AT Series with Spur Quarter-Turn Gear Boxes
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Section 1: Preface

1.1 Purpose

Bettis Actuation Technologies is an Emerson Business Unit that specializes in the manufacture of valve actuators and manual operators. Its manual actuation product range consists of three series of valve operators as mentioned below:

- Quarter-turn worm gear operators for manual valve operation (AT Series)
- Quarter-turn worm gear operators for electrical actuation of valves (AT Series)
- Quarter-turn worm gear manual overrides for pneumatic/hydraulic operation of valves (mor series)

The AT Series is a selection of quarter turn worm gear operators for manually operated valve systems. The AT Series gear operator is used to operate the valve manually with the help of a hand wheel.

The AT Series gearbox is used to operate either a butterfly valve or a ball valve or a plug valve or used in damper applications or any 90-degree device. The torque is transmitted through the hand wheel and worm shaft which in turn drives the worm wheel thereby multiplying the torque transmitted from worm shaft to the valve stem which is connected to the worm wheel.

The purpose of this IOM manual is to help the user of this equipment on the following:

- Safety instructions
- Installation of AT Series Gearboxes
- Operation of AT Series Gearboxes
- Maintenance of AT Series Gearboxes

Safety notices in this manual highlight the precautions the user must take in order to avoid personal injury and damage to the equipment. The user must read this manual before attempting to install the equipment or operate or carry out maintenance of the equipment. Failure to follow the instructions mentioned in this manual could result in serious personal injury, equipment damage, operational difficulty and voiding of the warranty.

Emerson will not be responsible for any possible damage or physical injury resulting from the use of their equipment other than the designed application or the lack of care taken by the user during installation, operation or maintenance of the equipment. Such risks lie entirely with the user.
Section 2: About the AT Series

2.1 Introduction

The AT Series gear operators are quarter turn worm gearboxes which are used to operate quarter turn valves like ball, butterfly and plug valves or any other quarter turn device.

The AT Series gearbox has one valve mounting face on the bottom side (either plain face or ribbed face depending on model) and the worm wheel of the gearbox has a bore to suit the valve stem directly or suit the coupling between valve stem and gearbox. This is so because the gearbox can be directly mounted onto the valve or it can be coupled with the valve with the help of a bracket and coupling.

Please find below different views of the AT Series gearbox highlighting its different parts as well as instructions and warning plates.

2.2 The AT Series Operator

Figure 1 AT Series General View
Section 2: About the AT Series

Figure 2  AT Series Exploded View

Table 1.  Component List

<table>
<thead>
<tr>
<th>Component Number</th>
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<tr>
<td>1</td>
<td>Housing</td>
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<td>3</td>
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<td>5</td>
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<td>6</td>
<td>Spur Housing</td>
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<td>8</td>
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<td>9</td>
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<tr>
<td>11</td>
<td>'O'-Ring</td>
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<td>12</td>
<td>Indicator</td>
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<td>13</td>
<td>Hand wheel</td>
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</tbody>
</table>
Figure 3  AT Series Bottom View

![AT Series Bottom View](image-url)
Section 3: Storage and Preinstallation

3.1 Before Installation

1. Firstly check whether the AT Series gearbox received is not in damaged condition during transportation.
2. Also, check whether the data on the nameplate corresponds to the expected product data.
3. If the AT Series gearbox is to be stored indoors for a brief period (less than 12 months), it should be ensured that the gearbox is kept in a dry place preferably on a wooden pallet and protected from dust.
4. If the AT Series gearbox is to be stored outdoors for a brief period (less than 12 months), it should be protected from coming in direct contact with rain with a canvas or something similar. Also, it should be kept on a wooden pallet or a raised platform to avoid direct contact with the ground and protected from dust.
5. If the AT Series gearbox is to be stored for a longer period (more than 12 months), then the mating surfaces, couplings, exposed parts, etc. should be coated with a protective oil or grease to avoid corrosion.
Section 4: Installation

4.1 Mounting Types

The AT Series gearbox can be installed onto the valve in two different ways:

1. **DIRECT MOUNTING** -- This involves mounting the gearbox directly on the valve stem and valve mounting flange.

2. **BRACKET MOUNTING** – This involves installing the bracket on the valve flange. The AT Series Gearbox is mounted on the bracket and is coupled to the valve stem with a coupling.

Following procedure should be followed while installation of AT Series gearboxes onto valve systems:

1. The valve and gearbox should be in the same position i.e. completely 'open' or completely 'closed' position, at the time of installation. Any exception to this will cause a condition wherein the person operating the valve might try to open the valve with a gearbox which is already in open position. This will lead to excessive torque on the worm and worm wheel assembly which might lead to excessive wear / breakage of internals.

2. The gearbox should be positioned in such a way so that “clockwise rotation of hand wheel gives clockwise rotation of output to close the valve”.

3. Check whether the mounting dimensions (stem dia. and mounting PCD) between valve and the gearbox are correct and as per the requirement.

4. The mounting flange of valve and gearbox should be de-greased.

5. Mount the gearbox on valve or spigot carefully making sure the valve stem / coupling enters the sector gear bore. Never use the hand wheel or spur gear attachment to lift the gearbox while mounting onto the valve.

6. Fasten the mounting bolts with the help of spring washers. Use 8.8 grade fasteners or above.

7. In case of re-installation after a long storage period, check the status of oil seals, ‘O’ rings and also whether the gearbox body / cover are cracked or broken.
Section 5: AT Series Gearbox Operation

5.1 Manual Use

1. The gearbox is to be operated with a hand wheel which is supplied along with the gearbox.

2. Do not manually operate the gearbox with devices other than the hand wheel. Using cheater bars, wheel wrenches or other such devices on the gearbox hand wheel may cause serious injury and/or damage to the gearbox or valve.

3. In standard applications, “clockwise rotation of hand wheel gives clockwise rotation of output to close the valve”.

Figure 4 Hand Wheel Rotation
5.2 Stopper Setting

1. There are two mechanical stoppers on all AT Series gearboxes to limit the stroke from ‘open’ to ‘close’.

2. This stroke of 90° needs to be set correctly for all gearboxes as described below.

3. Withdraw the stoppers completely. Rotate the valve to the fully closed position by rotating the hand wheel clockwise. Once the valve is fully closed, advance the stopper till it touches the sector gear. Secure this stopper position with a nut.

4. Similarly, for stopper setting at fully open position of the valve, withdraw the stopper at open side completely. Rotate the valve to the fully open position by rotating the hand wheel anti-clockwise. Once the valve is fully opened, advance the stopper till it touches the sector gear. Secure this stopper position with a nut.
Figure 6  Stopper Bolt Location
Section 6: Lubrication

6.1 Application

1. The AT Series gearbox is grease lubricated.

2. All AT Series gearboxes are supplied with EP-1 premium quality lithium soap based grease (NLGI grade 1) suitable for an ambient temperature of -20° to +120° (in case of specialty greases, the temperature range could be different).

3. Grease should be changed after 6 months if the gearbox is in continuous operation whereas it should be changed after 12 months if it is operated intermittently.

4. Do not mix different greases.
Section 7: Disassembly and Reassembly Instructions

7.1 Removal of Cover

- Remove the cover by loosening the cover bolts with a spanner.
- Each time the cover is removed, the gasket sealing is lost as it is a liquid sealant. Re-apply gasket sealant (Loctite no. 596 or equivalent).
- Take proper care not to damage the mating surface of the cover.

Figure 7   Cover Removal
7.2 Disassembly of Spur Gear Reduction Unit

- Remove the cover by loosening the cover bolts with a spanner.
- Each time the cover is removed, the gasket sealing is lost as it is a liquid sealant. Re-apply gasket sealant (Loctite no. 596 or equivalent).

![Figure 8 Spur Gear Bolts](image1)

- Both spur pinions and spur gears can be removed with a circlip plier once the cover is removed.
- Remove the spur gear unit casing by loosening the allen cap screws with which it is mounted on the main AT Series GB casing.

![Figure 9 Spur Housing Disassembled](image2)
7.3 Dismantling of Worm Line Assembly

- Loosen the grub screw and key / spring pin with which the worm is fixed to the input shaft.
- Pull the input shaft out of the main housing. This will disassemble the entire worm line assembly. Now, remove the worm and all other small parts like spacers, washers, bearings, etc. from this assembly.

Figure 10  Grub Screw Removal

Figure 11  Removal of Spring Pin
7.4 Removal of Worm Wheel

- Remove the worm wheel by lifting it from the gearbox housing.
- Replace and lubricate the ‘O’ rings in the housing before reassembling the worm wheel.

Figure 12 Removing the Worm Wheel

7.5 Reassembly of AT Series Gearbox

- In reassembly of the AT Series gearbox, follow all above steps in reverse order.
- Be sure to lubricate all mating / rotating parts with grease
- Ensure to provide a liquid sealant on both covers and housing
## Section 8: Document Revision

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* Signatures on file Bettis, Houston, Texas

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Document Revision
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