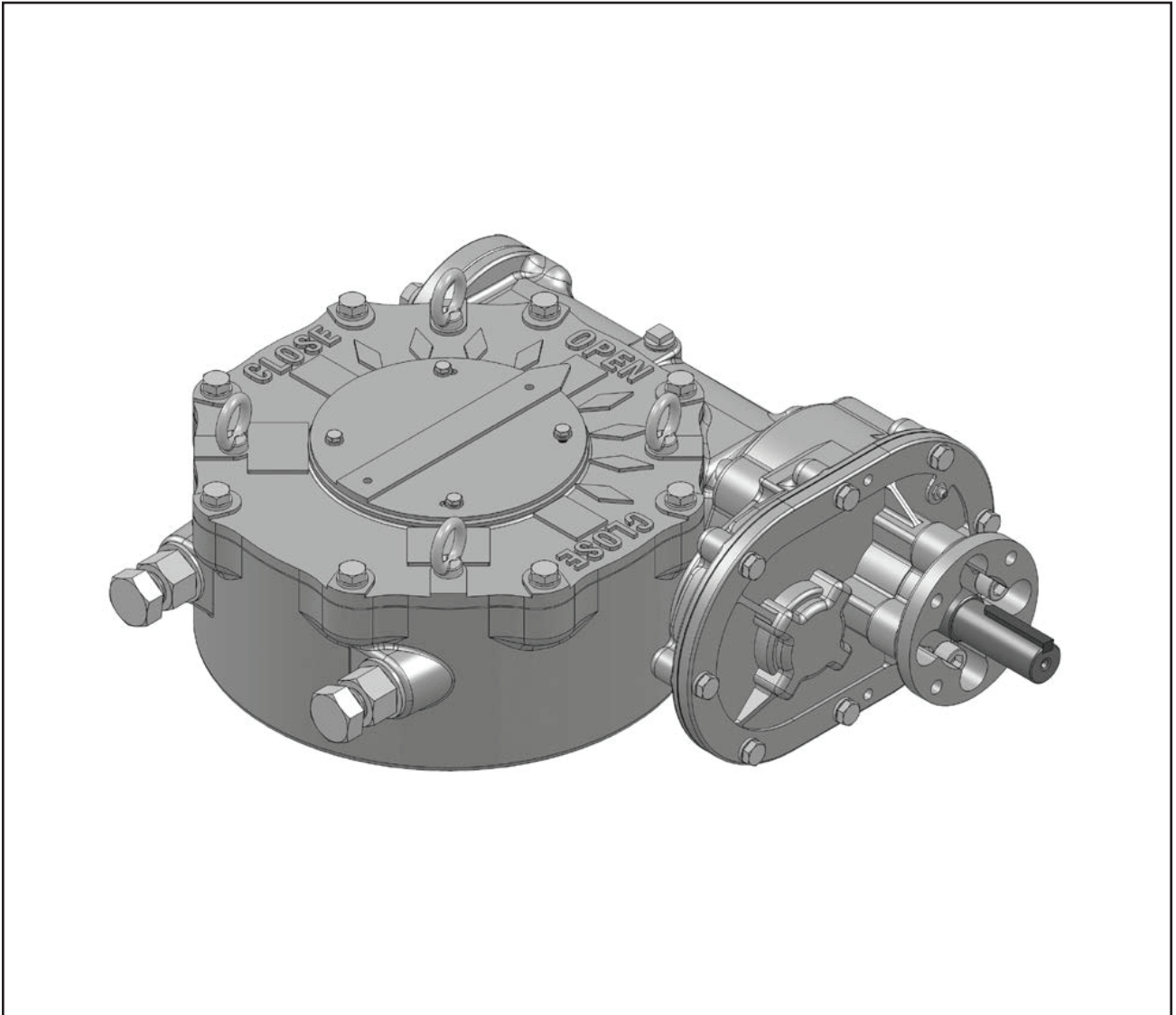


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Section 1: Introduction

1.1 Purpose

The installation and operation manual (IOM) explains how to install and maintain the Emerson WG operator. Information on installation, disassembly, reassembly, 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 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, voiding of the warranty, or operational difficulty.

Safety notice is 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.

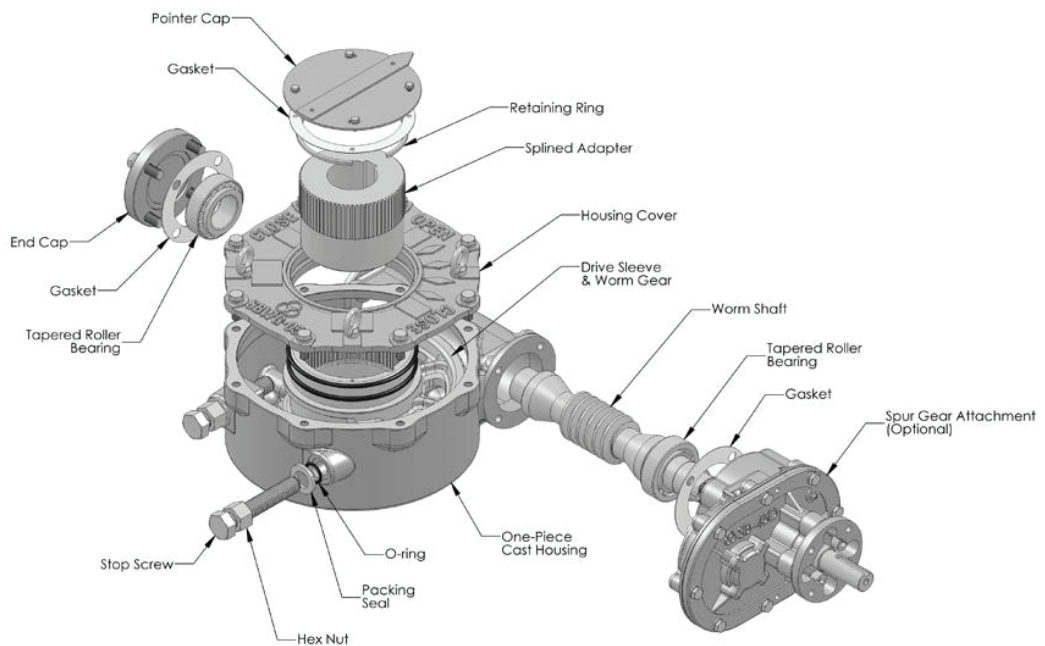
NOTE:

Highlights information critical to the user's understanding of the operator's installation and operation.

Section 2: Inspection, Installation and Mounting Procedures

2.1 Worm Gear (WG) Exploded View

Figure 1 The Typical WG



⚠ WARNING: DO NOT OPERATE USING CHEATER BARS

Do not manually operate the WG operator with devices other than the installed handwheel or wrench nut. Using additive force devices (cheater bars, wheel wrenches, pipe wrenches, or other devices of this nature) on the operator handwheel, wrench or wrench nut may cause serious personal injury and/or damage to the operator or valve.

2.2 Inspection and Recording

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

1. Carefully remove 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 operator with the following information:
 - Operator size
 - Assembly position
 - Order number
 - Serial number
 - Customer tagging

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

2.3 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 one year)

Store operators on wooden skids to protect the machined mounting flange. Place the wooden skids containing the operators in a clean, dry, protected warehouse. If the operators must be stored outside, they must be covered in polyethylene protection with silica gel crystals to absorb moisture. If an electric actuator is attached to the WG, refer to the storage procedures in its respective manual for appropriate storage procedures. Rotate input shafts every three months to mix the lubricant.

2.4 General Mounting Instructions

⚠ CAUTION: ENSURE CORRECT ORIENTATION

To avoid the potential for disengaging the worm gear segment, ensure that the pointer cap pointer is oriented to the mid-point of the 90-degree valve travel. Full stroke rotation of the quadrant should not move the pointer past the corresponding Open or Close ID marks on the housing cover.

The mounting instructions for the WG Series worm gearboxes are outlined below. The WG-00 through WG-35 gearboxes are designed with a bottom entry splined adapter. The WG-04 through WG-12 gearboxes are designed with a top entry splined adapter. A separate set of instructions for each design is provided. See Section 2.4.1 for the WG-00 through WG-35 and Section 2.4.2 for the WG-04 through WG-12.

2.4.1 WG-00 through WG-35

1. Place the valve disk in the full closed position.

NOTE:

If the splined adapter is already installed in the operator, go to step 6.

2. Remove the pointer cap (see Section 4 for removal instructions).
3. Turn the gearbox upside down so that the bottom of the housing is accessible.
4. Remove the retaining ring, and install the splined adapter.

NOTE:

The notch in the worm gear at the closed position must be aligned with the keyway in the splined adapter.

-
5. Reinstall the retaining ring.
 6. Place the gearbox in the upright position so that the top of the gearbox is accessible.
 7. Mount the operator on the valve and bolt securely.
 8. Rotate the input shaft to align the keyway of the splined adapter with the keyway of the valve shaft and install the key.
 9. Confirm that the gearbox stop screws are properly set for valve disk travel in both the open and close directions of travel. See Section 2.6.
 10. Reinstall the pointer cap.

2.4.2 WG-04 through WG-12

1. Place the valve disk in the full closed position.
2. Remove the pointer cap (see Section 4 for removal instructions).

NOTE:

If the splined adapter is already installed in the operator, go to step 6.

-
3. Remove the retaining ring and install the splined adapter.

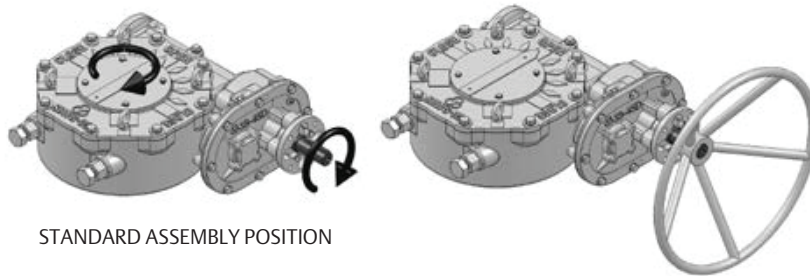
NOTE:

The notch in the worm gear at the closed position must be aligned with the keyway in the splined adapter.

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4. Reinstall the retaining ring.
 5. Mount the operator on the valve and bolt securely.
 6. Rotate the input shaft to align the keyway of the splined adapter with the keyway of the valve shaft and install the key.
 7. Confirm that the gearbox stop screws are properly set for valve disk travel in both the open and close directions of travel. See Section 2.6.
 8. Reinstall the pointer cap.

2.5 Assembly Positions

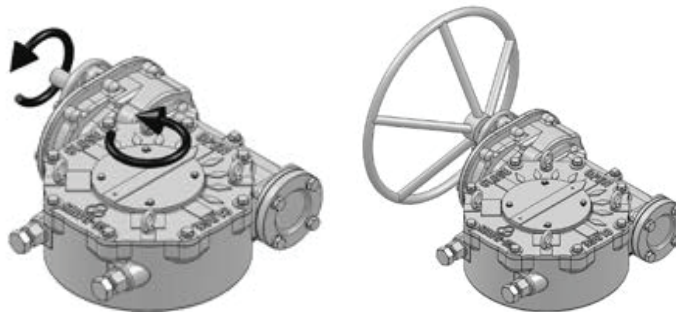
Figure 2 Position A



STANDARD ASSEMBLY POSITION

Clockwise Input Rotation
Clockwise Output Rotation

Figure 3 Position D



OPTIONAL ASSEMBLY POSITION

Clockwise Input Rotation
Counterclockwise Output Rotation

2.6 Setting Position Limit Stops WG-00 Through WG-12

Refer to Figure 2.4

1. Loosen the hex nut (pc# 16) and turn it several turns to allow for stop screw adjustment.
2. Adjust the stop screw by turning it counterclockwise to back the screw away from the worm gear/drive sleeve (pc# 5).
3. Place the valve disk in the full closed position.
4. Turn the stop screw (pc# 15) in the clockwise direction until the end of the screw contacts the worm gear/drive sleeve.
5. Tighten the hex nut to secure the closed set position.
6. Move the valve disk to the full open position.
7. Follow steps 1 through 5.

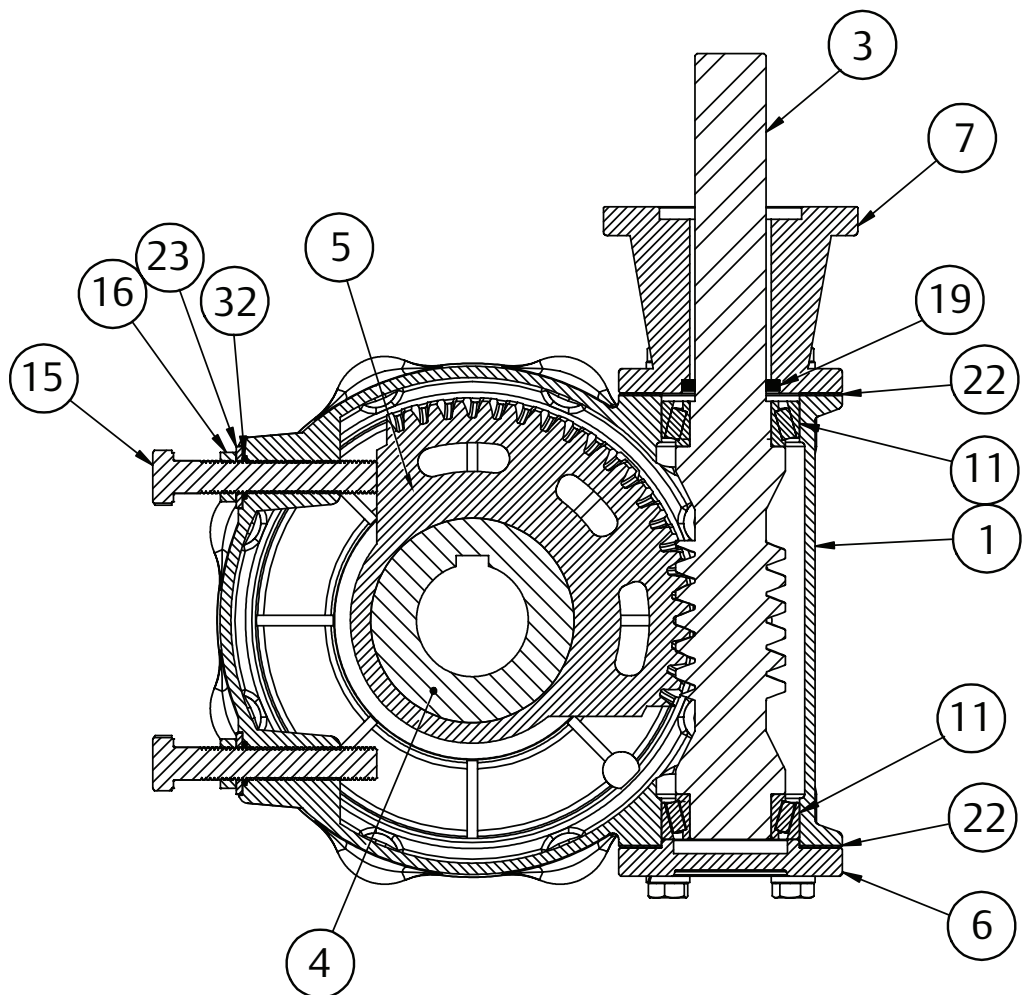
⚠ CAUTION: OBSERVE ACTUATOR LIMIT SWITCHES

If the valve is operated with an electric actuator/gear operator combination, and the valve is position-seated, set the actuator limit switches to trip prior to engagement of the worm gear/drive sleeve with the stop screws. Damage to the operator could result from the worm gear/drive sleeve contacting the stop screw under motorized operation.

NOTE:

The stops are adjustable to +/- 5° of total travel to allow for proper positioning of the worm gear quadrant.

Figure 4 Setting Position Limit Stops – WG-00 through WG-12



Section 3: Lubrication

3.1 Operator Lubricants

Emerson WG operators are shipped with the following lubricants:

Table 1. Lubricants

Product	Lubricant	Soap Base	Temperature Range
WG-00 through WG-10	Zenith LH 2	Calcium	-40°C to 90°C (-40°F to 194°F)

NOTE:

The lubricant should be checked every 18 months for manual operators.

⚠ CAUTION: USE THE CORRECT LUBRICANT

Do not add a different lubricant to a Emerson operator unless it is of the same soap base as the existing lubricant, or you have received the approval of the lubricant manufacturer.

Quantity

Emerson operators are built to operate on the partial immersion principle. The primary concern regarding the amount of lubricant is whether the “worm” is totally immersed in grease. This can be verified by the use of one or more of the “fill” and “drain” plugs provided on the operator housing in most sizes.

Quality

When removing a fill or drain plug to inspect the lubricant level, remove a small amount and ensure that it is clean and free of any contaminant, including water. Should dirt, water or other foreign matter be found, the operators should be flushed with a commercial degreaser/cleaner which is non-corrosive and does not affect seal materials such as Buna-N or Viton. Repack operator with fresh lubricant.

Consistency

The main gear box lubricant should be slightly fluid, approximating a standard NLGI-2 grade consistency or less.

Alternate lubricants may be used in place of the standard lubricants supplied by Emerson, provided they are of a formulation similar to those listed above for the respective product.

Section 4: Disassembly and Reassembly Instructions

4.1 Safety Precautions

⚠ WARNING: OPERATE CAREFULLY

Read this Installation, Operation and Maintenance manual carefully and completely before attempting to install, operate or troubleshoot the Emerson operator.

Potential high-pressure vessel — be aware of high-pressure hazards associated with the attached valve or other actuated device when installing or performing maintenance on the operator. Do not remove the operator mounting bolts from the valve or actuated device unless the valve or device stem is secured or there is no pressure in the line.

For maintenance and/or disassembly of the operator while installed on the valve, ensure that the operator is not under thrust or torque load. If the valve must be left in service, the valve stem must be locked in such a way as to prevent any movement of the valve stem.

Do not manually operate the operator with devices other than the installed handwheel. Using force beyond the ratings of the operator and/or using additive force devices such as cheater bars, wheel wrenches, pipe wrenches, or other devices on the operator handwheel may cause serious personal injury and/or damage to the operator and valve.

Do not exceed any design limitations or make modifications to this equipment without first consulting Emerson.

Use of this product must be suspended any time it fails to operate properly.

⚠ CAUTION: CHECK LIMIT SWITCH SETTINGS FIRST

If a motor actuator is driving the manual operator, do not operate the valve under motor operation without first checking and setting the limit switch and checking for correct motor rotation.

Do not use replacement parts that are not genuine Emerson parts, as serious personal injury and/or damage to the operator and valve may result.

4.2 Safety Practices

The following checkpoints should be performed to maintain safe operation of the WG 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 WG worm gear operator are correctly and appropriately adjusted.

4.3 WG-00 Through WG-35

Refer to Figures 4.1 through 4.6.

4.3.1 Disassembly Instructions:

1. Place the operator upside down to access the mounting base.
2. Remove retaining ring (pc# 10) and splined adapter (pc# 4).
3. Return the operator to the upright position (mounting base down) and remove the hex head cap screws (pc# 14), pointer cap (pc# 8) and O-rings (pc# 18 & 31).
4. Remove the hex head cap screws (pc# 12), housing cover (pc# 2) and cover gasket (pc# 21).
5. Remove the input flange (pc# 7), with oil seal (pc# 19) and gasket (pc# 22), or remove the spur gear attachment (See Section 4.5 or 4.6).
6. Remove worm shaft (pc# 3) with tapered roller bearing (pc# 11) from the housing (pc# 1).
7. Remove the tapered roller bearing (pc# 11) from the worm shaft (pc# 3), if required.
8. Remove the end cap (pc# 6) and gasket (pc# 22).
9. Remove the tapered roller bearing (pc# 11).
10. Remove the worm gear/drive sleeve (pc# 5), O-rings (pc# 17), and thrust washers (pc# 9).
11. Remove the stop screws (pc# 15) with hex nuts (pc# 16), packing seals (pc# 23) and O-rings (pc# 32).

4.3.2 Reassembly Instructions:

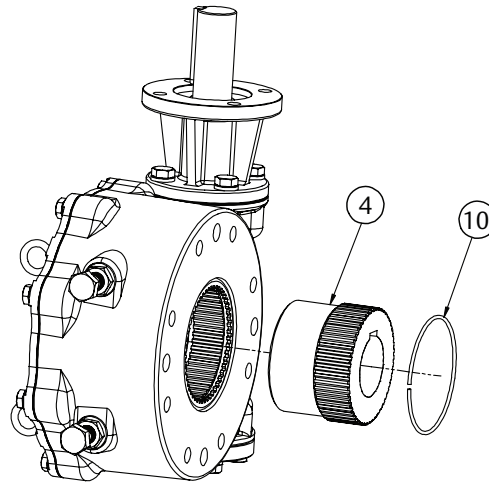
1. Install the stop screws (pc#15), including the O-rings (pc# 32), packing seals (pc# 23) and hex nuts (pc# 16).
2. Place the lower thrust washer (pc# 9) in the housing (pc# 1).
3. Replace the lower O-rings (pc# 17) in the base of the housing (pc# 1).

NOTE:

Lubricate all O-rings before installation.

4. Install the worm gear/drive sleeve (pc# 5).
5. Install the tapered roller bearing (pc# 11) into the housing bore on the end cap side.

Figure 5 Splined Adapter Assembly



6. Install the end cap (pc# 6) and gasket (pc# 22).
7. Insert the worm shaft (pc# 3) into the housing bore.
8. Install the tapered roller bearing (pc# 11) onto the worm shaft in the housing bore.
9. Replace the oil seal (pc# 19) in the input flange (pc# 7), if required.
10. Install the input flange (pc# 7) with gasket (pc# 22) or install the spur gear attachment (See Section 4.5 or 4.6).

NOTE:

Lubricate the worm gear mesh to replace lubricant lost during disassembly (see Lubrication Section 3).

11. Place the upper thrust washer (pc# 9) on the worm gear/drive sleeve (pc# 5).
12. Replace the upper O-ring (pc# 20) in the housing cover (pc# 2).

NOTE:

Lubricate all O-rings before installation.

13. Install the housing cover (pc# 2) with cover gasket (pc# 21).
14. Replace the upper O-ring (pc# 18) in the housing cover (pc# 2).
15. Replace the pointer cap O-ring (pc# 31) in the top of the worm gear/drive sleeve (pc# 5).

NOTE:

Lubricate all O-rings before installation.

16. Install the pointer cap (pc# 8).
17. Turn the operator upside down and insert the splined adapter (pc# 4).
18. Install the splined adapter retaining ring (pc# 10).

Figure 6 WG-00 through WG-35 Exploded View

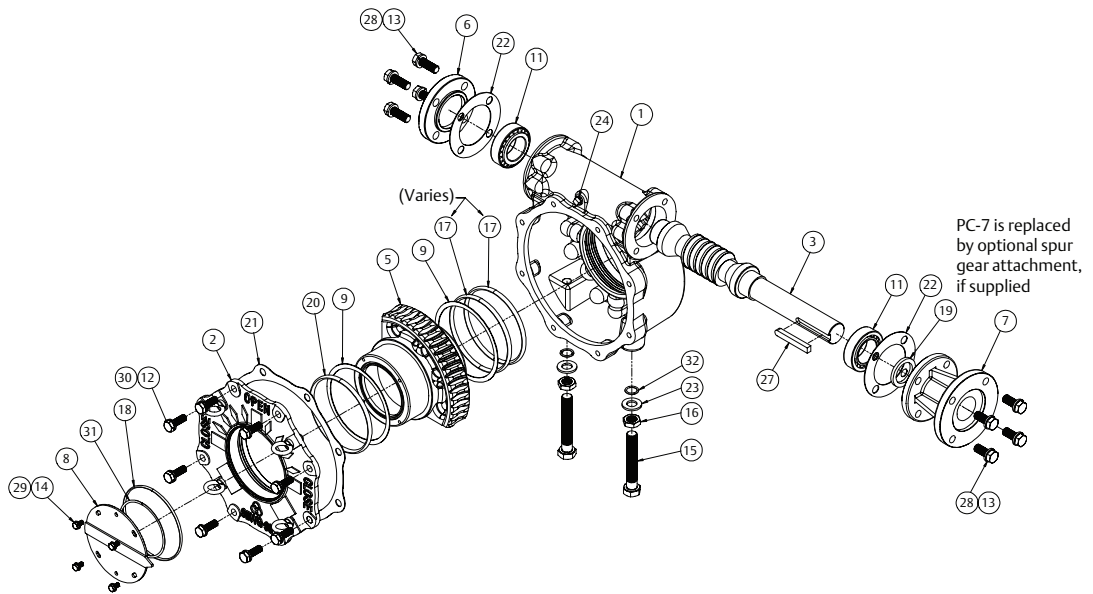


Figure 7 WG-00 through WG-35 Assembly View (1)

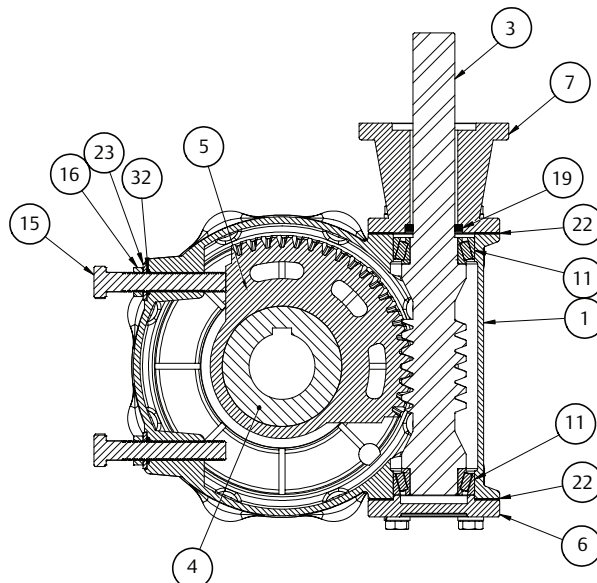


Figure 8 WG-00 through WG-35 Assembly View (2)

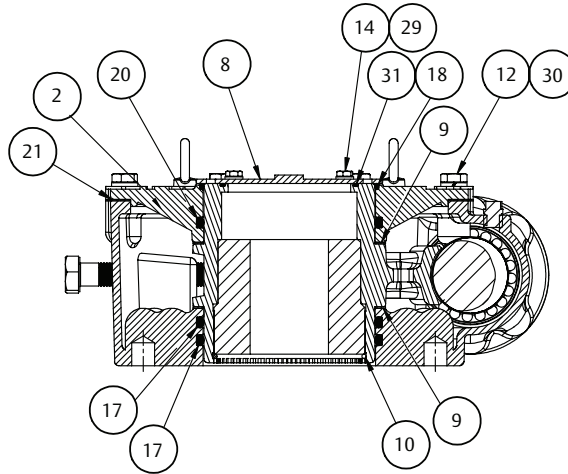


Figure 9 WG-00 through WG-35 Assembly View (3)

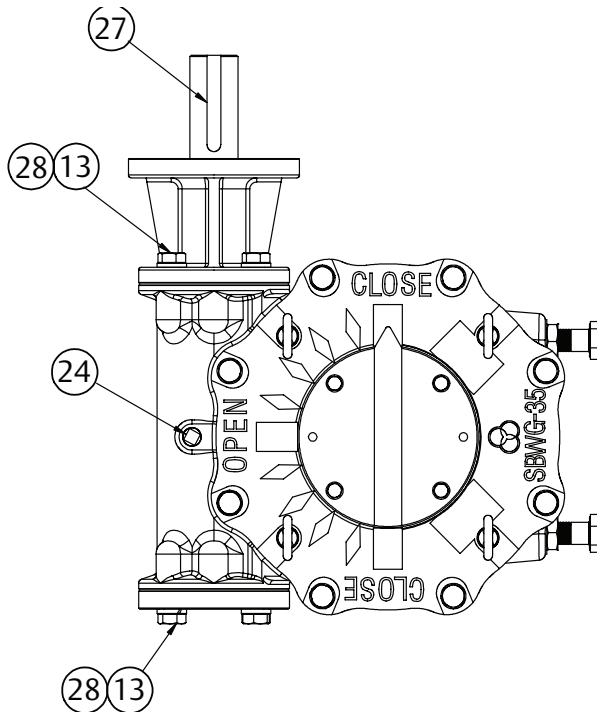


Figure 10 WG-00 through WG-35 Assembly View (4)

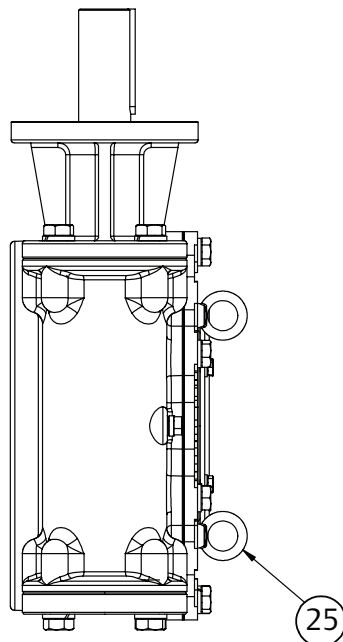


Table 2. WG-00 through WG-35 Parts List

Item	Description	Quantity
1	Housing	1
2	Housing Cover	1
3	Worm Shaft	1
4	Splined Adapter	1
5	Worm Gear/Drive Sleeve	1
6	End Cap	1
7	Input Flange	Varies
8	Pointer Cap	1
9	Thrust Washer	2
10	Splined Adapter Retaining Ring	1
11	Tapered Roller Bearing	2
12	Hex Head Cap Screw	8
13	Hex Head Cap Screw	4
14	Hex Head Cap Screw	4
15	Stop Screw	2
16	Hex Nut	2
17	Drive Sleeve O-Ring	Varies
18	Drive Sleeve O-Ring	1
19	Oil Seal	1
20	Drive Sleeve O-Ring	1
21	Cover Gasket	1
22	Gasket	2
23	Packing Seal	2
24	Pipe Plug/Grease Fitting	1
25	Eye Bolt	4
26	N/A	-
27	Key	1
28	Lock Washer	4
29	Lock Washer	4
30	Lock Washer	8
31	Pointer Cap O-Ring	1
32	Stop Screw O-Ring	2

4.4 WG-04 Through WG-12

Refer to Figures 4.7 through 4.12

Disassembly Instructions:

1. Remove the hex head cap screws (pc# 14), pointer cap (pc# 8), gasket (pc# 31) and O-ring¹ (pc# 18).
2. Remove retaining ring (pc# 10) and splined adapter (pc# 4).
3. Remove the hex head cap screws (pc# 12), housing cover (pc# 2), cover gasket (pc# 21), and O-ring (pc# 20).

NOTE:

Remove O-ring (pc# 18) if applicable¹.

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4. Remove the input flange (pc# 7) and gasket (pc# 22), or remove the spur gear attachment (See Section 4.5 or 4.6).
 5. Remove worm shaft (pc# 3) with tapered roller bearing (pc# 11) and ball bearing² (pc# 26) from the housing (pc# 1).
 6. Remove the tapered roller bearing (pc# 11) and ball bearing² (pc# 26) from the worm shaft (pc# 3), if required.
 7. Remove the end cap (pc# 6) and gasket (pc# 22).
 8. Remove the tapered roller bearing (pc# 11) and ball bearing² (pc# 26).
 9. Remove the worm gear/drive sleeve (pc# 5), O-rings (pc# 17), and thrust washers (pc# 9).
 10. Remove the stop screws (pc# 15) with hex nuts (pc# 16), packing seals (pc# 23) and O-rings (pc# 32), if applicable.

Reassembly Instructions:

1. Install the stop screws (pc# 15), including the hex nuts (pc# 16), packing seals (pc# 23) and O-rings (pc# 32), if applicable.
2. Place the lower thrust washer (pc# 9) in the housing (pc# 1).
3. Replace the lower O-rings (pc# 17) in the base of the housing (pc# 1).

NOTE:

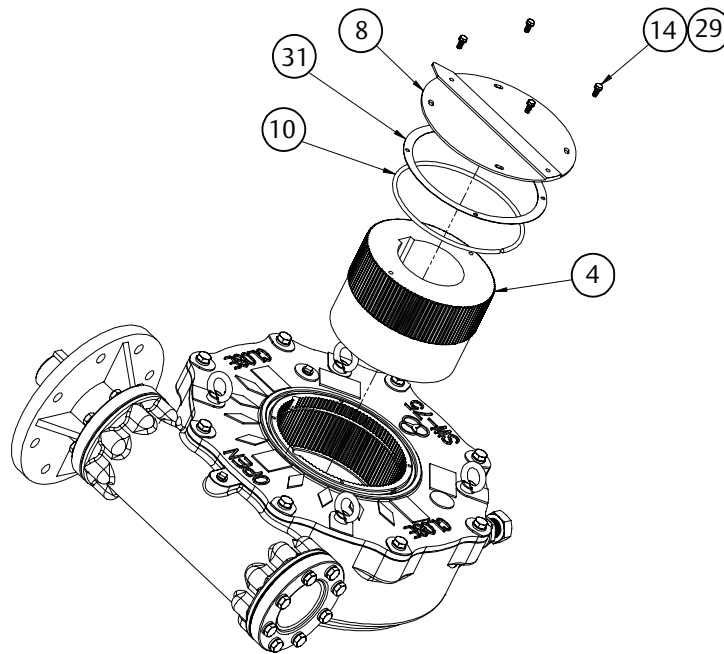
Lubricate all O-rings before installation.

-
4. Install the worm gear/drive sleeve (pc# 5).
 5. Install the ball bearing² (pc# 26) and the tapered roller bearing (pc# 11) into the housing bore on the end cap side.
 6. Install the end cap (pc# 6) and gasket (pc# 22).
 7. Insert the worm shaft (pc# 3) into the housing bore.
 8. Install the ball bearing² (pc# 26) and the tapered roller bearing (pc# 11) onto the worm shaft in the housing bore.
 9. Replace the oil seal (pc# 19) in the input flange (pc# 7), if required.
 10. Install the input flange (pc# 7) with gasket (pc# 22) or install the spur gear attachment (See Section 4.5 or 4.6).

NOTE:

Lubricate the worm gear mesh to replace lubricant lost during disassembly (See Lubrication, Section 3).

Figure 11 WG-04 through WG-12 Splined Assembly View



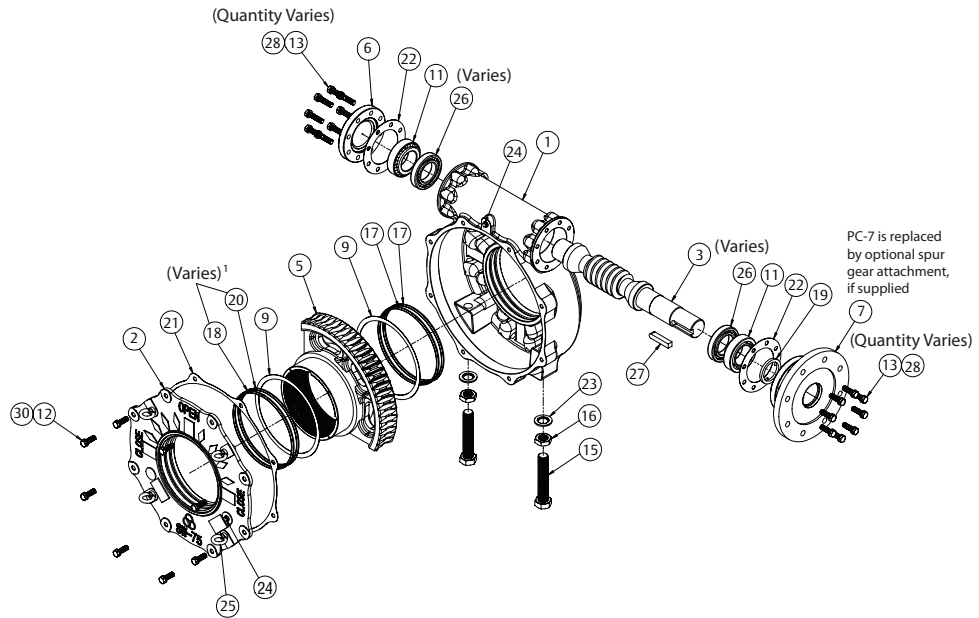
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11. Place the upper thrust washer (pc# 9) on the worm gear/drive sleeve (pc# 5).
 12. Replace the O-rings (pc# 20) in the housing cover (pc# 2).
-

NOTE:

Lubricate the O-rings before installation.

13. Install the housing cover (pc# 2) with the cover gasket (pc# 21).
14. Insert the splined adapter (pc# 4) into the worm gear/drive sleeve (pc# 5).
15. Install the splined adapter retaining ring (pc# 10). Varies¹
16. Install the pointer cap (pc# 8), gasket (pc# 31) and drive sleeve O-ring¹ (pc# 18).

Figure 12 WG-04 through WG-12 Exploded View



¹ O-Ring (pc# 18) applies to WG-04 through -07 only, (Pc# 20), quantity of 2, applies to WG-75 through WG-12.
² Ball Bearing (pc# 26) applies to WG-55 thru -12 only.

Figure 13 WG-04 through WG-12 Assembly View (1)

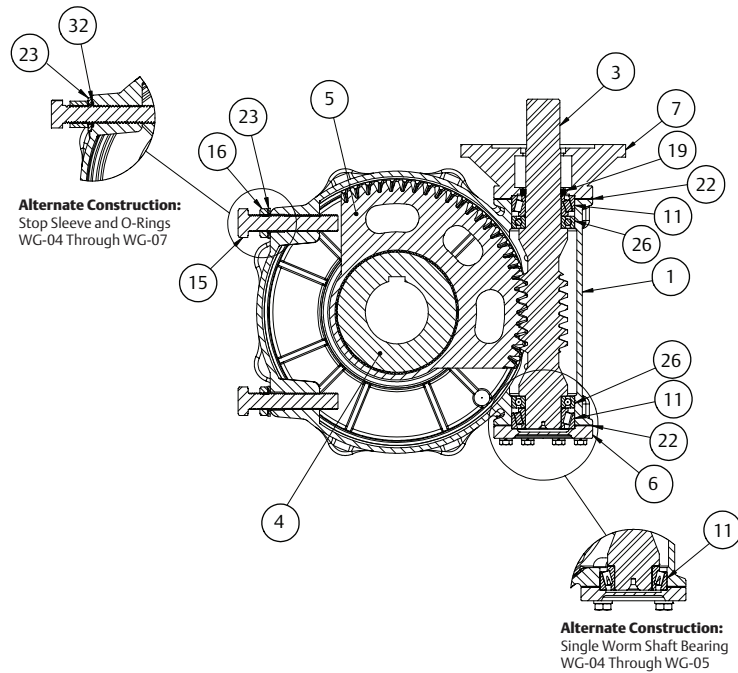


Figure 14 WG-04 through WG-12 Assembly View (2)

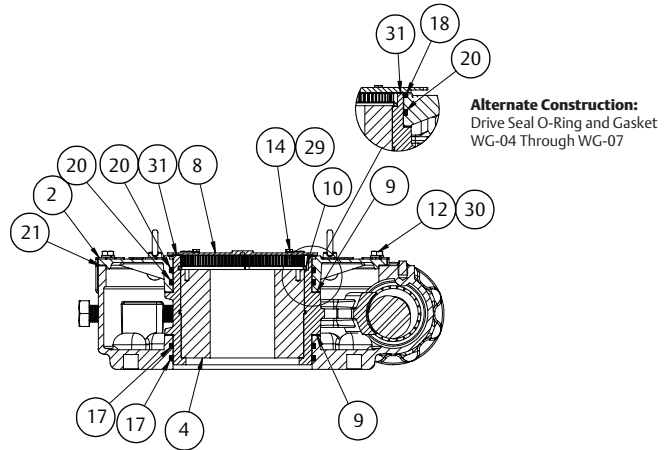


Figure 15 WG-04 through WG-12 Assembly View (3)

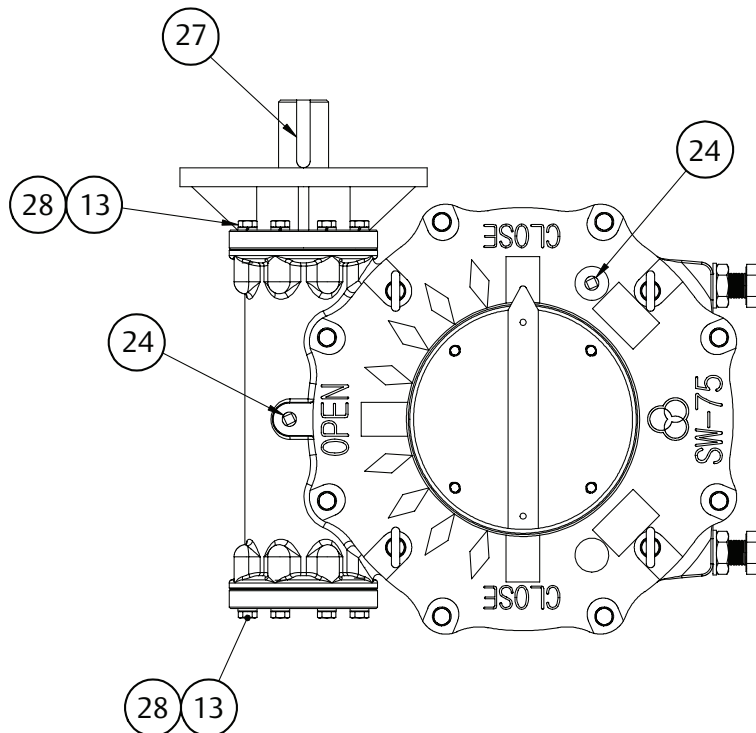


Figure 16 WG-04 through WG-12 Assembly View (4)

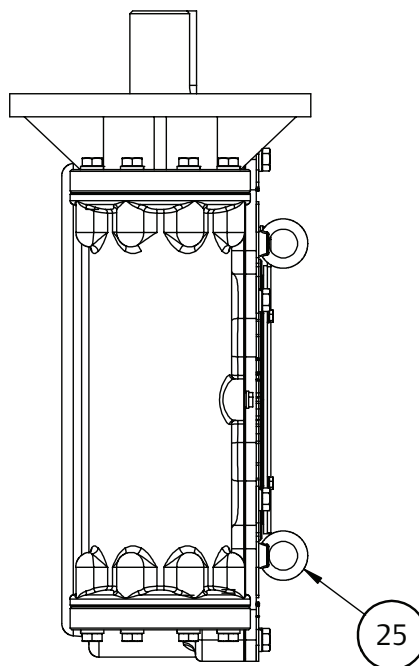


Table 3. WG-04 through WG-12 Parts List

Item	Description	Quantity
1	Housing	1
2	Housing Cover	1
3	Worm Shaft	1
4	Splined Adapter	1
5	Worm Gear/Drive Sleeve	1
6	End Cap	1
7	Input Flange	1
8	Pointer Cap	1
9	Thrust Washer	2
10	Splined Adapter Retaining Ring	1
11	Tapered Roller Bearing	2
12	Hex Head Cap Screw	8
13	Hex Head Cap Screw	Varies
14	Hex Head Cap Screw	4
15	Stop Screw	2
16	Hex Nut	2
17	Drive Sleeve O-Ring	2
18	Drive Sleeve O-Ring	Varies
19	Oil Seal	1
20	Drive Sleeve O-Ring	Varies
21	Cover Gasket	1
22	Gasket	2
23	Packing Seal	2
24	Pipe Plug/Grease Fitting	2
25	Eye Bolt	4
26	Ball Bearing	Varies
27	Key	1
28	Lock Washer	Varies
29	Lock Washer	4
30	Lock Washer	8
31	Pointer Cap Gasket	1
32	Stop Screw O-Ring	Varies

4.5 Single Reduction Spur Gear Attachment (1S)

Refer to Figure 4.13

Disassembly Instructions:

1. Remove the Socket Head Cap Screws and Input Flange (not shown) from the Cover (pc# 4).
2. Remove the Hex Head Cap Screws (pc# 12) and Cover (pc# 4).
3. Remove all traces of the Cover Gasket (pc# 9).
4. Remove the Input Shaft/Pinion (pc# 3) and Ball Bearings (pc# 6) from the Cover (pc# 4).
5. Remove the Ball Bearing (pc# 10) and Retaining Ring (pc# 5) from the Worm Shaft.
6. Remove Gear (pc# 2) and Key (pc# 8) from the Worm Shaft.
7. Remove the Socket Head Cap Screws (not shown) which mount the Spur Gear Attachment to the WG Gearbox and remove the Spur Gear Housing (pc# 1)
8. If disassembly of the WG Gearbox is required, see Sections 4.3 or 4.4.

Reassembly Instructions:

1. Install the Spur Gear Housing (pc# 1) on the WG Gearbox, ensuring proper gasket is installed between Gearbox and Spur Gear Housing (see Section 4.3 or 4.5).
2. Install Gear (pc# 2) onto the WG Gearbox Worm Shaft with Key (pc# 8). Fasten with Retaining Ring (pc# 5).
3. Install Ball Bearing (pc# 10) onto the Worm Shaft.
4. Install Ball Bearing (pc# 6) into the Spur Gear Housing (pc# 1).
5. Install the Input Shaft/Pinion (pc# 3).
6. Install Ball Bearing (pc# 6) onto the Input Shaft/Pinion (pc# 3).
7. Replace the Cover Gasket (pc# 9).
8. Replace the Oil Seal (pc# 11) in the Cover (pc# 4).

NOTE:

Lubricate the Spur Gearing. See Section 3.

9. Install the Cover (pc# 4), mounting with Hex Head Cap Screws (pc# 12).
 10. Install the Input Flange (not shown) onto the Cover (pc# 4) using Socket Head Cap Screws (not shown).
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NOTE:

Replace any worn or damaged O-rings or Gaskets to ensure proper sealing and operation.

Figure 17 WG-00 through WG-12 Spur Gear Attachment (1S) Exploded View

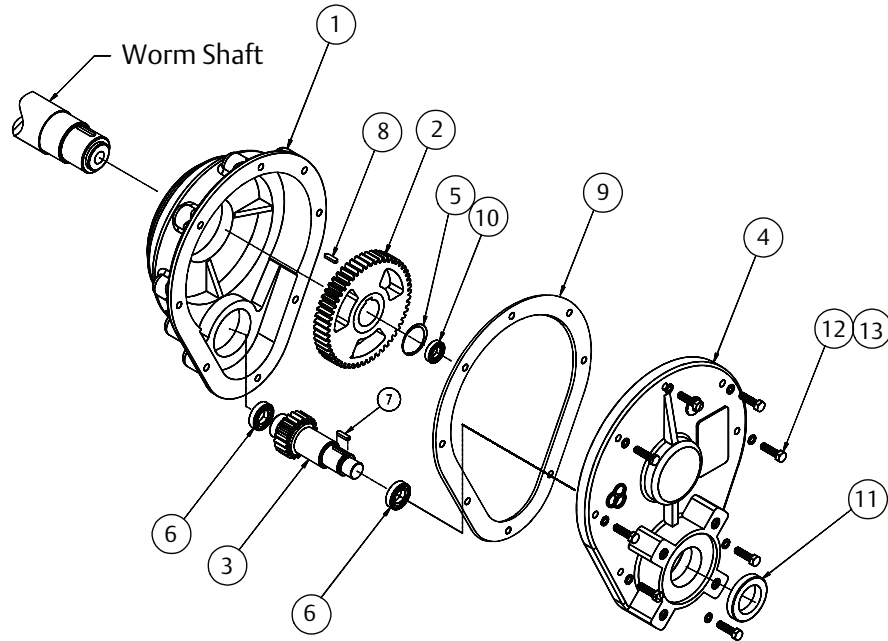


Table 4. WG-00 through WG-12 Spur Gear Attachment (1S) Parts List

Item	Description	Quantity
1	Housing	1
2	Gear	1
3	Input Shaft Position	1
4	Cover	11
5	Retaining Ring	1
6	Ball Bearing	2
7	Key	1
8	Key	1
9	Gasket	1
10	Ball Bearing	1
11	Oil Seal	1
12	Hex Head Cap Screw	8
13	Lockwasher	8

4.6 Double Reduction Spur Gear Attachment (1SD)

Refer to Figure 4.14

Disassembly Instructions:

1. Remove the socket head cap screws (pc# 19) and input flange (pc# 18) from the cover (pc# 12).
2. Remove the hex head cap screws (pc# 14) and cover (pc# 12).
3. Remove the helical gear/second set pinion subassembly.
4. Remove all traces of the cover gasket (pc# 13).
5. Remove the input shaft/pinion subassembly from the cover (pc #12) by removing the retaining ring (pc# 16).
6. Remove the retaining ring (pc# 4) and ball bearings (pc# 11) from the input shaft/pinion (pc #9).
7. Remove the ball bearing (pc# 8) from the 2nd set pinion (pc# 5).
8. Remove the retaining ring (pc# 4) and the helical gear (pc# 2) from the 2nd set pinion (pc# 5).
9. Remove the retaining ring (pc# 4) and the helical gear (pc# 2) from the worm shaft.
10. Remove the socket head cap screws (pc# 20) from the spur gear housing (pc# 1) and remove the spur gear housing (pc# 1) from the WG gearbox.
11. If disassembly of the WG gearbox is required, see Sections 4.3 or 4.4.

Reassembly Instructions:

1. Install the spur gear housing (pc# 1) on the WG gearbox, ensuring proper gasket is installed between gearbox and spur gear housing (See Section 4.3 or 4.4).
2. Install the helical gear (pc# 2) on the WG gearbox worm shaft with two keys (pc# 3). fasten with retaining ring (pc# 4).
3. Insert the bushing (pc# 10) into the end of the input shaft/pinion (pc# 9).
4. Install the ball bearings (pc# 11) and retaining ring onto the input shaft/pinion (pc# 9)
5. Install the input shaft/pinion with ball bearings (pc# 11) into the cover (pc# 12) using retaining ring (pc# 16).
6. Install the ball bearing (pc# 6) in the spur gear housing (pc# 1).
7. Assemble the helical gear (pc# 2) on the 2nd set pinion (pc# 5) with two keys (pc# 7). fasten with retaining ring (pc# 4).
8. Install the ball bearing (pc# 8) on the 2nd set pinion (pc# 5).
9. Install the helical gear/2nd set pinion subassembly in the ball bearing (pc# 6).

NOTE:

Replace any worn or damaged O-rings or gaskets to ensure proper sealing and operation.

10. Replace the gasket cover (pc# 13).
11. Install the cover (pc# 12) with input shaft/pinion subassembly onto the spur gear housing, ensuring proper mesh of gear teeth on input shaft/pinion (pc# 9) and helical gear (pc# 2), and alignment of ball bearing (pc# 8) with cover (pc# 12).
12. Replace the oil seal (pc# 15).
13. Install the input flange (pc# 18).

NOTE:

Replace any worn or damaged O-rings or gaskets to ensure proper sealing and operation.

Figure 18 WG-00 through WG-12 Spur Gear Attachment (1SD) Exploded View

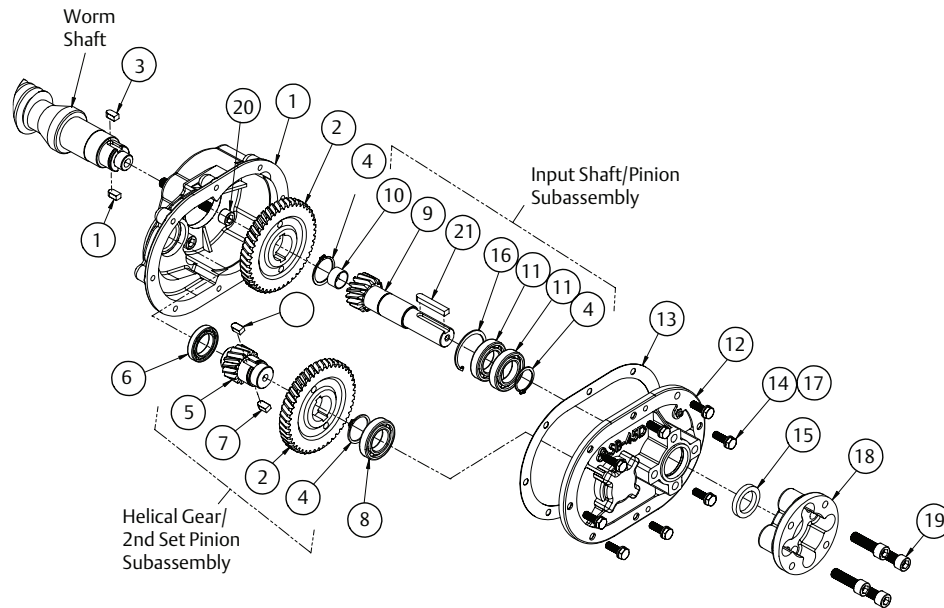


Table 5. WG-00 through WG-12 Spur Gear Attachment (1SD) Parts List

Item	Description	Quantity
1	Spur Gear Housing	1
2	Helical Gear	2
3	Key	2
4	Retaining Ring	3
5	2 nd Set Pinion	1
6	Ball Bearing	1
7	Key	2
8	Ball Bearing	1
9	Input Shaft / Pinion	1
10	Bushing	1
11	Ball Bearing	2
12	Cover	1
13	Gasket - Cover	1
14	Hex Head Cap Screw	8
15	Oil Seal	1
16	Retaining Ring	1
17	Lockwasher	8
18	Input Flange	1
19	Socket Head Cap Screw	4
20	Socket Head Cap Screw	Varies

Section 5: Document Revision

Table 6. Revision Overview

ECN	DATE	REVISION	STATUS	BY *	DATE

* Signatures on file Bettis, Houston, Texas

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