Installation, Operation and Maintenance Manual
MAN 684 Rev. 6
January 2021

Biffi Worm Gear Reducer

Electric Actuator

BIFFI

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Revision Details

Rev.	Date	Description	Prepared	Checked	Approved
6	January 2021	Migration to new template			
5	19/01/2017	Added sight glass with optional relief version	Toscani	Orefici	Vigliano
4	18/04/2016	Updated applicable regulation (Chapter 1.7)	Ermanni	Orefici	Vigliano
3	11/06/2012	Revised Chapter 11 (Parts List)	Ermanni	Ghiadoni	Vigliano
2	08/03/2012	Revised Pictures	Guarnieri	Ghiadoni	Vigliano
1	23/05/2010	Revised Chapter 7	Schiavi	Ghiadoni	Vigliano
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NOTICE

Biffi Italia has taken every care in collecting and verifying the documentation contained in this Instruction and Operating Manual. The information herein contained are reserved property of Biffi Italia. Contents may change without notice.

Section 1: General Safety Instructions

1.1 Manufacturer

Manufacturer with respect to the Machinery Directive 2006/42/EC is Biffi Italia, as specified on the machinery label.

1.2 Machine Intended Use

The machines to whose this Instruction and Operating Manual applies are the **WGR series (on-off type, up to 60 starts/hour) and WGR-DW series (intermittent type up to 1200 starts/hour)**, designed to operate any kind of quarter-turn industrial valve for applications in heavy industrial, chemical, petrochemical, food, water and power generating plants. They are designed for motor operation in conjunction with electric actuators.

Biffi Italia will not be liable for any possible damage or physical injury resulting from use in other than the designated application or by lack of care during installation, operation, adjustment and maintenance of the machinery. Such risks lie entirely with the user.

Depending on the specific working conditions, additional precautions may be required.

WGR reducers are produced by Biffi Italia and identified on the proper label by product designation **WGR-XXXX**.

NOTICE

This manual provides basic information for the setting of WGR series reducers; more detailed information on the setting and control of Electric Actuators ICON2000 can be found in MAN 618, which forms part of the mandatory instructions documentation.

⚠ WARNING

It is assumed that the installation, setting, commissioning and maintenance and repair works are carried out by qualified personnel and checked by responsible specialists.

⚠ WARNING

Read this installation and maintenance manual carefully and completely before storage or installation of the device. If an electric actuator is attached to the WGR reducer, please be aware of the electrical hazards and consult the relevant electric actuator installation and maintenance manual for guidance.

The **WGR series** is designed in accordance with the applicable International Rules and Specifications, but in all cases the following regulation must be observed:

- the general installation and safety regulations.
- the plant specific regulations and requirements.
- the proper use of personal protective equipment (goggles, clothing, gloves).
- the proper use of tools, lifting and transport equipment.

1.3 Terms and Conditions

Biffi Italia guarantees each single product to be free from defects and in accordance to current goods specifications and applicable regulations. The warranty period is 12 months from the date of installation by the first user or 18 months from the date of shipment to the first user, whichever occurs first. No warranty is given for products which have been subject to damage or corrosion due to improper storage, improper installation, misuse, or which have been modified or repaired by unauthorised personnel.

Repair work due to improper use will be charged at standard rates.

1.4 Manufacturer's Liability

Biffi Italia declines all liability in the event of:

- use of the machinery in contravention of local safety-at-work legislation.
- incorrect installation, disregard or incorrect application of the instructions provided on the product nameplate and in this Instruction and Operating Manual.
- modification of the product without Biffi's authorisation.
- work done on the product by unqualified or unsuitable personnel.

1.5 Applicable Standards and Regulations

EN ISO 12100-1	Safety of machinery - Basic concepts, general principles for design. Part 1-Basic terminology, methodology.
EN ISO 12100-2	Safety of machinery - Basic concepts, general principles for design. Part 2-Technical principles and specification.
2006/42/EC	Machinery Directive.
2014/34/EU	ATEX Directive.

1.6 Installation in Hazardous Area

⚠ WARNING

In case the WGRs are to be installed in a HAZARDOUS AREA, as defined by the applicable Rules, it is mandatory to check whether the nameplates of the associated ICON2000/ ICON2000EC specify that the assembly is suitable to be installed in HAZARDOUS AREA with the indication of appropriate degree of protection. Maintenance and repair works must be carried out by qualified personnel and checked by responsible specialists.

Standard WGRs have IP66/67/68 degree of protection according to EN 60529.
IP 68 achieved with a submersion under 15 meter for 100 hours.

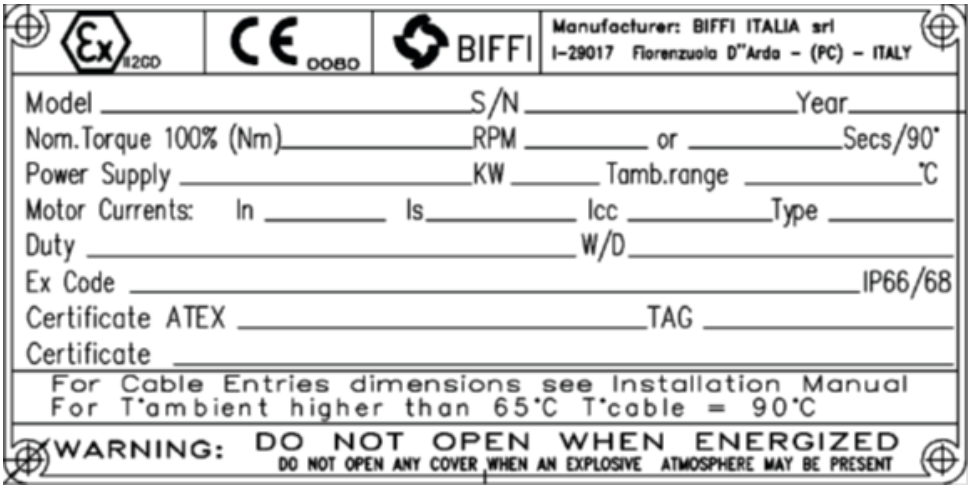
1.7 Marking for Application in Hazardous Area

1.7.1 Label for ICON2000/ICON2000EC

The ICON2000/ICON2000EC associated to the WGR, for the application in hazardous areas, must bear a label with the following marking description:

0080	=	Notified Body for ATEX
II	=	Group II (Surface)
2	=	Category 2 apparatus
G	=	Explosive atmosphere by gas
D	=	Explosive atmosphere by dust
IP 66/68	=	Degree of protection

Figure 1



1.7.2 Extract from the Standard

Table 1.

Type of Hazard	Classification of Zones	Categories according to 2014/34/EU Directive
Gas, mists or vapours	Zone 0	1G
Gas, mists or vapours	Zone 1	2G
Gas, mists or vapours	Zone 2	3G
Dust	Zone 20	1D
Dust	Zone 21	2D
Dust	Zone 22	3D

Section 2: Machine Description

2.1 General

The **WGR** is a worm gear reducer designed to operate, in conjunction with ICON2000 electric actuator, any kind of quarter-turn industrial valve.

The gearbox is suitable to guarantee the output bush rotation of 90° with the possibility to obtain an extra stroke of 5° for each direction of rotation. The rotation bush is stopped, in both the rotation direction, against mechanical stoppers integrated in the gearbox frame with the possibility to regulate the travel of 5° for each rotation direction. The housing is provided with an optional vent valve in order to avoid any eventual overpressure.

2.2 Main Parts Description

Figure 2

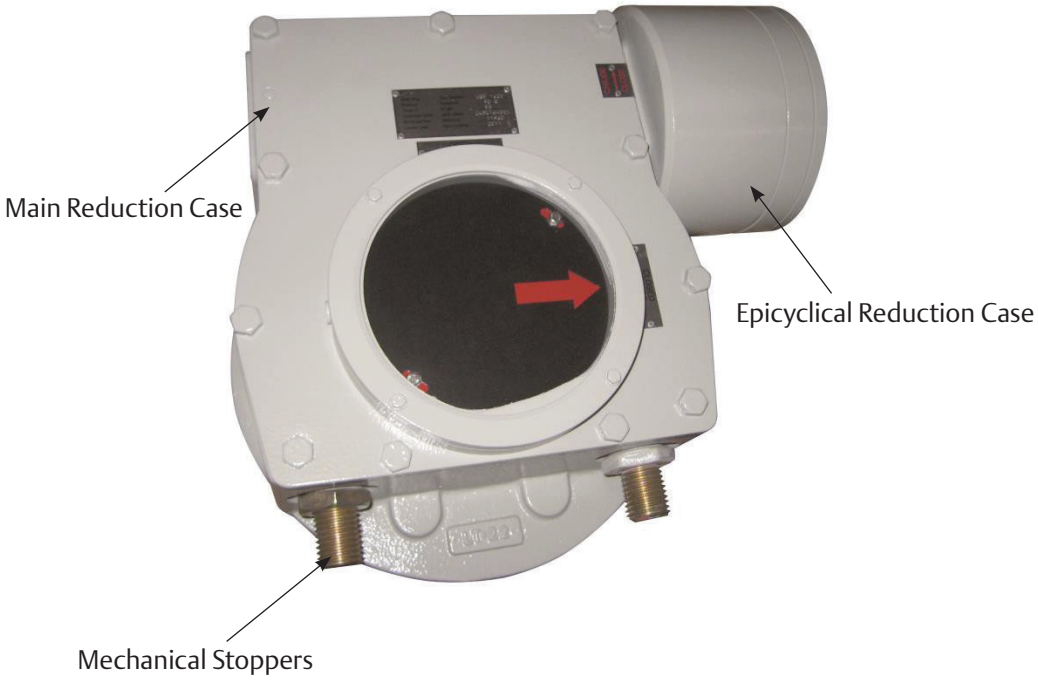
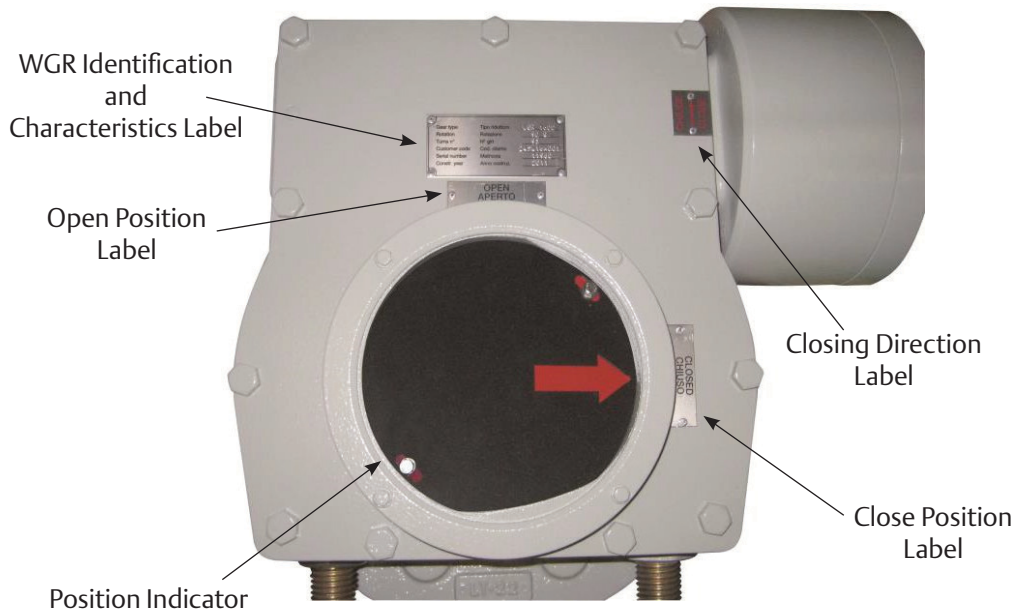


Figure 3


WGR Identification and Characteristics Label
Open Position Label
Position Indicator
Closing Direction Label
Close Position Label
OPEN
APERTO
CLOSED
CHIUSO

Section 3: Technical Data

Table 2.

WGR Model	ICON2000 Model	Nominal Torque (100%) (Nm)	Maximum Torque (Nm)	WGR Ratio (±10%)	Valve Attachment ISO 5211
WGR100	010	1.000	1.500	50:1	F14
WGR200	010	2.000	3.000	98:1	F16
WGR400	010	4.000	6.000	124:1	F16
WGR800	020	8.000	12.000	183:1	F25/F30
WGR1600	020	16.000	24.000	373:1	F25/F30
WGR3200	020	32.000	48.000	747:1	F30/F35
	030	32.000	48.000	400:1	F30/F35
WGR6300	020	63.000	94.500	1680:1	F40
	030	63.000	94.500	920:1	F40
	040	63.000	94.500	377:1	F40

3.1 Application Range

WGR gearboxes are suitable to operate in on-off or intermittent service up to 60 starts/hour max. WGR-DW gearboxes are suitable to operate in modulating service (up to 1200 starts/hour max).

Quarter-turn worm screw gearboxes are suitable to be motorized for applications in standard temperature range from -30 °C to +85 °C (low temperature version are suitable to operate in temperature range from -40 °C up to +85 °C).

WGR gearboxes are suitable to guarantee the output bush rotation of 90° with the possibility to obtain a 5° extra stroke for each direction of rotation.

WGR gearboxes have protection degree IP66M and IP67M according to EN 60529, complete with third party certificate (the enclosure protection IP66/IP67/IP68 refers to the interior of the gearboxes, but not to the coupling compartment).

IP 68 achieved with a submersion under 15 meter for 100 hours.

WGR gearboxes are also available with protection degree IP68 according to EN 60529 (the enclosure protection IP68 refers to the interior of the gearboxes, but not to the coupling compartment).

Please check with Biffi the acceptance of the submersion request (depth, medium, etc.) in order to verify the compatibility requirements.

Section 4: Transport and Storage

NOTICE

Not performing the following procedures will invalidate the product guarantee.

NOTICE

Gearbox (and actuator) lifting and transportation must be done by qualified personnel only and in accordance with the local regulation and area classification.

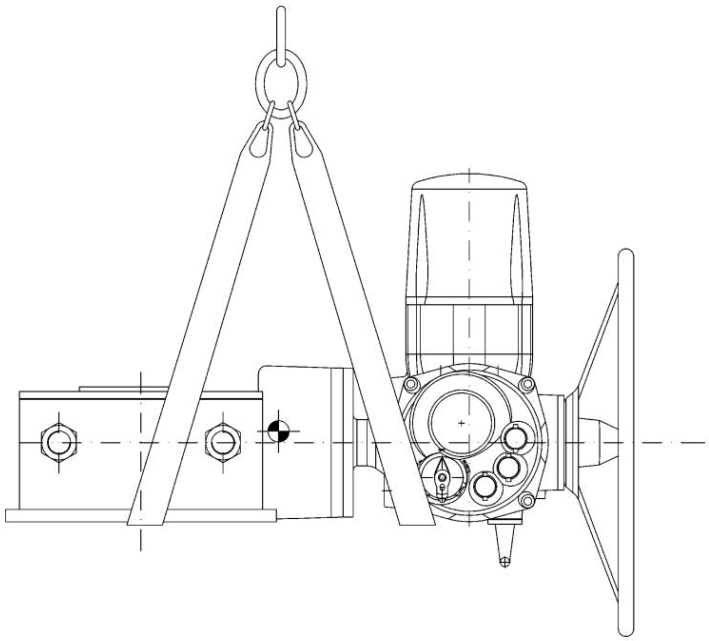
⚠ WARNING

The lifting studs are suitable for the transportation of the actuator and gearbox only, NOT for the valve-actuator assembly. The actuator and gearbox weights are indicated on delivery documents.

4.1 Transport

- Make sure the worm gearbox has a strong protecting packing during transport to destination.
- If the worm gearbox is assembled onto the electric actuator, hoist it with ropes or hooks making sure they are attached to the gearbox and not to the actuator.

Figure 4 Centre of Gravity



4.2 Checks to be Carried Out on Receipt of the WGR Reducer

- Carefully remove the reducer from its shipping carton or skid. Check that the worm gearbox has not been damaged during transport. If damaged, immediately report the damage to the transport company.
- First of all check whether the information on the nameplate (Model, Nominal torque, Degree of protection, etc.) correspond to the order acknowledgement data.
- If the actuator and WGR are already assembled onto the valve, the setting of the mechanical stops and of the electric end of travel has already been done in-house.
- If the actuator and WGR are shipped separately from the valve, the setting of the mechanical stops and of the electric end of travel must be checked and, if necessary, carried out while assembling the actuator and the gearbox onto the valve.
- Check that the fitted accessories comply with those listed in the order acknowledgement and the delivery note.

4.3 Storage Procedure

NOTICE

Please make sure you stick to the following storage procedure to maintain top WGR integrity during storage; failure to comply with the recommended procedure will invalidate the warranty.

The worm gearboxes leave the factory in excellent working conditions and with an excellent finish (these conditions are guaranteed by an individual inspection); in order to maintain these characteristics until installation on the plant, it is necessary to observe a few rules and take appropriate measures during the storage period.

- Store in a well-ventilated, protected, dry room.
- Store the gearboxes on wooden skids or shelves to protect the machined mounting flange.
- If the WGRs are supplied separately from the valves, they must be placed onto a wooden pallet. In case of long-term storage (over six months), the worm gearboxes must be covered and protected from dust and dirt, and it is necessary to apply a suitable corrosion protection agent to bare surfaces, particularly the output drive parts and mounting surfaces.
- In case of long-term storage, it is advisable to keep the worm gearboxes in a clean, dry place in order to provide at least some means of weather protection.
- If the gearboxes must be stored outside, they must be adequately protected (for example covered in polyethylene protection with silica gel crystals to absorb moisture).

For the storage of the Electric Actuator supplied together with the worm gearbox, please refer to the storage instructions included in the actuator's IOM (MAN 618).

Section 5: Installation

5.1 Working Condition

Standard WGR gearboxes are suitable for the following ambient temperatures:

- From -30 °C to +85 °C (from -22 °F to +185 °F).

The low temperature version is suitable for temperature ranges:

- From -40 °C up to +85 °C.

NOTICE

Check the "temperature ambient range" on the nameplate for correct use. Installation in ambient with temperature range outside the specified values will invalidate the warranty.

5.2 Safety Instructions for installation in Hazardous Area

5.2.1 Instructions for the Explosion-proof Enclosures

NOTICE

For the installation of the assembly WGR - Electric Actuator in hazardous areas, please refer to the Electric Actuator IOM (MAN 618).

5.2.2 Installation in Ambient with Explosive Dusts

NOTICE

For the installation of the assembly WGR - Electric Actuator in ambient with explosive dusts, please refer to the Electric Actuator IOM (MAN 618).

Section 6: Assembling the Worm Gearbox onto the Valve

The worm gearbox is provided with an output flange and an insert (machined or not machined, based on Customer requirements) for the coupling to the valve. The assembly position (orientation) of the valve/actuator (gearbox) package must comply with the plant requirements.

To assemble the actuator onto the valve proceed as follows:

- Check that the valve coupling dimensions of the flange and stem, or of the relevant extension, meet the worm gearbox coupling dimensions.
- Arrange the valve in the position related to the worm gearbox operation (for both butterfly valves and ball valves the recommended position is OPEN).
- Lubricate the valve stem with oil or grease in order to make the assembly easier: be careful not to contaminate with lubricant the flange surfaces which have to be connected to transmit the actuator torque.
- Clean the valve flange and remove anything that might prevent a perfect adherence to the worm gearbox flange and especially all traces of grease.
- If the insert supplied is not machined, remove it from the WGR output drive, machine it and reassemble it in the WGR output drive.
- Bring the worm gearbox to the recommended position (for both butterfly valves and ball valves the recommended position is OPEN).
- Clean the worm gearbox flange and remove anything that might prevent a perfect adherence to the valve flange and especially all traces of grease.
- Lower the actuator/WGR package onto the valve so that the WGR output drive couples with the valve stem (for example, if the connection is made by key, the valve stem key groove must match with the WGR output drive key groove). This coupling must take place without forcing and only with the weight of the actuator and worm gearbox. When the worm gearbox output drive and the valve stem are connected, check the holes of the valve flange. If they do not meet with the holes of the spool piece flange or the stud bolts screwed into them, the worm gearbox output drive must be rotated until coupling is possible.
- Tighten the nuts of the connecting stud bolts evenly with the torque prescribed in the table. If no different materials are specified, the stud bolts must be made of ASTM A 320 Grade L 7 steel, the nuts must be made of ASTM A 194 Grade 2 or better.
- If possible, operate the actuator to check that it moves the valve smoothly.

Table 3.

Thread size	Recommended tightening torque (Nm)
M16	160
M20	320
M22	420
M24	550
M27	800
M30	1100
M36	1700

Section 7: Adjusting the Mechanical Stoppers

7.1 Grease-lubrication-type Gearbox (WGR Standard Type)

Please refer to Figure 5.

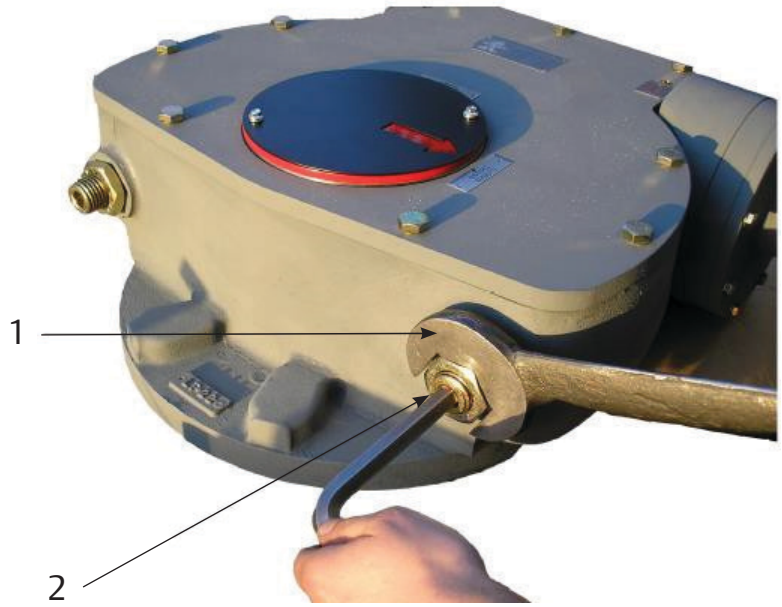
NOTICE

Closed positions:

1. Loose the nut (1).
2. Loose the stopper (2) with a hex-head wrench. Stopper shall be taken out as much as possible from the body of the gear.
3. Set-up actuator stroke limits according to the procedure described in MAN 618, Section 1, Section 1.1 and Section 1.2.
4. Tighten the stopper (2) until it stops, then step back a quarter of turn.
5. Tighten the nut (1).

Open position:
The same procedure of closed position, on the opposite stopper.

Figure 5



7.2 Oil-lubrication-type Gearbox (WGR-DW Series Models)

Please refer to Figure 6.

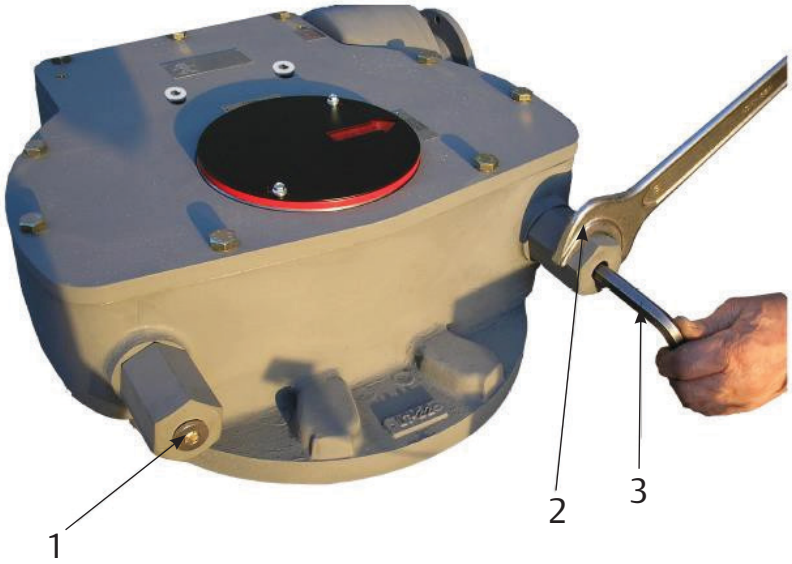
NOTICE

Closed positions:

1. Remove the plug (1) with a hex-head wrench.
2. Release the cap (2).
3. Loose the nut (1).
4. Loose the stopper (2) with a hex-head wrench. Stopper shall be taken out as much as possible from the body of the gear.
5. Set-up actuator stroke limits according to the procedure described in MAN 618, Section 1, Section 1.1 and Section 1.2.
6. Tighten the stopper (2) until it stops, then step back a quarter of turn.
7. Tighten the nut (1).

Open position:
The same procedure of closed position, on the opposite stopper.

Figure 6



Section 8: Maintenance

8.1 Standard Maintenance

Biffi worm gearboxes require no maintenance.

- After commissioning and once a year, check the paint-coat of the worm gearbox. If some areas are damaged, repair the paint-coat according to the applicable specification.
- In chemically aggressive or saline environments, remove rust from surfaces and protect with a rust preventative.
- Approximately six months after commissioning and once a year, check that the nuts and bolts securing the worm gearbox to the electric actuator and to the valve are tight, and, if necessary, retighten.
- Approximately every 2 years visually inspect the gearbox for grease leakage. For oil lubrication type gearboxes (WGR-DW series models) visually inspect for oil leakage approximately every year.
- For severe applications or if worm gearbox operation is infrequent, perform maintenance checks at shorter intervals.

8.2 Special Maintenance

In case of malfunction, in case of grease leaks, or in case of scheduled preventive maintenance, the worm gearbox must be disassembled: any damaged part can be requested from Biffi with reference to the attached exploded view drawing and parts list.

Every spare parts request must clearly indicate the relevant gearbox serial number and the spare part item number.

Special maintenance is also recommended when, during operations, the actuator generates an excessive noise.

NOTICE

After maintenance works, a few operations of the assembly actuator/WGR must be done to check that movement is regular.

NOTICE

For maintenance instructions of the Electric Actuator ICON2000 supplied together with the worm gearbox WGR, please refer to the ICON2000 IOM (MAN 618).

Section 9: Disassembly Instructions

9.1 Access to the Main Reduction and to the Epicyclical Reduction

Please refer to the following Figures 7, 8 and 9.

- Unscrew the screws (1) and remove the position indicator cover
- Unscrew the screws (2) and remove the position indicator (3)
- Release the cylindrical pin (4)
- Unscrew the screws (5) and remove the upper cover (6)
- Unscrew the screws (7) and remove the trunk (8)
- After completing these operations, the main reduction and the epicyclical reduction will appear as shown in Figure 9

The flexoid gasket (9) and the O-ring (10) (please refer to Figure 9) must be replaced every time the upper cover is opened.

Figure 7

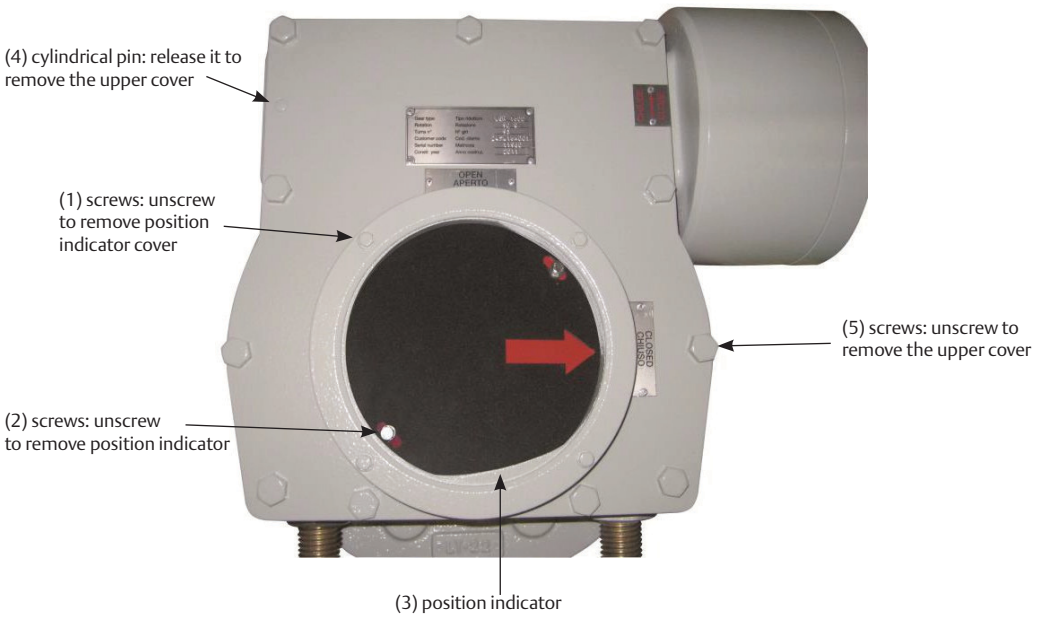


Figure 8

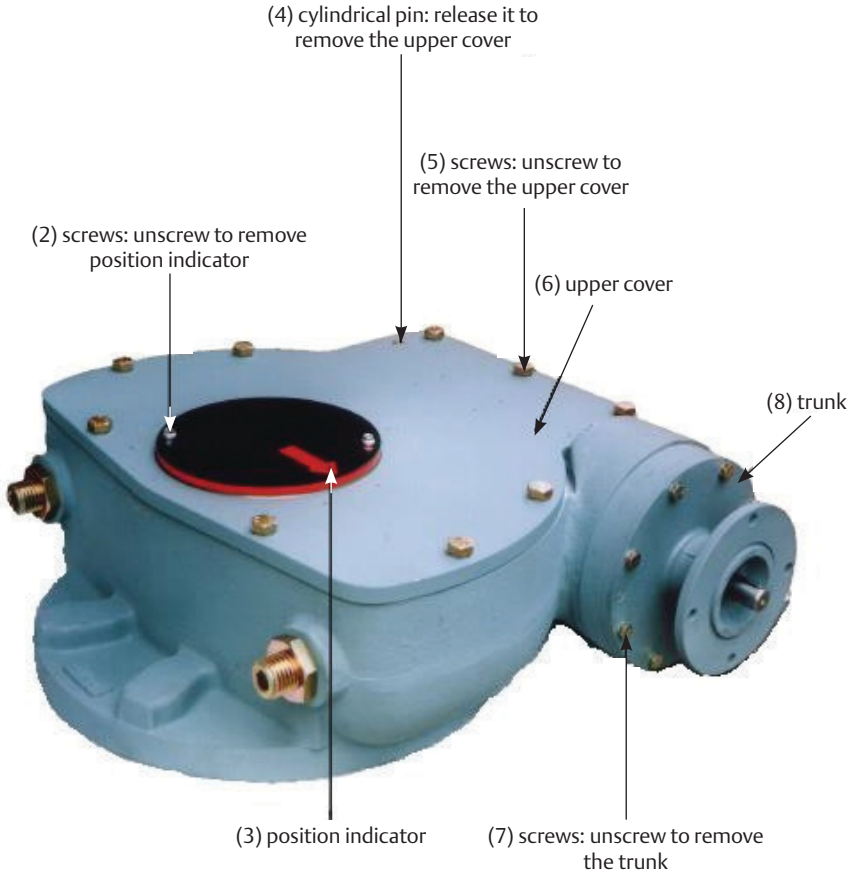
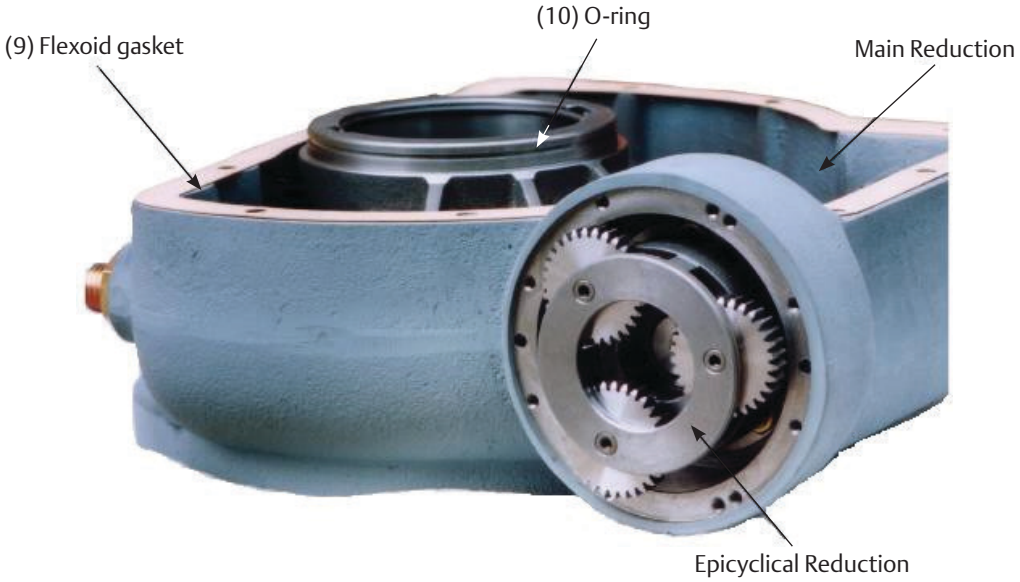


Figure 9

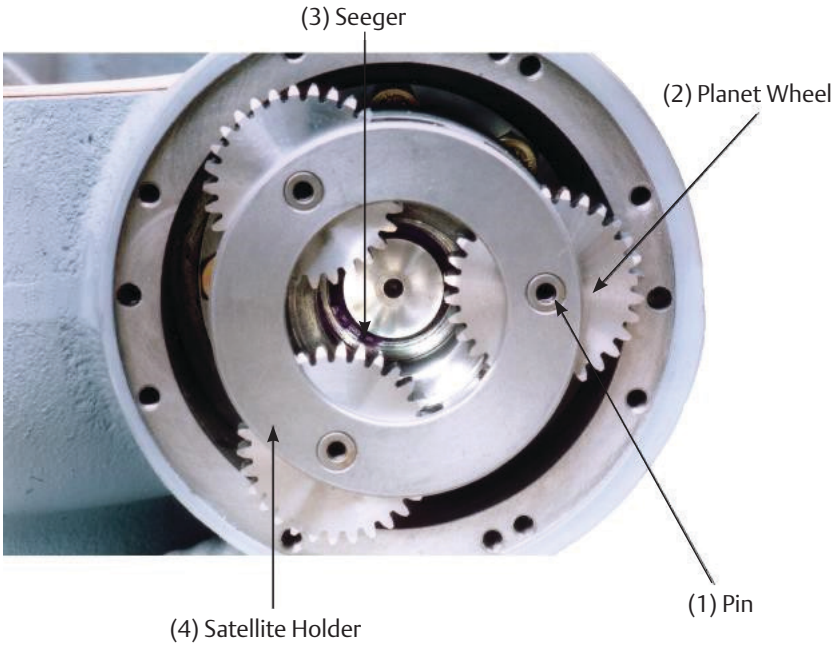


9.2 Epicyclical Reduction Removal

Please refer to Figure 10.

- Remove the trunk (8 in Figure 8) following the instructions on Section 9.1
- Remove the pin (1)
- Remove the operating gear (planet wheel) (2)
- Remove the seeger (3)
- Remove the satellite holder (4)

Figure 10



9.3 Main Reduction Removal

Please refer to Figure 11 and Figure 12.

- Remove the epicyclical reduction following the instructions on Section 9.2
- Remove the bolts (1)
- Remove the thrust flange (2)
- Remove the first thrust ball bearings couple (3)
- Remove the endless screw (4)
- Remove the second thrust ball bearings couple (5)
- Remove the gear (6)

Figure 11

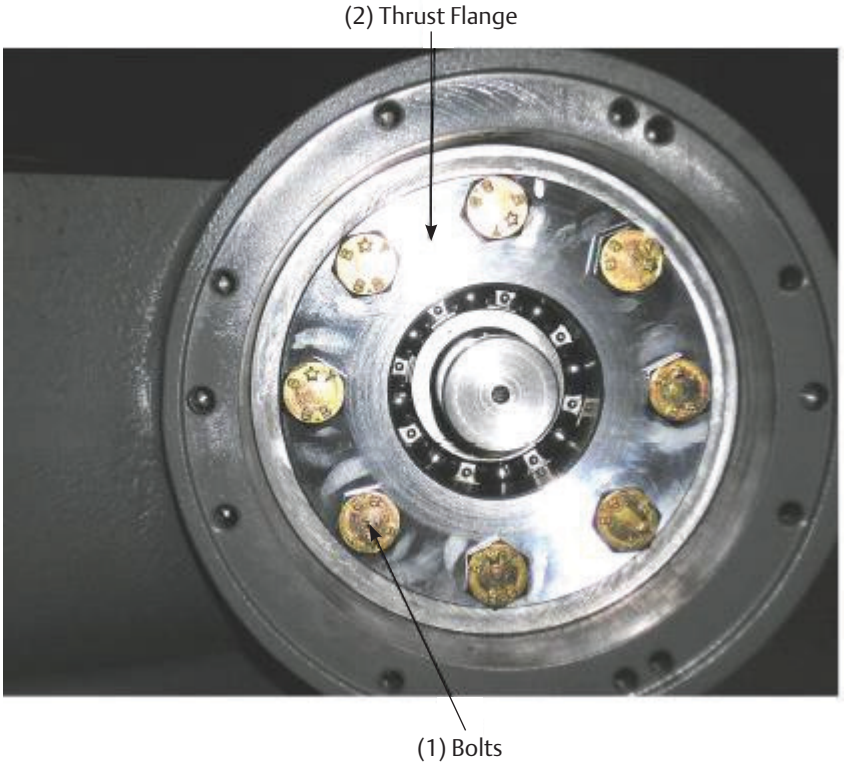
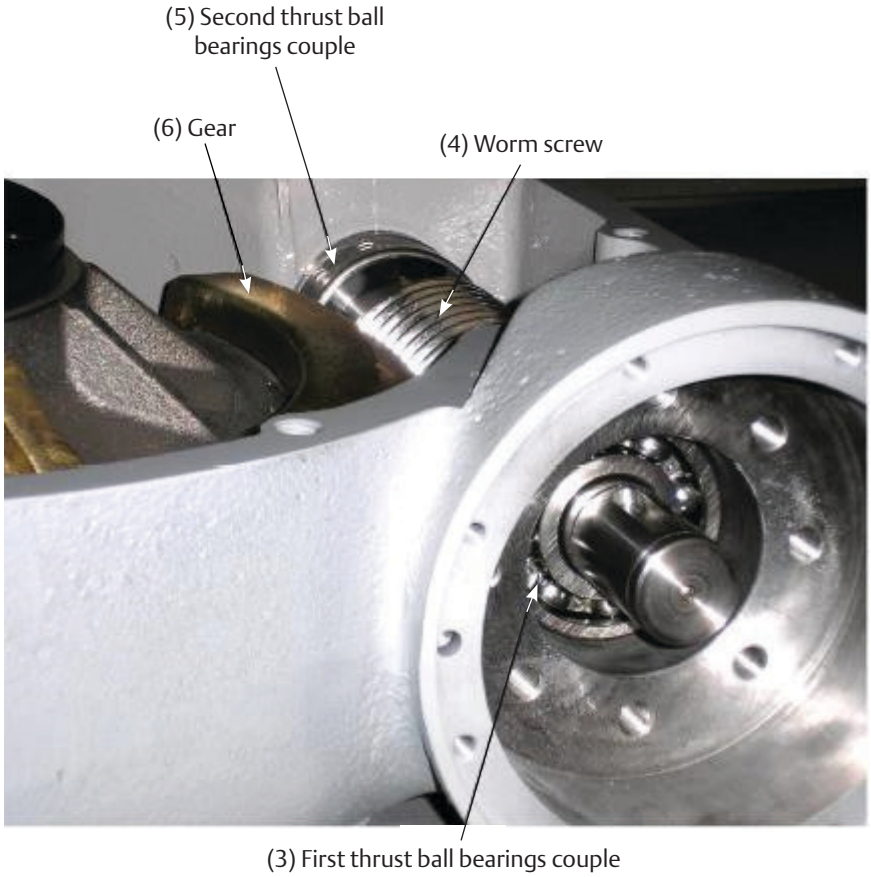


Figure 12



9.4 Greasing the Main Reduction and the Epicyclical Reduction

Please refer to Figure 13 and Figure 14.

- Remove the reductions as explained in Section 9.2 and Section 9.3
- Grease the worm screw and the two thrust ball bearings couple (Figure 13)
- Grease the gears of the epicyclical reduction (Figure 14)

Figure 13

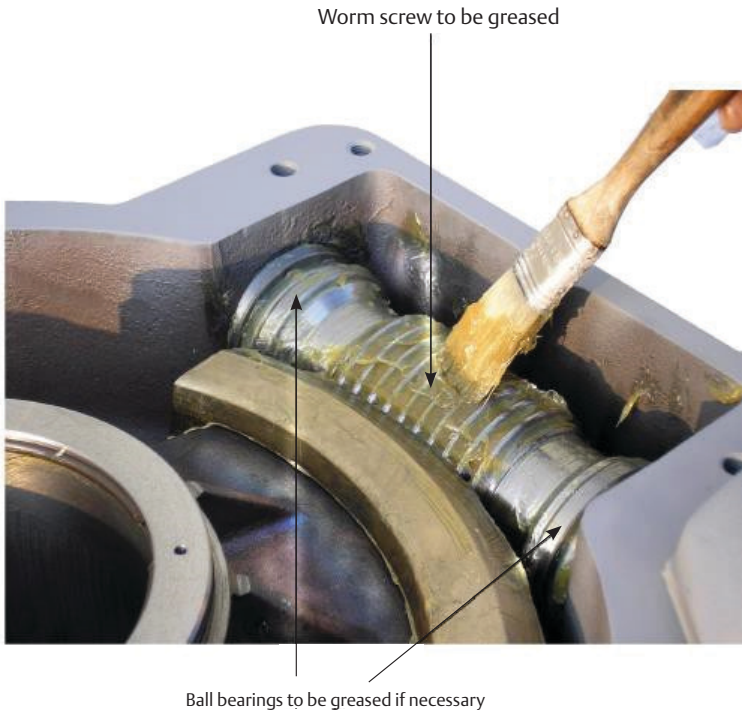
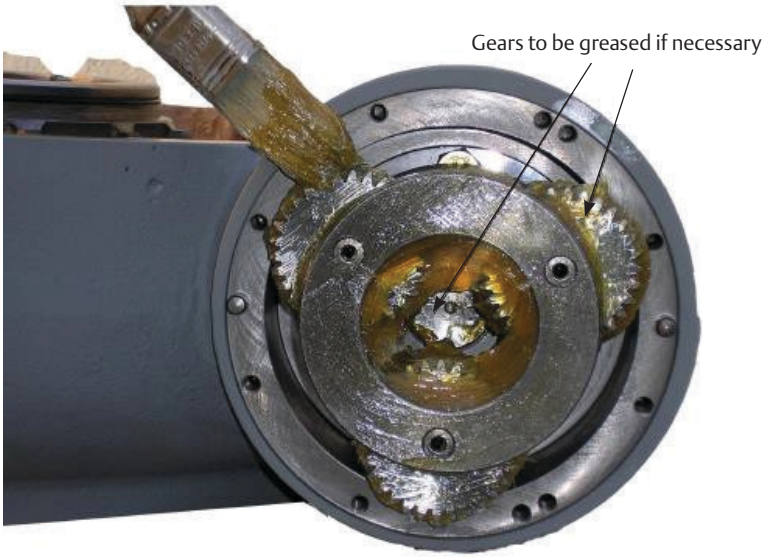


Figure 14



NOTICE

Before reassembling the worm gearbox, the flexoid gasket and the O-ring (please see Section 8.1) must be replaced.

Section 10: Lubrication

10.1 Grease Lubrication Type Gearbox (WGR Standard Type)

Use grease type indicated in the following table:

Table 4.

BL82EP	IBGR-2
To be used with ST107 (-30 °C/+85 °C) series gearboxes	To be used with ST109 (-40 °C/+85 °C) series gearboxes

10.2 Oil Lubrication Type Gearbox (WGR-DW Series Models)

The DW series worm gearboxes are shipped with oil type Quaser RIDGR 320.

In case of oil refilling, the requested oil quantity for optimal lubrication is indicated in the following table:

Table 5.

Gearbox Model	Oil Quantity (ml)
WGR100	600
WGR200	800
WGR400	800
WGR800	1000
WGR1600	2200
WGR3200	600
WGR6300	9500

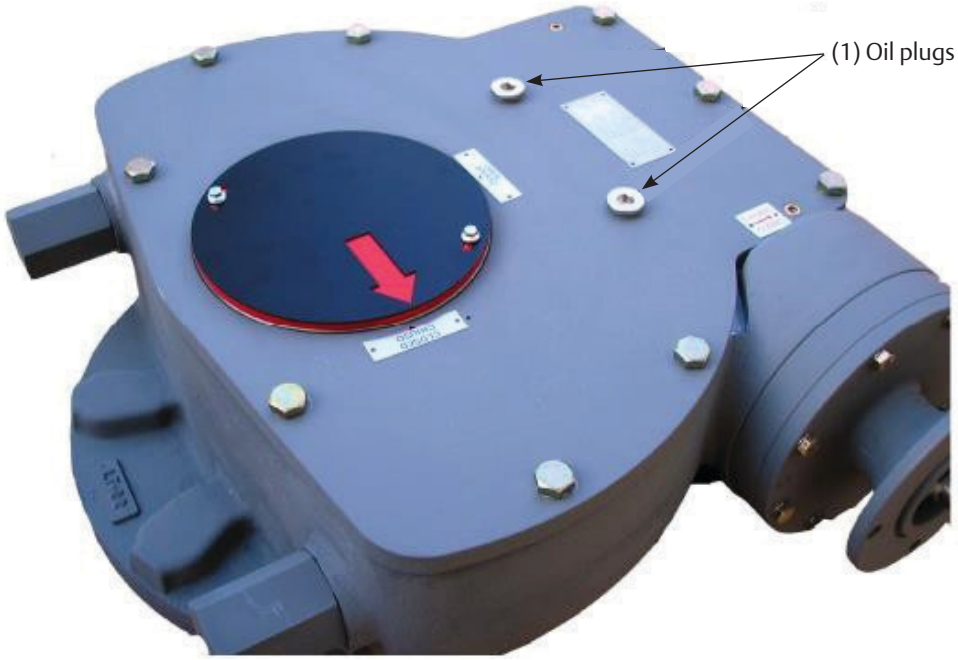
This lubricant is suitable for a temperature range of -30 °C to +85 °C (from -22 °F to +185 °F).

10.3 Refilling Procedure (Only for WGR-DW Series Models)

Please refer to Figure 15.

- Remove both the oil plugs (1) with a hex-head wrench
- Refill by pouring the oil inside one hole (the other hole is used for pressure compensation)

Figure 15



Section 11: Parts List

11.1 How to Order Parts List

To order parts or obtain further information about Biffi valve actuators, contact your local distributor sales office or:

Biffi Italia s.r.l.

Strada Biffi 165 29017 Fiorenzuola d'Arda (PC) Italy

Telephone: 0039 0523 944 411

Fax: 0039 0523 944 546

All inquiries and orders must be accompanied by the following information, to be found on the nameplate:

1. Model, size and ratio;
2. Acknowledgment number;
3. Serial number.

11.2 WGR100 Parts List

Figure 16

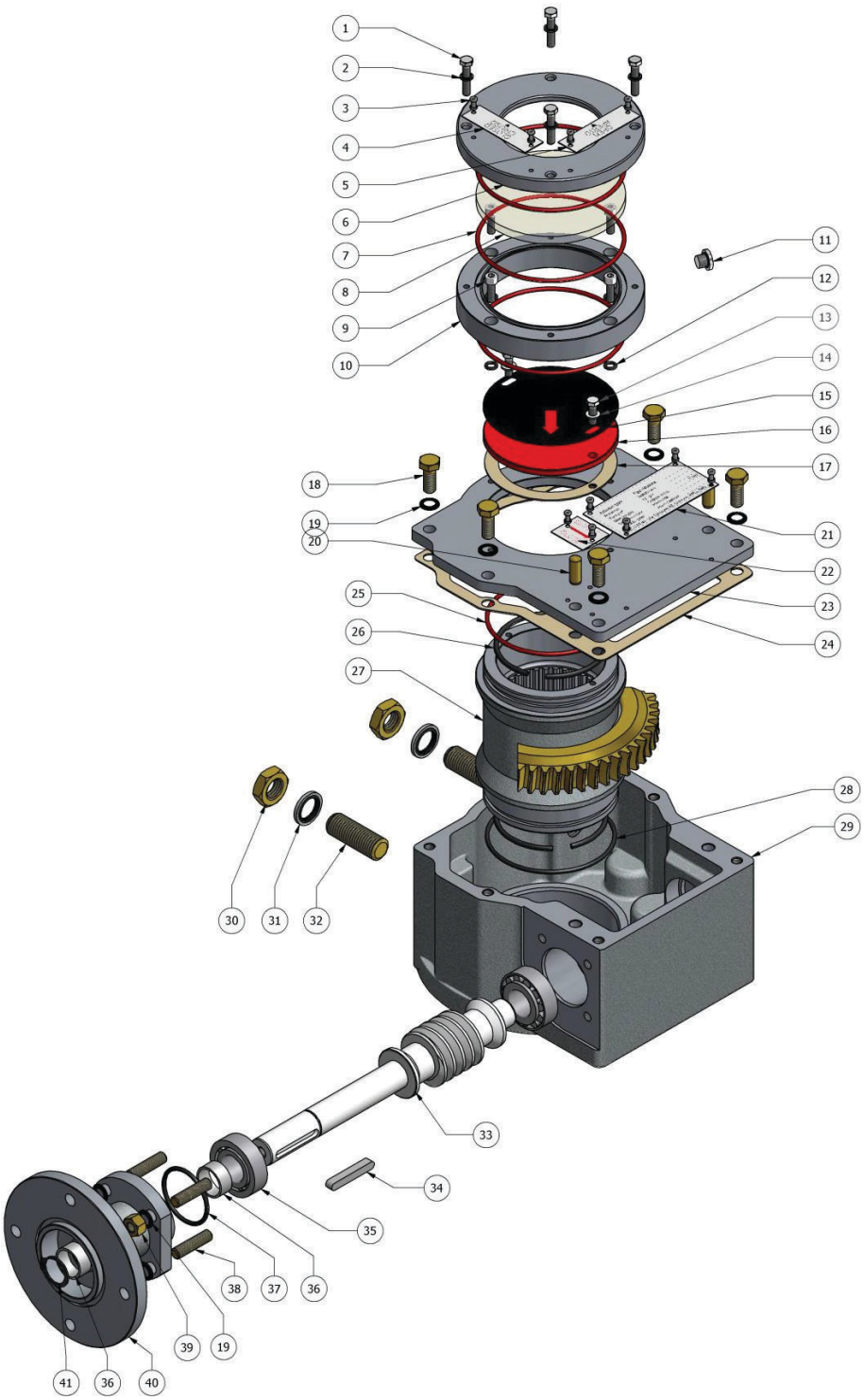


Table 6. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	10	Rivets	Aluminum
4	1	Closed Plate	AISI 316
5	1	Open Plate	AISI 316
6	1	Top Flange (Porthole)	Fe E355
7	3	O-ring	* SIlicone
8	1	Glass	Glass
9	4	Screw	A4-70
10	1	Down Flange (Porthole)	Fe E355
11	1	Cylindrical Plug	Brass with Nickel + NBR
12	4	O-ring	* NBR
13	2	Screw	A4-70
14	2	Washer	A4-70
15	1	Position Indicator (Top)	Carbon Steel
16	1	Position Indicator (Down)	C20
17	1	Indicator Gasket	* Flexoid
18	6	Screw	8.8 UNI3740 Glvanized
19	10	Washer	C72
20	2	Cylindrical Pin	C40
21	1	Characteristics Plate	AISI 316
22	1	Close Plate	AISI 316
23	1	Bonnet	Fe360
24	1	Bonnet Gasket	Flexoid
25	1	O-ring	* Silicone
26	2	Elastic Stop Ring	C72
27	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
28	1	O-ring	* NBR
29	1	Casing	GJS-350-22-LT
30	2	Nut	8.8 UNI3740 Galvanized
31	2	Washer	Galvanized Steel + NBR
32	2	Set Screw	8.8 UNI3740 Galvanized
33	1	Endless Screw	39NiCrMo3
34	1	Key	C40
35	2	Bearing	UNI C100 Cr5
36	2	Bushing	Du-Dry
37	1	O-ring	* NBR
38	4	Set Screw	8.8 UNI3740 Galvanized
39	4	Nut	8.8 UNI3740 Galvanized
40	1	Trunk	GJS-350-22-LT
41	1	Seeger	C72

NOTE:
* Recommended spare parts

11.3 WGR200 Parts List

Figure 17

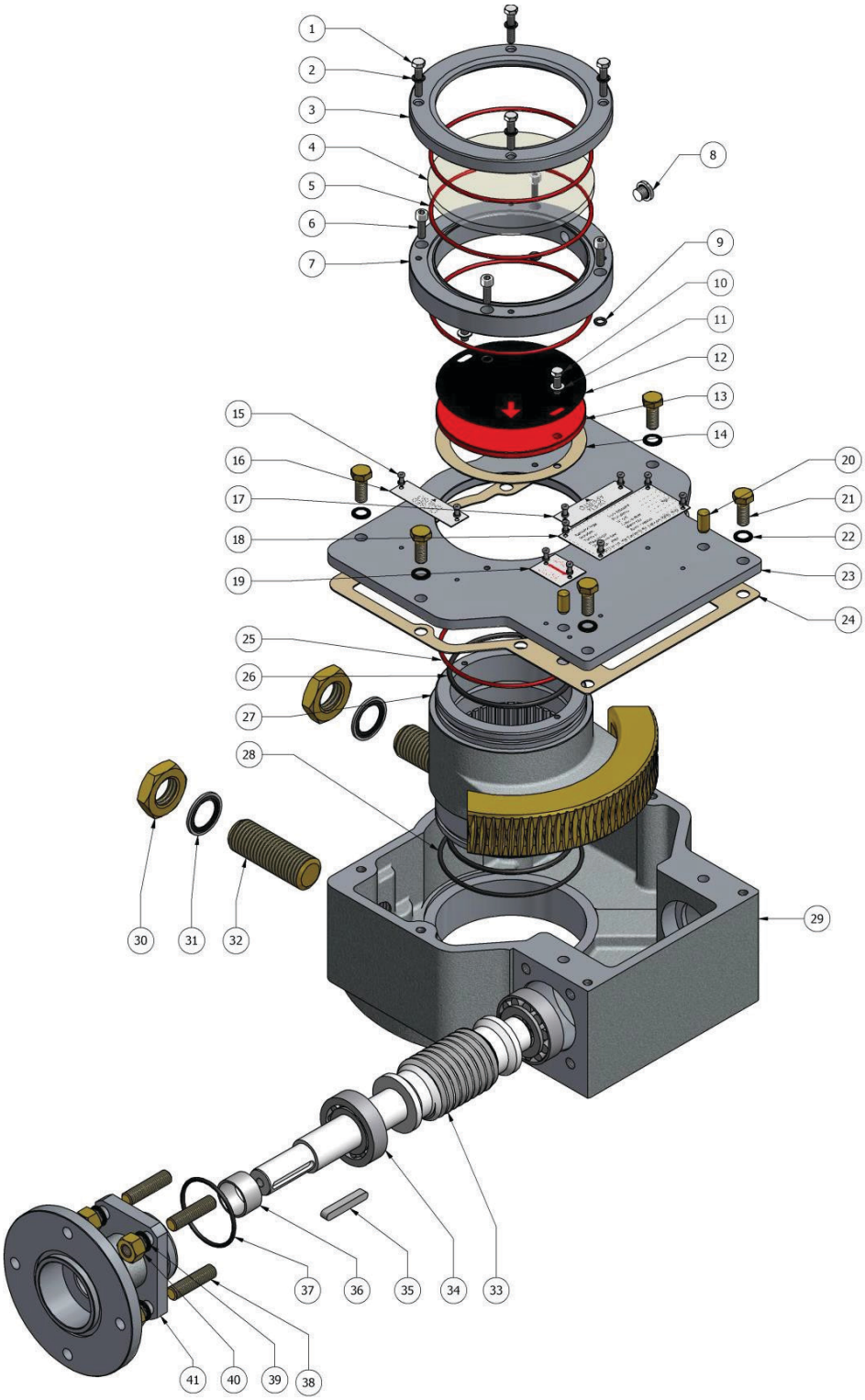


Table 7. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	1	Glass	Glass
5	3	O-ring	* Silicone
6	4	Screw	Fe E355
7	1	Down Flange (Porthole)	A4-70
8	1	Cylindrical Plug	Brass with Nickel + NBR
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	1	Position Indicator (Top)	Carbon Steel
13	1	Position Indicator (Down)	C20
14	1	Indicator Gasket	* Flexoid
15	10	Rivets	Aluminum
16	1	Closed Plate	AISI 316
17	1	Open Plate	AISI 316
18	1	Characteristics Plate	AISI 316
19	1	Close Plate	AISI 316
20	2	Cylindrical Pin	C40
21	6	Screw	8.8 UNI3740 Galvanized
22	6	Washer	C72
23	1	Bonnet	Fe360
24	1	Bonnet Gasket	Flexoid
25	1	O-ring	* Silicone
26	2	Elastic Stop Ring	C72
27	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
28	1	O-ring	* NBR
29	1	Casing	GJS-350-22-LT
30	2	Nut	8.8 UNI3740 Galvanized
31	2	Washer	Galvanized Steel + NBR
32	2	Set Screw	8.8 UNI3740 Galvanized
33	1	Endless Screw	39NiCrMo3
34	2	Bearing	UNI C100 Cr5
35	1	Key	C40
36	1	Bushing	Du-Dry
37	1	O-ring	* NBR
38	4	Set Screw	8.8 UNI3740 Galvanized
39	4	Washer	C72
40	4	Nut	8.8 UNI3740 Galvanized
41	1	Trunk	GJS-350-22-LT

NOTE:
* Recommended spare parts

11.4 WGR400 Parts List

Figure 18

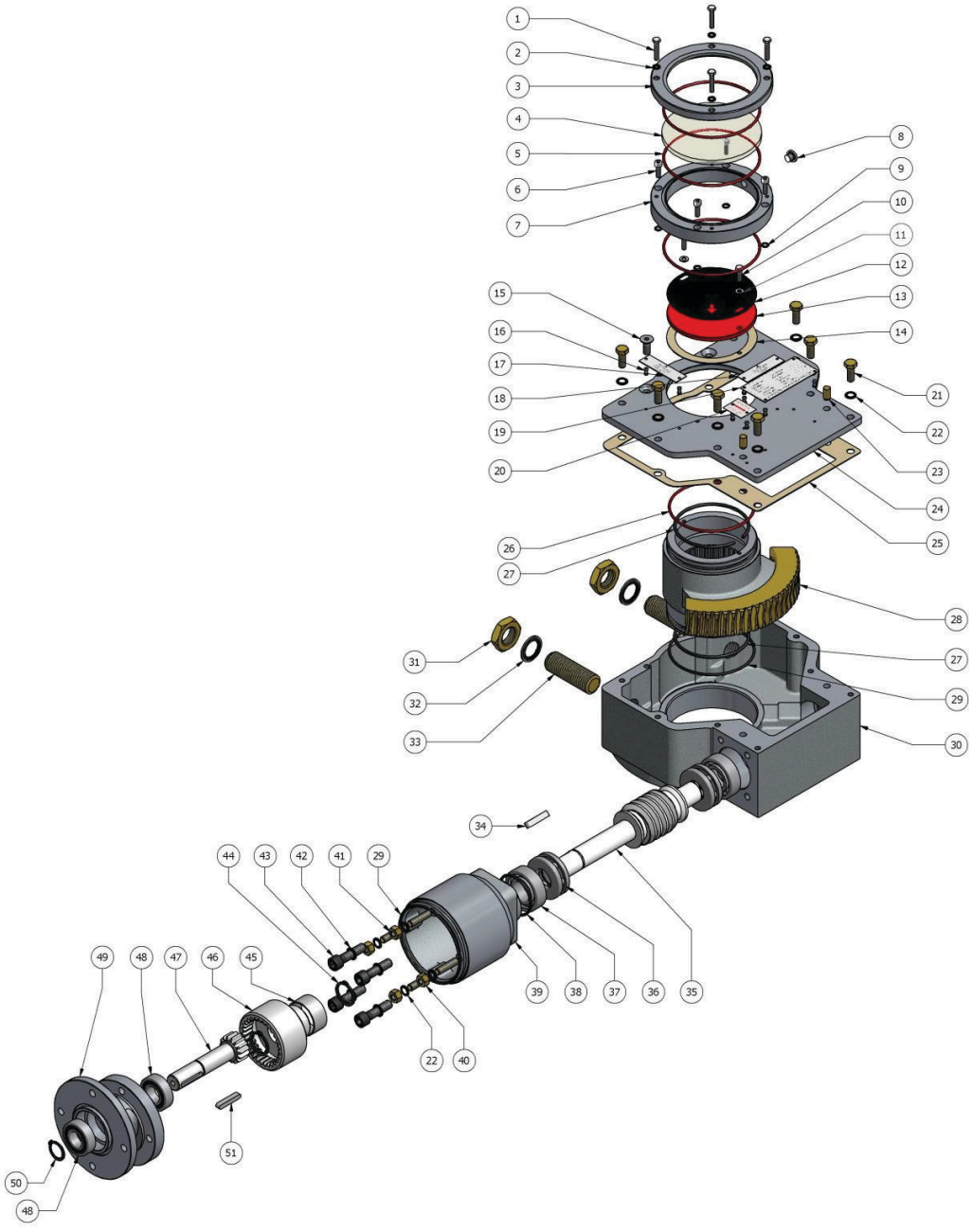


Table 8. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	1	Glass	Glass
5	3	O-ring	* Silicone
6	4	Screw	A4-70
7	1	Down Flange (Porthole)	Fe E355
8	1	Cylindrical Plug	Brass with Nickel + NBR
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	1	Position Indicator (Top)	Carbon Steel
13	1	Position Indicator (Down)	C20
14	1	Indicator Gasket	* Flexoid
15	2	Screw	8.8 UNI3740
16	10	Rivets	Aluminum
17	1	Closed Plate	AISI 316
18	1	Open Plate	AISI 316
19	1	Characteristics Plate	AISI 316
20	1	Close Plate	AISI 316
21	8	Screw	8.8 UNI3740 Galvanized
22	12	Washer	C72
23	2	Cylindrical Pin	C40
24	1	Bonnet	Fe360
25	1	Bonnet Gasket	Flexoid
26	1	O-ring	* Silicone
27	2	Elastic Stop Ring	C72
28	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
29	2	O-ring	* NBR
30	1	Casing	GJS-350-22-LT
31	2	Nut	8.8 UNI3740 Galvanized
32	2	Washer	Galvanized Steel + NBR
33	2	Set Screw	8.8 UNI3740 Galvanized
40	4	Nut	8.8 UNI3740 Galvanized
35	1	Endless-Screw	39NiCrMo3
36	2	Bearing	UNI C100 Cr5
37	2	Bearing	UNI C100 Cr5
38	1	O-ring	* NBR
39	1	Reduction Casing	GJS-350-22-LT
41	4	Set Screw	8.8 UNI3740 Galvanized
42	4	Washer	C72
43	4	Screw	8.8 UNI3740
44	2	Seeger	C72
34	1	Key	C40
45	1	Bushing	Cu-Dry
46	1	Driven Wheel	39NiCrMo3
47	1	Pinion	39NiCrMo3
48	2	Bearing	UNI C100 Cr5
49	1	Trunk	GJS-350-22-LT
50	1	Seeger	C72
51	1	Key	C40

NOTE:
* Recommended spare parts

11.5 WGR800 Parts List

Figure 19

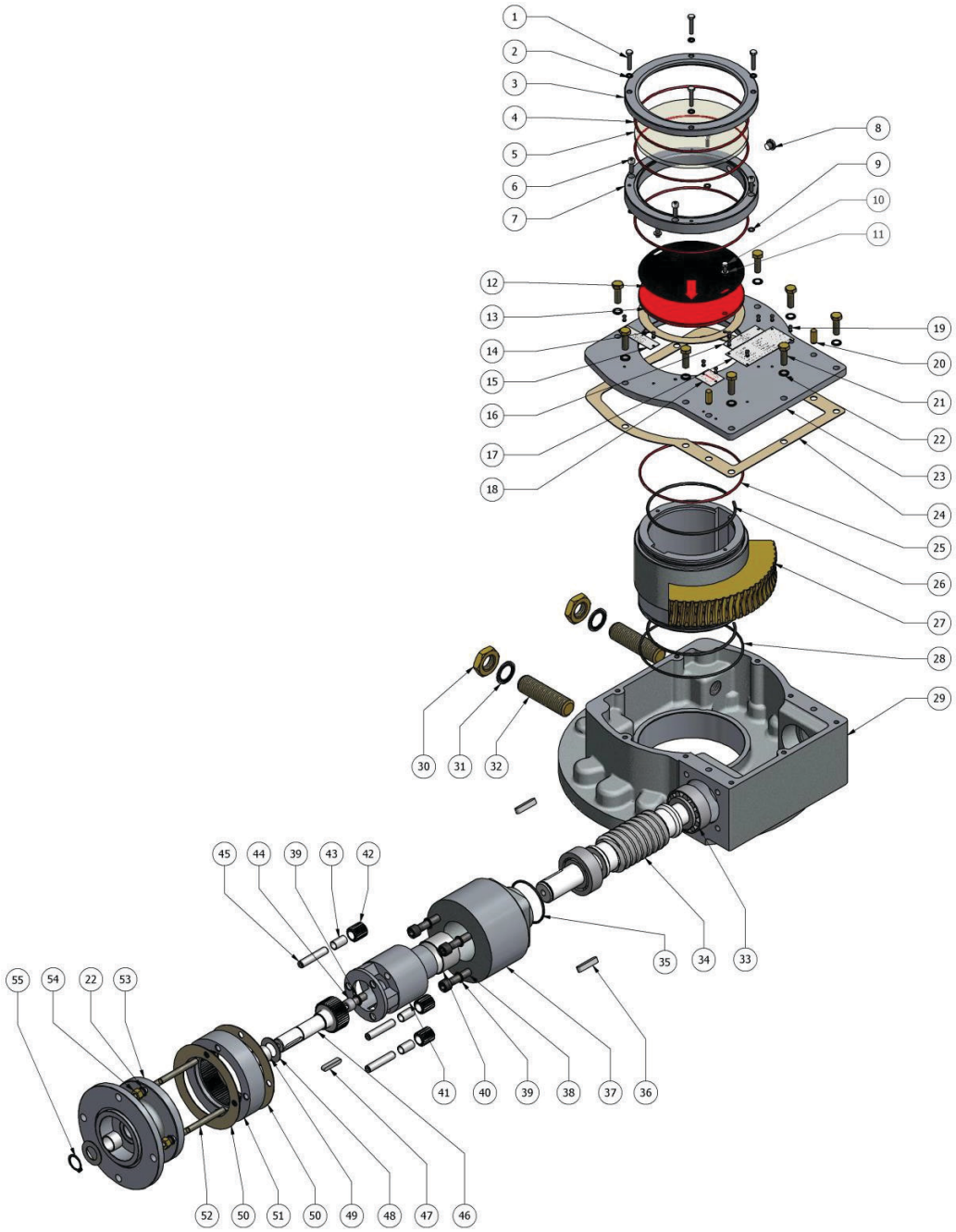


Table 9. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	3	O-ring	* Silicone
5	1	Glass	Glass
6	4	Screw	A4-70
7	1	Down Flange (Porthole)	Fe E355
8	1	Cylindrical Plug	Brass with Nickel + NBR
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	1	Position Indicator (Top)	Carbon Steel
13	1	Position Indicator (Down)	C20
14	1	Indicator Gasket	* Flexoid
15	1	Closed Plate	AISI 316
16	1	Open Plate	AISI 316
17	1	Characteristics Plate	AISI 316
18	1	Close Plate	AISI 316
19	10	Rivets	Aluminum
20	2	Cylindrical Pin	C40
21	9	Screw	8.8 UNI3740 Galvanized
22	13	Washer	C72
23	1	Bonnet	Fe360
24	1	Bonnet Gasket	Flexoid
25	1	O-ring	* Silicone
26	2	Elastic Stop Ring	C72
27	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
28	1	O-ring	* NBR
29	1	Casing	C40
30	2	Nut	8.8 UNI3740 Galvanized
31	2	Washer	Galvanized Steel + NBR
32	2	Set-Screw	8.8 UNI3740 Galvanized
33	2	Bearing	UNI C100 Cr5
34	1	Endless-Screw	39NiCrMo3
35	1	O-ring	* NBR
36	2	Key	C40
37	1	Reduction Casing	GJS-350-22-LT
38	4	Screw	8.8 UNI3740
39	5	Washer	C72
40	1	Bushing	Du-Dry
41	1	Satellites Holder	GJS-400-12
42	3	Satellites	39NiCrMo3
43	3	Bushing	Du-Dry
46	1	Pinion	39NiCrMo3
44	1	Screw	8.8 UNI3740 Galvanized
45	3	Cylindrical Pin	C40
47	1	Key	C40
48	2	Thrust Block	C40
49	2	Bushing	Du-Dry
50	2	Reduction Casing Gasket	Flexoid
51	1	Toothed Gear	Fe #355
52	4	Set-Screw	8.8 UNI3740 Galvanized
53	1	Trunk	GJS-350-22-LT
54	4	Nut	8.8 UNI3740 Galvanized
55	1	Seeger	C72

NOTE:
* Recommended spare parts

11.6 WGR1600 Parts List

Figure 20

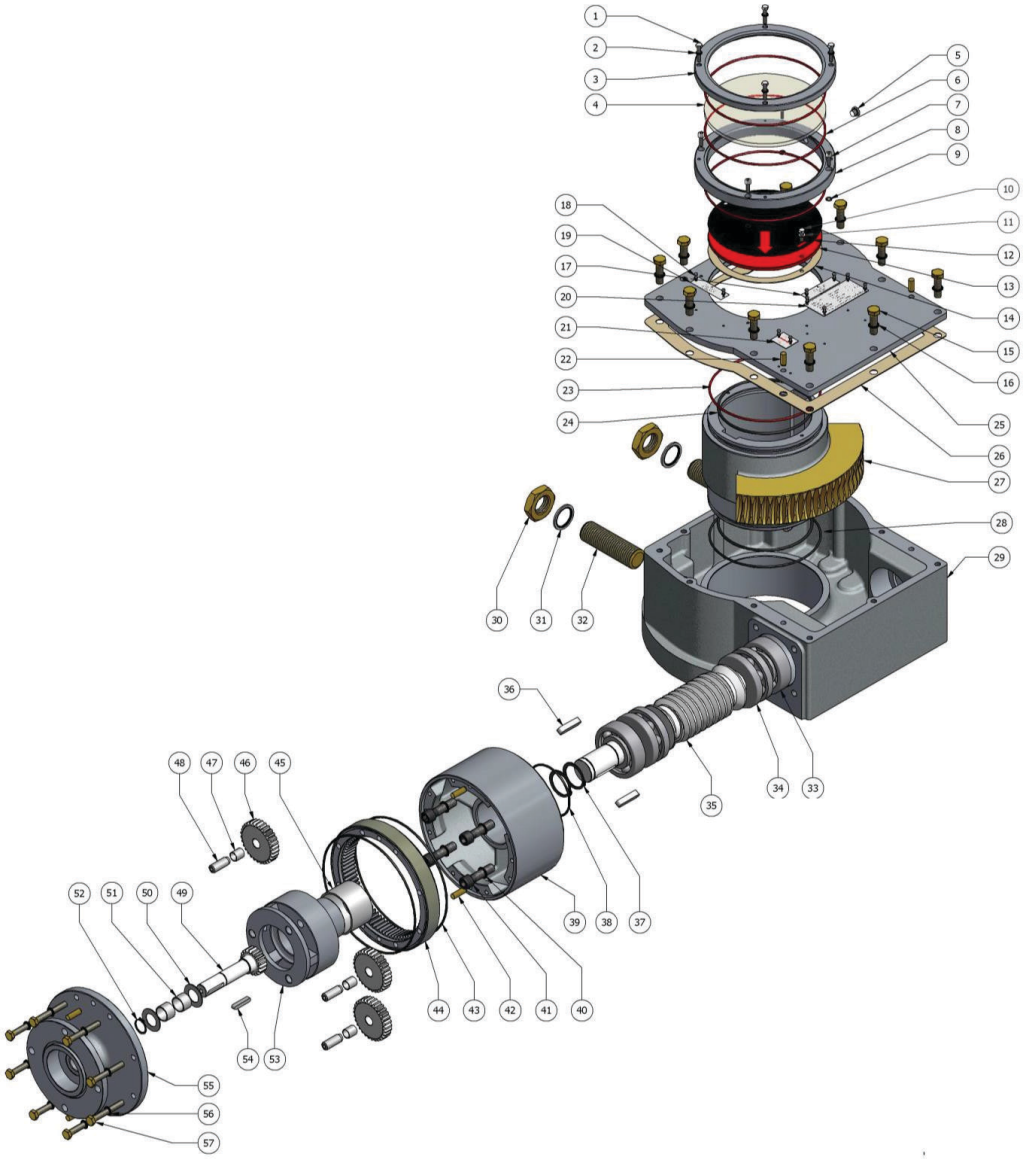


Table 10. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	1	Glass	Glass
5	1	Cylindrical Plug	Brass with Nickel + NBR
6	3	O-ring	* Silicone
7	4	Screw	A4-70
8	1	Down Flange (Porthole)	Fe E355
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	1	Position Indicator (Top)	Carbon Steel
13	1	Position Indicator (Down)	C20
14	1	Indicator Gasket	* Flexoid
15	11	Screw	8.8 UNI3740 Galvanized
16	11	Washer	C72
17	10	Rivets	Aluminum
18	1	Closed Plate	AISI 316
19	1	Open Plate	AISI 316
20	1	Characteristics Plate	AISI 316
21	1	Close Plate	AISI 316
22	2	Cylindrical Pin	C40
23	1	O-ring	* Silicone
24	2	Elastic Stop Ring	C72
25	1	Bonnet	Fe360
26	1	Bonnet Gasket	Flexoid
27	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
28	1	O-ring	* NBR
29	1	Casing	GJS-350-22-LT
30	2	Nut	8.8 UNI3740 Galvanized
31	2	Washer	Galvanized Steel + NBR
32	2	Set-Screw	8.8 UNI3740 Galvanized
33	2	Bearing	UNI C100 Cr5
34	2	Bearing	UNI C100 Cr5
35	1	Endless-Screw	C40
36	2	Key	C72
37	2	Seeger	8.8 UNI3740
38	1	O-ring	* NBR
39	1	Reduction Casing	GJS-350-22-LT
40	4	Washer	C72
41	4	Screw	8.8 UNI3740
42	4	Cylindrical Pin	C40
43	2	O-ring	* NBR
44	1	Toothed Gear	Fe E355
45	1	Bushing	Du-Dry
46	3	Satellite	39NiCrMo3
47	3	Bushing	Du-Dry
48	3	Cylindrical Pin	C40
49	1	Pinion	39NiCrMo3
50	2	Thrust Block	C40
51	2	Bushing	Du-Dry
52	1	Seeger	C72
53	1	Satellite Holder	GJS-400-12
54	1	Key	C40
55	1	Trunk	GJS-350-22-LT
56	8	Washer	C72
57	8	Screw	8.8 UNI3740 Galvanized

NOTE:
* Recommended spare parts

11.7 WGR3200 Parts List

Figure 21

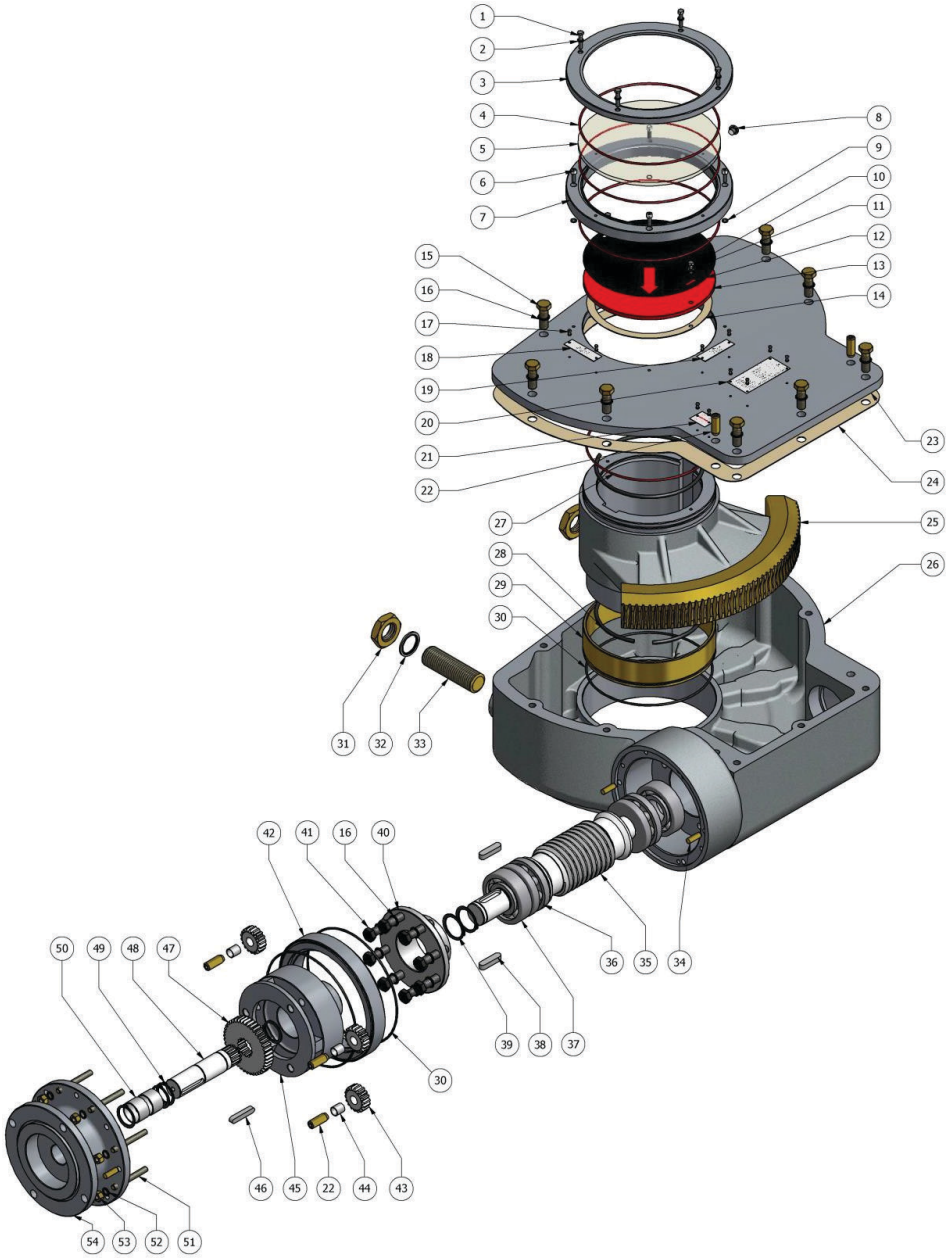


Table 11. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	3	O-ring	* Silicone
5	1	Glass	Glass
6	4	Screw	A4-70
7	1	Down Flange (Porthole)	Fe E355
8	1	Cylindrical Plug	Brass with Nickel + NBR
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	1	Position Indicator (Top)	Carbon Steel
13	1	Position Indicator (Down)	C20
14	1	Indicator Gasket	* Flexoid
15	9	Screw	8.8 UNI3740 Galvanized
16	17	Washer	C72
17	10	Rivets	Aluminum
18	1	Closed Plate	AISI 316
19	1	Open Plate	AISI 316
20	1	Characteristics Plate	AISI 316
21	1	Close Plate	AISI 316
22	5	Cylindrical Pin	C40
23	1	Bonnet	Fe360
24	1	Bonnet Gasket	Flexoid
25	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
26	1	Casing	GJS-350-22-LT
27	1	O-ring	* Silicone
28	2	Elastic Stop Ring	C72
29	1	Bushing	Bronze
30	3	O-ring	* NBR
31	2	Nut	8.8 UNI3740 Galvanized
32	2	Washer	Galvanized Steel + NBR
33	2	Set-Screw	8.8 UNI3740 Galvanized
34	4	Cylindrical Pin	C40
35	1	Endless-Screw	39NiCrMo3
36	2	Bearing	UNI C100 Cr5
37	2	Bearing	UNI C100 Cr5
38	2	Key	C40
39	2	Seeger	C72
40	1	Thrust Flange	C40
41	8	Screw	8.8 UNI3740 Galvanized
42	1	Toothed Gear	Fe E355
43	3	Satellite	39NiCrMo3
44	3	Bushing	Du-Dry
45	1	Satellites Holder	GJS-400-12
46	1	Key	C40
47	1	Toothed Gear	39NiCrMo3
48	1	Slotted Shalf	39NiCrMo3
49	4	Seeger	C72
50	2	Bushing	Du-Dry
51	8	Set-Screw	8.8 UNI3740 Galvanized
52	8	Washer	C72
53	8	Nut	8.8 UNI3740 Galvanized
54	1	Trunk	GJS-350-22-LT

NOTE:
* Recommended spare parts

11.8 WGR3200 Parts List

Figure 22

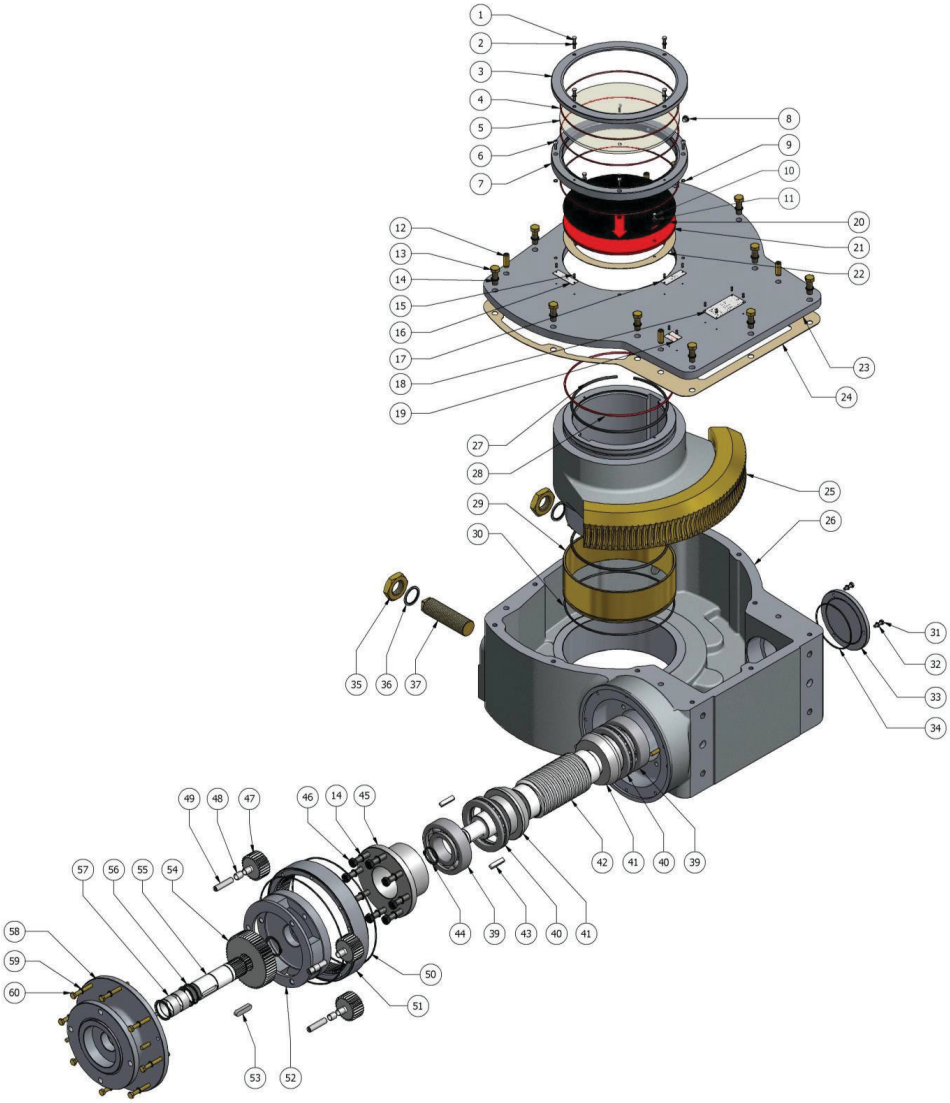


Table 12. Parts List

Item	Qty	Description	Material
1	4	Screw	A4-70
2	4	Washer	Galvanized Steel + NBR
3	1	Top Flange (Porthole)	Fe E355
4	3	O-ring	* Silicone
5	1	Glass	Glass
6	4	Screw	A4-70
7	1	Down Flange (Porthole)	Fe E355
8	1	Cylindrical Plug	Brass with Nickel + NBR
9	4	O-ring	* NBR
10	2	Screw	A4-70
11	2	Washer	A4-70
12	4	Cylindrical Plug	C40
13	11	Screw	8.8 UNI3740 Galvanized
14	19	Washer	C72
15	10	O-ring	Aluminum
16	1	Closed Plate	Aluminum
17	1	Open Plate	Aluminum
18	1	Characteristics Plate	Aluminum
19	1	Close Plate	Aluminum
20	1	Position Indicator (Top)	Carbon Steel
21	1	Position Indicator (Down)	C20
22	1	Indicator Gasket	* Flexoid
23	1	Bonnet	FE 430
24	1	Bonnet Gasket	Fe E355
25	1	Female-Screw	GJS-500-7 + Cu Al 10 Fe5 Ni5
26	1	Casing	GJS-350-22-LT
27	1	O-ring	* Silicone
28	2	Elastic Stop Ring	C72
29	1	Bushing	Bronze
30	1	O-ring	* NBR
34	1	O-ring	* NBR
33	1	Little Bonnet	Fe 37
32	3	Washer	C72
31	3	Screw	8.8 UNI3740 Galvanized
37	2	Set-Screw	8.8 UNI3740 Galvanized
35	2	Nut	8.8 UNI3740 Galvanized
36	2	Washer	Galvanized Steel + NBR
38	4	Cylindrical Pin	C40
39	2	Bearing	UNI C100 Cr5
40	2	Bearing	UNI C100 Cr5
41	2	Spacer Endless-Screw	Fe E355
42	1	Endless-Screw	39NiCrMo3
43	2	Key	C40
44	1	Seeger	C72
45	1	Thrust Flange	C40
46	8	Screw	8.8 UNI3740 Galvanized
47	3	Satellite	39NiCrMo3
48	6	Bushing	Du-Dry
49	3	Cylindrical Pin	C40
50	2	O-ring	* NBR
51	1	Toothed Gear	Fe E355
52	1	Satellites Holder	GJS-400-12
53	1	Key	C40
54	1	Toothed Gear	39NiCrMo3
55	1	Slotted Shalf	39NiCrMo3
56	4	Seeger	C72
57	2	Bushing	Du-Dry
58	1	Trunk	GJS-350-22-LT
59	8	Washer	C72
60	8	Screw	8.8 UNI3740 Galvanized

NOTE:
* Recommended spare parts

11.9 Optional Equipment (Applicable to all WGR Models)

11.9.1 Relief Valve on Sight Glass Version

In applications where a gas leak may occur through the main valve, that passing through the junction between the valve and gearbox can lead to pressurize the volume between the female screw and sight glass it is possible to install a relief valve on sight glass to prevent overpressure.

The Relief valve, item 43 in the following picture typical for all WGR models, is installed in place of the cylindrical plug (item 8 of previous part lists).

The relief part number is 345RELOBLO.

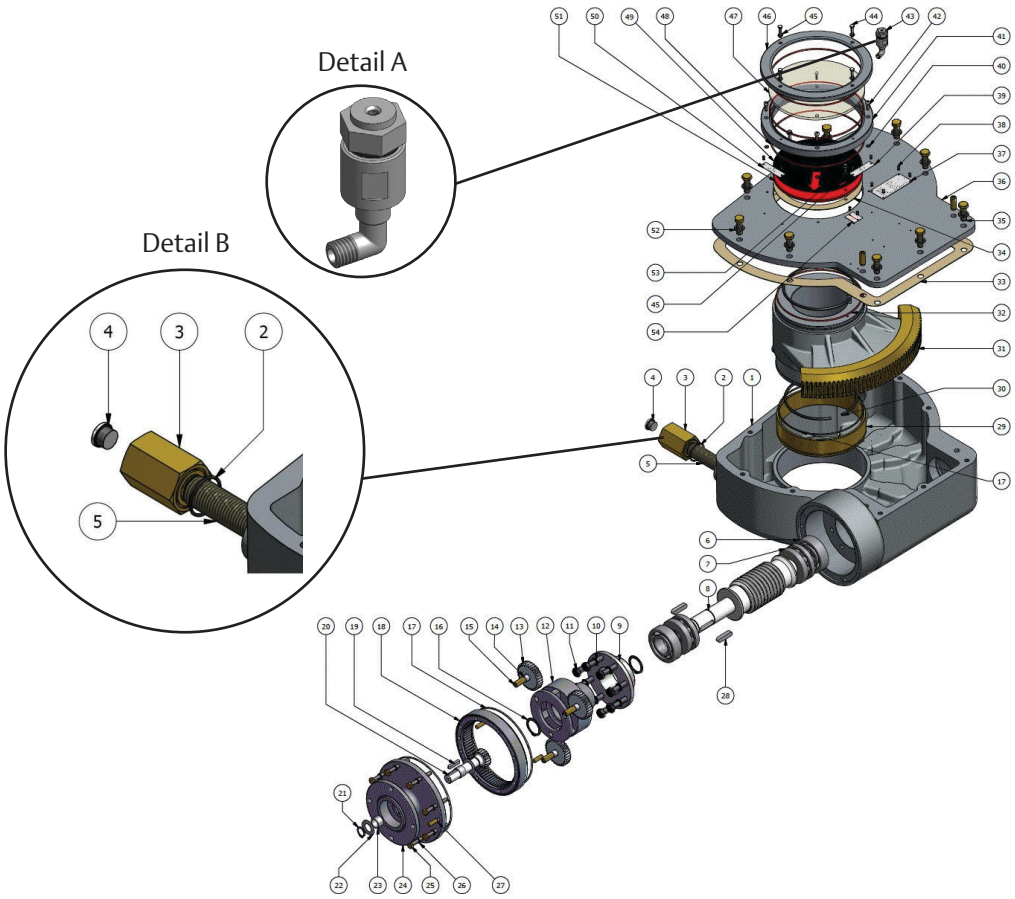
Please refer to detail “A” in Figure 23 below.

11.9.2 Mechanical Stopper Protection

Also note the possibility of providing, on request, the option of stopper provided with stopper protection (please refer to item 2+3+4+5 of Detail B).

Please refer to detail “B” in Figure 23 below.

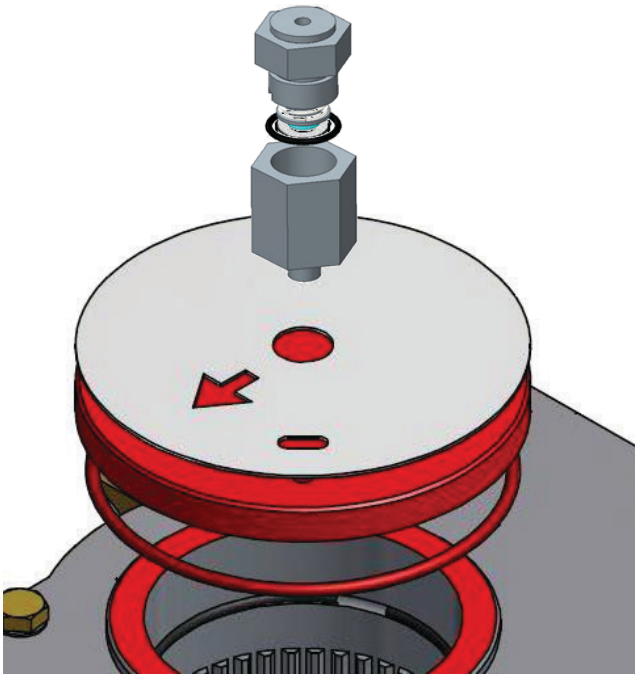
Figure 23



11.9.3 Relief on Indicator Plate

The relief valve, as an improvement on obsolete WGR version, can be installed as per previous reason (see Section 11.9) also directly on the indicator plate.

Figure 24



Section 12: Disassembling and Demolition

Biffi gearboxes have en extremely long lifetime, but after several years of operation they have to be replaced.

The design of the gearboxes allows an easy disassembly. When disassembling, please separate and sort the various parts according to materials, i.e.:

- Metals (different types);
- plastics;
- rubbers;
- oils and greases.

Please observe the national and local regulations for waste disposal.

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