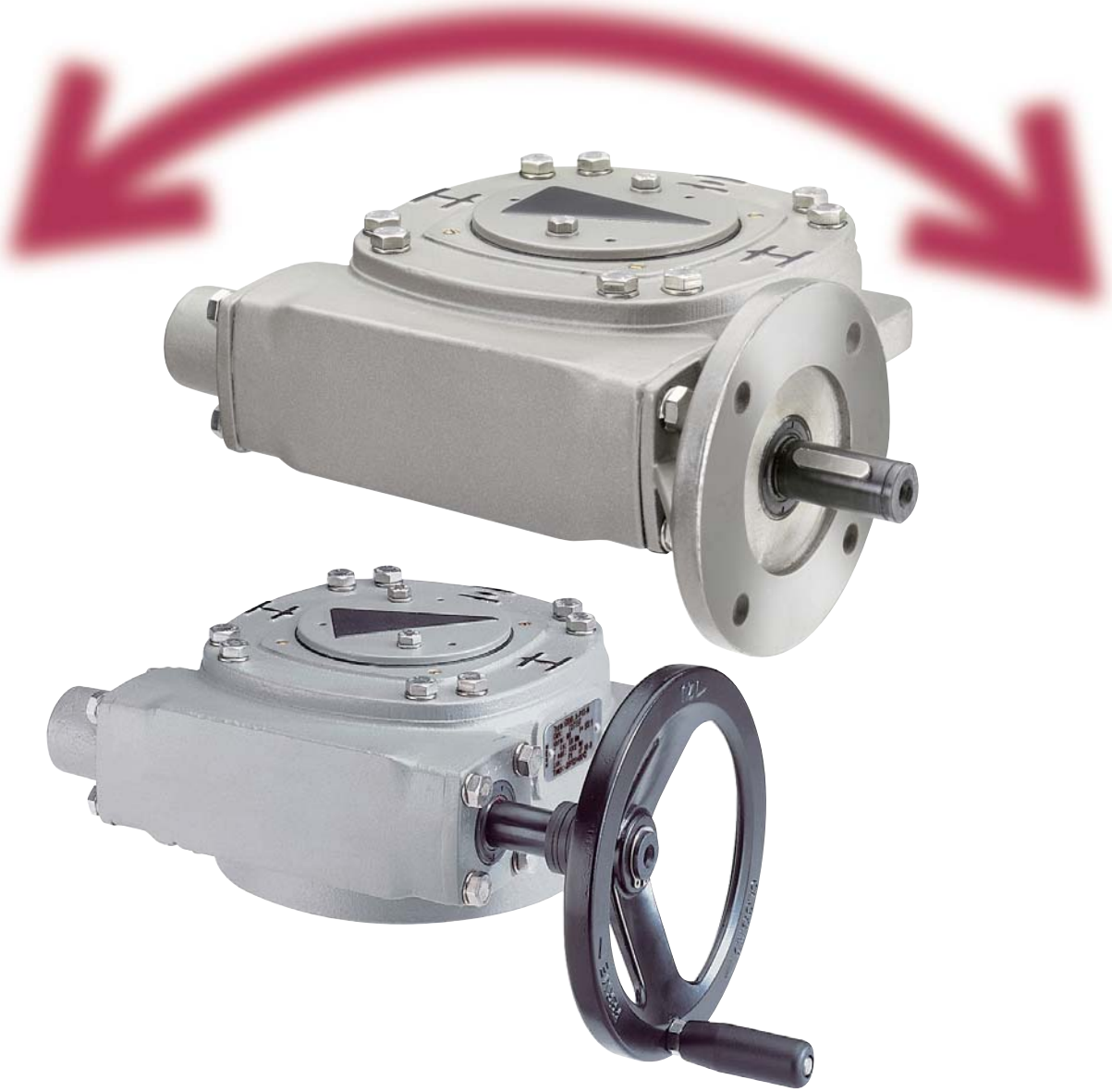
auma®

Part-turn gearboxes

Worm gearboxes
GS 50.3 – GS 250.3
for flange types FA



AUMA Actuators, Inc.
Registered to ISO 9001
Certificate No. A4682

Operation instructions

Scope of these instructions: These operation instructions are valid for worm gearboxes of the type range GS 50.3 – GS 125.3 with primary reduction gearings VZ 2.3 – VZ 4.3. and GS 160.3 – GS 250.3 with primary reduction gearings GZ 160.3 – GZ 250.3.

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1. Safety instructions

1.1 Range of application

AUMA worm gearboxes GS 50.3 – GS 250.3 are used for the operation of valves (e.g. butterfly valves and ball valves).
They are designed for manual operation as well as motor operation in conjunction with electric actuators.
For other applications, please consult us. The manufacturer is not liable for any possible damage resulting from use in other than the designated applications. Such risk lies entirely with the user.
Observance of these operation instructions is considered as part of the gearboxes' designated use.

1.2 Maintenance

The maintenance instructions (refer to page 19) must be observed, otherwise a safe operation of the worm gearbox is no longer guaranteed.

1.3 Warnings and notes

Non-observance of the warnings and notes may lead to serious injuries or damage. Qualified personnel must be thoroughly familiar with all warnings and notes in these operation instructions.
Correct transport, proper storage, mounting and installation, as well as careful commissioning are essential to ensure a trouble-free and safe operation.
The following references draw special attention to safety-relevant procedures in these operation instructions. Each is marked by the appropriate pictograph.

This pictograph means: Note!
"Note" marks activities or procedures which have major influence on the correct operation. Non-observance of these notes may lead to consequential damage.

This pictograph means: Warning!
"Warning" marks activities or procedures which, if not carried out correctly, can affect the safety of persons or material.

2. Technical data

Features and functions

Version	Standard: clockwise rotation RR, counterclockwise rotation LL, option: RL or LR
Housing material	Standard: cast iron (GJL-250), Option: spheroidal cast iron (GJS-400-15)
Self-locking	The gearboxes are self-locking when at stand-still under normal service conditions; strong vibrations may cancel the self-locking effect. While in motion, safe breaking is not guaranteed. If this is required, a separate brake must be used.

Output torques

Type	Output torques				
	100 % max. ft lbs.	140 % max. ft lbs.	175 %[1] max. ft lbs.	200 %[1] max. ft lbs.	Modulating torque[2] max. ft lbs.
GS 50.3	184	258	–	369	92
GS 63.3	369	516	–	738	184
GS 80.3	738	1,033	–	1,475	369
GS 100.3	1,475	2,065	–	2,950	738
GS 125.3	2,950	4,130	–	5,900	1,475
GS 160.3	5,900	8,298	10,326	–	2,950
GS 200.3	11,801	16,595	20,652	–	5,900
GS 250.3	23,602	32,822	41,303	–	16,000

End stops: Positive for both end positions by traveling nut, sensitive adjustment

Strength of end stop: Guaranteed strength of end stop (in ft lbs.) for input side operation

Type	GS 50.3	GS 63.3	GS 80.3	GS 100.3			GS 125.3		
Reduction gearing	–	–	–	VZ 2.3	VZ 3.3	VZ 4.3	VZ 2.3	VZ 3.3	VZ 4.3
ft lbs.	185	330	330	370		185	370		185

Type	GS 160.3		GS 200.3			GS 250.3		
Reduction gearing	GZ 160.3		GZ 200.3			GZ 250.3		
Reduction ratio	4:1	8:1	4:1	8:1	16:1	4:1	8:1	16:1
ft lbs.	370	330	370			370		

Swing angle GS 50.3 – GS 125.3	Standard: Fixed swing angle up to max. 100°; set in the factory to 92° unless ordered otherwise. Options: Adjustable in steps of: 10°– 35°, 35° – 60°, 60° – 80°, 80° – 100°, 100° – 125°, 125° – 150°, 150° – 170°, 170° – 190° For version with worm wheel made of bronze: swing angle > 190°, Multi-turn version without end stops, version GSD[3]
Swing angle GS 160.3 – GS 250.3	Standard: Adjustable 80° – 100°; set in the factory to 92° unless ordered otherwise. Options: Adjustable in steps of: 20° – 40°, 40° – 60°, 60° – 80°, For version with worm wheel made of bronze: swing angle > 100°, Multi-turn version without end stops, version GSD[3]
Mechanical position indicator	Standard: Pointer cover for continuous position indication Options: Sealed pointer cover for horizontal outdoor installation[4] Protection cover for buried service instead of pointer cover
Input shaft	Cylindrical with parallel key according to DIN 6885.1

Operation

Motor operation	With electric multi-turn actuator, directly or through primary reduction gearing VZ/GZ Flanges for mounting of actuator, refer also to separate technical data sheets.
Type of duty	According to actuator

Manual operation[5]: Via handwheel, directly or through primary reduction gearing VZ/GZ
Available handwheel diameters, selection according to the max. output torque:

Type	GS 50.3	GS 63.3	GS 80.3	GS 100.3				GS 125.3			
Reduction gearing	–	–	–	–	VZ 2.3	VZ 3.3	VZ 4.3	–	VZ 2.3	VZ 3.3	VZ 4.3
Handwheel Ø mm	160 200 250	250 315	315 400	400 500	315 400	315 400	250 315	500 630 800	400 500	400 500	315 400

Type	GS 160.3			GS 200.3				GS 250.3			
Reduction gearing	–	GZ 160.3		–	GZ 200.3			–	GZ 250.3		
Handwheel Ø mm	630 800	400	315	–	500 630	400	315	–	800	500 630	400

25.4 mm correspond to 1 inch

1) With worm wheel made of spheroidal cast iron
2) Requires worm wheel made of bronze
3) Special sizing is required
4) For gas applications with sealed pointer cover, an air vent in the pointer cover or venting grooves in the valve mounting flange must be provided
5) Handwheel sizes shown reflect general industrial selection criteria. For information on gearbox/handwheel selection in accordance with AWWA Standard C504, please refer to separate selection list/chart.

Primary reduction gearing	
Primary reduction gearing	Planetary gear with various reduction ratios for reducing the input torques
Valve attachment	
Valve attachment	Dimensions according to SP 101 Standard: GS 50.3 – GS 125.3: without spigot GS 160.3 – GS 250.3: without spigot Options: GS 50.3 – GS 125.3: with spigot GS 160.3 – GS 250.3: with spigot
Splined coupling for connection to the valve shaft	Standard: without bore or pilot bore from GS 160.3 Worm gearbox can be repositioned 4 x 90° on coupling Options: Machined with bore and keyway, square bore or bore with two-flats
Service conditions	
Enclosure protection according to EN 60 529[6)]	Standard: IP 68-3, dust and water tight up to max. 3 m head of water Options[7)]: IP 68-6, dust and water tight up to max. 6 m head of water IP 68-10, dust and water tight up to max. 10 m head of water IP 68-20, dust and water tight up to max. 20 m head of water
Corrosion protection	Standard: KN Suitable for installation in industrial units, in water or power plants with a low pollutant concentration Options: KS Suitable for installation in occasionally or permanently aggressive atmosphere with a moderate pollutant concentration (e.g. in wastewater treatment plants, chemical industry) KX Suitable for installation in extremely aggressive atmosphere with high humidity and high pollutant concentration
Paint	Standard: GS 50.3 – GS 125.3: Two-component iron-mica combination GS 160.3 – GS 250.3: Two-component iron-mica combination
Color	Standard: Grey (DB 702, similar to RAL 9007) Option: Other colors on request
Ambient temperature	Standard: – 20 °F to + 175 °F/ – 25 °C to + 80 °C Options: – 40 °F to + 140 °F/ – 40 °C to + 60 °C (low temperature), version L – 75 °F to + 140 °F/ – 60 °C to + 60 °C (extreme low temperature), version EL + 32 °F to + 250 °F/ – 0 °C to + 120 °C (high temperature), version H
Lifetime	Open-close duty: The lifetime is based on a load profile typical for part-turn valves

Type	**Operating cycles (OPEN - CLOSE - OPEN) for swivel movements of 90° (max. 100°) and a maximum output torque of**			
	100 %	140 %	175 %[8)]	200 %[9)]
GS 50.3	15,000	5,000	–	1,000
GS 63.3	15,000	5,000	–	1,000
GS 80.3	15,000	5,000	–	1,000
GS 100.3	15,000	5,000	–	1,000
GS 125.3	15,000	5,000	–	1,000
GS 160.3	15,000	5,000	1,000	–
GS 200.3	15,000	5,000	1,000	–
GS 250.3	10,000	3000	750	–

Modulating duty: min. 2.5 million operations[8)]

6) Refer to section enclosure protection IP 68

7) Not available for GS 50.3

8) With worm wheel made of spheroidal cast iron

9) The lifetime for modulating duty depends on the load and the number of starts. A high starting frequency will rarely improve the modulating accuracy. To reach the longest possible maintenance and fault-free operation time, the number of starts per hour chosen should be as low as permissible for the process

Accessories	
Valve position indicators	Valve position indicator WSG for the signalization of intermediate and end positions for precise and low-backlash feedback for swing angles ranging from 82° – 98° (refer to separate data sheet)
	Valve position indicator WGD for signalization of intermediate and end positions for swing angles > 180° (refer to separate data sheet)
Limit switching	Limit switching WSH for manually operated valves. For the signalization of intermediate and end positions (refer to separate data sheet)
Further information	
Reference documents	Product description Worm gearboxes GS 50.3 – GS 250.3 /GS 315 – GS 500 Dimension sheets GS 50.3 – GS 125.3, GS 160.3 – GS 250.3 Technical data GS 50.3 – GS 125.3, GS 160.3 – GS 250.3 Technical data SA, SAR, WSG, WGD, WSH
Lever gearboxes	See separate documents

3. Transport, storage and packaging

3.1 Transport

- Transport to place of installation in sturdy packing.
- If mounted together with actuator:
  Attach ropes or hooks for the purpose of lifting by hoist only to the gearbox and not to the actuator.
- If eyebolts are supplied with the gearbox, they should be used to lift the gearbox only and not the valve

3.2 Storage

- Store in well-ventilated, dry room.
- Protect against floor dampness by storage on a shelf or on a wooden pallet.
- Cover to protect against dust and dirt.
- Apply suitable corrosion protection agent to bare surfaces.

In case worm gearboxes are to be stored for a long period (more than 6 months), the following points must be observed additionally:

- Prior to storage: Protect bare surfaces, in particular the output drive parts and mounting surface, with long-term corrosion protection agent.
- Check for corrosion approximately every 6 months. If first signs of corrosion show, apply new corrosion protection.

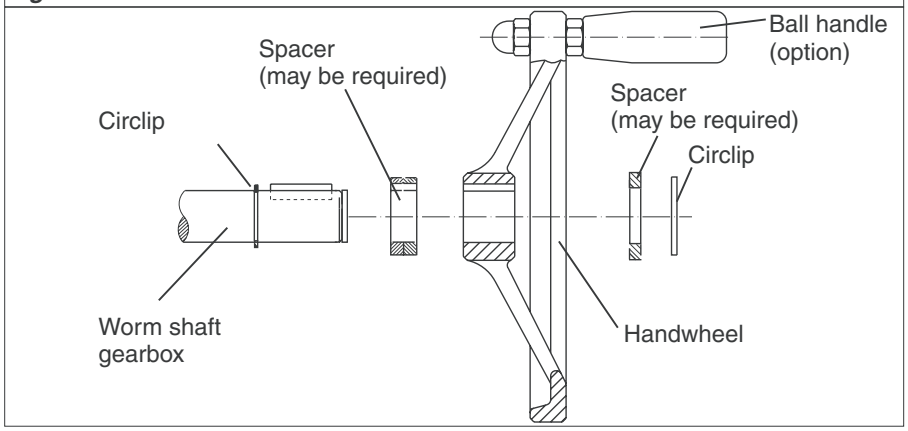
3.3 Packaging

Our products are protected by special packaging for the transport ex works. The packaging consists of environmentally friendly materials which can easily be separated and recycled.
For the disposal of the packaging material, we recommend recycling and collection centers.

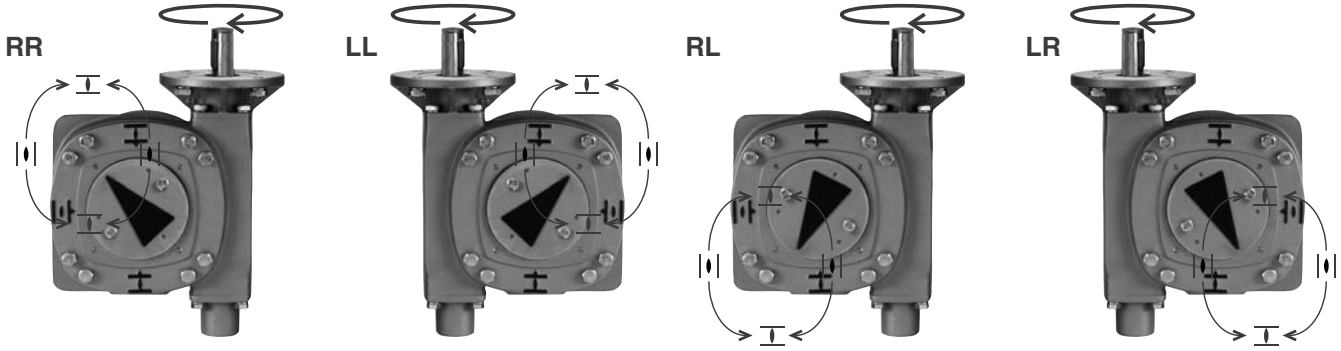
4. Fitting the handwheel

For worm gearboxes designed for manual operation the handwheel may be supplied separately. Fitting is done on site according to figure A.

Figure A: Handwheel



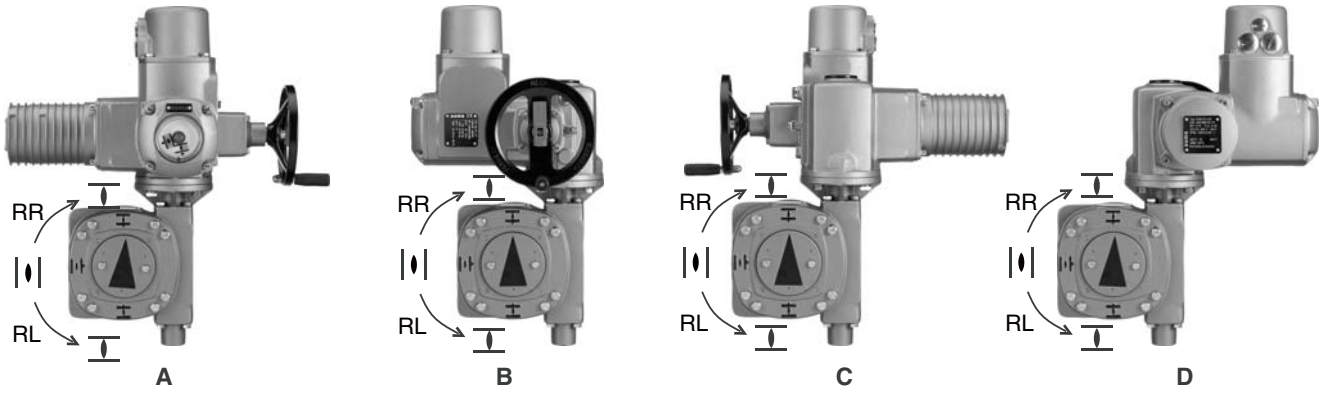
5. Mounting positions of the different versions



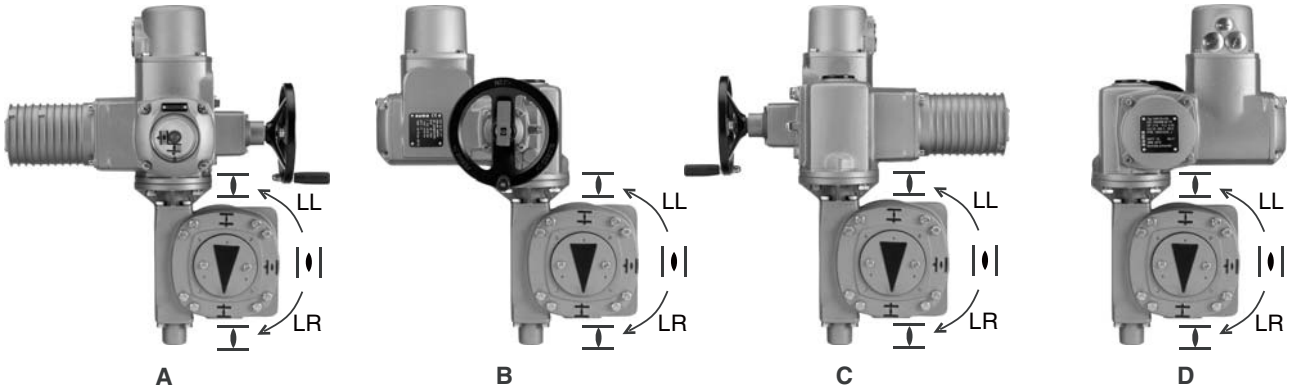
Description of the 4 versions (viewed at the pointer cover):

Code	Direction of rotation at input shaft	Position of worm shaft	Direction of rotation at output drive
RR	clockwise	**R**ight side	clockwise
LL	clockwise	**L**eft side	counterclockwise
RL	clockwise	**R**ight side	counterclockwise
LR	clockwise	**L**eft side	clockwise

Mounting positions of AUMA multi-turn actuator with AUMA worm gearbox (please indicate when ordering)
GS versions **RR / RL**



GS versions **LL / LR**



Mounting positions can easily be changed at a later date.

Limitation: For SA/SAR 14.1/14.5 with GS 125.3, mounting position “C” in version RR/RL and “A” in version LL/LR is only possible for a handwheel diameter up to 12.4 ”.

Up to size GS 125.3, the actuator-gearbox combination is delivered in the ordered mounting position. For packing reasons, actuator and gearbox is delivered separately from size GS 160.3.

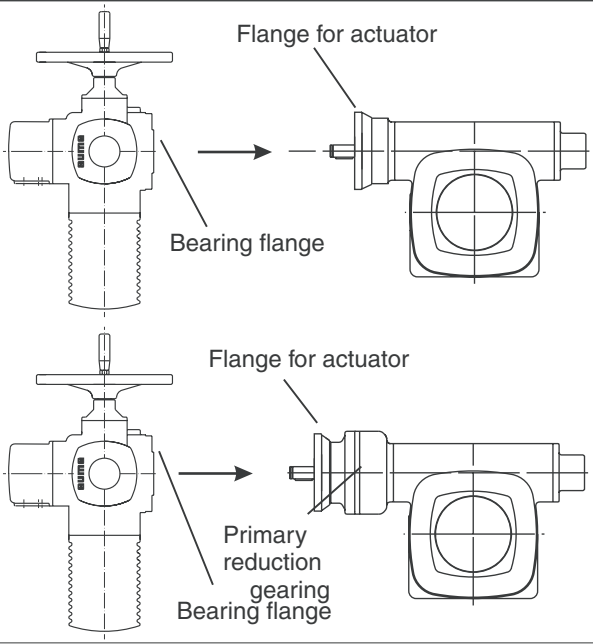
6. Mounting multi-turn actuators SA/SAR

When gearboxes and multi-turn actuators are supplied together, the mounting has been done in the factory up to gearbox size GS 125.3. For sizes GS 160.3 and larger, the mounting of gearboxes is performed as follows.

In case flange for actuator is not attached to gearbox or reduction gearing:

- Thoroughly degrease the mounting faces of the gearbox or reduction gearing as well as the flange for actuator.
- For GS 100.3 – GS 250.3:
  Insert pin in the corresponding groove of the bearing cover.
- Fit flange for actuator and fasten with bolts and lock washers.
- Fasten bolts crosswise with a torque according to table 2.

Figure B: Mounting multi-turn actuator to worm gearbox



Mounting the multi-turn actuator:

- Thoroughly degrease the faces of the flange for actuator at the gearbox or reduction gearing as well as the actuator's bearing flange.
- Place the multi-turn actuator on the worm gearbox or reduction gearing. The multi-turn actuator can be mounted on the valve at every 90°
  (see page 8, mounting positions).
- Ensure that the spigot mates uniformly in the recess and that the mounting faces are in complete contact.
- Fasten actuator with bolts and lock washers (see table 1) at the flange of the worm gearbox.
- Fasten bolts crosswise with a torque according to table 2.

Do not attach ropes or hooks for the purpose of lifting the actuator by hoist to the handwheel. If multi-turn actuator is mounted on gearbox, attach ropes or hooks for the purpose of lifting by hoist to gearbox and not to multi-turn actuator.

Table 1: Bolts for mounting AUMA actuators to worm gearboxes/ primary reduction gearing (strength class min. 8.8)

Worm gearbox/ primary reduction gearing	SA(R) 07.1-FA10			SA(R) 07.5-FA10		
	Bolt (UNC)	Lock washer	Qty.	Bolt (UNC)	Lock washer	Qty.
GS 50.3	3/8-16x1	3/8	4			
GS 63.3	3/8-16x1	3/8	4	3/8-16x1	3/8	4
GS 80.3				3/8-16x1	3/8	4
GS 100.3						
GS 100.3/VZ	3/8-16x1	3/8	4	3/8-16x1	3/8	4
GS 125.3						
GS 125.3/VZ				3/8-16x1	3/8	4
GS 160.3						
GS 160.3/GZ	3/8-16x1	3/8	4	3/8-16x1	3/8	4
GS 200.3						
GS 200.3/GZ	3/8-16x1	3/8	4	3/8-16x1	3/8	4

Worm gearbox/ primary reduction gearing	SA(R) 10.1-FA10			SA(R) 14.1-FA14			SA(R) 14.5-FA14			SA(R) 16.1-FA16		
	Bolt (UNC)	Lock washer	Qty.	Bolt (UNC)	Lock washer	Qty.	Bolt (UNC)	Lock washer	Qty.	Bolt (UNC)	Lock washer	Qty.
GS 63.3	3/8-16x1	3/8	4									
GS 80.3	3/8-16x1	3/8	4									
GS 100.3	3/8-16x1	3/8	4	5/8-11x1½	5/8	4						
GS 100.3/VZ	3/8-16x1	3/8	4									
GS 125.3				5/8-11x1½	5/8	4	5/8-11x1½	5/8	4			
GS 125.3/VZ	3/8-16x1	3/8	4	5/8-11x1½	5/8	4						
GS 160.3							5/8-11x1½	5/8	4	¾-10x2	3/4	4
GS 160.3/GZ	3/8-16x1	3/8	4	5/8-11x1½	5/8	4						
GS 200.3										¾-10x2	3/4	4
GS 200.3/GZ	3/8-16x1	3/8	4	5/8-11x1½	5/8	4	5/8-11x1½	5/8	4			
GS 250.3												
GS 250.3/GZ	3/8-16x1	3/8	4	5/8-11x1½	5/8	4	5/8-11x1½	5/8	4	¾-10x2	3/4	4

Worm gearbox/ primary reduction gearing	SA(R) 25.1-FA25			SA(R) 30.1-FA30		
	Bolt (UNC)	Lock washer	Qty.	Bolt (UNC)	Lock washer	Qty.
GS 160.3						
GS 160.3/GZ						
GS 200.3	5/8-11x2	5/8	8			
GS 200.3/GZ						
GS 250.3	5/8-11x2	5/8	8	¾-10x2	3/4	8
GS 250.3/GZ						

7. Mounting to valve

AUMA worm gearboxes GS and primary reduction gearings VZ/GZ can be operated in any mounting position.

- For **butterfly valves,** the recommended mounting position is end position CLOSED
  (Prior to mounting, bring the gearbox to the mechanical end stop CLOSED by turning the handwheel clockwise).
- For **ball valves,** the recommended mounting position is end position OPEN
  (Prior to mounting, bring the gearbox to the mechanical end stop OPEN by turning the handwheel counterclockwise).
- Alternatively, the limit stop housing can be turned up to the end position of the respective valve.
- Thoroughly degrease mounting faces of gearbox and valve.
- Place coupling sleeve onto valve shaft and secure (refer to figure C, detail A or B), ensure that dimensions X, Y, and Z are observed (refer to table 2).
- Apply non-acidic grease at splines of coupling.
- Mount gearbox on valve. Ensure that the spigot (if provided) mates uniformly in the recess and that the mounting faces are in complete contact.
- Fasten gearbox with bolts (quality min. 8.8) and lock washers.
- Fasten bolts crosswise with a torque according to table 2.

Figure C

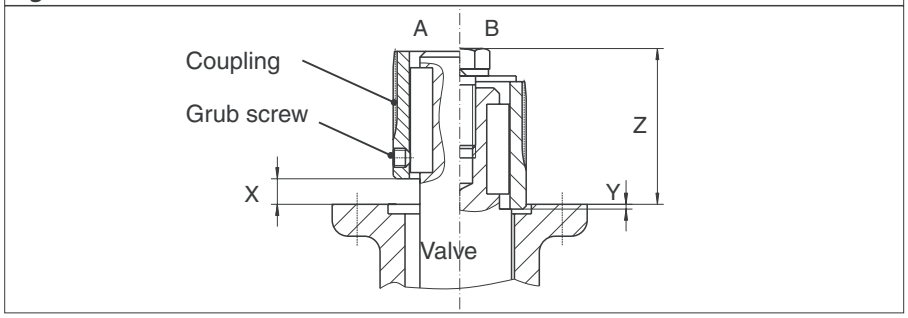


Table 2: Standard dry fastening torques for bolts

Gearbox	Dimensions			Bolts	Strength class Grade 5
Flange type	X max	Y max	Z max	Qty. x threads (UNC)	Fastening torque T_A [Ft lbs.]
GS 50.3-FA10	14	5	61	4 x ⅜ - 16	33
GS 63.3-FA10	7	18	73	4 x ⅜ - 16	33
GS 63.3-FA12	10	13	76	4 x ½ - 13	78
GS 80.3-FA14	23	5	88	4 x ⅝ - 11	155
GS 100.3-FA14	22	13	123	4 x ⅝ - 11	155
GS 100.3-FA16	22	8	123	4 x ¾ - 10	257
GS 125.3-FA16	17	35	126	4 x ¾ - 10	257
GS 125.3-FA25	17	27	126	8 x ⅝ - 11	155
GS 160.3-FA25	15	11	130	8 x ⅝ - 11	155
GS 160.3-FA30	30	0	140	8 x ¾ - 10	255
GS 200.3-FA30	19	19	160	8 x ¾ - 10	255
GS 200.3-FA35	44	0	190	8 x 1 - 8	590
GS 250.3-FA35	8	8	220	8 x 1 - 8	590
GS 250.3-FA40	13	0	230	8 x 1¼ - 7	1,200

Note:
Experience showed that it is very difficult to fasten bolts or nuts of 1-8 UNC or larger with the defined torques. The worm gearbox may be moved radially against the valve flange by accident.
To improve adhesion between valve and gearbox, we recommend to apply Loctite 243 (or similar products) on mounting faces.

8. Setting the end stops for manual operation

If worm gearboxes GS are supplied on a valve the end stops are already set by the valve manufacturer.

8.1 Worm gearboxes on butterfly valves

Setting end position CLOSED

- Remove all bolts (03) at limit stop housing (figures D, E).
- Turn valve manually to end position CLOSED.
- In case limit stop housing (10) has not yet rotated, turn it clockwise up to the stop.
- If the holes of limit stop housing (10) do not align with the threads of the housing (1), take off the limit stop housing (10) and replace it in the required position.
- Fasten bolts (03) with lock washers (04).
- Fasten bolts crosswise with a torque according to table 3.

Table 3

Gearbox	End stops fastened with bolts (03)	Material	Protective cap fastened with bolts (054)	Material	Fastening torque T_A [Nm]
GS 50.3	M 8	A2-80			24
GS 63.3	M 8	A2-80			24
GS 80.3	M 8	A2-80			24
GS 100.3	M 12	A2-80			82
GS 125.3	M 12	A2-80			82
GS 160.3	M 10	A2-80	M 6	A2-80	48
GS 200.3	M 12	A2-80	M 6	A2-80	82
GS 250.3	M 16	A2-80	M 6	A2-80	200
Conversion factor: 1 Nm corresponds to 1.3529 ft lbs.					

Figure D: End stop up to GS 125.3

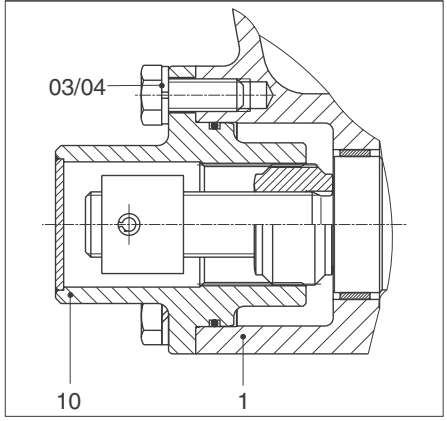
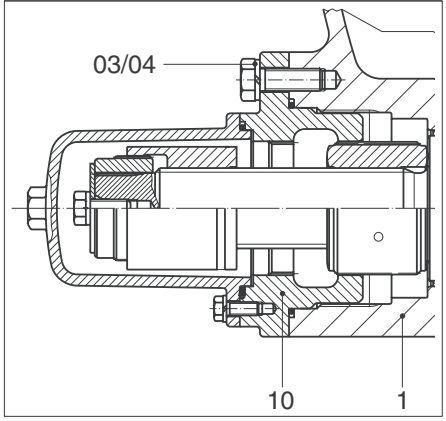


Figure E: End stop from GS 160.3



- If the position of the pointer cover does not correspond to the symbol CLOSED, slightly loosen the screws of the pointer cover. Turn the pointer cover to the CLOSED symbol and fasten the screws again.

Setting end position OPEN

The end stop need not be set since the required swing angle has been set in the factory.
If the swing angle does not match, refer to section 10.

8.2 Worm gearboxes on ball valves

In case end stops require adjustment, set end position OPEN first. If the exact end position of the valve cannot be seen through a position marking at the valve shaft, the setting may have to be done with the valve removed.

Setting end position OPEN

- Remove all bolts (03) at limit stop housing (10) (figures D, E).
- Turn valve manually to end position OPEN.
- In case limit stop housing (10) has not yet rotated, turn it counterclockwise up to the stop.
- If the holes of limit stop housing (10) do not align with the threads of the housing (1), take off the limit stop housing (10) and replace it in the required position.
- Fasten bolts crosswise with a torque according to table 3.
- If the position of the pointer cover does not correspond to the symbol OPEN, slightly loosen the screws of the pointer cover. Turn the pointer cover to the OPEN symbol and fasten the screws again.

Setting end position CLOSED

The end stop need not be set since the required swing angle has been set in the factory.
If the swing angle does not match, refer to section 10.

9. Setting the end stops with mounted multi-turn electric actuator

- **If worm gearboxes GS and multi-turn actuators are supplied on a valve, the end stops as well as limit and torque switching should already have been set by the valve manufacturer.**
- **If the limit and torque switching have not yet been set, they have to be set according to the operation instructions SA/SAR and the specifications of the valve manufacturer.**
- **The valve manufacturer states whether the valve should be limit or torque seated.**

9.1 Worm gearboxes on butterfly valves

- Determine the overrun of the multi-turn actuator for both directions, i. e. how much does the valve move after the motor has been switched off?

Setting end position CLOSED

- Remove all bolts (03) at limit stop housing (figures D, E).
- Change actuator to manual drive and move the valve manually to end position CLOSED.
- In case limit stop housing (10) has not yet rotated, turn it clockwise up to the stop.
- Turn limit stop housing (10) back counterclockwise by ½ turn. This ensures that the mechanical end stop is not reached in electric operation and thus the valve can close tightly, provided that torque seating has been specified.
- If the fixing holes of limit stop housing (10) do not align with the threads of the housing (1), take off the limit stop housing (10) and replace it in required position.
- Fasten bolts (03) with lock washers (04).
- Fasten bolts crosswise with a torque according to table 3.
- If the position of the pointer cover does not correspond to the symbol CLOSED, slightly loosen the screws of the pointer cover. Turn the pointer cover to the CLOSED symbol and fasten the screws again.

Limit seating in end position CLOSED

- Turn back the valve from the end position by an amount equal to the overrun.
- Set limit switching according to the operation instructions SA/SAR.
- Check torque switching for end position CLOSED according to the operation instructions SA/SAR, and, if necessary, set to the required value.

Torque seating in end position CLOSED

- Turn handwheel counterclockwise by approx. 4 – 6 turns.
- Set limit switching for the end position CLOSED according to the operation instructions SA/SAR (for actuator indication).
- Check torque switching for end position CLOSED or set to the required value.

Setting end position OPEN

The end stop need not be set since the required swing angle has been set in the factory.

- Move gearbox to the end stop in position OPEN.

The last part of the travel has to be made manually.

- To turn the valve back manually from the end position by an amount equal to the overrun, proceed as follows:

  For actuators mounted directly:
  by approx. 4 to 6 turns at the handwheel.
  With mounted primary reduction gearing VZ/GZ:
  by approx. 10 to 15 turns at the handwheel, according to the reduction ratio of the primary reduction gearing.

- Set limit switching in actuator for the end position OPEN according to the operation instructions SA/SAR.
  If the swing angle does not match, refer to section 10.

Figure G: End stop up to GS 125.3

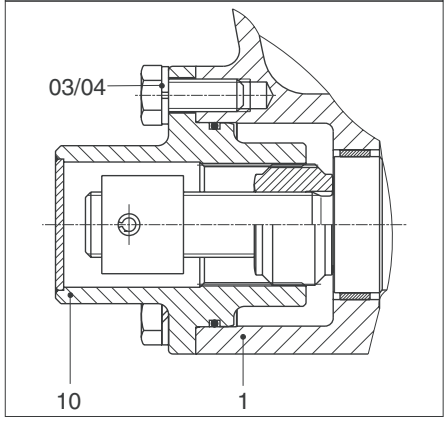
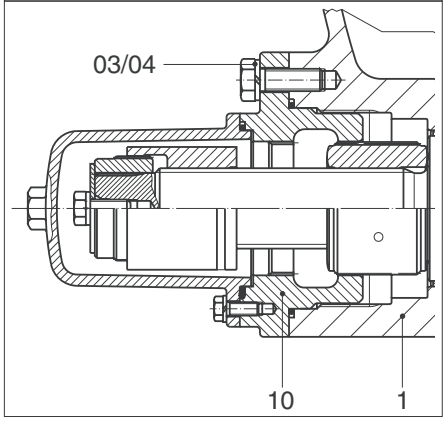


Figure F: End stop from GS 160.3



9.2 Worm gearboxes on ball valves

In case end stops require adjustment, set end position OPEN first. If the exact end position of the valve cannot be seen through a position marking at the valve shaft, the setting may have to be done with the valve removed.

- Determine overrun of the actuator for both directions, i. e. how much does the valve move after the motor has been switched off?

Setting end position OPEN

- Remove all bolts (03) at limit stop housing (10) (figures G, F).
- Change to manual drive and move the valve manually to end position OPEN.
- In case limit stop housing (10) has not yet rotated, turn it counterclockwise up to the stop.
- Turn limit stop housing (10) back by ½ turn clockwise. This ensures that the mechanical end stop is not reached in electric operation.
- If the holes of limit stop housing (10) do not correspond to the threads of the housing (1), take off the limit stop housing (10) and replace it in the required position.
- Fasten bolts (03) with lock washers (04).
- Fasten bolts crosswise with a torque according to table 3.
- If the position of the pointer cover does not align with the symbol OPEN, slightly loosen the screws of the pointer cover. Turn the pointer cover to the OPEN symbol and fasten the screws again.

Switching off in end position OPEN

- Turn back the valve from the end position by an amount equal to the overrun.
- Set limit switching according to the operation instructions SA/SAR.

Setting end position CLOSED

The end stop need not be set since the required swing angle has been set in the factory.

- Move gearbox to the end stop in position CLOSED.

The last part of the travel has to be made manually.

- To turn the valve back manually from the end position by an amount equal to the overrun, proceed as follows:

  For actuators mounted directly:
  by approx. 4 to 6 turns at the handwheel.
  With mounted primary reduction gearing VZ/GZ:
  by approx. 10 to 15 turns at the handwheel, according to the reduction ratio of the primary reduction gearing.
- Set limit switching in actuator for the end position CLOSED according to the operation instructions SA/SAR.
  If the swing angle does not match, refer to section 10.

10. Changing the swing angle

The adjustment is made in end position OPEN.

Optional for size GS 50.3 – GS 125.3
Standard for size GS 160.3 – GS 250.3

Accuracy:
GS 50.3 – GS 125.3: 0.6°
GS 160.3 – GS 250.3: 0.11° to 0.14°

10.1 Changing the swing angle for sizes GS 50.3 – GS 125.3 (*option*)

- Unscrew protective cap (16) at limit stop housing (10) (figure H).
- Remove roll pin (020) with appropriate tool (available from AUMA).

Increasing the swing angle

- Turn end stop nut (15) back counterclockwise.

When turning back the end stop nut (015), make sure the roll pin (020) can still be tapped in within the oblong hole.

- Move valve into the desired end position.
- Turn end stop nut (15) clockwise until it is tight up to the stop nut (7).

Reducing the swing angle

- Move valve into the desired end position.
- Turn end stop nut (15) clockwise until it is tight up to the stop nut (7).

The end stop nut (15) must entirely cover the roll pin (020).

Figure H: End stop up to GS 125.3

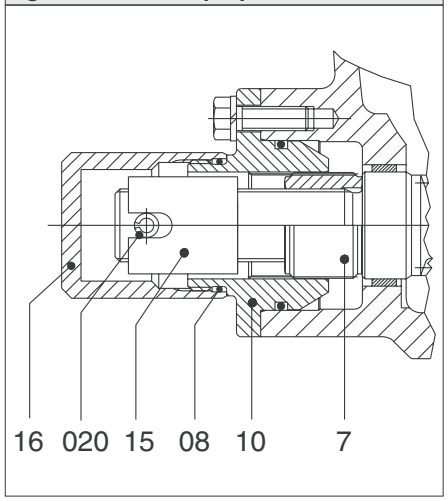
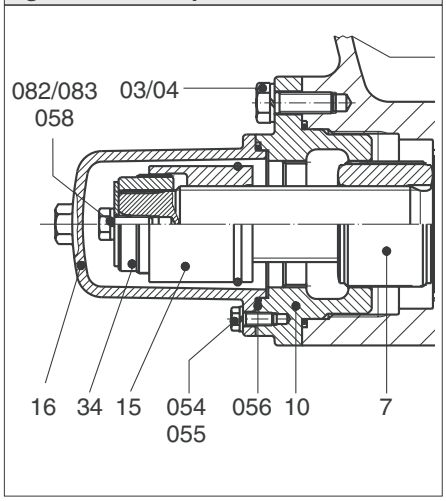


Figure I: End stop from GS 160.3



- Tap in roll pin (020) with tool. If slot in end stop nut (15) does not align with the hole in the worm shaft, turn end stop nut (15) slightly counterclockwise until it is in alignment, then tap in roll pin.
- Check O-ring (08) and replace, if damaged.
- Replace protective cap (16).
- If gearbox is mounted to a multi-turn actuator, set limit switching again for the end position OPEN according to the operation instructions SA/SAR. Allow for overrun.

10.2 Changing the swing angle for sizes GS 160.3 – GS 250.3

- Remove all bolts (054) and pull off protective cap (16) (figure I).
- Remove screw (082) with washer (058) and setting ring (34).

Increasing the swing angle

- Turn end stop nut (15) back counterclockwise.
- Move valve into the desired end position.
- Turn end stop nut (15) clockwise until it is tight up to the stop nut (7).

Reducing the swing angle

- Move valve into the desired end position.
- Turn end stop nut (15) clockwise until it is tight up to the stop nut (7).
- Place setting ring (34), secure with washer (058) and screw (082).
- Check O-ring (056) and replace, if damaged.
- Place protective cap (16), fasten bolts (054) with lock washers (055).
- Fasten bolts crosswise with a torque according to table 3.
- If gearbox is mounted to a multi-turn actuator, set limit switching again for the end position OPEN according to the operation instructions SA/SAR. Allow for overrun.

11. Enclosure protection IP 68

Definition

According to EN 60 529, the conditions for meeting the requirements of enclosure protection IP 68 (requirements exceed those of IP 67) are to be agreed between manufacturer and user. AUMA worm gearboxes and primary reduction gearings in enclosure protection IP 68 meet the following requirements according to AUMA:

- IP 68-3, submersible in water up to 3 m head of water
- IP 68-6, submersible in water up to 6 m head of water
- IP 68-10, submersible in water up to 10 m head of water
- IP 68-20, submersible in water up to 20 m head of water

For size GS 50.3, only enclosure protection IP 68-3 is available.

If submersed in other media, additional measures for corrosion protection may be necessary; please consult AUMA. Submersion in aggressive media, e.g. acids or alkaline solutions, is not permitted.

Review

Gearboxes in enclosure protection IP 68-3 were type tested in the factory. Gearboxes in enclosure protection IP 68-6, IP 68-10 and IP 68-20 undergo a routine testing for tightness in the factory.

Note:

- The enclosure protection IP 68 refers to the interior of the gearboxes, but not to the coupling compartment.
- If the gearboxes are likely to be repeatedly submersed, a higher corrosion protection KS or KX is required.
- For gearboxes intended for buried service we strongly recommend to use the higher corrosion protection KS or KX.
- For horizontal outdoor installation of the gearboxes, a sealed pointer cover should be used.
  For gas applications with sealed pointer cover, an air vent in the pointer cover or venting grooves in the valve mounting flange must be provided.
- In case of permanent submersion of the gearboxes or for buried service, a protection cover must be fitted instead of a pointer cover. This will be taken into account in the factory if indicated on the purchase order. Subsequent exchange of the pointer cover for the protection cover is possible.
- Use suitable sealing material between valve flange and gearbox.
- Water can enter into the coupling compartment along the valve shaft. This would lead to corrosion of hub and coupling. Therefore a suitable anticorrosive (or sticky grease) must be applied to the hub and coupling of the gearbox before mounting.
- With corrosion protection KX, the hub and coupling are provided with a high quality corrosion protection as standard.

12. Maintenance

12.1 General notes

After commissioning, check worm gearbox for damage to paint finish.
Do a thorough touch-up to prevent corrosion.
Original paint in small quantities can be supplied by AUMA.

AUMA worm gearboxes require only very little maintenance.
To ensure that the worm gearbox is always ready to operate, we recommend for gearboxes operated less than 10 times per year, the following measures:

- Approximately six months after commissioning and every year after check bolts between multi-turn actuator, worm gearbox, and valve for tightness. If required, tighten applying the torques given in table 2 (page 11).
- Perform a test run every six months.
- Perform a visual inspection for grease leakage on each gearbox every 2 years.
- Carry out a detailed functional test for each gearbox every 5 years. Record the results for future reference.
- For gearboxes permanently exposed to ambient temperatures above 104 °F, maintenance must be performed at shorter intervals.

Seals:
Seals made of elastomeric materials are subject to ageing. The theoretical usable lifetime of the seals made of NBR is 13.5 years from the date of manufacture. These figures are based on an average ambient temperature of 104 °F. Seal kits may be obtained from AUMA.

Grease:
A grease and seal change is recommended after the following operation time:
- if operated seldom after 10 – 12 years
- if operated frequently, after 6 – 8 years
- in modulating duty after 4 – 6 years

- **Only original AUMA grease must be used.**
- **For the grease type, refer to the name plate.**
- **Lubricants should not be mixed.**

Table 4: Grease quantities for worm gearboxes and primary reduction gearings

GS		50.3	63.3	80.3	100.3	125.3	160.3	200.3	250.3
Qty	dm³	0.1	0.3	0.4	1.0	1.3	3.3	6.6	12.2
Weight[1)]	g	90	270	360	900	1,170	3,000	6,000	11,000

Primary reduction gearing		VZ			GZ				
		2.3	3.3	4.3	160.3	200.3		250.3	
						4:1/8:1	16:1	4:1/8:1	16:1
Quantity	dm³	0.35	0.35	0.35	1.0	1.5	2.0	2.2	2.8
Weight[1)]	g	320	320	320	900	1,400	1,800	2,000	2,250

1) for ρ = approx. 900 g/dm³; conversion factor: 1 oz corresponds to 28.35 g

The removed lubricant and the cleaning agent used must be disposed of according to the relevant regulations.

12.2 Grease change for worm gearboxes GS 50.3 – GS 125.3 and primary reduction gearing VZ 2.3 – VZ 4.3

- For gearboxes with multi-turn actuator: Remove multi-turn actuator.
- Remove gearbox from the valve:

During this time, the valve/pipeline must not be under pressure!

12.2.1 Worm gearboxes

Refer to spare parts list GS 50.3 – GS 125.3, page 24.
Grease type, see name plate; grease quantities, see page 19, table 4.

- Mark position of the gearbox on the valve, loosen connecting bolts to the valve and remove the worm gearbox.
- Remove fastening bolts with lock washers from the housing cover (518.0) and take off housing cover.
- Remove bolts with lock washers from the bearing cover (522.0). Lift worm wheel carefully from the housing. For this, the worm shaft must be pulled from the bearings and tilted slightly in the worm channel.
- Remove old grease completely from the housing and the individual parts and clean gear housing. For this purpose, a suitable cleaning agent should be used.
- Clean mounting faces at housing and housing cover (518.0). Replace O-rings at the worm wheel (010, 011) by new ones.
- Re-insert worm wheel carefully and bring worm shaft into correct position, fasten bearing cover (522.0) at housing with bolts and lock washers.
- Fill with new grease.
- Place housing cover (518.0) on housing, while ensuring the proper position of the O-rings (010, 011) at the worm wheel. Place bolts with lock washers and fasten them evenly crosswise.
  – Thoroughly degrease mounting faces at mounting flange.
  – Apply non-acidic grease at splines of coupling
  – Mount worm gearbox to valve, ensure correct position, observe mark made in previous step
  – Fasten with bolts of minimum quality 8.8 using lock washers, fasten bolts crosswise to the appropriate torque according to table 2, page 11.
- Gearbox without primary reduction gearing: Continue with section “After maintenance”.
- Gearbox with reduction gearings VZ 2.3 – VZ 4.3: Perform grease change at the reduction gearing according to the following subsection.

12.2.2 Primary reduction gearing

Refer to spare parts list VZ 2.3 – VZ 4.3., page 24.
Grease type, see name plate; grease quantities, see page 19, table 4.

- Remove bolts with lock washers from housing cover (020.0) and pull off housing cover (020.0) with the complete input drive shaft (021.0).
- Take off plate with internal teeth (045.0) and planet carrier (022.0) with the planet wheels.
- Remove old grease completely from the housing and the individual parts and clean them. For this purpose, a suitable cleaning agent should be used.
- Clean mounting faces at housing (019.0), housing cover (020.0) and plate with internal teeth (045.0). Replace O-rings by new ones.
- Insert planet carrier (022.0) with planet wheels.
- Fill with new grease.
- Place plate with internal teeth (045.0) and insert the input drive shaft (021.0) completely. Screw in bolts with lock washers and fasten them evenly crosswise to the appropriate torque according to table 2, page 11.
- Continue with section “After maintenance”, page 22.

12.3 Grease change for worm gearboxes GS 160.3 – GS 250.3 and primary reduction gearing GZ 160.3 – GZ 250.3

- For gearboxes with multi-turn actuator: Remove multi-turn actuator.
- Remove gearbox from the valve:

During this time, the valve/pipeline must not be under pressure!

12.3.1 Worm gearboxes

Refer to spare parts list GS 160.3 – GS 250.3, page 26.
Grease type, see name plate; grease quantities, see page 19, table 4.
Tools: Lock nut tool, can be obtained from AUMA.

- Mark position of the gearbox on the valve, loosen connecting bolts to the valve and remove the worm gearbox.
- Remove bolts with lock washers from the housing cover (518.0) and take off housing cover.
- Remove bolts with lock washers from the bearing cover (522.0). Take off bearing lock nut (537.0) by loosening the grub screw. Remove protective cap (536.0), pull off snap ring from end nut (526.0). Remove end stop (523.0). Lift worm wheel carefully from the housing. For this, the worm shaft must be pulled from the bearings and tilted slightly in the worm channel.
  Pull out worm shaft from housing in direction of the input shaft.
- Remove old grease completely from the housing and the individual parts and clean gear-housing. For this purpose, a suitable cleaning agent should be used.
- Clean mounting faces at housing and housing cover (518.0). Replace O-rings at the worm wheel (010, 011) by new ones.
- Re-insert worm wheel carefully and bring worm shaft into correct position. Screw in bearing lock nut (537.0) and secure with grub screw. Fasten bearing cover (522.0) at the housing with bolts and lock nuts.
- Fill with new grease.
- Place housing cover (518.0) on housing, while ensuring the proper position of the O-rings (010, 011) at the worm wheel. Place bolts with lock washers and fasten them evenly crosswise.
  – Thoroughly degrease mounting faces at mounting flange and valve.
  – Apply non-acidic grease at splines of coupling.
  – Mount worm gearbox to valve, ensure correct position, observe mark.
  – Fasten with bolts of minimum quality 8.8 using lock washers, fasten bolts crosswise to the appropriate torque according to table 2, page 11.
- Gearbox without primary reduction gearing: Continue with section “After maintenance”.
- Gearbox with reduction gearings GZ 160.3 – GZ 250.3: Perform grease change at the reduction gearing according to the following sections.

12.3.2 Single-stage reductions gearings GZ 160.3 – GZ 250.3 (reduction ratios 4:1 and 8:1)

Refer to spare parts list GZ 160.3 – GZ 250.3, page 28.
Grease type, see name plate; grease quantities, see page 19, table 4.

- Remove bolts with lock washers at housing cover (002.0) and pull off housing cover (002.0) with the input drive shaft (003.0) and the plate with internal teeth).
- Remove screws from the plate with internal teeth and separate the plate with internal teeth from the input drive shaft.
- Remove old grease completely from the housing and the individual parts and clean them.
- For this purpose, a suitable cleaning agent should be used.
- Clean mounting faces at housing (001.0), housing cover (002.0) and plate with internal teeth. Replace O-rings by new ones.
- Fill housing cover (002) with new grease.
- Fix plate with internal teeth (006.0) with screws at housing cover.

- Fill housing (001.0) with remaining grease and fit the complete housing cover with input drive shaft (003.0). Screw in bolts with lock washers and fasten them evenly crosswise to the appropriate torque according to table 2, page 11.
- Continue with section “After maintenance”, page 22.

12.3.3 Double-stage primary reduction gearing GZ 200.3 – GZ 250.3 (reduction ratio 16:1)

Refer to spare parts list GZ 160.3 – GZ 250.3, page 28.
Grease type, see name plate; grease quantities, see page 19, table 4.

- Remove bolts with lock washers from housing cover (002.0) and pull off housing cover with the complete input drive shaft (003.0).
- Take off screws with lock washers from housing frame (010.0) and remove housing frame with planet carrier and hollow wheel.
- Remove screws from the plate with internal teeth and separate the plate with internal teeth from the input drive shaft (003.0).
- Remove screws (021) from the second stage of the plate with internal teeth and separate it from the pinion (011.1).
- Remove old grease completely from the housing and the individual parts and clean them. For this purpose, a suitable cleaning agent should be used.
- Clean mounting faces at housing (001.0), housing frame, housing cover (002.0) and hollow wheels. Replace O-rings by new ones.
- Fill housing (001.0) with new grease.
- Fix second stage of the plate with internal teeth on housing frame (010.0).
- Replace complete housing frame. Screw in bolts with lock washers and fasten them evenly crosswise to the appropriate torque according to table 2, page 11.
- Fill housing frame (010.0) and housing cover (002.0) with the remaining grease.
- Fix first stage of the plate with internal teeth on the housing cover (002.0).
- Place complete housing cover with input drive shaft onto housing frame. Screw in bolts with lock washers and fasten them evenly crosswise to the appropriate torque according to table 2, page 11.

12.4 After maintenance

- If applicable, mount multi-turn actuator.
- Reset the end stops.
- For gearboxes with multi-turn actuator, check the setting of the limit switching according to the operation instructions for multi-turn actuators; if required, reset.
- Perform test run to ensure the proper function.
- Check worm gearbox for damage to paint finish. Do a thorough touch-up to prevent corrosion. Original paint in small quantities can be supplied by AUMA.

13. Disposal and recycling

AUMA gearboxes have an extremely long lifetime. However, they have to be replaced at one point in time.
Our gearboxes have a modular design and may therefore easily be disassembled, separated and sorted according to materials, i.e.:

- various metals
- plastics
- greases and oils

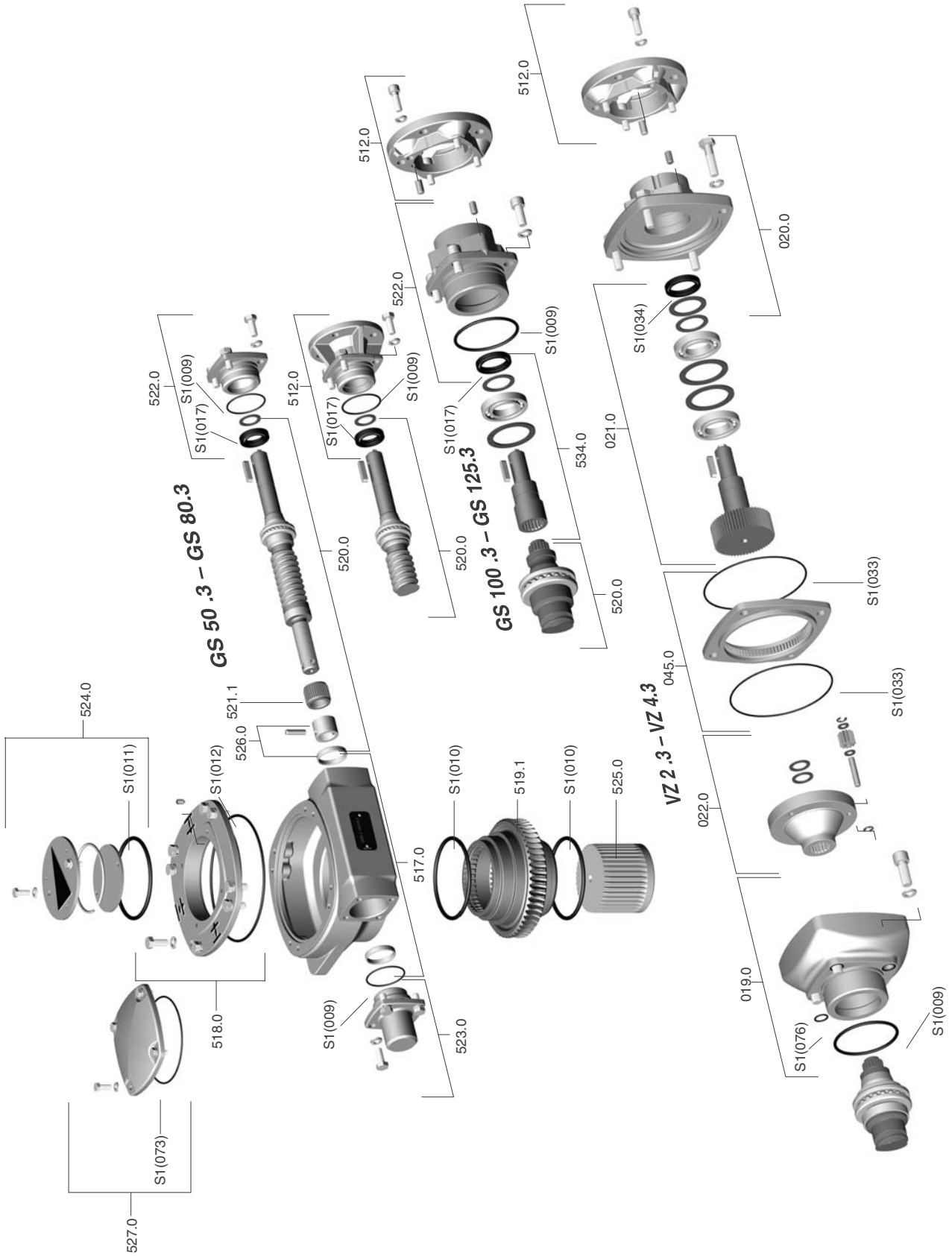
The following generally applies:

- Collect greases and oils during disassembly. As a rule, these substances are hazardous to water and must not be released into the environment.
- Send disassembled material to a sound disposal or to separate recycling center according to materials.
- Observe the local regulations for waste disposal.

14. Service

AUMA offers extensive services such as maintenance and inspection for gearboxes.
The AUMA service department can be reached at:
phone: 724-743-AUMA (2862)
fax: 724-743-4711
email: mailbox@auma-usa.com
www.auma-usa.com or www.auma.com.

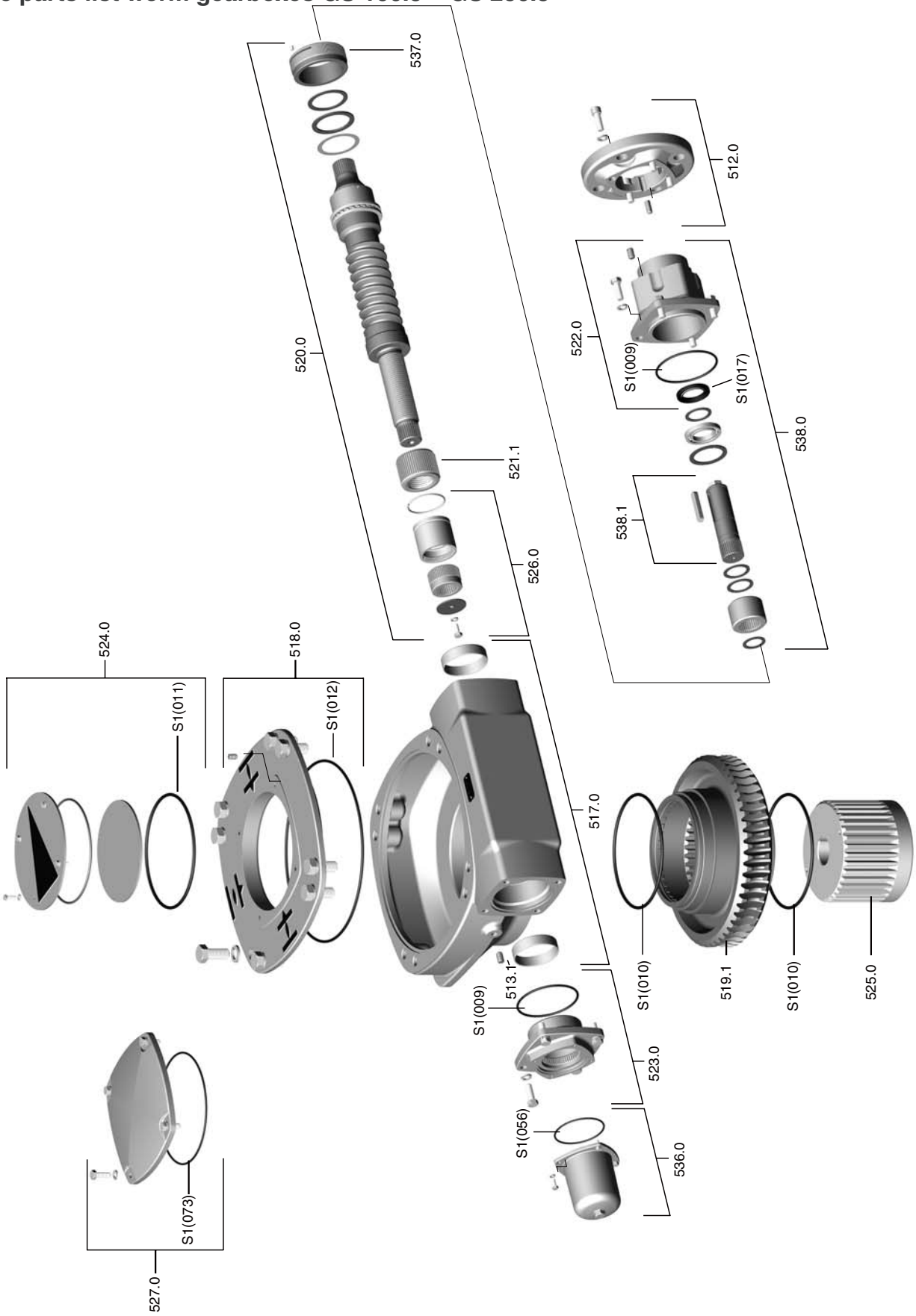
15. Spare parts list worm gearboxes GS 50.3 – GS 125.3 and reduction gearing VZ 2.3 – VZ 4.3



Note: Please state type and commission no. of the device (see name plate) when ordering spare parts. Only original AUMA spare parts should be used. Delivered spare parts may slightly vary from the representation in these instructions.

No.	Designation	Type
019.0	Housing VZ	Sub-assembly
020.0	Housing cover VZ	Sub-assembly
021.0	Input drive shaft VZ	Sub-assembly
022.0	Planet carrier VZ	Sub-assembly
045.0	Plate with internal teeth VZ	Sub-assembly
512.0	Flange for actuator	Sub-assembly
517.0	Housing	Sub-assembly
518.0	Housing cover	Sub-assembly
519.1	Worm wheel	Component
520.0	Worm shaft	Sub-assembly
521.1	Travelling nut	Component
522.0	Bearing cover	Sub-assembly
523.0	Limit stop housing	Sub-assembly
524.0	Pointer cover	Sub-assembly
525.0	Coupling	Sub-assembly
526.0	End stop nut	Sub-assembly
527.0	Protection cover	Sub-assembly
534.0	Input shaft	Sub-assembly
536.0	Cap	Sub-assembly
S1	Seal kit	Set

16. Spare parts list worm gearboxes GS 160.3 – GS 250.3

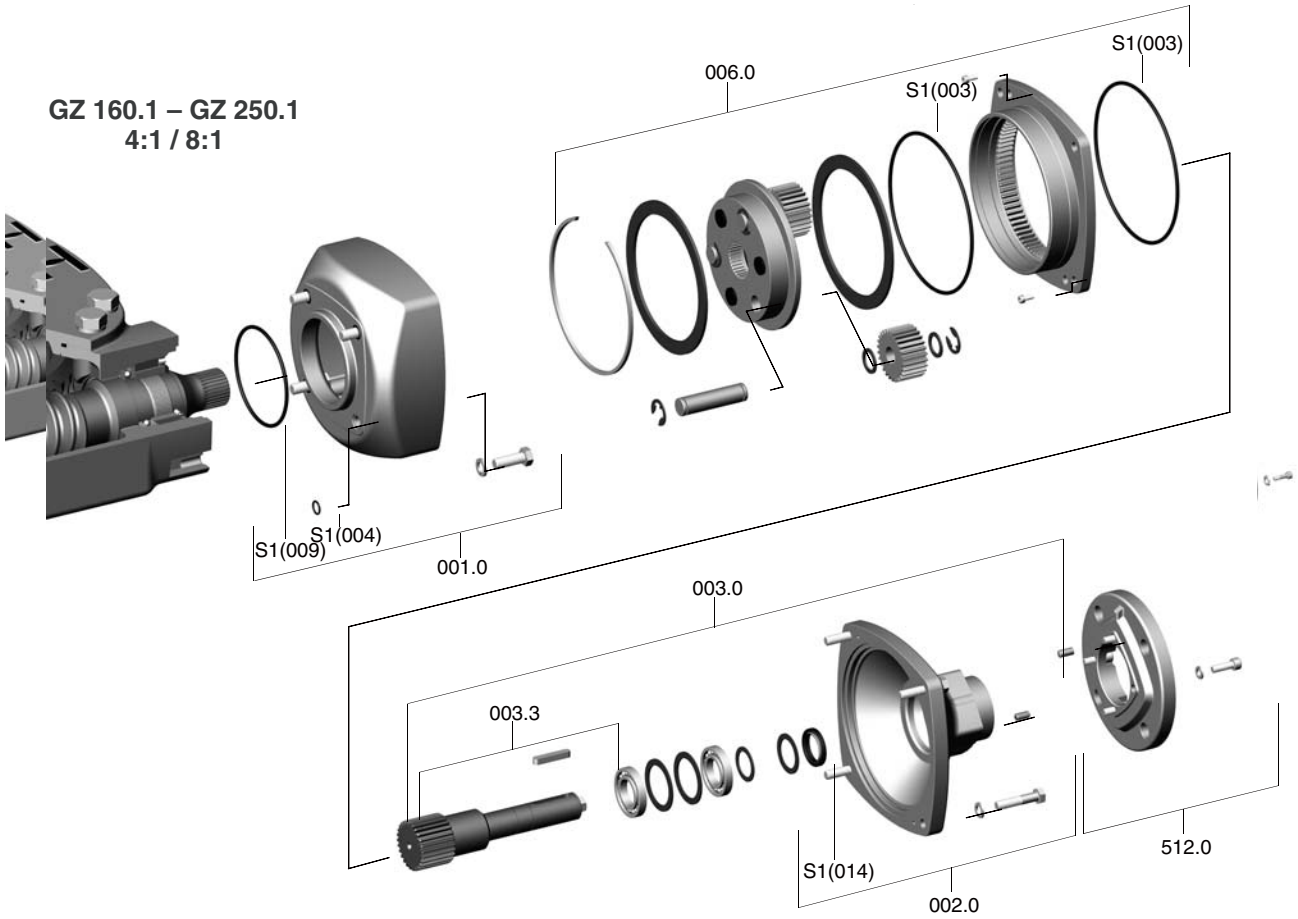


Note: Please state type and commission no. of the device (see name plate) when ordering spare parts. Only original AUMA spare parts should be used.
Delivered spare parts may slightly vary from the representation in these instructions.

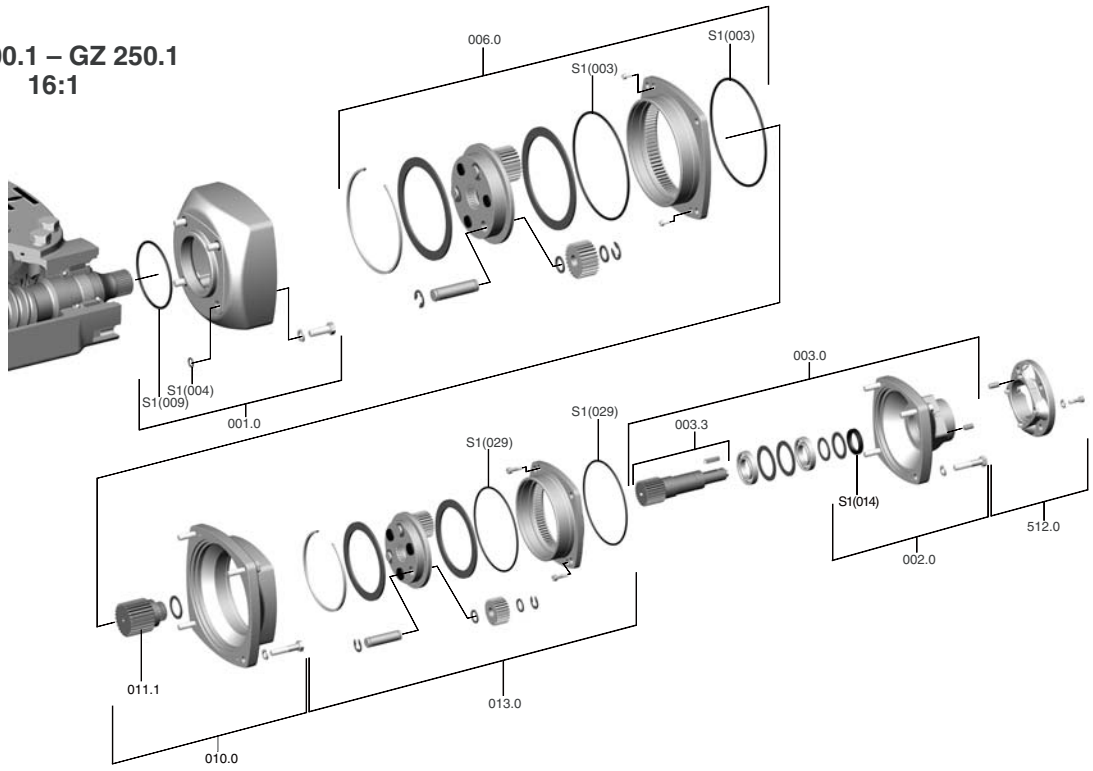
No.	Designation	Type
512.0	Flange for actuator	Sub-assembly
513.0	Grub screw	Component
517.0	Housing	Sub-assembly
518.0	Housing cover	Sub-assembly
519.1	Worm wheel	Component
520.0	Worm shaft	Sub-assembly
521.1	Travelling nut	Component
522.0	Bearing cover	Sub-assembly
523.0	Limit stop housing	Sub-assembly
524.0	Pointer cover	Sub-assembly
525.0	Coupling	Sub-assembly
526.0	End stop nut	Sub-assembly
527.0	Protection cover	Sub-assembly
536.0	Cap	Sub-assembly
538.0	Input shaft	Sub-assembly
538.1	Input shaft	Sub-assembly
S1	Seal kit	Set

17. Spare parts list reduction gearings GZ 160.3 – GZ 250.3 (reduction ratios 4:1, 8:1 and 16:1)

GZ 160.1 – GZ 250.1
4:1 / 8:1



GZ 200.1 – GZ 250.1
16:1



Note:
Please state type and commission no. of the device (see name plate) when ordering spare parts. Only original AUMA spare parts should be used. Delivered spare parts may slightly vary from the representation in these instructions.

No.	Designation	
001.0	Housing	Sub-assembly
002.0	Housing cover	Sub-assembly
003.0	Housing cover	Sub-assembly
003.3	Input drive shaft	Sub-assembly
006.0	Planetary gear	Sub-assembly
010.0	Housing frame	Sub-assembly
011.1	Pinion	Sub-assembly
013.0	Planetary gear 1st stage	Sub-assembly
512.0	Flange for actuator	Sub-assembly
S1	Seal kit	Set

Notes

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