



USER INSTRUCTIONS

Limitorque MT Series

FCD LMENIM4201-00 – 06/10

*Installation
Operation
Maintenance*



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1 Introduction

1.1 Purpose

This Installation, Operation and Maintenance Manual (IOM) explains how to install and maintain the MT 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.

2

Product Capabilities and Features

Designed to make operation of multi-turn valves easier The MT gear operator makes it easier to both manually operate multi-turn valves and convert to a motorized service.

Built for reliable valve control — whether manual or motorized The MT offers torque ranges up to 6,000 ft-lb (8,135 N m) and thrust capacities to 150,000 lb (667 kN) for any application demanding superior strength and accuracy.

Easily adaptable for other applications The MT 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 Product Identification

The operator nameplate is located on top of the torque housing, over the input shaft. The nameplate provides the product type and size, ratio, order and serial numbers, lubrication type and tagging information.

2.2 Initial Inspection and Recording of Operator Data

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

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 2.1 – MT Nameplate



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)

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 solid (blank) stem nut, motorized adapter, with and without spur gear attachment, are provided below:

Table 3.1 – Operator Weights

Operator	Without SGA		With SGA	
	lb	kg	lb	kg
MT-2	95	43	124	56
MT-3	218	99	273	124
MT-4	745	339	875	398

4

Installation Instructions

4.1 Safety Precautions

- ⚠ **WARNING:** Read this Installation, Operation and Maintenance Manual carefully and completely before attempting to install, operate, or troubleshoot the Limitorque operator.
- ⚠ **WARNING:** 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.
- ⚠ **WARNING:** 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.
- ⚠ **WARNING:** Do not manually operate the operator with devices other than the installed hand-wheel. 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.
- ⚠ **WARNING:** Do not exceed any design limitations or make modifications to this equipment without first consulting Limitorque.
- ⚠ **WARNING:** Use of the product must be suspended any time it fails to operate properly.
- ⚠ **CAUTION:** 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 setting and checking for correct motor rotation.
- ⚠ **CAUTION:** Do not use replacement parts that are not genuine Flowserve Limitorque parts, as serious personal injury and/or damage to the operator and valve may result.

4.2 Safety Practices

The following check points should be performed to maintain safe operation of the MT 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 MT 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 (MT-2, 3 and 4, 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 (MT-2 and 3) or tapered thrust bearings (MT-4), 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, and 6.4 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 (MT-4)

(Piece numbers refer to Figure 6.4 and Table 6.4).

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 ($\frac{1}{4}$ -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 $\frac{1}{4}$ inch, if so desired. Stem Nuts can also be positioned to extend below the Thrust Drive Sleeve approximately $\frac{1}{4}$ 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

The MT 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 MT 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 MT series operator gear case is factory-lubricated with EP-0 lithium soap, mineral base grease, suitable for temperatures from -20°F (-29°C) to 225°F (107°C).

▲ CAUTION: Do not mix lubricants of dissimilar bases.

Table 5.1 – Lubricant Quantities

Operator	Without SGA		With SGA	
	lb	kg	lb	kg
MT-2	1.2	0.6	1.7	0.8
MT-3	2.2	1.0	2.7	1.2
MT-4	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 (158°C) 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 MT 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 disassembly and reassembly, 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 ball bearings located between the bevel gear and thrust housing. These bearings are non-caged, hardened ground balls.

The table below indicates the number of ball bearings utilized by each MT size.

Table 6.1 – Quantity of Ball Bearings

Operator	Quantity
MT-2	57
MT-3	53
MT-4	66

6.1 Disassembly and Reassembly of MT-2

6.1.1 Disassembly

(Piece numbers refer to Figure 6.1 and 6.2)

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

NOTE: Please note the number and position of each Shim (piece #25).

6.1.2 Reassembly

(Piece numbers refer to Figures 6.1 and 6.2).

1. Install the Ball Bearings (piece #8) and the Bevel Gear (piece #3) onto the Thrust Housing (piece #2).
2. Install the Gasket (piece #62) and attach the Bevel Housing (piece #1) to the Thrust Housing (piece #2).
3. Slide in the Bevel Pinion Shaft/Bearing Subassembly (pieces #21, 22, and 23) together with the Shims (piece #25).
4. Attach the End Cover (piece #20).
5. Insert the Raceway Washer (piece #7), Needle Bearings (piece #6), and another Raceway Washer (piece #7) onto the top flange of the Stem Nut (piece #4).
6. Insert the Stem Nut (piece #4) into the Thrust Housing.
7. Insert the Raceway Washer (piece #7), Needle Bearings (piece #6), and another Raceway Washer (piece #7) onto the lower flange of the Stem Nut.
8. Attach the Thrust Ring (piece #5).

NOTE: Gasket compound is to be used on the Motorized Adapter - to - Actuator interface and the Thrust Plate - to - Valve interface.

NOTE: Gasket compound is to be used on the Bevel Housing - to - End Cover/Motorized Adapter interface.

Figure 6.2 – MT-2 Parts Diagram, Base View

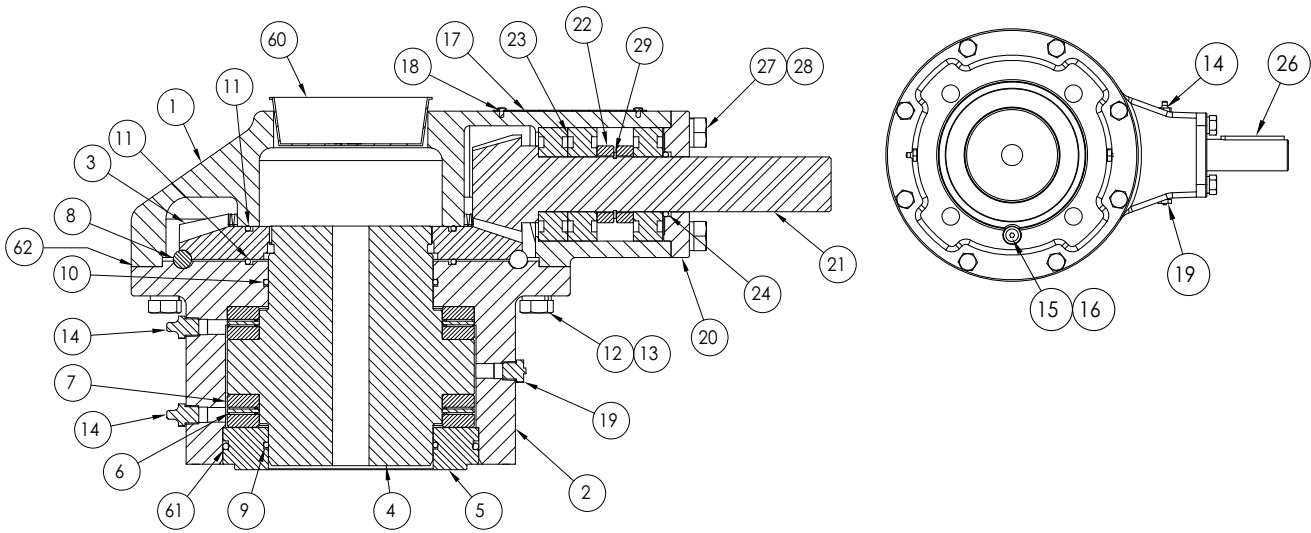


Table 6.2– MT-2 Parts List

Piece	Quantity	Description
1	1	Bevel Housing
2	1	Thrust Housing
3	1	Bevel Gear
4	1	Stem Nut
5	1	Thrust Ring
6	2	Needle Bearings
7	4	Raceway Washer
8	57	Ball Bearing
9, 10	2	O-ring
11	2	O-ring
12	8	Lockwasher
13	8	Hex Head Cap Screw
14	3	Grease Fitting
15	1	Flat Washer
16	1	CSK Socket Set Screw

Piece	Quantity	Description
17	1	Nameplate (Blank)
18	2	Drive Screw
19	2	Relief Fitting
20	1	End Cover/ Motorized Adapter
21	1	Input Pinion
22	2	Spacer
23	3	Radial Ball Bearing
24	1	O-Ring
25	1	Shim
26	1	Key
27	4	Lockwasher
28	4	Hex HD Cap Screw
29	1	Retaining Ring
60	1	Transit Plug
61	1	O-Ring
62	1	Gasket
63	1	Pipe Plug

Figure 6.1 – MT-2 Parts Diagram, Side View

6.2 Disassembly and Reassembly of MT-3

6.2.1 Disassembly

(Piece numbers refer to Figure 6.3)

1. Remove the Thrust Ring (piece #11).
2. Pull out the Stem Nut (piece #10), Raceway Washers (piece #13), and Needle Bearings (piece #12).
3. Remove Motorized Adapter (piece #9).
4. Slide out the Bevel Pinion Shaft/Bearing Subassembly (piece# 5, 7, and 8) together with Spacers (piece #6).
5. Remove the Bevel Housing (piece #4) from the Thrust Base (piece #1).
6. Remove the Bevel Gear (piece #3) and Ball Bearings (piece #2).

NOTE: Please note the number and position of each Spacer (piece #6).

6.2.2 Reassembly

(Piece numbers refer to Figures 6.3).

1. Install the Ball Bearings (piece #2) and Bevel Gear (piece #3) onto the Thrust Base (piece #1).
2. Attach the Bevel Housing (piece #4) to the Thrust Base (piece #1).
3. Slide in the Bevel Pinion Shaft/Bearing Subassembly (piece #5, 7, and 8) together with the Spacers (piece #6).
4. Attach the Motorized Adapter (piece #9).
5. Insert the Raceway Washer (piece #13), Needle Bearings (piece #12), and another Raceway Washer (piece #13) onto the top flange of the Stem Nut (piece #10).
6. Insert the Stem Nut (piece #10).
7. Insert the Raceway Washer (piece #13), Needle Bearings (piece #12), and another Raceway Washer (piece #13) onto the lower flange of the Stem Nut.
8. Attach the Thrust Ring (piece #11).

NOTE: Gasket compound is to be used on the Motorized Adapter - to - Actuator interface and the Thrust Plate - to - Valve interface.

NOTE: Gasket compound is to be used on the Bevel Housing - to - End Cover/Motorized Adapter interface.

Figure 6.3 – MT-3 Parts Diagram

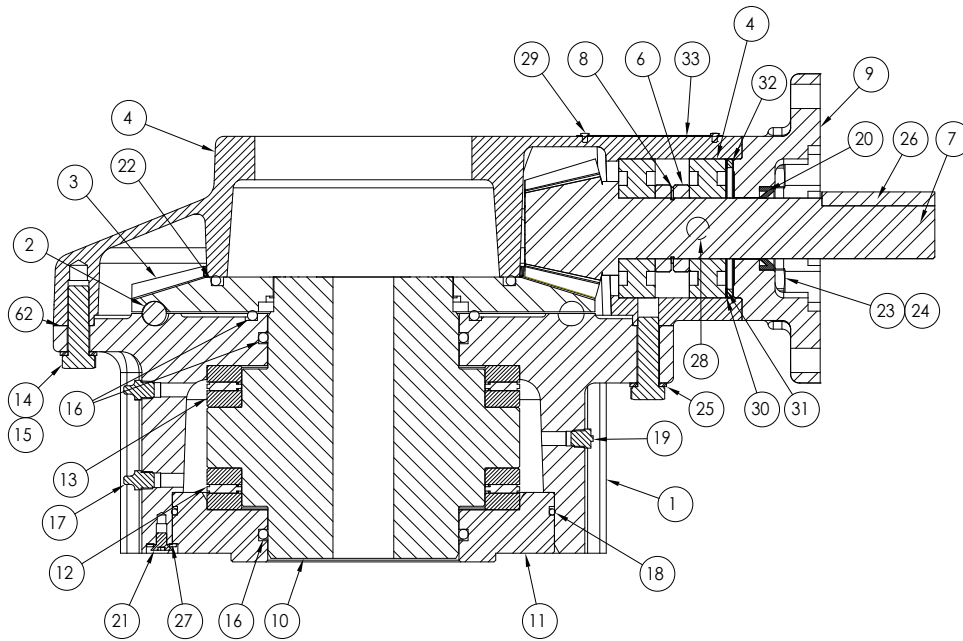


Table 6.3– MT-3 Parts List

Piece	Quantity	Description
1	1	Thrust Base
2	53	Ball Bearing
3	1	Bevel Gear
4	1	Bevel Housing
5	2	Radial Ball Bearing
6	2	Spacer
7	1	Input Pinion
8	1	Retaining Ring
9	1	Motorized Adapter
10	1	Stem Nut
11	1	Thrust Ring
12	2	Needle Bearings
13	4	Raceway Washer
14	8	Hex HD Cap Screw
15	7	Lockwasher
16	3	O-Ring
17	3	Relief Fitting

Piece	Quantity	Description
18	1	Lip Seal
19	1	Flat Head Screw
20	1	Lockwasher
21	1	Stat-O-Seal Washer
22	1	O-Ring
23	4	Hex HD Cap Screw
24	4	Lockwasher
25	1	Stat-O-Seal Washer
26	1	Key
27	1	Flat Washer
28	4	Pipe Plug
29	2	Drive Screw
30	1	Shim
31	1	Shim
32	1	Spacer Ring
33	1	Nameplate
62	1	Gasket

6.3 Disassembly and Reassembly of MT-4

6.3.1 Disassembly

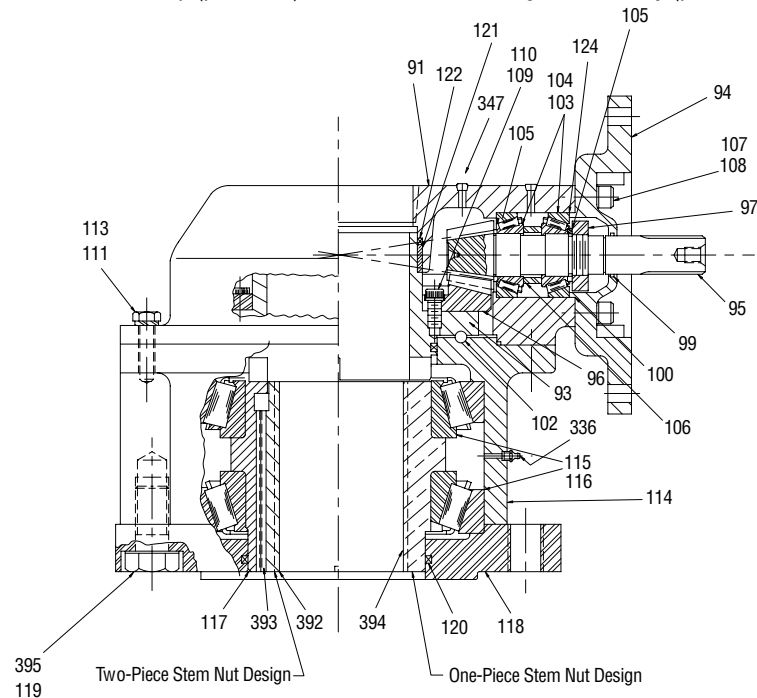
(Piece numbers refer to Figure 6.4).

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).

6.3.2 Reassembly

(Piece numbers refer to Figure 6.4).

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).

NOTE: Gasket compound is to be used on the Motorized Adapter - to - Actuator interface and the Thrust Plate - to - Valve interface.

Figure 6.4 – MT-4 Parts Diagram

Table 6.4 – MT-4 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	Pipe Plug
392	1	Stem Nut
393	1	Key
394	1	Thrust Drive Sleeve (1-pc)
395	1	Lockwasher

6.4 Disassembly and Reassembly of Spur Gear Attachments

6.4.1 Disassembly of 3:1 Spur Gear Attachment for MT-2

(Piece numbers refer to Figure 6.5 and Table 6.5).

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 of MT-2 and MT-3.

6.4.2 Reassembly of 3:1 Spur Gear Attachment for MT-2

(Piece numbers refer to Figure 6.5 and Table 6.5).

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).

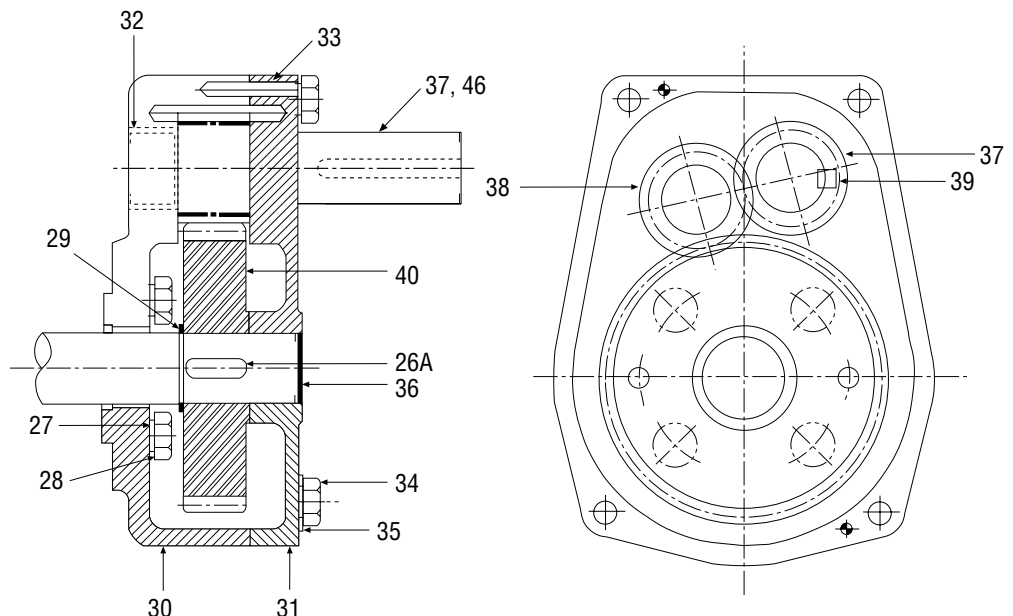


Table 6.5 – 3:1 SGA Parts List for MT-2

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

6.4.3 Disassembly of 6.3:1, 10.3:1, and 10.8:1 Spur Gear Attachments for MT-3

(Piece numbers refer to Figure 6.6 and Table 6.6).

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 MT-2 and MT-3.

6.4.4 Reassembly of 6.3:1, 10.3:1, and 10.8:1 Spur Gear Attachments for MT-3

(Piece numbers refer to Figure 6.6 and Table 6.6).

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 6.6 – 6.3:1, 10.3:1, and 10.8:1 SGA Parts Diagram for MT-3

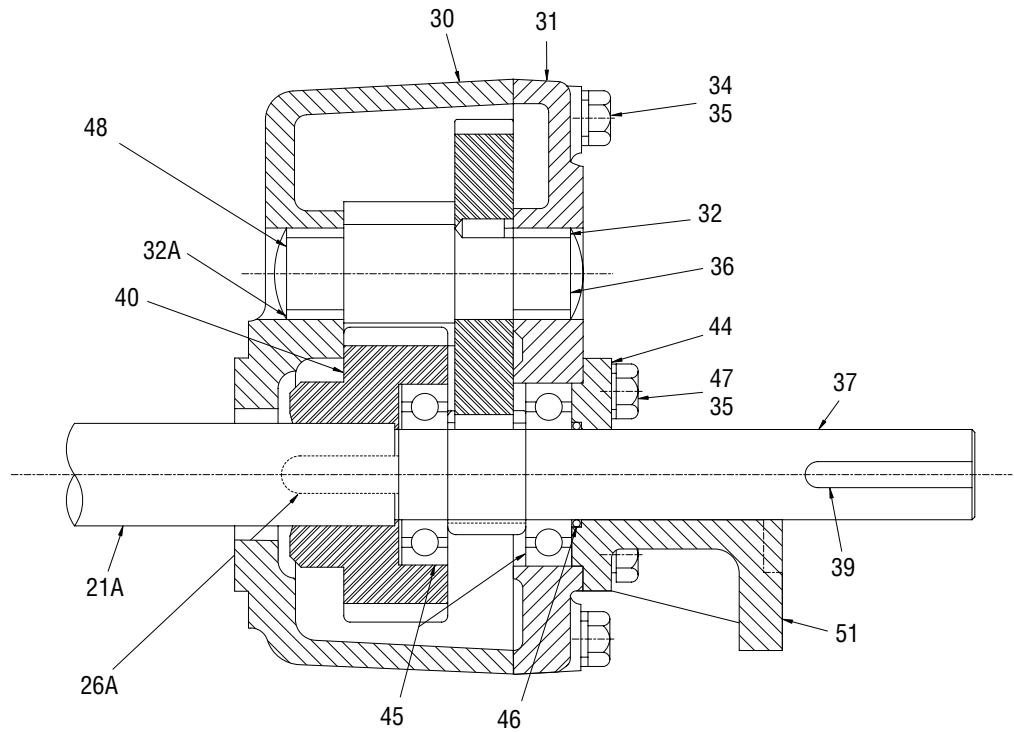


Table 6.6 – 6.3:1, 10.3:1, and 10.8:1 SGA Parts List for MT-3

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)

6.4.5 Disassembly of 5:1 Spur Gear Attachment for MT-4

(Piece numbers refer to Figure 6.7 and Table 6.7).

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 6.2, Disassembly and Reassembly of MT-4.

6.4.6 Reassembly of 5:1 Spur Gear Attachment for MT-4

(Piece numbers refer to Figure 6.7 and Table 6.7).

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 6.7 – 5:1 SGA Parts Diagram for MT-4

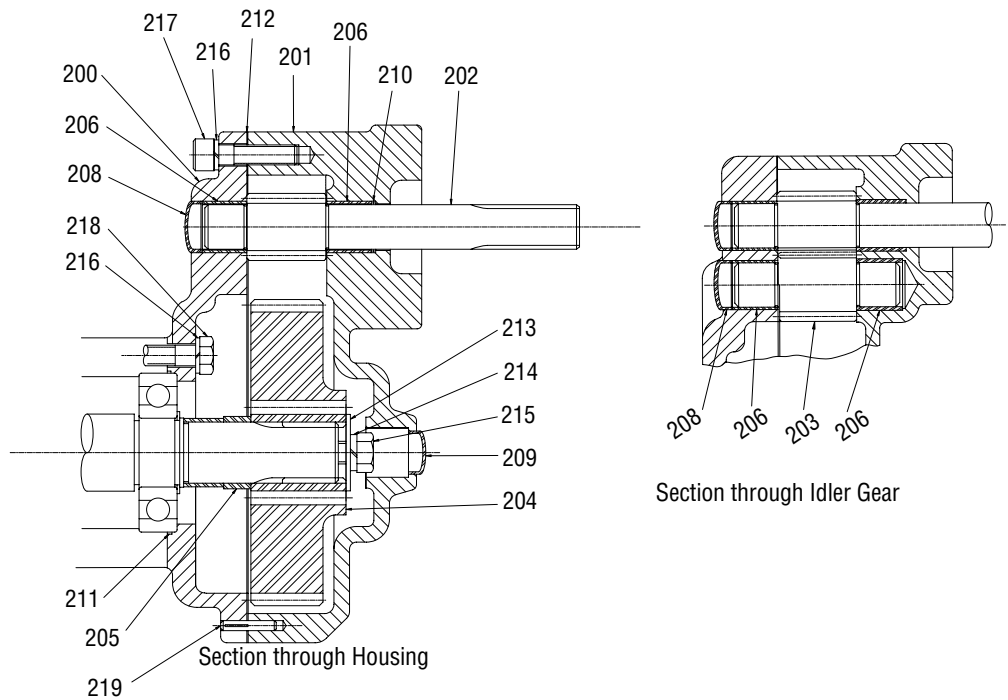


Table 6.7 – 5:1 SGA Parts List for MT-4

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	Pipe Plug (not shown)

6.4.7 Disassembly of 17.5:1 Spur Gear Attachment for MT-4

(Piece numbers refer to Figure 6.8 and Table 6.8).

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 and 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 and Reassembly – MT-4.

6.4.8 Reassembly of 17.5:1 Spur Gear Attachment for MT-4

(Piece numbers refer to Figure 6.8 and Table 6.8).

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 6.8 – 17.5:1 SGA Parts Diagram for MT-4

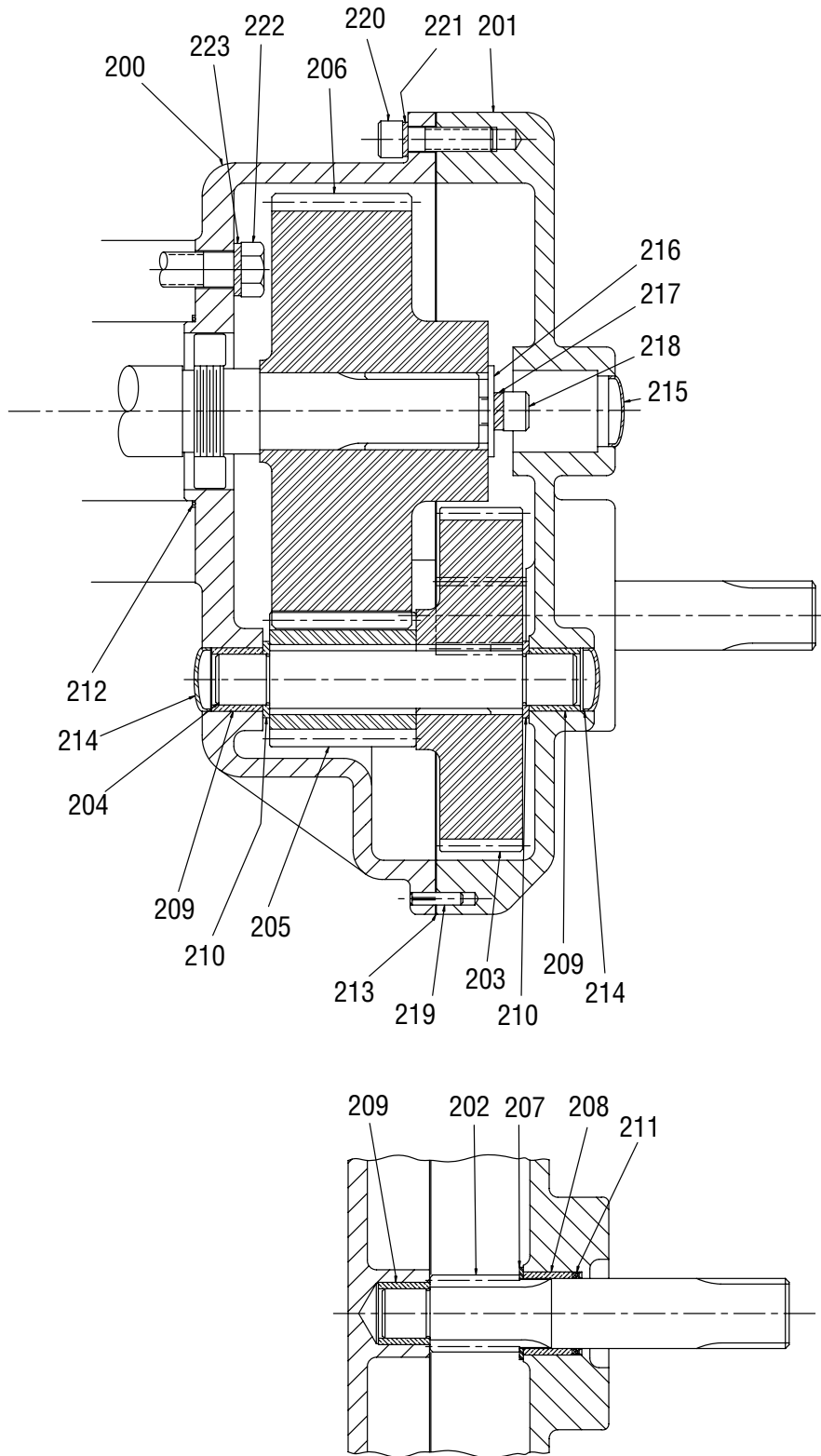


Table 6.8 – 17.5:1 SGA Parts List for MT-4

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	Pipe Plug (not shown)

7

How to Order Parts

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

Flowserve Flow Control
Limitorque Actuation Systems
5114 Woodall Road
P.O. Box 11318
Lynchburg, VA 24506-1318

Telephone 434 528 4400
Fax 434 845 9736
www.flowserve.com/valves

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

1. Actuator Size
2. Limitorque Order Number
3. Limitorque Serial Number



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