

Gearbox Installation Manual

Rotork Gears IW, MOW, MTW, IB and IS ranges

(Electronic copy available on www.rotork.com)

- ! This manual contains important safety information. Please ensure it is thoroughly read and understood before installing the gearbox.**
- ! This manual is produced to enable a competent person to install, operate, adjust and inspect Rotork gearboxes. Only persons competent by virtue of their training or experience should install, maintain and repair Rotork gearboxes.**
- ! The gearbox weight is recorded on the packaging and on a label attached to the gearbox.**
- ! WARNING: Gearbox may present an unbalanced load.**
- ! WARNING: With respect to handwheel operation of Rotork gearboxes, under no circumstances should any additional lever device such as a wheel-key or wrench be applied to the handwheel in order to develop more force when closing or opening the valve as this may cause damage to the valve and/or gearbox or may cause the valve to become stuck in the seated/backseated position.**
- ! WARNING: Damage to protective coatings should be correctly rectified and may invalidate warranty.**

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1. Introduction

Unless otherwise specified the gearbox is supplied assembled. In the case of quarter turn gearboxes, the gearbox stops have been set to a nominal 90° open and close position.

! The IW gearbox stops must be re-set for the stroke of the valve after combination installation.

2. Health and Safety

Work undertaken must be carried out in accordance with the instructions in this and any other relevant manuals. The user and those persons working on this equipment should be familiar with their responsibilities under any statutory provisions relating to the Health and Safety of their workplace. Due consideration of additional hazards should be taken when using the gearbox with other equipment. Should further information and guidance relating to the safe use of the Rotork products be required, it will be provided on request.

The mechanical installation should be carried out as outlined in this manual and also in accordance with relevant standards such as British Standard Codes of Practice. No inspection or repair should be undertaken unless it conforms to the specific hazardous area certification requirements. For maintenance of the actuator, refer to the actuator installation and maintenance manual.

! WARNING: The gearbox enclosure materials may include cast iron, SG iron, carbon steel or stainless steel.

3. Storage

If your gearbox cannot be installed immediately store it in a clean dry place until you are ready to install in situ. Recommended storage temperature range: 0°C to 40°C (32°F – 104°F).

4. Unpacking

Gearboxes are packed in a variety of configurations depending on size, type and quantity of the consignment.

It is the responsibility of the individual unpacking and handling the combination to carry out a risk assessment for the supplied arrangement to ensure safe working. Refer to Section 5 Handling.

Packaging material used may include wood, cardboard, polyethylene and steel. Packaging should be recycled according to local regulations.

5. Handling

! Individual weights for gearboxes are recorded on their respective nameplates

! Only trained and experienced personnel should carry out handling. At all times, safe handling must be ensured.

! Each combination must be assessed to identify all risks associated with handling.

! The gearboxes must be fully supported until full valve shaft/stem engagement is achieved and the gearbox is secured to the valve flange.

! Once connected to the valve, each assembly must be assessed on an individual basis for safe handling/lifting. Never lift the complete combination-valve assembly via the gearbox.

! If it is necessary to lift the gearbox using lifting equipment, certified soft slings are recommended. Damage to protective coatings should be correctly rectified and may invalidate warranty.

! We recommend fitting a bolt and washer system onto the baseplate of IB and IS gearboxes before moving them, as demonstrated in Figure 7 and Figure 8.

6. Installation & Maintenance of Worm Combinations

6.1. Output Sleeve Removal, Machining and Re-Fitting

Gearbox sizes IW12 to IW16 have an output which is directly machined as specified with the order. All other worm gearbox combinations have a removable output sleeve. See Item 1, Figure 1.

Figure 1 shows the removal of the output sleeve from the gearbox. See Figure 2 for removing the output sleeve without damaging the sealing faces.

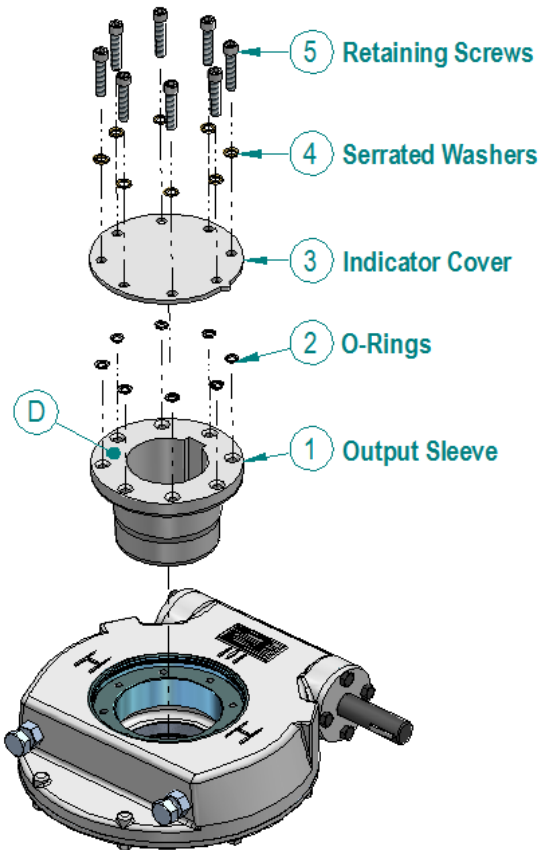


Figure 1 - IW3-11 Output Sleeve Fitting

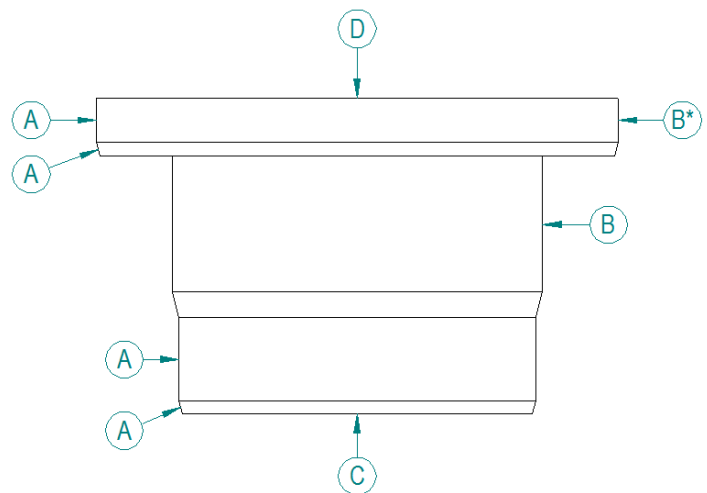


Figure 2 - IW Output Sleeve, Important Surfaces

Important Notes in Figure 2:

- A:** The surfaces marked 'A' are sealing or bearing faces and must not be damaged.
- B:** The surfaces marked 'B' can be used for chucking the output sleeve. *Note, this surface can only be used for chucking on MTW gearboxes. NOT IW or MOW units.
- C:** To remove the output sleeve from the gearbox, a force may have to be applied to the face marked 'C' of the output sleeve.
- D:** It is recommended to apply silicon sealant to the face marked 'D' when fitting the indicator plate.

Unless specifically requested at the ordering stage, the output sleeve will be supplied blank and must be machined to suit the valve shaft.

Referring to the item numbers in Figure 1, the output sleeve can be easily removed from the top of the gearbox by first removing the retaining screws (5). The screws are either serrated under their heads or are fitted with serrated washers (4). Then remove the indicator/cover plate (3).

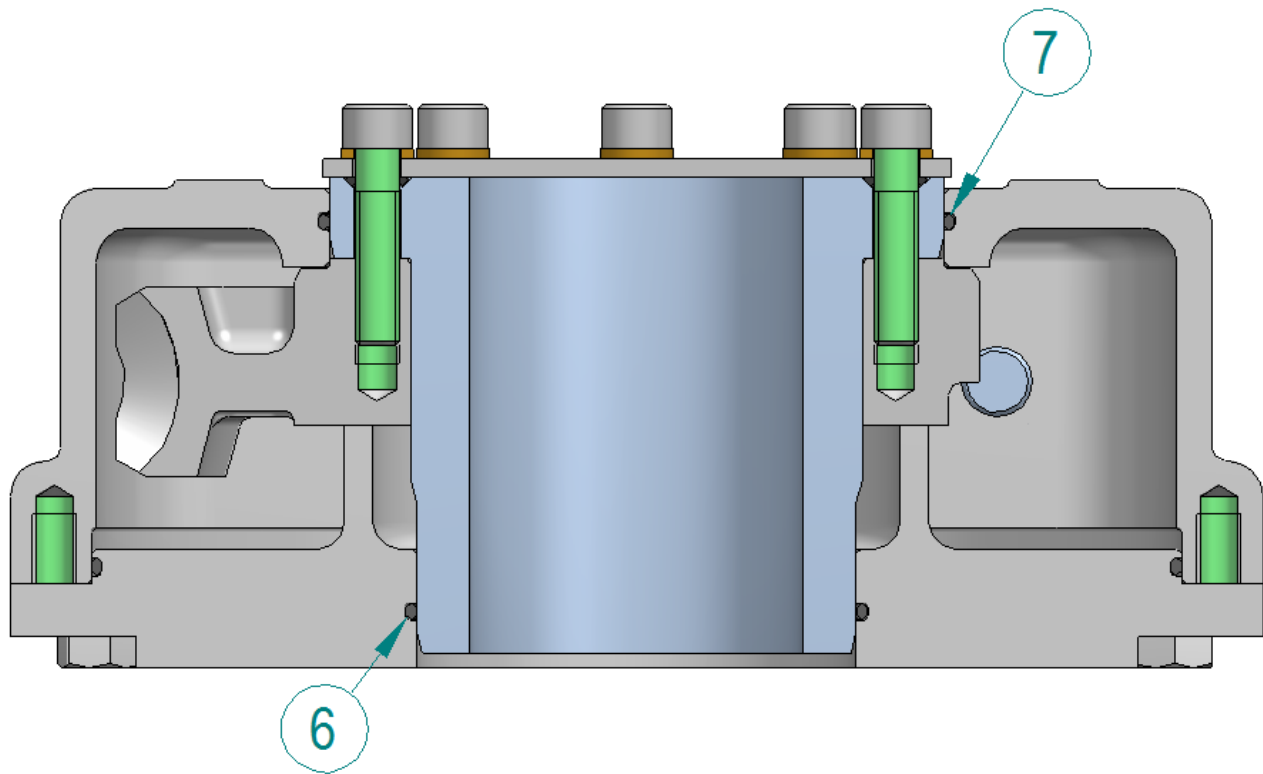


Figure 3 - O-Ring Inspection

Referring to Figure 3, O-rings (6) and (7) are to be inspected for damage, greased and properly seated before re-fitting the output sleeve. If the O-ring is damaged then it should be replaced prior to fitting the output sleeve.

! WARNING: Removing the retaining screws will result in the loss of control of the valve.

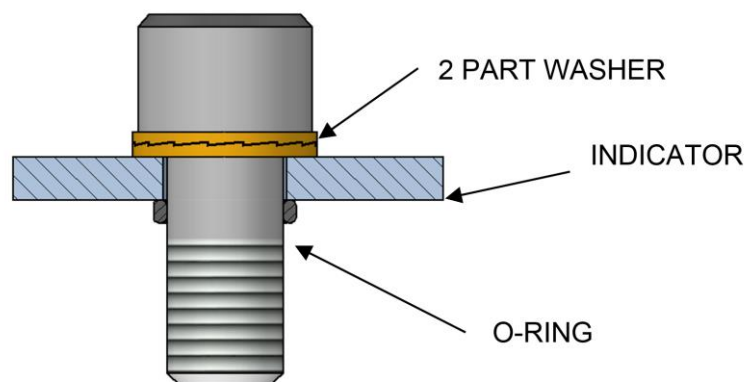
Referring to Figure 1, O rings (2) are used to seal the indicator plate, output sleeve and retaining screws. Upon final installation on the valve, screws (5) must be tightened to the correct torque figures as shown on the label on the underside of the indicator/cover plate.

Before re-fitting the output sleeve after machining, check that the surfaces marked 'A' in Figure 2 are not damaged. Damaged surfaces can break the gearbox seals and cause water ingress or grease leakage. Applying a thin layer of grease to the faces marked 'A' will make refitting of the sleeve easier.

As detailed in Figure 1 and Figure 2, it is recommended that silicon sealant is applied to face 'D' to seal the indicator/cover plate to the output sleeve. Taking care not to apply sealant to the o rings (2) or the sealing faces with the o rings.

Before re-assembly, clean and de-grease the top face of the output sleeve, underside of the indicator/cover plate, and the socket head cap screws. Make a note of the tightening torque required for the output sleeve screws on the label on the underside of the indicator plate. Insert the screws and washers into the holes in the indicator/cover plate, as per Figure 1.

It is essential to fit the two part washers the correct way round with the cam faces of the washers joining. Place the O-rings over the screw threads and against the indicator plate.



Apply a thin coat of silicon sealant to the top face of the output sleeve. Place the indicator on the output sleeve, with the indicator pointer in the correct orientation if applicable. Engage each screw through the indicator and output sleeve into the tappings in the gear quadrant. Fasten the screws evenly. As the screws start to tighten, press down on the indicator plate to extrude any excess sealant. Wipe away the excess. Tighten each screw to the recommended torque previously noted.

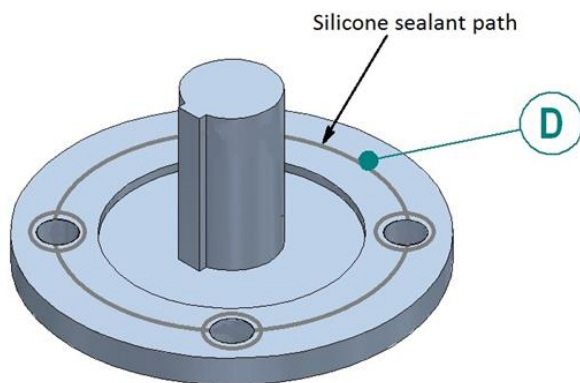
! WARNING: It is absolutely essential to assemble and torque tighten the screws immediately after the sealant is applied to the indicator/cover plate and screws. Any delay will allow the sealant to start to cure. This will result in a flexible joint being formed between the output sleeve and indicator/cover plate. This joint would relax over time, allowing the screws to loosen.

6.2. Mounting to the Valve

! WARNING: Ensure the valve is fully supported and capable of accepting increased weight and change of centre of gravity resulting from the addition of the gearbox combination.

If the gearbox has been supplied with a handwheel, it is recommended that this be fitted to the gearbox before mounting onto the valve. This will make it easier to rotate the gearing to pick up on the valve stem, either key, flats or square.

- 1) Ensure gearbox output is in the same relative position as the valve shaft (open or closed). Gearbox output position can be moved by rotating the input shaft or turning the actuator handwheel.
- 2) Apply a ring of silicone sealant around the mounting face of the flange, the ring should be at the same radius from the shaft as the bolt holes. Apply small rings of sealant around each of the bolt holes to completely seal the faces (see Fig. 4)



Important Note for Figure 4:

D: It is recommended that flanges be sealed on assembly with silicon sealant. The face marked 'D' on Figure 4 shows where sealant can be applied to the valve mounting flange.

Figure 4 - Sealing of Valve Mounting Flange

- 3) Align gearbox baseplate flange square and parallel to valve flange (see Figure 4), It is recommended that flanges be sealed on assembly with silicon sealant. Grease the output sleeve and the valve shaft.
- 4) Engage gearbox output sleeve onto the valve shaft ensuring the valve shaft keyway, square etc. is in alignment (if necessary rotate output sleeve – refer to 1)
- 5) It is essential that the gearbox baseplate is flush with the valve bonnet flange before the mounting screws are tightened. Mounting screws or studs/nuts must be high tensile steel (grade 8.8 or higher). Firmly tighten down fixings onto the valve flange to the torque required. See Table 5 in section 9.

6.3. Baseplate Thread Depths

Gearbox	Base	Min Thread Depth	Max Drill Depth
IW3 / MOW3	F/FA10, F/FA12	18	24
	F/FA14, F/FA16	24	27
IW4 / MOW4	F/FA12, F/FA14	16	20
	F/FA16	30	34
IW5 / IW52 / MOW5	F/FA14, F/FA16	20	25
	F/FA25	16	20
	F/FA25	30	34
IW6 / IW62 / IW63 / MOW6	F/FA16, F/FA25	16	25
	F/FA16, F/FA25, F/FA30	20	26
	F/FA30	30	34
IW7 / IW72 / MOW7	F/FA16, F/FA30	24	29
	F/FA30	24	28
	F/FA35	30	40
IW8 / IW82 / MOW8	F/FA25, F/FA30, F/FA35, F/FA40	24-36	30-40
	F/FA25, F/FA30, F/FA35	30	36
	F/FA40, F/FA48	36	46
IW9 / MOW9	F/FA30, F/FA35, F/FA40	25-36	34-44
	F/FA30, F/FA35, F/FA40	25-36	46
	F/FA40, F/FA48	36	44
IW10 / MOW10	F/FA35, F/FA40	30-36	41-46
	F/FA48	36	46
	F/FA60	36	46
IW11 / IW11BB / IW115 / IW115BB / MOW11	F/FA35, F/FA40, F/FA48	30-36	44
	F/FA60	36	39
IW12 / IW13	F/FA40, F/FA48, F/FA60	38	48
	F/FA48, F/FA60	38	48

Table 1 - Baseplate Mounting Hole Details

6.4. Setting the Gearbox Stops to Suit the Valve (IW and MOW Only)

This procedure should be carried out by the valvemaker/supplier and should be done when the valve opening and closing operations can be visibly checked. Once installed within the pipe the stops should not be altered without the authorisation of the valve maker/supplier.

The gearbox stops are factory set but require adjusting for optimum valve performance. If an actuator is to be used to operate the gearbox, then the mating faces between the gearbox input flange and the actuator output must be sealed prior to assembly using a ring of silicone sealant applied at the same radius as the bolt holes, a small ring of sealant should be applied around each bolt hole to completely seal the faces (see Figure 4). The actuator limit and torque switch settings should be set up according to the actuator manufacturer's recommendations. The gearbox open & closed stop screws should then be set (see Figure 5).

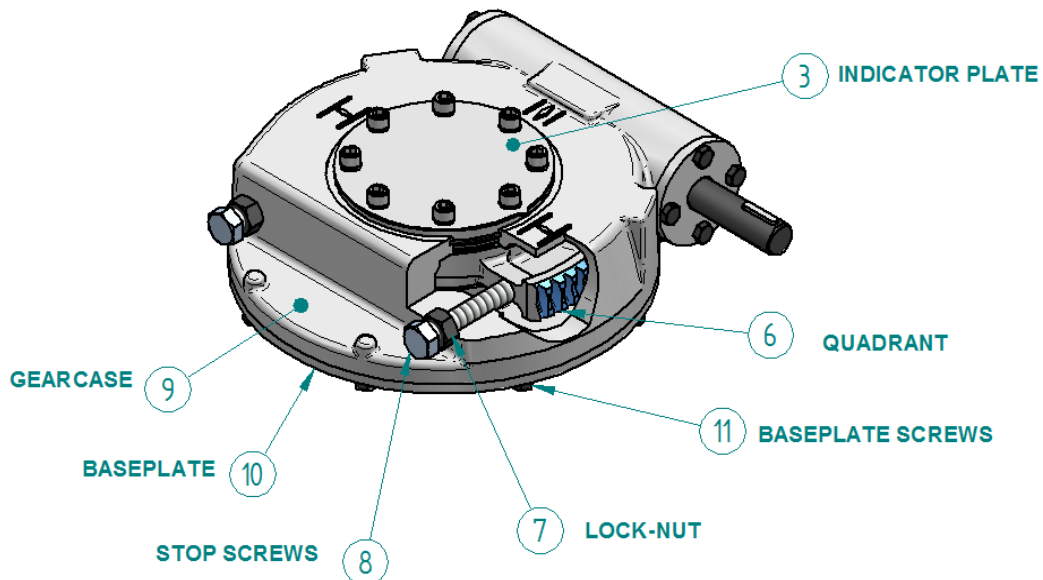


Figure 5 - Setting Stop-Bolts

Close the valve, using the actuator where applicable. Referring to Figure 5, use the indicator plate (3) pointer as an indication of position.

Loosen the lock nuts (7) and turn the stop screws out approximately 3 complete turns, apply a small amount of silicone sealant to the threads where the screws meet the gearcase. Operate the gearbox to the closed position and screw in stop screw (8) until it touches the gearbox quadrant (6). Rotate the screw back one turn, then tighten the lock-nut (7) to secure the stop screw. Open the valve with the actuator, and then repeat the process with the open position stop screw. If the stop screws are re-adjusted at a later date then silicone sealant must be re-applied.

Note – movement between baseplate (10) and gearcase (9) can occur when operating at near rated torques. It is recommended that regular maintenance occurs to verify baseplate screws (11) are correctly torqued.

6.5. Worm Combination Maintenance

Under normal operating conditions, no maintenance is required for the gearbox. Should the valve be taken out of service for overhaul, the gearbox baseplate may be removed and the lubricant changed using one of the lubricants in Table 2. The baseplate must be sealed using silicone sealant on re-assembly, unless fitted with o-rings. These should be replaced.

Gearbox	Manufacturer	Name	Temperature Range
IW	Fuchs	Renolit CL-X2	-60°C to +120°C
MOW	Fuchs	Renolit LST 0	-20°C to +120°C
MTW	Fuchs	Renolit EPLITH 00	-10°C to +120°C

Table 2 - Recommended Lubrication for Worm Gearboxes

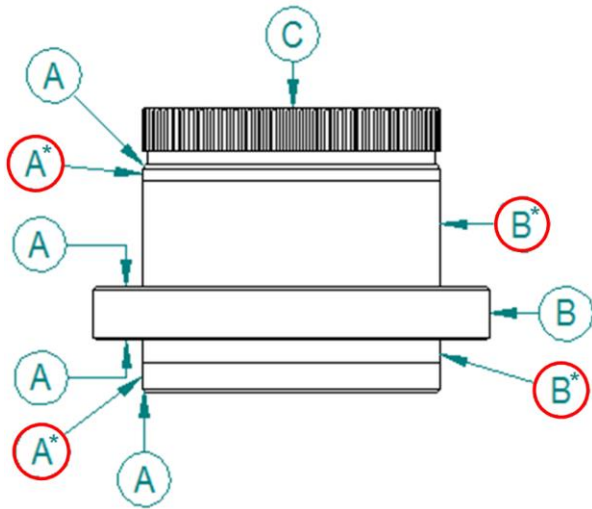
An equivalent extreme pressure lubricant may be used. For extreme temperature applications, please consult Rotork Gears.

7. Installation & Maintenance for Multi-Turn IB & IS Combinations

7.1. Output Sleeve Removal, Machining and Re-Fitting

IB and IS range of gearboxes have a removable output sleeve. Unless specifically requested at the ordering stage, the output sleeve will be supplied blank and must be machined to suit the valve stem. Before re-fitting the output sleeve after machining, check that the surfaces marked 'A' in Figure 6 are not damaged.

Damaged surfaces can break the gearbox seals or bearings and cause water ingress or grease leakage.



Important Notes:

- A: The surfaces marked 'A' are sealing or bearing faces and must not be damaged.
- B: The surface marked 'B' can be used for chucking the output sleeve for machining.
- C: To remove the output sleeve from the gearbox, a force may have to be applied to the face marked 'C' of the Output Sleeve.

Figure 6 - Splined Output Sleeve - Important Surfaces

An anti-friction compound containing molybdenum disulphide, such as MI-Setral-9M should be applied to the faces marked with "*" and highlighted in red in Figure 6, before inserting the output sleeve back into the gearbox. For clarification on the suitability of an anti-friction compound, please contact Rotork Gears.

Referring to Figure 7 below, note that the output sleeve arrangement is identical for IB and IS gearboxes. The sleeve (14) can be easily removed from the gearbox by first removing the spigot ring (15) from the baseplate (16). A small force may have to be applied to the face marked 'C' in Figure 6 to assist in removing the sleeve.

- ! **WARNING:** It is imperative that the thrust bearings in the output are fitted correctly, along with the output sleeve and the spigot ring. That is, the needle thrust bearings **MUST** have a thrust washer (12) at each side of the needle race (13). A bearing / washer assembly **MUST** be fitted at each side of the output sleeve thrust shoulder.
- ! **WARNING:** Bearings, Output sleeve and Valve Stem/shaft should be thoroughly greased with appropriate grease before fitting anytime they are fitted into the gearbox/valve. Note the spigot ring has an internal and external seal that should also be greased.

The IB and IS output sleeves are splined and may have to be rotated slightly to engage with the mating spline in the output gear.

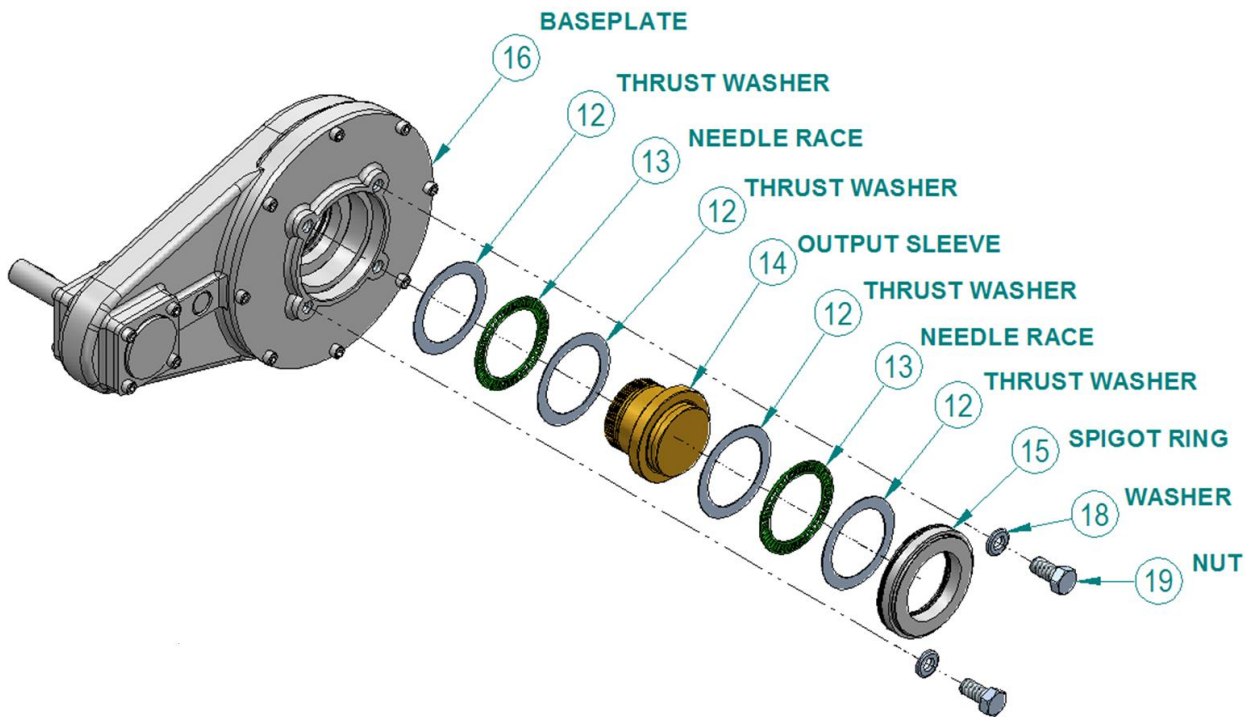


Figure 7 - IB / IS Output Sleeve Assembly

! WARNING – We recommend fitting a nut (19) and washer (18) fixture into the base of the gearbox as demonstrated in Figure 7 and Figure 8. Note that the washers must overlap the spigot ring (15). This will stop the output sleeve assembly from becoming detached from the main body. The bolts and washers are not supplied by Rotork Gears.

If the gearbox has been supplied with a handwheel, it is recommended that this be fitted to the gearbox before mounting onto the valve. This will make it easier to rotate the gearing to pick up the valve stem, key, thread or spline location.

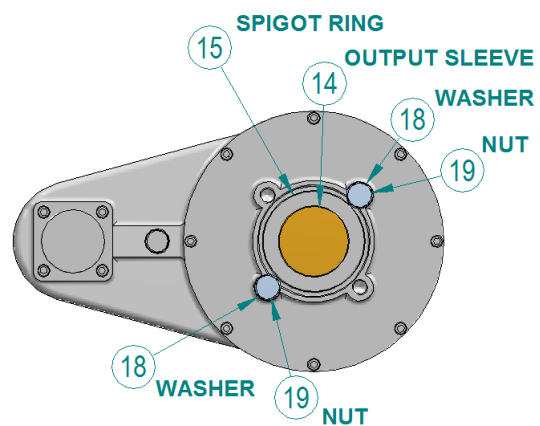


Figure 8 - Securing Spigot Example

7.2. Mounting to the Valve

- ! WARNING: Ensure the valve is fully supported and capable of accepting increased weight and change of centre of gravity resulting from the addition of the actuator-gearbox combination. The recommended maximum unsupported length for cover tubes is shown in table 3.**
- ! WARNING: Bearings, Output sleeve and Valve Stem/shaft should be thoroughly greased with appropriate grease before fitting into the gearbox/valve. Note the spigot ring has an internal and external seal that should also be greased.**

7.2.1. Gearboxes IB2 to IB13 and IS2 to IS13, IS15 and IS17.

- In addition to the points in Section 7.2.3, it is recommended that the machined output sleeve assembly is assembled onto the valve stem first and then the gearbox lowered onto the output sleeve assembly. See Figure 9 and Figure 10 for assembly details.

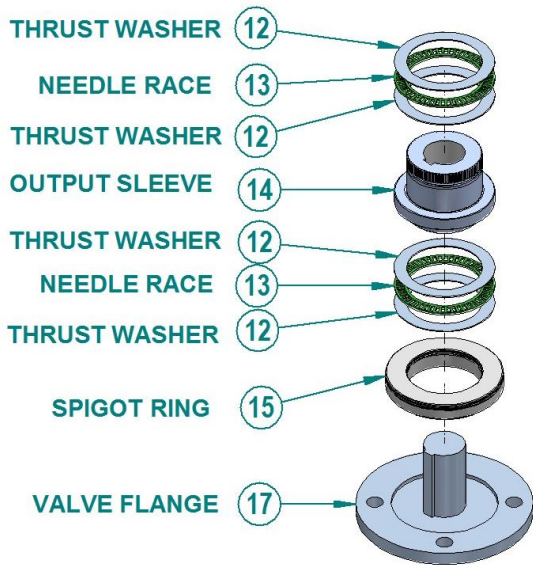


Figure 9 - Valve Stem Assembly

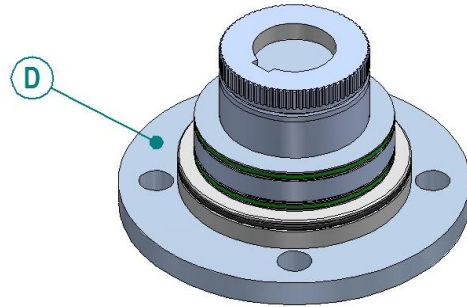


Figure 10 - Valve Stem (Assembled)

- Fit the machined output sleeve (14), thrust bearings (12 & 13) and baseplate spigot ring (15) on the valve shaft as shown in the Figure . Bearings should be lubricated with the appropriate grease (see Table 4). Grease the bearings, output sleeve and valve stem. Note that the spigot ring has an internal and external seal that should also be greased.

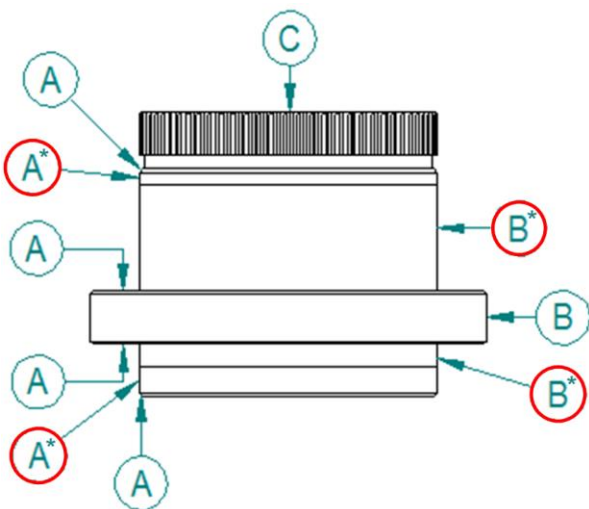


Figure 11 - Splined Output Sleeve - Important Surfaces

Important Notes:

- A:** The surfaces marked 'A' are sealing or bearing faces and must not be damaged.
- B:** The surface marked 'B' can be used for chucking the output sleeve for machining.
- C:** To remove the output sleeve from the gearbox, a force may have to be applied to the face marked 'C' of the Output Sleeve.

- An anti-friction compound containing molybdenum disulphide, such as MI-Setral-9M should be applied to the faces marked with '*' and highlighted in red in figure 11, before inserting the output sleeve back into the gearbox. For clarification on the suitability of an anti-friction compound, please contact Rotork Gears.

7.2.2. Gearboxes IB14 and IS14, IS16, and IS18-IS21

- In addition to the points in Section 7.2.3, it is recommended that the cylindrical roller bearings and machined output sleeve are assembled onto the valve stem first and then the gearbox lowered to locate on the output sleeve assembly. See Figure 12 for assembly details:

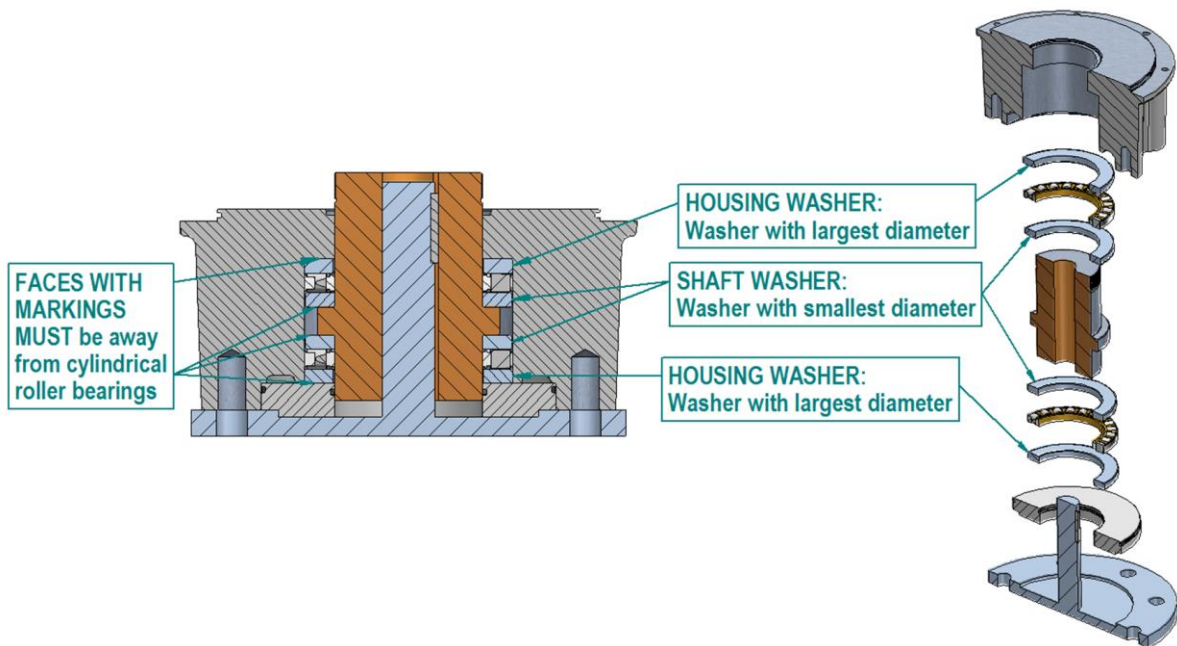
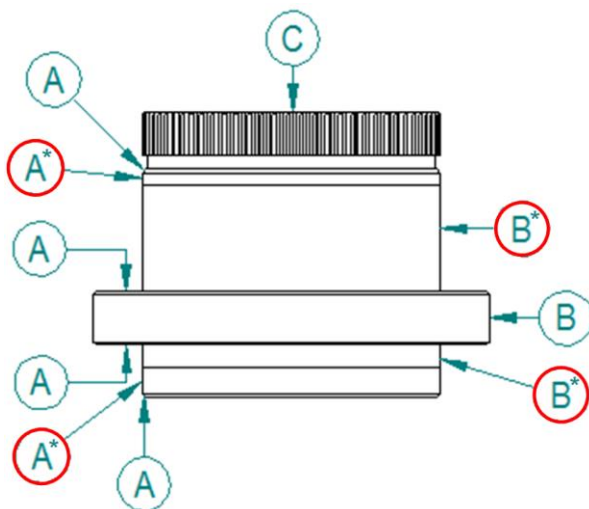


Figure 12 - Valve Stem Assembly with Cylindrical Roller Bearings

- Fit in the following order:
 - o Spigot Ring,
 - o Housing Washer (Largest Outside Diameter),
 - o Bearing
 - o Shaft Washer (Smallest Outside Diameter),
 - o Output Sleeve,
 - o Shaft Waster (Smallest Outside Diameter),
 - o Bearing
 - o Housing washer (Largest Outside Diameter)
- The washer faces that are either chamfered or have markings MUST FACE AWAY from the bearings to decrease wear on the bearing. Bearings should be lubricated with the appropriate grease. Grease the output sleeve and valve stem. Note that the spigot ring has an internal and external seal that should also be greased.



Important Notes:

- A: The surfaces marked 'A' are sealing or bearing faces and must not be damaged.
- B: The surface marked 'B' can be used for chucking the output sleeve for machining.
- C: To remove the output sleeve from the gearbox, a force may have to be applied to the face marked 'C' of the Output Sleeve.

Figure 13 - Splined Output Sleeve - Important Surfaces

- An anti-friction compound containing molybdenum disulphide, such as MI-Setral-9M should be applied to the faces marked with “*” and highlighted in red in figure 13, before inserting the output sleeve back into the gearbox. For clarification on the suitability of an anti-friction compound, please contact Rotork Gears.

7.2.3. All IB and IS Gearboxes

- Ensure that the gearbox baseplate is parallel to the valve flange when lowering. This will avoid jamming.
- It is recommended that a silicon sealant is used between the gearbox baseplate and the valve flange. ‘D’ in Figure 4 highlights where this sealant should be applied.
- When lowering the gearbox onto the valve rotate the handwheel to ensure the gearbox internal splines correctly engage with the external splines on the output sleeve. Once engaged keep lowering the gearbox until the valve and gearbox flanges are in contact. Align mounting base holes and secure using screws or studs with a minimum tensile strength of 800 N/mm². Tighten fasteners onto the valve flange to the torque required. See Table 5 in Section 9.
- For rising stem valves, a cover tube must be fitted to protect the valve stem. **! WARNING: Do not pack the cover tube with grease as this can lead to a pressure build up in the cover tube.** Screw or bolt the cover tube into the gearbox and seal with a suitable sealant to prevent water ingress.
- Cover tubes are extensions to the gearcase and thus, damage to the cover tube can cause damage to the gearcase. It is essential that the cover tubes are protected or supported to avoid side loads as a result of the environment or the application. See Table 3:

Gearbox	Maximum Unsupported Tube Length
IB3 to IB5, IS4 to IS5	2.0m (6.6ft)
IB6 to IB7, IS6 to IS7	2.8m (9.2ft)
IB8 to IB9, IS8 to IS9	3.0m (9.8ft)
IB10 to IB14, IS10 to IS20	5.0m (16.4ft)

Table 3 - Maximum Unsupported Tube Lengths

- When an actuator is being installed to the input of the gearbox, it is important to apply a ring of silicone sealant between the mating faces prior to assembly (see Figure 4).

7.3. Maintenance Instructions for IB & IS Gear Operators

For standard duties, all gear cavities are lubricated for life with Fuchs Renolit CL-X2 grease. Under normal operating conditions, no maintenance is required for the gearbox. However, should the valve be taken out of service for overhaul, the gearbox baseplate may be removed and the grease changed using the following recommended lubricant. The baseplate must be sealed using silicone sealant on re-assembly, unless fitted with an O ring. All O rings should be renewed.

An anti-friction compound containing molybdenum disulphide, such as MI-Setral-9M should be applied to the faces marked with “*” and highlighted in red in figure 9, before inserting the output sleeve back into the gearbox. For clarification on the suitability of an anti-friction compound, please contact Rotork Gears.

Note: All thrust elements and bearing cavities must be re-greased and re-fitted in the correct order. The recommended lubricant is shown in Table 4.

Gearbox	Manufacturer	Name	Temperature Range
IB and IS	Fuchs	Renolit CL-X2	-60°C to +120°C

Table 4 - Recommended Lubrication for Bevel and Spur Gearboxes

An equivalent extreme pressure lubricant may be used. For extreme temperature applications, please consult the factory.

8. Paint Repair Procedure

If paint repair is required, the following procedure should be followed:

- Clean surface using solvent if necessary.
- Rinse surface with clean fresh water to remove any foreign matter and traces of solvent.
- Abrade area using wet and dry sandpaper, or power sander, feather edges of sound intact paint around damaged area by 2.5 cm
- Apply paint system as per originally applied to unit ensuring that dry film thickness (dft) limits are met and time is allowed for each coat to cure. All as per the paint manufacturer's data sheets.

Ambient Conditions - No cleaning or coating application shall be undertaken if:

- The relative humidity is more than 85%
- The metal temperature is less than 3°C above the dew point.
- The ambient conditions are outside those stated in the paint manufacturer's data sheet for each coating.
- Coatings shall only be applied or cured at ambient and steel temperatures above 10°C or otherwise recommended by paint supplier.

9. Reference

Table 5 shows recommended tightening torques for mounting the gearbox to the valve.

Gearbox to valve fixing must conform to Material Specification ISO Class 8.8, yield strength 628N/mm² to use Table 5 below:

Imperial Size (Hex)	Torque		Metric Size (Hex)	Torque	
	Nm	lbs/ft.		Nm	lbs/ft.
3/8"	34	25	M5	5	4
7/16"	55	40	M6	9	6
1/2"	83	61	M8	21	15
9/16"	120	89	M10	41	30
5/8"	166	122	M12	71	53
3/4"	291	215	M16	177	131
7/8"	469	346	M20	346	255
1"	702	518	M24	598	441
1 1/4"	1403	1035	M30	1189	877
1 1/2"	2441	1800	M36	2079	1533

Table 5 - Torque Tightening Figures

10. Handwheel Types

Handwheel Type - Weight Kgs (lbs)					
Size in mm	CD (Cast)	PS (Pressed Steel)	SG (Steel - Welded)	S (Stainless Steel)	F/FS (Steel - Welded)
50	0.11 (0.24)	-	-	-	-
75	0.21 (0.46)	-	-	-	-
100	0.32 (0.71)	0.15 (0.33)	-	-	-
125	0.54 (1.19)	0.2 (0.44)	-	-	-
150	-	-	1 (2.20)	0.4 (0.88)	-
160	-	0.35 (0.77)	-	-	-
200	1 (2.20)	0.75 (1.65)	1.35 (2.98)	1 (2.20)	1 (2.20)
250	-	1.5 (3.31)	1.4 (3.09)	-	-
300	-	-	1.8 (3.97)	-	1.5 (3.31)
315	-	2 (4.41)	-	-	-
350	-	-	2.3 (5.07)	1.5 (3.31)	-
400	-	3.5 (7.72)	2.8 (6.17)	-	2.2 (4.85)
450	-	-	3 (6.61)	-	-
500	-	-	3.5 (7.72)	-	3 (6.61)
600	-	-	4.5 (9.92)	-	3.2 (7.05)
700	-	-	5 (11.02)	-	5.5 (12.13)
800	-	-	5.5 (12.13)	-	6.6 (14.55)
900	-	-	6 (13.23)	-	7.2 (15.87)
1000	-	-	-	-	8.4 (18.52)
1100	-	-	-	-	9.4 (20.72)
1200	-	-	-	-	10.27 (22.64)

Table 6 - Handwheel Weights by Type