

Technical Documentation

Job No.	29025
Customer Order No.	4500024401
Year	2005

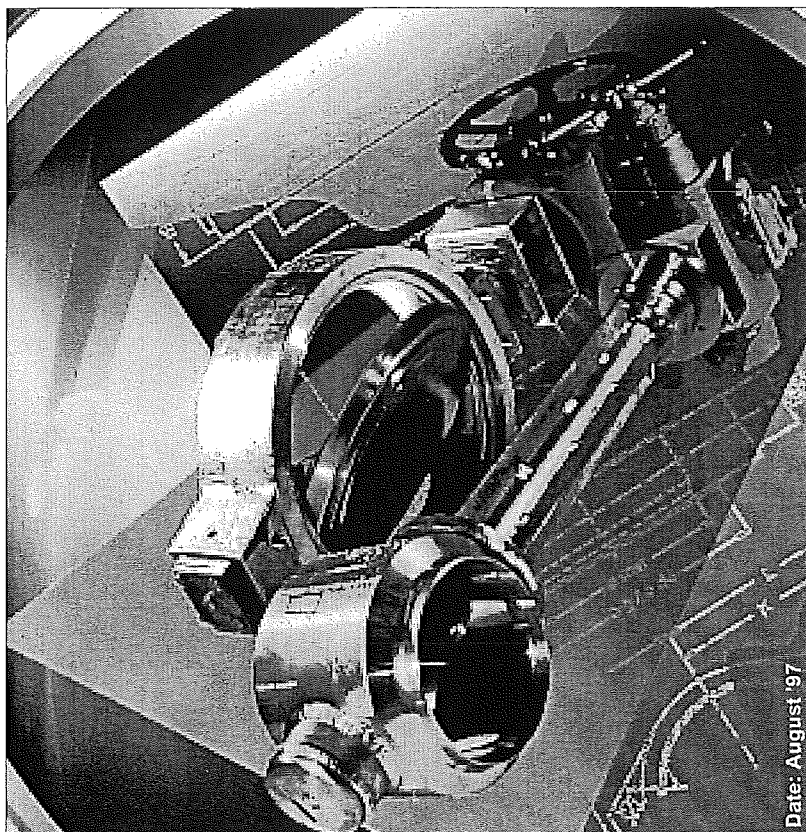
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- 5 Actuator
- 6 Declaration of conformity and ATEX-Certificate
- 7 Inspection certificate 3.1 B

1 Summary scope of delivery

Job No. 29025
Customer Order No. 4500024401
Year 2005

Pos.	Tag No.	DN	PN	Type	Actuator	Accessories	PS bar	TS °C
1	K24102 K24202	200	16	K598	Mastergear M12/SR10 SW27	—	6	24

General instruction manual for heavy-duty valves (section 1)



Date: August '97

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1 Proper use

The butterfly valve supplied to you has been specially designed to satisfy the requirements that are specified in the documentation relating to this order, particularly as regards the operating parameters pressure, temperature and medium. If pipes are by mistake subjected to a wrong medium, a higher pressure level or a higher or lower temperature, this can lead to destruction of the complete unit. The damaged parts then have to be replaced immediately.

There must be no contamination of the pipes and the medium used at any time. If there is, this may have an adverse effect on the tightness of the butterfly valve seal.

One of the requirements which proper use of the butterfly valve involves is that the operating, installation and maintenance personnel have read and understood this instruction manual.

All installation work must be carried out by appropriately trained skilled personnel.

Important note:

If you are operating the butterfly valve in high or low temperature ranges, we recommend that you provide the butterfly valve with external insulation, as there is otherwise a considerable danger of injury. When there is a manual actuator system, the hand wheel may only be operated wearing suitable gloves in such cases!



In operating temperatures higher than 50°C or lower than -50°C, the valves must be insulated to prevent the risk of injury caused by contact (security) and to maintain the function of the valve (varying heat expansion).

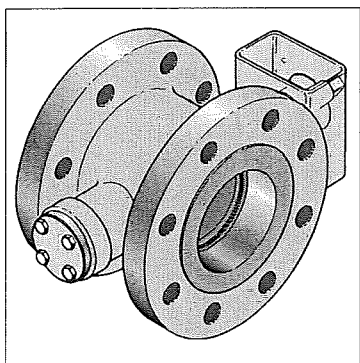
The insulation must be designed such that the temperature generated by the medium does not exceed 50°C on its outside. We do not accept any liability for structural alterations that are made without the express approval of the Linde AG MAPAG plant. Please make sure that you always use genuine spare parts. If you intend to use the butterfly valve for a different medium, different temperatures or different pressure levels than originally specified, please find out in advance from our specialists whether the butterfly valve is suitable for the requirements concerned. We will be delighted to advise you.

We do not accept any liability for injuries and damage to property that are caused by improper use of the butterfly valve.

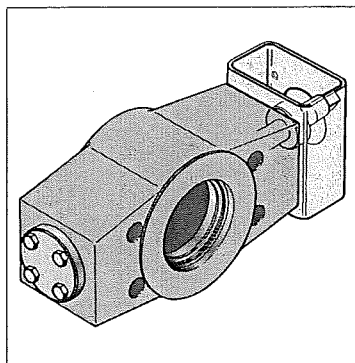
2 Configurations

The butterfly valve is supplied in one of four possible configurations: a flange configuration, a sandwich configuration, a monoflange configuration or a configuration with welding ends.

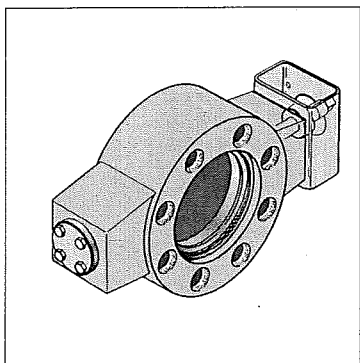
Information about the installation and removal of bodys with welding ends can be found in section 2 of the instruction manual for model E and model K valves.



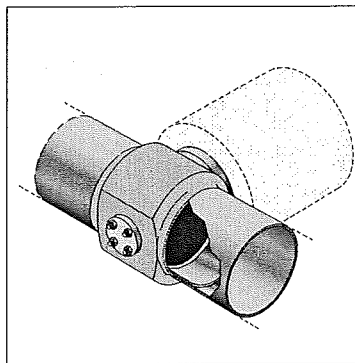
Flange



Sandwich

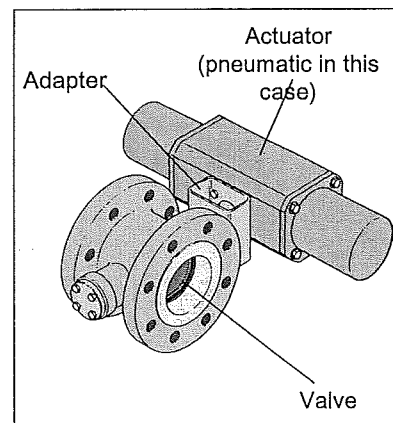


Monoflange



Welding ends

Flange-configuration butterfly valve with a pneumatic actuator. As an alternative, the valve can also be operated by a hand wheel or by an electric or hydraulic actuator.



The butterfly valve is normally delivered complete with a actuator unit. Special parts or spare parts are only supplied if they have been included in the order confirmation.

3 Visual check

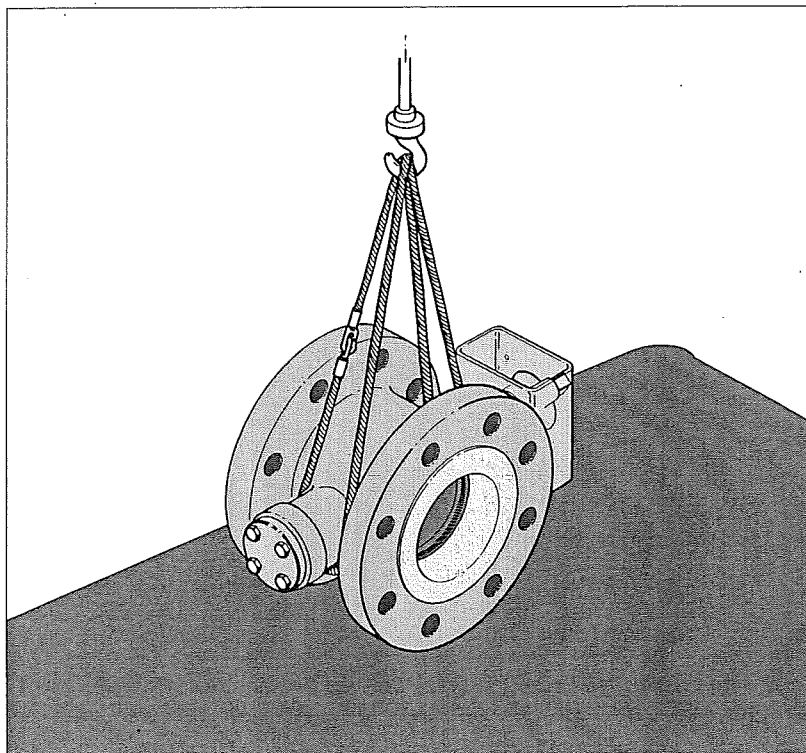
Before it left the MAPAG plant, the butterfly valve was checked by our quality assurance department to make sure it works properly and does not leak. It was also set appropriately in accordance with the documentation prepared for the order in question.

Please check the butterfly valve for any transport damage before you install it. If you find that any of the parts delivered have been damaged, please inform our specialists immediately.

Check that the butterfly valve is working properly before you install it. To do this, proceed as follows:

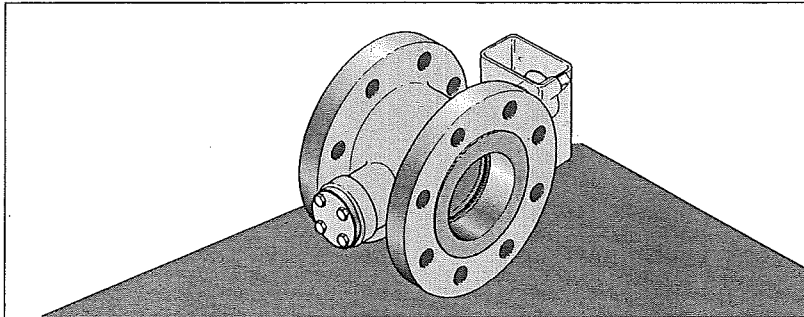
- You may need ropes to lift the butterfly valve, depending on its size and weight.

Make sure you always attach lifting ropes to the body (see illustration). The shaft could be damaged if you attach ropes to the actuator.



Preparing for the function test

- Set the butterfly valve up in a vertical position.



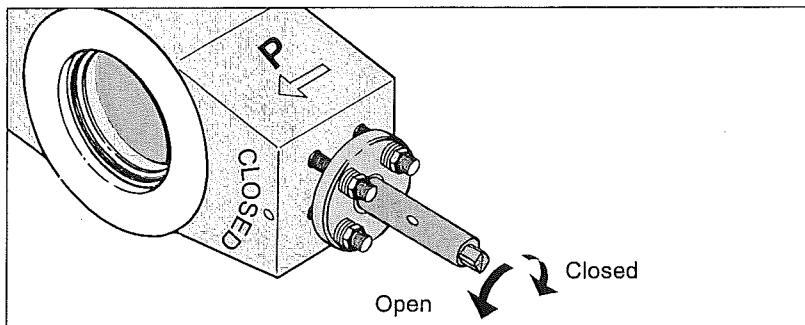
Function test

It is possible that the butterfly valve may move in an uncontrolled way in the course of the function test. It is therefore important to make sure that the butterfly valve cannot under any circumstances move or even tip over during the function test.



- Connect the energy supply system now. Make sure that the actuator opens into the correct direction of movement.

The general rule is: opening to the left, closing to the right (it is possible that a different arrangement may be specified in individual cases).



Direction of actuator movement

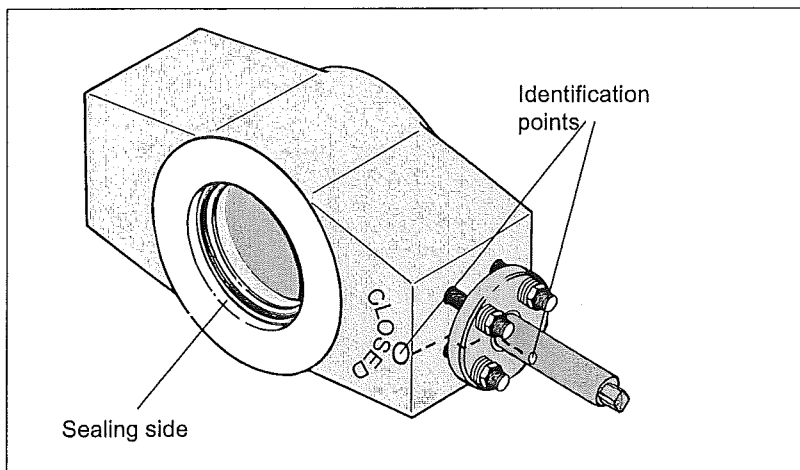
- Check whether the butterfly valve is working properly. Open and close the butterfly valve several times. The stop that is provided in the actuator makes sure that the shut-off disc cannot be turned beyond the closed position as set at the factory.
- Switch the energy supply off after the function test has been completed.

Please contact our specialists if the butterfly valve does not work smoothly in the function test.

4 Marking

The following marks have been made to identify the position of the disc when the unit has been installed:

- CLOSED sign with a coloured mark on the body (with an extension on the top flange of the lengthening joint in the case of insulated valves).
- Coloured mark on the valve shaft.



Direction of actuator movement and position of the shut-off disc

If these two red marks are aligned with each other, then the valve position is „Closed“. The sealing element is on the side of the body on which the „Closed“ sign is provided.

5 Installation

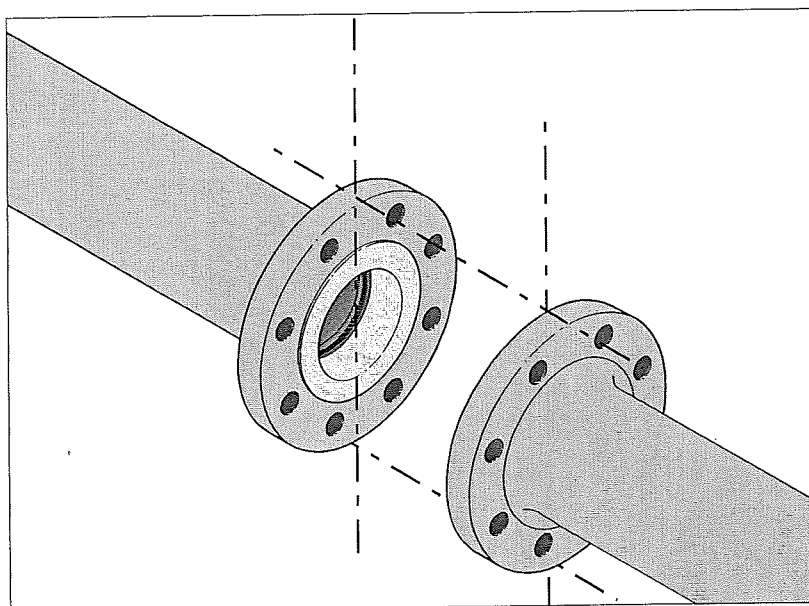
All butterfly valve installation work must be carried out by appropriately trained skilled personnel.



5.1 Planning

Consider the following points before you start to install the butterfly valve:

- You must install the butterfly valve in such a way that the actuator is accessible at all times.
- If you are operating the butterfly valves in high or low temperature ranges, we recommend that you provide the butterfly valve with external insulation, as there is otherwise a considerable danger of injury. When there is a manual actuator system, the hand wheel may only be operated wearing suitable gloves.
- The energy supply to actuators that are operated electrically, pneumatically or hydraulically must not be connected until the butterfly valve has been installed.
- The holes in the flanges at the ends of both pipes must be aligned precisely and the sealing surfaces of the opposite flanges must be parallel to each other. The holes in the flanges must not be out of line with each other at all, so that the butterfly valve is not subjected to tension of any kind when it is installed.



Alignment of the pipe flanges

5.2 Preparations

Make sure that the pipes are not contaminated in any way before you install the butterfly valve. Contamination of any kind - such as welding residue, rust or dirt - can have an adverse effect on the tightness of the butterfly valve and can damage the sealing surface of the shut-off disc or the sealing elements. When the butterfly valve is in operation, the medium must not carry any contaminants with it that might be deposited in the sealing area either.

Be careful when fitting valves with the safety setting „Spring opening“

If the shut-off disc projects beyond the fitting length of the unit, the butterfly valve has to be closed before it is installed (pneumatically, hydraulically etc.). It is essential that you make sure the energy supply facilities are attached securely and cannot under any circumstances be damaged or torn off during the installation operations.

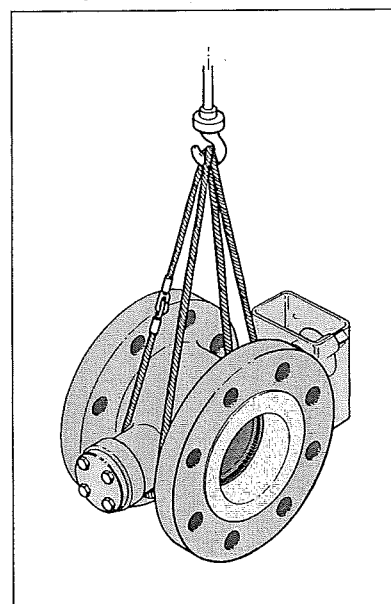
If the energy supply is suddenly interrupted, the valve opens abruptly. This can cause serious injury or material damage.

You need lifting tackle to fit larger butterfly valves in the necessary pipe. Information about the weight of the butterfly valve can be found in the documentation compiled for the order in question.

Always attach lifting ropes to the body - never attach them to the actuator, because this might damage the shaft.



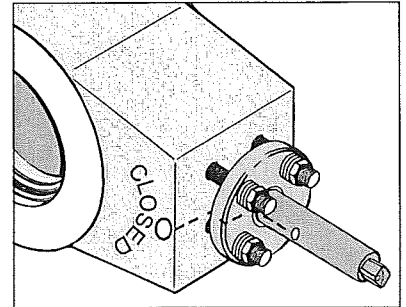
Equipment for lifting the butterfly valve



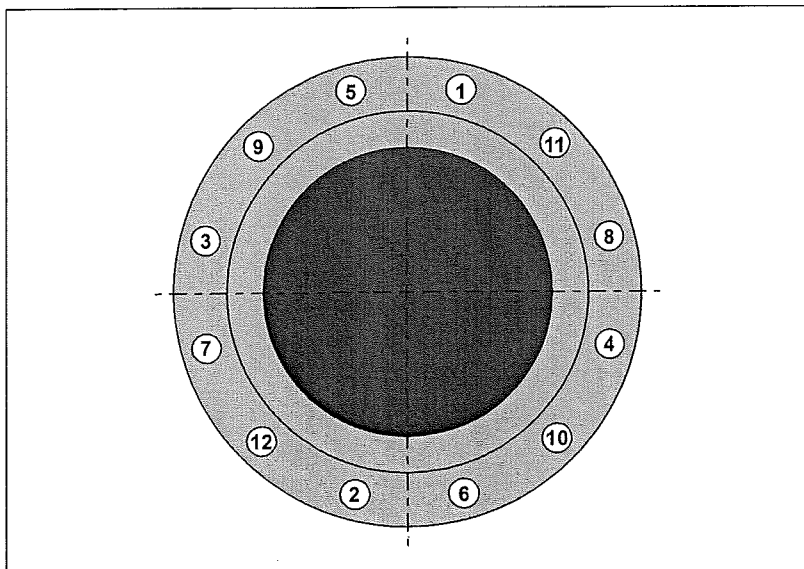
5.3 Fitting

Carry out the following procedure when you are fitting the butterfly valve:

- Turn the butterfly valve in such a way that the arrow (P) on the body points in the pressure direction (see the illustration „Pressure direction“).
- Close the butterfly valve for the duration of the installation operations. When it is open, the sealing surface of the shut-off disc may project out of the body and be damaged when the valve is being fitted.
- Use a o-ring that is suitable for your application on both sides of the butterfly valve between the body and the opposing flanges. The two o-rings are not supplied as standard. We can supply the required o-rings to you on request.
- Tighten the opposing flange nuts or bolts diagonally and evenly using a torque wrench.
- Connect the energy supply in a final operation.



Pressure direction



Example of how to connect the pipe flanges diagonally when there are twelve holes in each flange

5.4 Permissible tightening moments

Permissible tightening moments for bolts in steel category A2-70.2 and A4-70 with a metric coarse-pitch thread in accordance with DIN 13, 70% utilisation of the $R_p 0.2$, coefficient of friction 0.16.

Ø	Stressed cross-section AS in mm ²	Stress ¹⁾ Force at Tfe		Pre-stress force N	Tightening moment Nm
		$R_{p0.2}$ in N	R_m in N		
M4	8,8	3951	6146	2489	2,13
M5	14,2	6390	9940	4026	4,19
M6	20,1	9045	14070	5698	7,3
M8	36,6	16470	25620	10376	17,5
M10	58,0	26100	40600	16443	35,2
M12	84,3	37935	59010	23899	60,3
M14	115,0	51750	80500	32603	95,8
M16	157,0	70650	109900	44510	146,2
M18	192,0	86400	134400	54432	203,1
M20	245,0	110250	171500	69458	285,7
M22	303,0	75750	151500	47723	212,4
M24	353,0	88250	176500	55598	273,9
M27	459,0	114750	229500	72293	405,3
M30	561,0	140250	280500	88358	549,0

1) Figures corresponding to 100% of the 0.2% proof stress

There is a considerable danger of injury when any maintenance work is being carried out due to the unintentional actuation of the remote control.

If you use a remote control to operate the butterfly valve, you must install a device that interrupts the energy supply in the actuator unit for safety reasons (e.g. an emergency stop switch).

If you are operating the butterfly valve in high or low temperature ranges, we recommend that you provide the butterfly valve with external insulation. If necessary, install an external temperature gauge to provide protection against injury.



6 Removal

The butterfly valve must be closed during installation and removal operations in order to avoid damage to it.

6.1 Preparations

The following conditions have to be met before you remove the butterfly valve:

- Make sure that the pipes are depressurised and empty.

Check whether the butterfly valve has already cooled down or warmed up to such an extent that there is no further danger due to extreme temperatures.



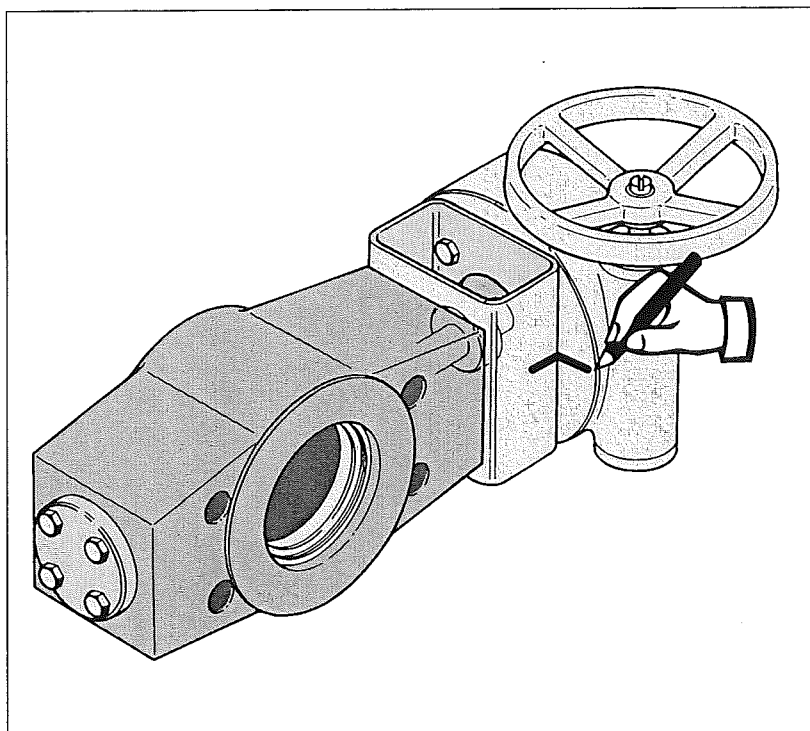
- Find out what medium last ran through the butterfly valve. There may be residues in the valve. Make sure that there is no danger of poisoning or burning if you come into contact with such residues. If necessary, protect yourself by wearing appropriate protective clothing, safety goggles and breathing equipment.

If you are not removing the valve yourself, warn the staff who are carrying out this assignment. Make protective clothing available to them if necessary.

6.2 Removal

Carry out the following operations in the specified order when you are removing the butterfly valve:

- Close the butterfly valve.
- If the actuator has to be taken off in order to remove the butterfly valve, mark the position of the actuator to the shaft and to the shut-off disc on the adapter before removing the actuator (see illustration). This will enable you to position the actuator again correctly when you re-install it, so that it does not cause any malfunctioning of the system.

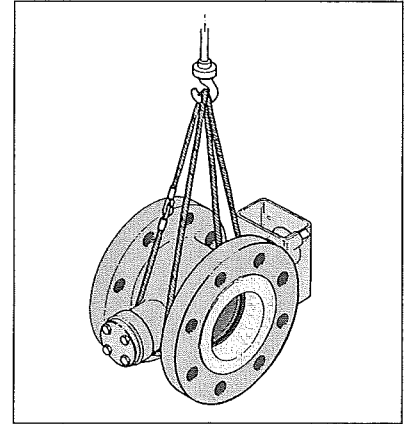


Mark the position of the actuator to the shaft and to the shut-off disc on the adapter before removing the actuator.

Switch the energy supply to the actuator off. To do this, actuate the emergency stop switch for the actuator energy supply or guard the remote control unit in such a way that no-one can switch the energy supply system on again by mistake.



- Remove the actuator.
- Secure the butterfly valve with ropes. Attach the ropes to the body (and not to the shaft) of the butterfly valve.
- Separate the flanges of the butterfly valve by undoing the opposing bolts or nuts diagonally.
- Transport the butterfly valve in such a way that it cannot be moved or damaged during the transport process.

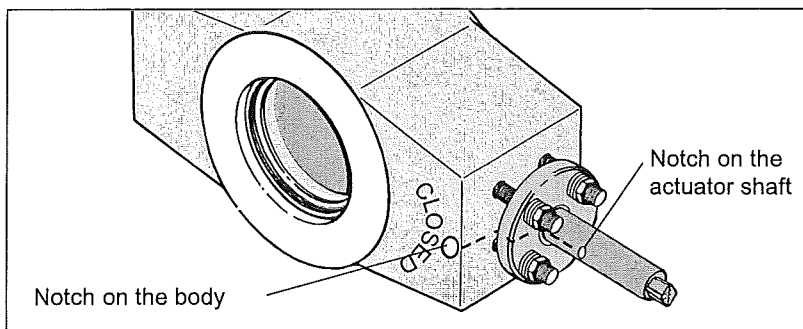


Securing the butterfly valve with ropes

7 Re-installation

Proceed as follows to re-install the butterfly valve:

- Close the butterfly valve.
- There is a round notch at the end of the actuator shaft and on the body of the butterfly valve. The round notch on the actuator shaft must point in the direction of the round notch on the body when the valve is installed again.
- Move the actuator to its closed position.



Installation marks

- Make sure that you fit the actuator to the actuator shaft in the right position. To do this, use the mark that you made on the adapter and the actuator when you removed the butterfly valve.
- Fit the butterfly valve between the pipes (see chapter 4 „Installation“).

8 Troubleshooting

The butterfly valve does not close tightly

1. Do not under any circumstances use force to close the butterfly valve. There is too great a risk that damage may occur.
2. Check whether the energy supply has been switched on.
3. Check whether the closed position of the actuator and the closed position of the shut-off disc match.
4. Check the sealing surface of the shut-off disc and the sealing elements to see if they have been damaged. Remove the butterfly valve. Check whether there are any foreign bodies between the shut-off disc and the sealing elements. Remove any foreign bodies or deposits that you find. Change any damaged parts.

You will find instructions about removing ...

...the butterfly valve on page 10
...in the chapter entitled Removal

...the sealing elements instruction manual, section 2
...in the chapter entitled Replacement of the sealing elements

...the shut-off disc instruction manual, section 2
...in the chapter entitled Replacement of mechanical parts

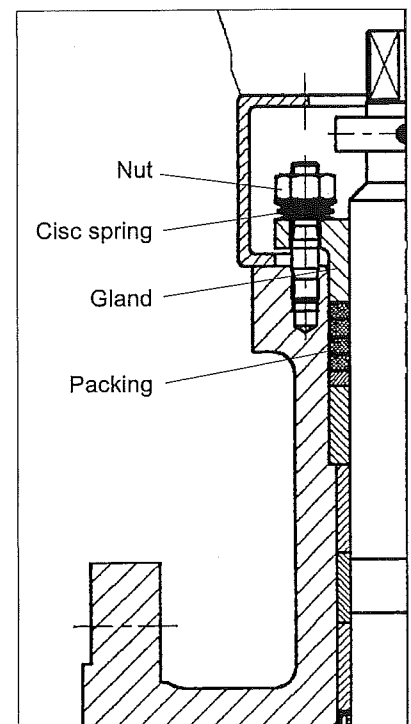
Please follow the instructions given in the chapter entitled
„Cleaning and maintenance“ in section 2 of the instruction
manual as well.

Liquid or gas is escaping ...

... from heavy-duty valves with a gland

Check whether the gland is still being pre-stressed effectively by the disc springs. It is possible that the disc springs may be damaged. If this is the case, change the disc springs. If the tension applied by the disc springs is too small, tighten the nuts more securely - but not as far as the stop, because this would damage the disc springs. If the tension applied by the disc springs is correct, then the packing is damaged. Change the packing. Instructions about removing the packing can be found in the chapter entitled „Replacement of mechanical parts“ in section 2 of the instruction manual.

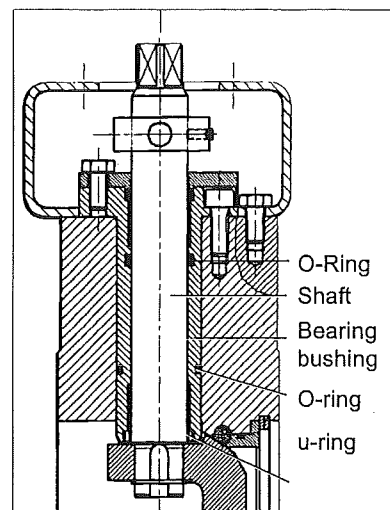
Heavy-duty valves with a gland



... from heavy-duty valves with an O-ring seal

Check whether the O-rings are damaged in the area of the bearing bushing. If so, change the O-rings and the u-ring.

Please read chapter 5 „Removal“ in this instruction manual for information about the removal process.

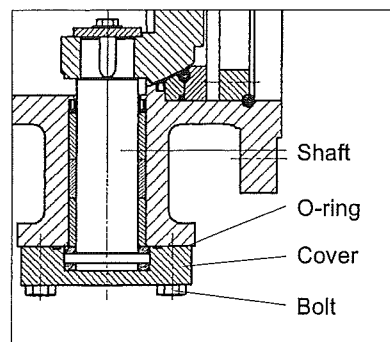


Heavy-duty valve with bearing bushing

Liquid or gas is escaping from the cover

Check whether the bolts on the cover have been tightened properly. Change the o-ring if necessary.

Please read chapter 5 „Removal“ in this instruction manual for information about the removal process.



Checking the tightness of the shaft

The medium is too cold when it is running through the valve

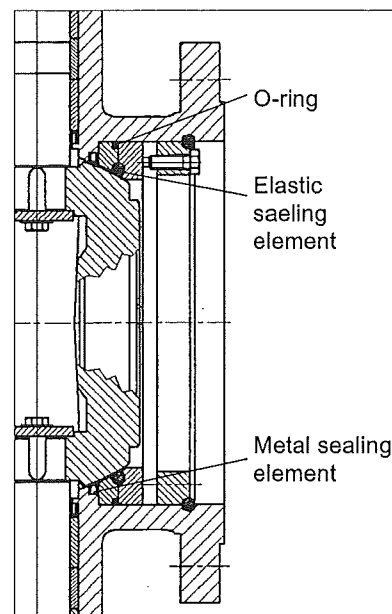
The minimum temperature for operating your butterfly valve depends to a very large extent on the materials used for your order. You will find information about the appropriate temperature range for your butterfly valve in the documentation compiled for your order.

The sealing element is chosen in accordance with the permissible temperature of the medium depending on the design of your system (see the order documents and the table on page 14). If the medium is running through the butterfly valve at a lower temperature by mistake, the sealing element may be damaged. In this situation it is necessary to check the condition of the sealing element and to carry out a function test. The sealing element may need to be replaced.

The medium is too hot when it is running through the valve

The maximum temperature for operating your butterfly valve depends to a very large extent on the materials used for your order. You will find information about the maximum operating temperature in the documentation compiled for your order.

Irrespective of this maximum operating temperature, the elastic sealing element and the O-ring must not be subjected to temperatures higher than their specified maximum limit. PTFE parts are designed to withstand temperatures up to a maximum of 220° C. These parts are destroyed if the medium is hotter than this. The butterfly valve continues to close tightly with the metal sealing element (23a), but the elastic sealing element (23) and the O-ring (16) have to be replaced immediately.



Important note!

If the elastic parts are destroyed by an excessively hot medium, the medium may escape from the gland / bearing bushing and the cover.



Temperature resistance of the flexible sealing elements

	FKM	EPDM	PTFE (rein)
Minimum temperature	-10°C	-60°C	-200°C
Maximum temperature	+180°C	+180°C	+220°C

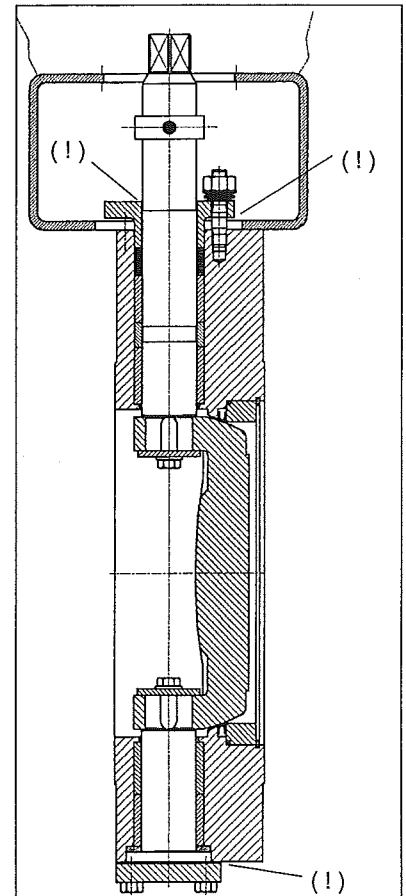
9 Safety instructions

Please observe the following safety instructions when you are installing, maintaining and operating the heavy-duty valve:

1. For safety reasons you are not allowed to make any changes to the method of operation of the heavy-duty valve or to its actuator.
2. All installation work on the heavy-duty valve must be carried out by appropriately trained skilled personnel.
3. When a function test is being made, there is a danger that the heavy-duty valve may suddenly move in an uncontrolled way due to the supply of energy. Make sure therefore that the valve cannot under any circumstances move or even tip over during the function test.
4. Be careful when fitting valves with the safety setting „Spring opening“. If the shut-off disc projects beyond the fitting length of the unit, the butterfly valve has to be closed before it is installed (pneumatically, hydraulically etc.). It is essential that you make sure the energy supply facilities are attached securely and cannot under any circumstances be damaged or torn off during the installation operations. If the energy supply is suddenly interrupted, the valve opens abruptly. This can cause serious injury or material damage.
5. There is a considerable danger of injury when any maintenance work is being carried out due to the unintentional actuation of the remote control. If you are planning to use a remote control unit in operation of the heavy-duty valve, you will need to incorporate an additional emergency stop switch in the actuator as a locking facility.
6. Make sure that cleaning agents cannot cause any undesirable chemical reactions in combination with possible residues in the heavy-duty valve.
7. When you are working in the area of the sealing surface of the shut-off disc, secure the shut-off disc with wooden wedges in order to eliminate the danger of crushing. Make sure that you do not damage the sealing area of the shut-off disc while you are doing this.
8. If the o-rings are destroyed by a medium that is too hot, the medium that is being used may escape from the shafts.



Possible leakage after an excessively hot medium has flowed through the butterfly valve



10 Spare parts

Most of the spare parts depend on the technical specification of your system.

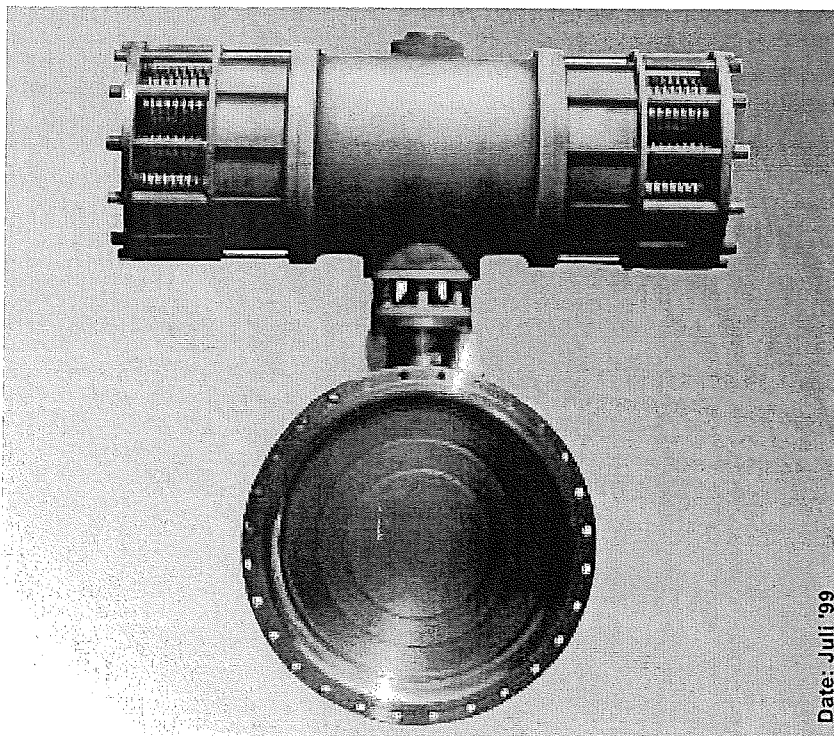
Every time you place an order for spare parts, please indicate to us therefore not only the identification number from the spare parts list but also the Mapag order number under which the heavy-duty valve was planned and supplied to you.

Our guarantee commitments only apply if genuine spare parts are used.

Mapag Butterfly Valve - Type K

For Cryogenic Applications

Instruction Manual (Section 2)



Date: Juli '99

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1 Method of operation

The purpose of MAPAG Model K butterfly valves is to shut off pipes and to regulate the flow of products in both directions.

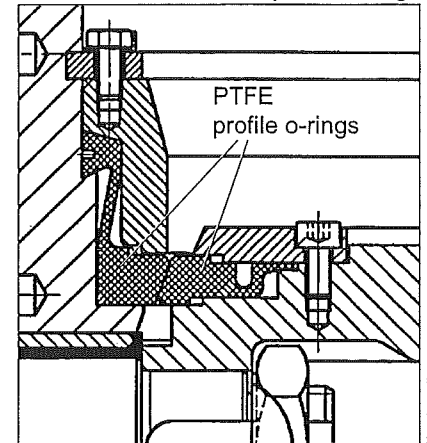
Model K butterfly valves are provided with a double o-ring. The butterfly valve can be used for liquids or gases between -273°C and $+100^{\circ}\text{C}$, depending on the medium and the configuration of your system. Information about the exact application area for your Model K butterfly valve can be found in the documentation compiled for your order.

The butterfly valve has been designed to have double-offset bearings in order to guarantee that the sealing elements have a long useful life. There is practically no friction when it closes.

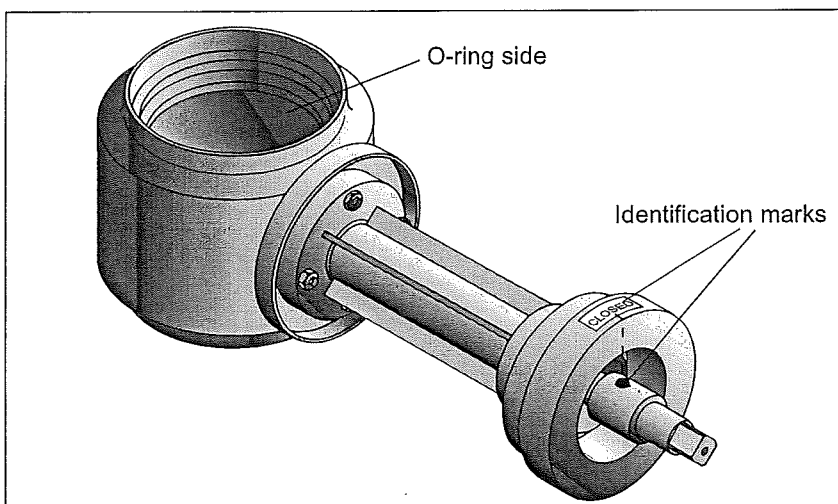
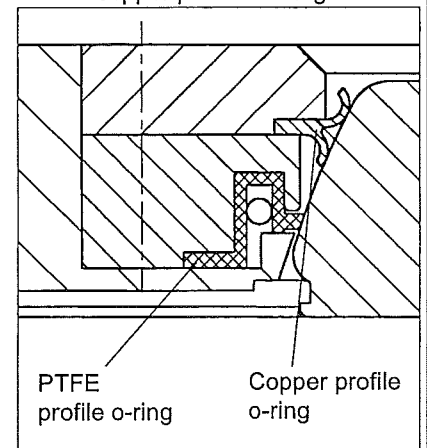
Model K butterfly valves have an extension (lengthening joint) to enable them to be insulated for their planned use in low temperature ranges. This extension guarantees that the gland packing which provides external sealing is accessible even when the valve is insulated. The low temperatures are not transferred to the actuator either.

MAPAG Model K butterfly valves are operated by an actuator (manual, electric, pneumatic or hydraulic). There is a mark on the actuator shaft as well as one on the o-ring side of the body. The valve is closed when the two marks are in line with each other.

Configuration 1 (K5C8)
with two PTFE profile o-rings



Configuration 2 (K592)
with one PTFE profile o-ring and one copper profile sealing element



Position of the installed shut-off disc

2 Cleaning and maintenance

Model K butterfly valves require practically no maintenance.

Check the butterfly valve regularly to make sure it is not leaking. You should replace the sealing elements (320 / 321) after two years at the latest. When you are doing this, make sure you also check the condition of the other seals, i.e. the O-ring (107), the o-ring (471) and the packing (451). Do not forget to check the sealing rings (301 / 302) and the retaining ring too. In some versions of the model K butterfly valve the sealing ring (302) is screwed directly to the body. The retaining ring is not included in this case.

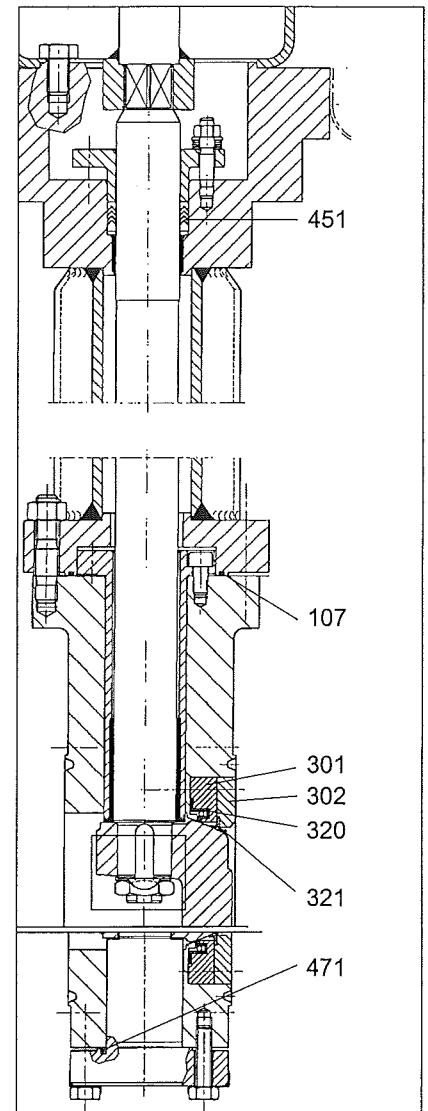
In order to avoid lengthy stoppages during maintenance operations, you should order the sealing elements (320 / 321) in good time. An even better solution is to keep the sealing elements (320 / 321) in stock.

If the medium carries contaminants that may have an adverse effect on the tightness of the butterfly valve, you will need to clean the sealing surface of the shut-off disc on a regular basis. Contamination can damage the sealing surface of the shut-off disc or the sealing elements.

Do not use any agents to remove residues that might attack the sealing surface or the sealing elements. Use water, soap suds or other liquid solvents and a soft, lint-free cloth instead.

Do not under any circumstances use files or sandpaper. And do not use any cleaning agents that might cause undesirable chemical reactions with the residues of the medium or might attack the sealing elements.

If you outsource the butterfly valve cleaning operation, it is essential that you draw attention to the dangers of the medium being used as well as to any residues that may be present.



Checking that the butterfly valve does not leak



2.1 Replacement of the sealing elements

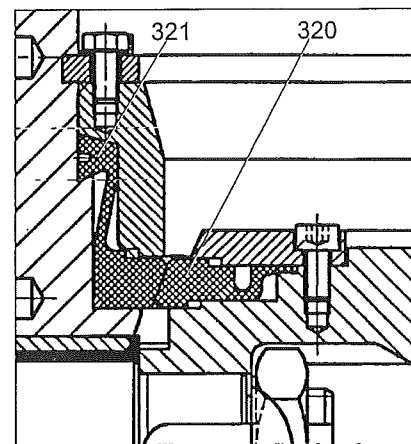
Please proceed as follows when you want to replace the sealing elements (320, 321) on the butterfly valve:

1. Remove the butterfly valve when it is in the closed position. Instructions on how to remove the valve can be found in section 1 of the instruction manual. The K5C8 configuration has a body with welding ends and first of all has to be cut out of the pipe using suitable equipment.
2. Secure the butterfly valve in position, so that it cannot move or tip over.
3. Open the shut-off disc by moving it to the left, so that it is in the 180° position and the sealing ring is exposed.

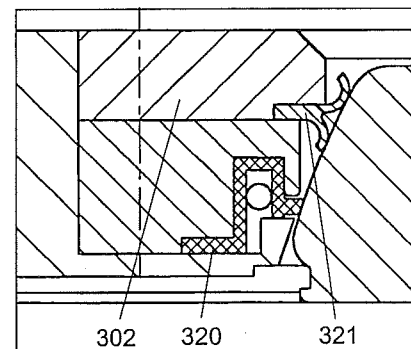
If you turn the shut-off disc by moving it to the right or by turning it beyond the 180° position, the sealing elements will be damaged. The shut-off disc must not hit against the body.

Now secure the shut-off disc - for example with wooden wedges - in order to eliminate the danger of crushing. Make sure that you do not damage the sealing area of the shut-off disc while you are doing this.

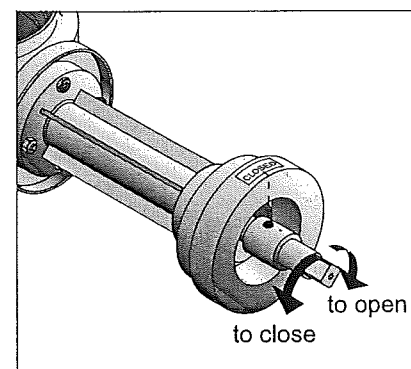
4. The remaining operations you need to carry out in order to remove the sealing elements depend on the configuration and - if relevant - the version of your butterfly valve. You will find the instructions for bodys with welding ends in section 2.1.1. The instructions for the monoflange configuration, in which the sealing ring (302) is screwed directly to the body, can be found in section 2.1.2.



Sealing element - configuration 1
(K5C8)



Sealing element - configuration 2
(K592)



Opening the shut-off disc

2.1.1 Replacement of the sealing elements on bodys with welding ends

Remove the bolts (313). You can now pull the following parts off one after the other and replace them if necessary:

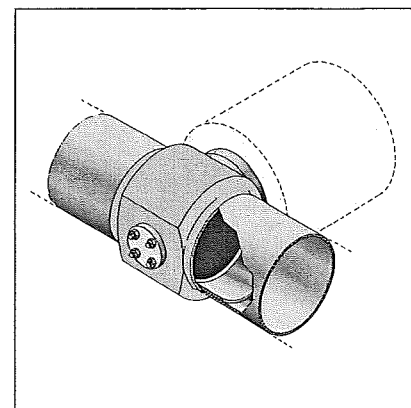
1. the retaining ring (310),
2. the sealing ring (301) and
3. the elastic sealing element (323).

Then remove the bolts (203). You can now pull the following parts off one after the other and replace them if necessary:

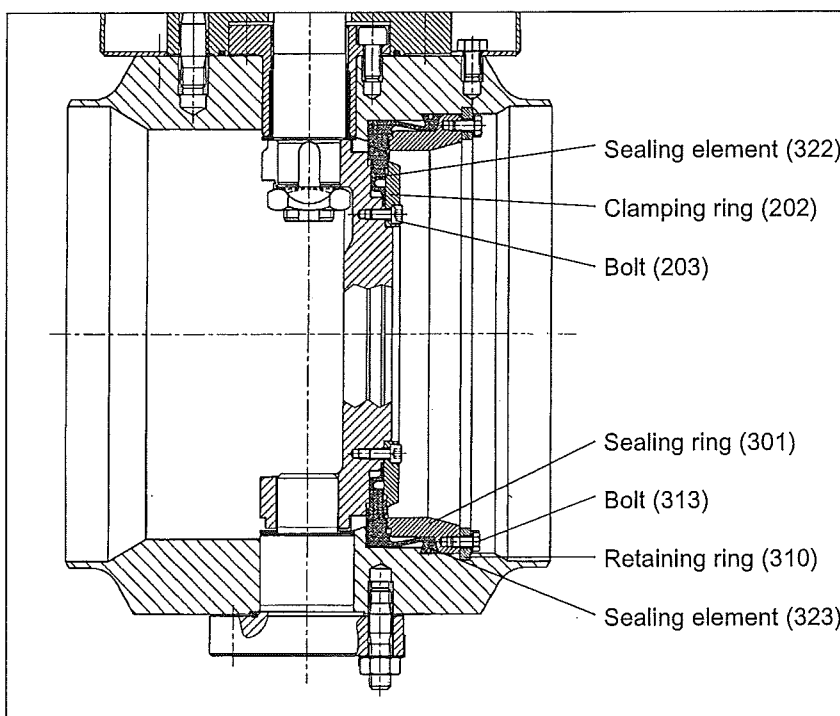
4. the clamping ring (202) and
5. the sealing element (322).

Installation is carried out by completing the same operations in the opposite order.

Check that the butterfly valve is tight before fitting it again. Information about the installation operations can be found in section 1 of the instruction manual.



Welding ends



Changing the sealing elements

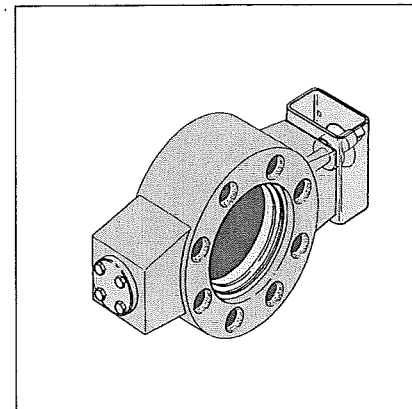
2.1.2 Replacement of the sealing elements in the monoflange configuration, where the sealing ring is attached directly to the body

Remove the bolt (306). You can now pull the following parts off one after the other and replace them if necessary:

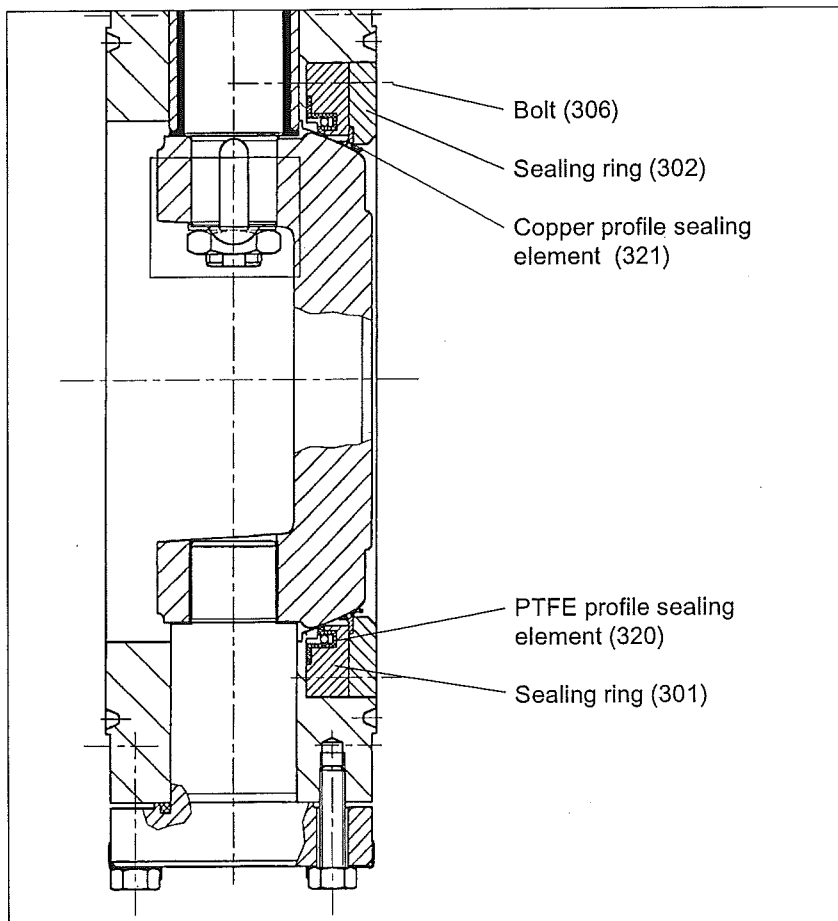
1. the sealing ring (302),
2. the copper profile sealing element (321),
3. the sealing ring (301) and
4. the PTFE profile sealing element (320).

Installation is carried out by completing the same operations in the opposite order.

Check that the butterfly valve is tight before fitting it again. Information about the installation operations can be found in section 1 of the instruction manual.



Monoflange configuration



Changing the sealing elements

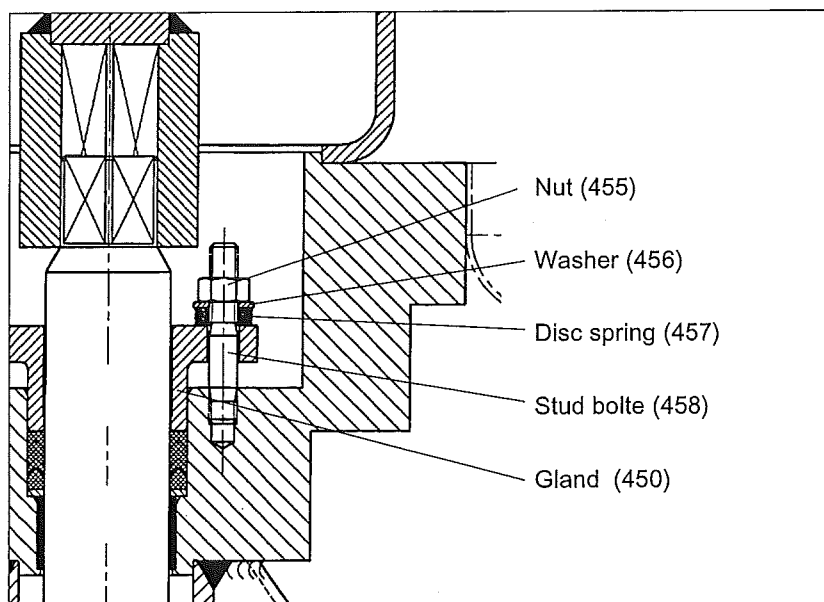
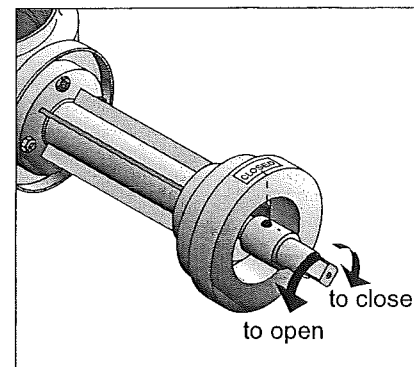
2.2 Replacement of mechanical parts on the actuator side

Proceed as follows to replace mechanical parts on the actuator side:

1. Start off by removing the adapter (501) and then pull the coupling (504) down.
2. Open the shut-off disc by moving it to the left, so that it is in the 180° position and the sealing ring is exposed.

If you turn the shut-off disc by moving it to the right or by turning it beyond the 180° position, the sealing elements will be damaged. The shut-off disc must not hit against the body. Now secure the shut-off disc - for example with wooden wedges - in order to eliminate the danger of crushing. Make sure that you do not damage the sealing area of the shut-off disc while you are doing this.

3. Undo and remove the nut (455), the washer (456) and the disc spring (457) and pull the gland (450) out.



Screw connection of the gland

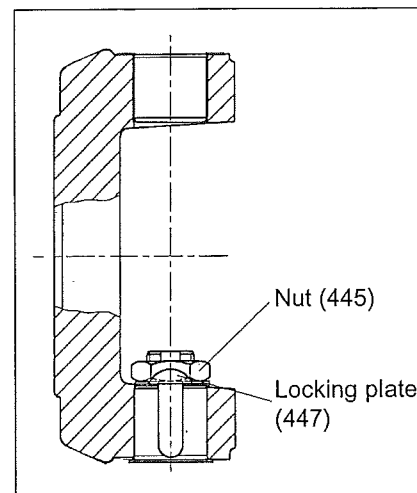
4. Undo the nut (104). You can now pull the lengthing joint (102) off over the actuator shaft (401).

The following parts are now accessible and can be replaced if necessary:

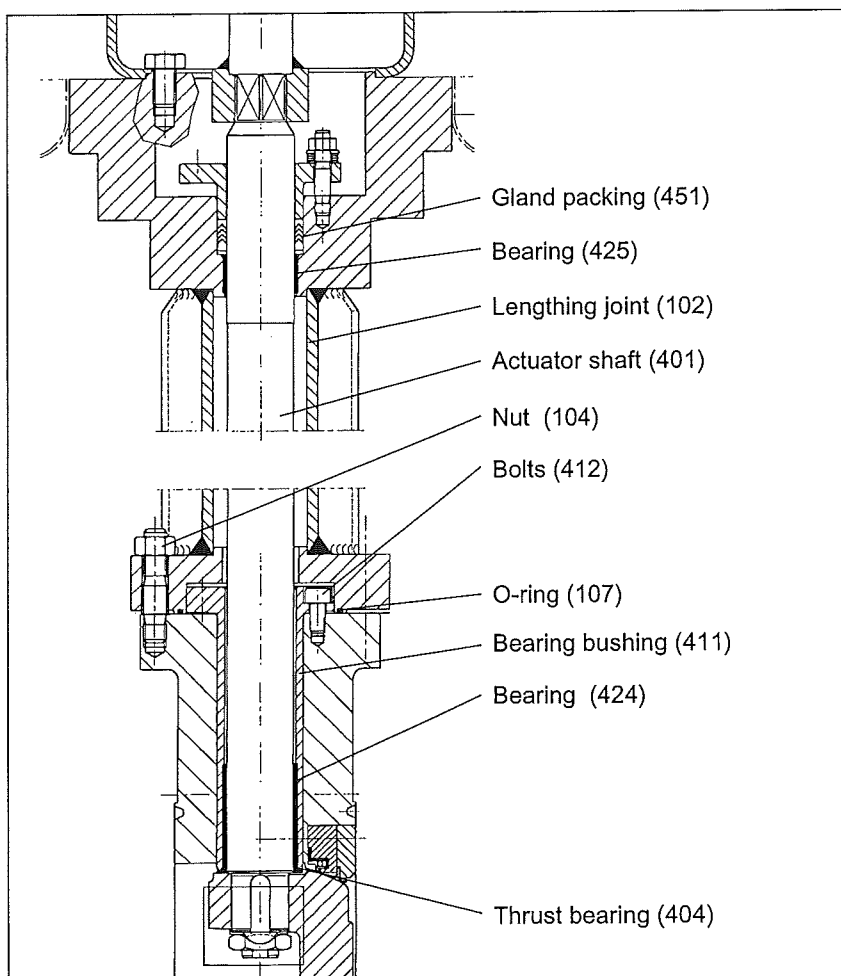
- the gland packing (451)
- the bearing (425) and
- the O-ring (107).

5. Bend the locking plate (447) upwards. Undo the nut (445) now and remove both of them. Then pull the actuator shaft (401) out.

6. Undo the bolts (412). The bearing bushing (411) can now be pulled out of the body and the bearing (424) and the thrust bearing (404) can be replaced.



Removal of the locking plate and the nut

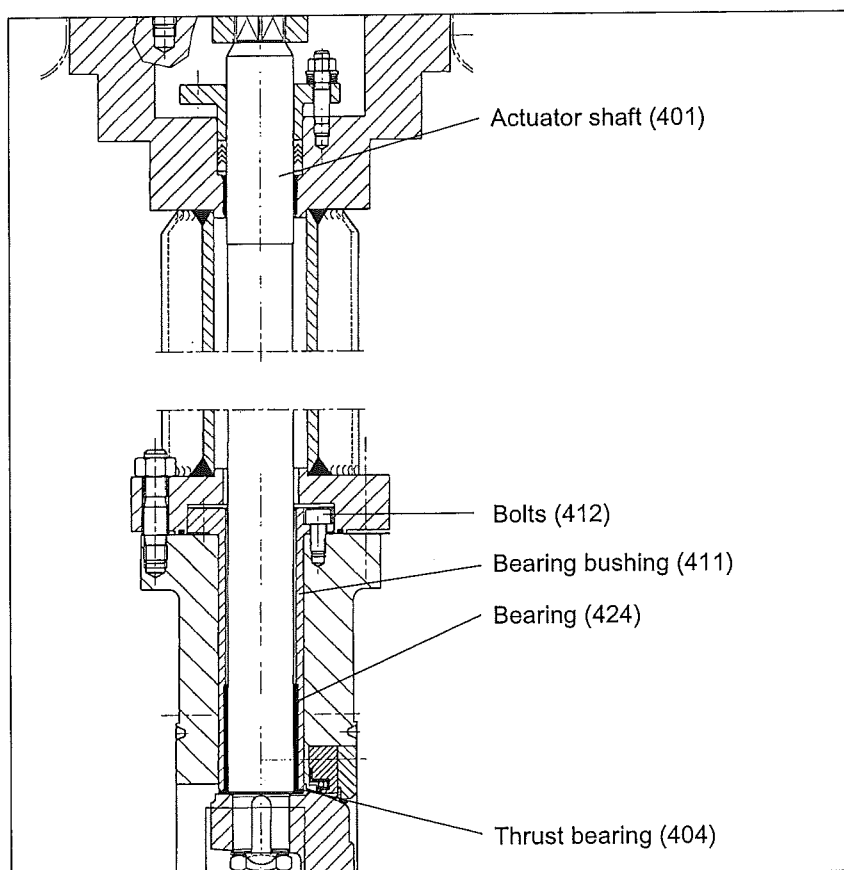


Mechanical parts on the actuator side

Installation is carried out as follows:

7. Insert the actuator shaft (401) through the body into the shut-off disc. Push the thrust bearing (404) and then the bearing bushing (411) - with the bearing (424) already fitted - onto the actuator shaft (401). Tighten the bearing bushing (411) with the bolts (412). Check whether the actuator shaft moves freely by turning it backwards and forwards repeatedly. Make sure that the thrust bearing (404) has been fitted properly.

The rest of the installation process is carried out by completing the same operations as before, except in the opposite order. Please do not tighten the nut (455) to the locking bolt (458) until it reaches the stop, because the disc spring (457) will be damaged if you do. The tighter you screw on the nut (455), the higher the resistance on the actuator shaft (401). When you attach the coupling (504), make sure that the two red points are aligned in accordance with the shut-off disc. Check that the butterfly valve is tight before fitting it again. Information about the installation operations can be found in section 1 of the instruction manual.



Mechanical parts on the actuator side

2.3 Replacement of mechanical parts on the cover side

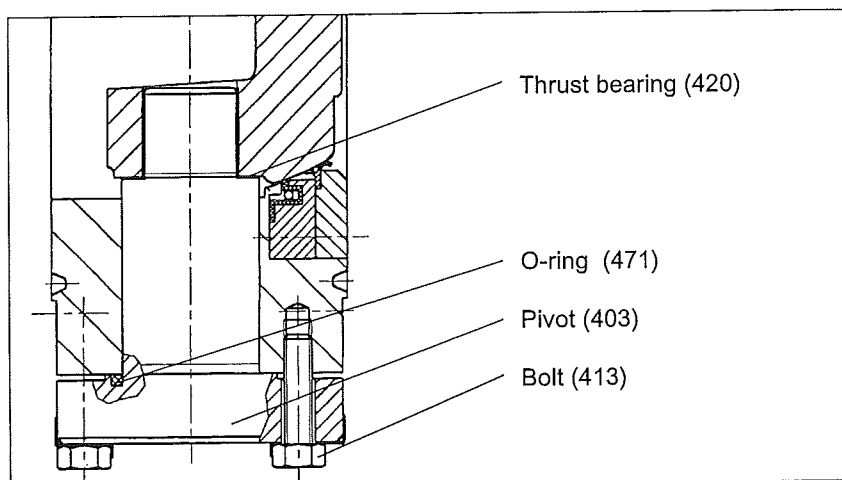
Proceed as follows to replace mechanical parts on the cover side:

1. Open the shut-off disc by moving it to the left, so that it is in the 180° position and the sealing ring is exposed.

If you turn the shut-off disc the wrong way or turn it further than the 180° position, the sealing elements will be damaged. The shut-off disc must not hit against the body. Now secure the shut-off disc - for example with wooden wedges - in order to eliminate the danger of crushing. Make sure that you do not damage the sealing area of the shut-off disc while you are doing this.

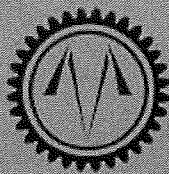
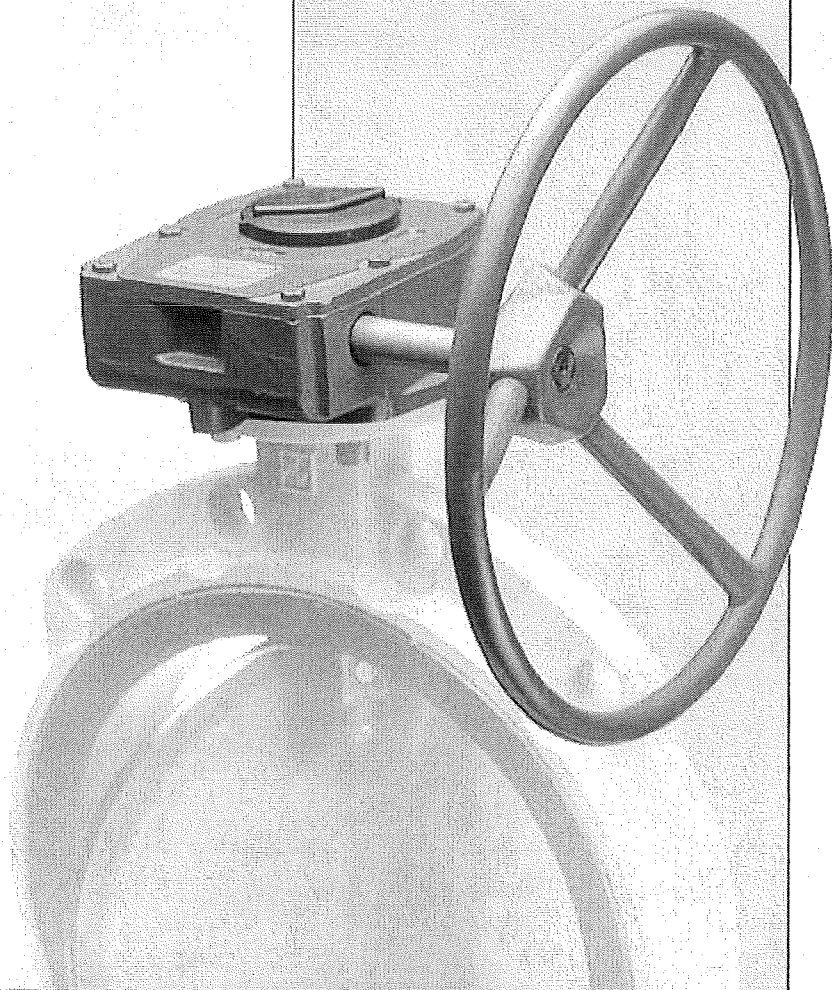
2. Remove the bolts (413) from the opposite side of the butterfly valve from the actuator.
3. Force the pivot (403) from the body using both threads.
4. You can now pull out the o-ring (471) and the thrust bearing (420) and replace them if necessary.

Installation is carried out by completing the same operations in the opposite order. Check that the butterfly valve is tight before fitting it again. Information about the installation operations can be found in section 1 of the instruction manual.



Mechanical parts on the cover side

M SERIES VALVE ACTUATORS

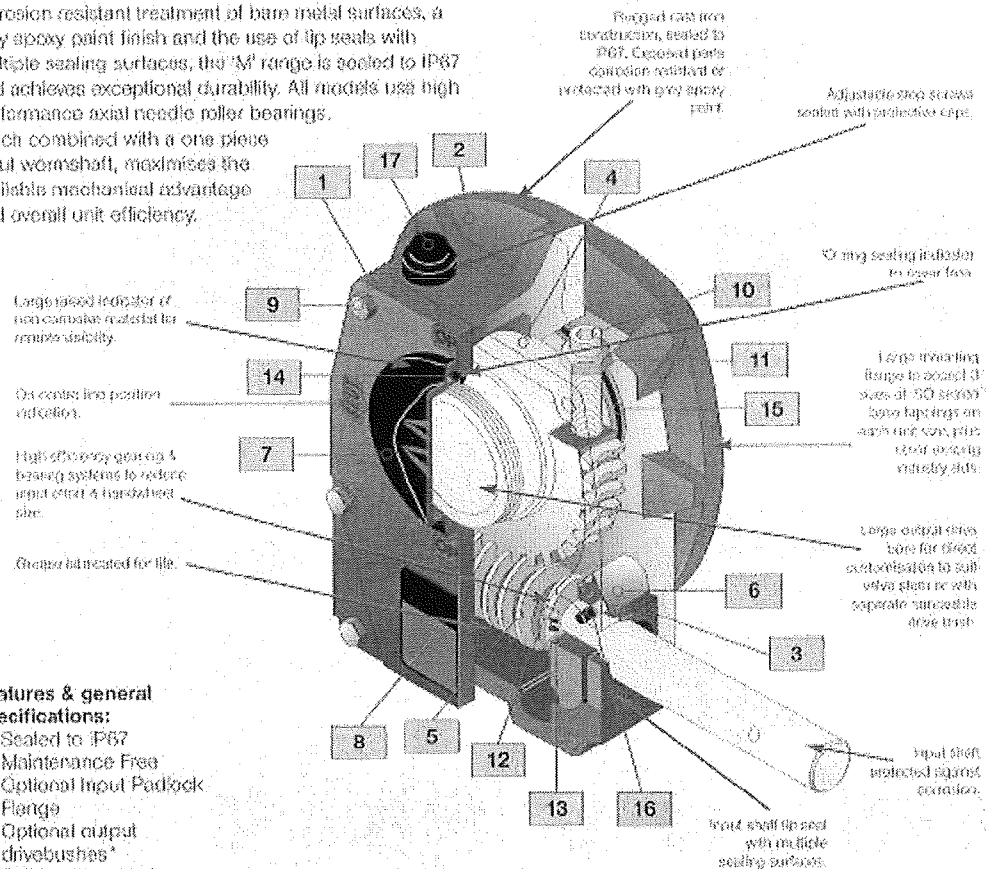


OPPERMAN MASTERGEAR Ltd

M SERIES MANUAL VALVE ACTUATORS

General description

The cast iron construction and rugged design of the Mastergear 'M' series range of manual valve actuators has been engineered to meet the arduous requirements demanded of industrial environments. Through corrosion resistant treatment of bare metal surfaces, a grey epoxy paint finish and the use of lip seals with multiple sealing surfaces, the 'M' range is sealed to IP67 and achieves exceptional durability. All models use high performance axial needle roller bearings, which combined with a one piece input wormshaft, maximises the available mechanical advantage and overall unit efficiency.

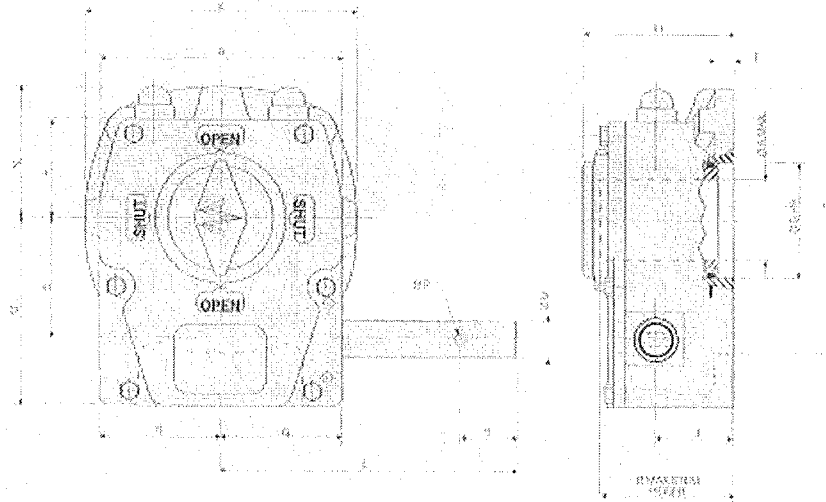


Features & general specifications:

- Sealed to IP67
- Maintenance Free
- Optional Input Padlock Flange
- Optional output drive bushes*
- Self Locking/High Efficiency
- High Mechanical Advantage
- Cast Iron Enclosure
- $90^\circ \pm 5^\circ$ (adjustable) travel
- To 4500 Nm output torque
- 7 frame sizes
- 50% grease filled for life
- Capability to withstand overload to twice maximum output torque rating
- -20°C to $+80^\circ\text{C}$ temperature range for continuous operation
- Unvalued versatility for direct fixing to valve
- * M05 and M07 have integral drivebush.

Item	Component	Material description	Material specification
1	Case	Grey cast iron	BS1452 grade 120
2	Cast iron	Grey cast iron	BS1452 grade 210
3	Wormshaft	Injection moulded plastic	Hydral 6523
4	Indicator	S.S. and PPS	BS2789 grade 500/7
5	Wormshaft	Stainless steel	BS570 BS2M35
6	Wormshaft bearings	Stainless steel	ISO 226 40
7	Indicator cap	Injection moulded plastic	Acetal Formid 24500
8	Indicator cap	Injection moulded plastic	Blue on white background
9	Cover screws	Hex head cap screws	BS3652 grade 8.8
10	Stop screw	Stainless steel	BS4169 part 2
11	Locknut	Hex locknut	BS3652
12	Bearing thrust washers	Stainless steel	Type A5
13	Thrust bearings	Stainless steel	Type AXK
14	Indicator O-ring	Medium Nitrile	BS5683 grade 120
15	Indicator O-ring	Medium Nitrile	BS5683 grade 120
16	Downs	Hardened & ground steel	BS7055 type A
17	Locking protection caps	Injection moulded plastic	Low density polyethylene

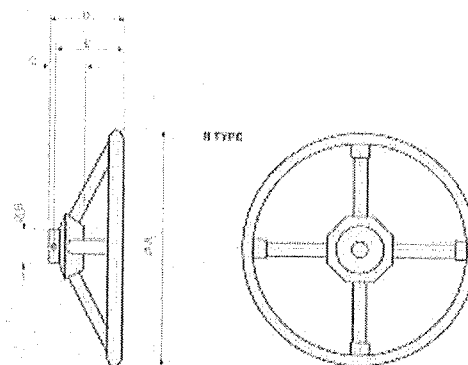
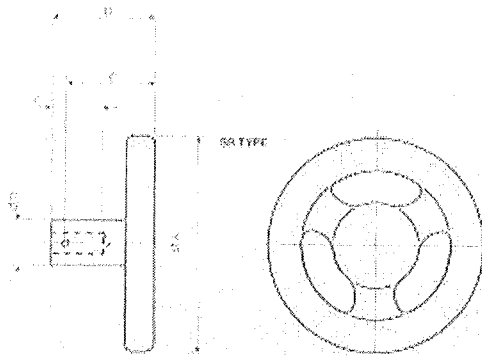
Performance specification and dimensions



UNIT SIZE	M05	M07	M10/F05	M10	M12	M14	M15/F12	M16	M16
MAX OUTPUT TORQUE (Nm)	125	260	500	500	1000	1800	3400	3400	4500
MECHANICAL ADVANTAGE	9.3	11.0	11.0	11.0	11.3	16.2	20.6	20.6	26.6
INPUT TORQUE (Nm)	13.4	22.7	45.5	45.5	88.5	111.0	166	166	170
RATIO	40:1	40:1	40:1	40:1	42:1	60:1	68:1	68:1	68:1
TURNS TO CLOSE	10	10	10	10	10.5	15	17	17	22
VALVE MOUNTING FLANGE ISO 5211	F05, F07	F05, F07	F05, F07	F07, F10	F10, F12	F12, F14	F12, F14	F14, F16	F16, F20
A MAX VALVE SHAFT DIAMETER	25	25	22	32	45	55	60	66	92
B MAX VALVE SHAFT HEIGHT	51	51	57	57	72	81	92	92	113
C	88	86	112	112	150	182	235	235	290
D	N/A	N/A	36	60	65	90	105	115	120
E	38.5	38.5	52	52	65.7	89.5	123	123	154
F	32.5	32.5	44	44	56	66	87.5	87.5	116
G	42	42	53	53	66	82.5	111	111	126
H	58	58	67	67	81	92.5	105.5	105.5	126.5
J	26.5	26.5	35	35	42	50	50	50	60
K	88	86	116	116	150	188	252	252	315
L1	120	120	135	135	158	195	260	260	275
L2 EXTENDED INPUT SHAFT	N/A	N/A	205	205	240	260	325	325	350
M	62	62	83.5	83.5	105	131	178	178	209
N	45	45	58	58	75	88	114	114	117
P	4	4	5	5	6	6	6	8	6
R	84	84	107	107	136	184	248	248	312.5
S	20	20	25	25	32	36	45	45	45
T	N/A	N/A	4.5	4.5	7.5	7.5	9.5	9.5	9.5
U	11.30	11.30	14.38	14.99	19.88	19.88	29.98	29.98	29.98
	11.34	11.34	14.94	14.94	19.34	19.34	29.04	29.04	29.94
UNIT WEIGHT (Kg)	2.5	2.6	4.5	4.2	8.2	14.5	28.0	27.2	41.2
RECOMMENDED HANDWHEEL	SR5	SR5	SR5, SR6 SR10	SR5, SR8 SR10	SR10, SR12 SR14, R18	SR14 R18, R24	R18, R24 R30, R36	R18, R24 R30, R36	R18, R24 R30, R36
			SR12	SR12	R24				

FOR HANDWHEEL SELECTION PLEASE REFER TO CHART OVERLEAF.

Handwheel selection data

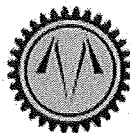
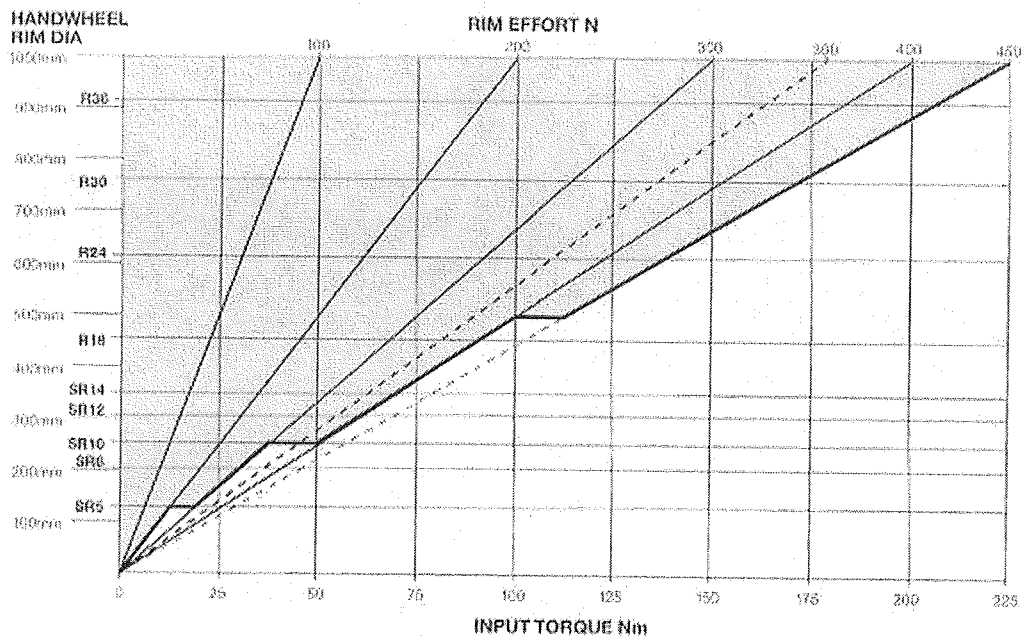


HANDWHEEL TYPE	SA	SB	C	D	E	WEIGHT (kg)
SR5	170	25	34	18	32	0.3
SR8	230	35	49	27	50	0.8
SR10	250	40	55	32	55	1.0
SR12	260	40	59	35	57	1.3
SR14	270	40	65	38	59	1.5
R18	450	64	100	60	100	3.5
R24	510	64	110	65	105	4.0
R30	560	64	120	70	110	5.1
R36	610	70	130	75	120	6.0

Handwheel selection procedure

1. For optimum performance handwheels should be selected from the green shaded area.
2. Determine the required input torque from 3 below.
3. Input torque = $\frac{\text{required output torque}}{\text{mechanical advantage}}$
4. Determine the maximum allowable handwheel rim effort for your application.
5. Select handwheel rim diameter.

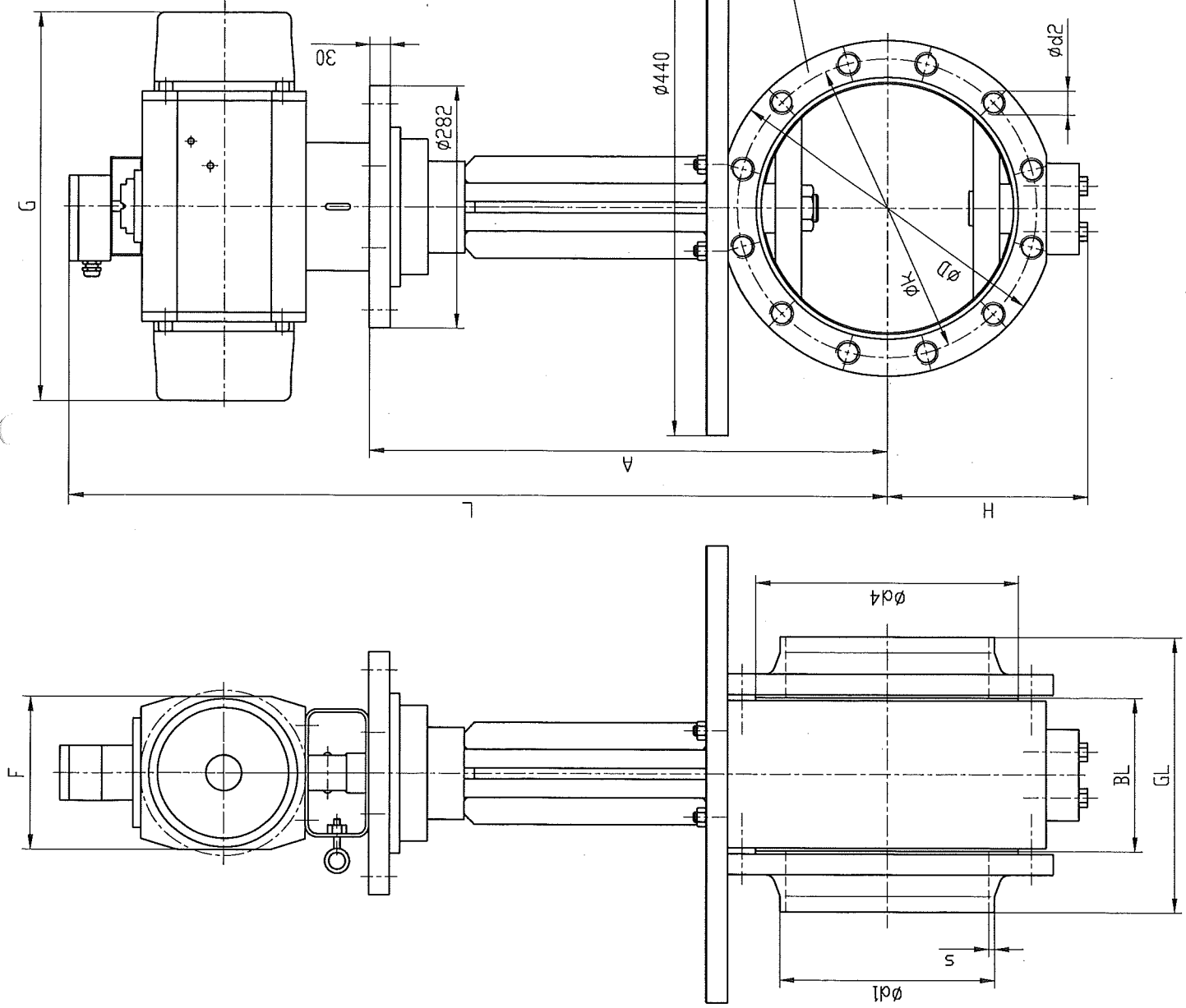
*For mechanical advantage refer to table on page 3.



OPPERMAN MASTERGEAR Ltd

Handkings Road, Newbury, Berkshire RG14 5TS, England
Telephone: 01635 811500 Fax: 01635 811501

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.



DN	STANDARD ABMESSUNGEN										FLANSCHANSCHLUSS		ANTRIEB	GESAMT-GEWICHT Kg
	GL	BL	H	A	L	G	F	Ød1	S	Øk	Ød2	ØD		
80	276	150	100	860	1260	405	170	89	155	160	M16	8	F 60-K	85
100	282	150	130	860	1260	405	170	114	6	180	M16	8	F 60-K	105
125	294	150	140	860	1260	405	170	141	6,5	200	M16	8	F 60-K	130
150	306	150	145	860	1300	635	195	168	7,1	240	M20	8	F 120-K	155
200	330	170	190	860	1300	635	195	219	6,5	295	M20	8	F 120-K	190
250	354	170	220	860	1420	720	260	273	4	350	M20	12	F 250-K	220
300	390	200	245	1060	1635	1050	290	324	7	400	M20	12	F 500-K	305
400	428	230	320	1060	1635	1050	290	406	7	515	M24	16	F 500-K	330

DN	STANDARD ABMESSUNGEN										FLANSCHANSCHLUSS		ANTRIEB	GESAMT-GEWICHT Kg
	GL	BL	H	A	L	G	F	Ød1	S	Øk	Ød2	ØD		
250	344	170	220	860	1420	720	260	273	4	355	M24	12	F 250-K	230
400	446	230	320	1060	1635	1050	290	406	7	525	M27	16	F 500-K	340

NPS	STANDARD ABMESSUNGEN										FLANSCHANSCHLUSS		ANTRIEB	GESAMT-GEWICHT Kg
	GL	BL	H	A	L	G	F	Ød1	S	Øk	Ød2	ØD		
12	424	200	260	1060	1635	-	-	324	10	43,8	7/8	12	Mastergear F14	

MESSER-Zeichnungs-Nr. 793.14166

Verstärkt		Übermaß 30 bis 12		Revision	
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L		II		II	
II		III		III	
III		IV		IV	
IV		V		V	
V		VI		VI	
VI		VII		VII	
VII		VIII		VIII	
VIII		IX		IX	
IX		X		X	
X		XI		XI	
XI		XII		XII	
XII		XIII		XIII	
XIII		XIV		XIV	
XIV		XV		XV	
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XVI		XVII		XVII	
XVII		XVIII		XVIII	
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XXVI		XXVII		XXVII	
XXVII		XXVIII		XXVIII	
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LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV		LXXXXXXXV		LXXXXXXXV	
LXXXXXXXV		LXXXXXXXVI		LXXXXXXXVI	
LXXXXXXXVI		LXXXXXXXVII		LXXXXXXXVII	
LXXXXXXXVII		LXXXXXXXVIII		LXXXXXXXVIII	
LXXXXXXXVIII		LXXXXXXXIX		LXXXXXXXIX	
LXXXXXXXIX		LXXXXXXX		LXXXXXXX	
LXXXXXXX		LXXXXXXXI		LXXXXXXXI	
LXXXXXXXI		LXXXXXXXII		LXXXXXXXII	
LXXXXXXXII		LXXXXXXXIII		LXXXXXXXIII	
LXXXXXXXIII		LXXXXXXXIV		LXXXXXXXIV	
LXXXXXXXIV					

MAPAG ARMATUREN VON LINDE



Parts-List:

Description	:	Butterfly valve	DN	:	200
Custom-Order-No.	:	4500024401	PN	:	16
Tag-No.	:	K24102, K24202	Pos.-No.	:	1
MAPAG-Com.-No.	:	29025	Type	:	200K598G016
MAPAG-Item-No.	:	446495	Drawing-No.:	:	446535

Date: 25.04.2005 Page 1 of 2

	Pos.	Qty.	Description	It. - No.	Material
	101	1	Body	446504	3.3547
	102	1	Shaft extension	446483	1.4541
	103	4	Stud bold	434247	A2-70
	104	4	Nut	003784	A2-70
	105	1	Bulk	446913	1.4301
	106	4	Screw	414457	A4-70
*	107	1	O-ring	423197	PTFE
	116	1	Balgkragen	445421	1.4301
	117	1	Sealing	446593	GUMMI
	201	1	Shut-off disc	430444	1.4308 OX
	202	1	Clamping ring	418291	1.4541
	203	8	Screw	276324	A2-70
	301	1	Sealing ring1	418305	1.4301
	310	1	Retaining ring	414318	1.4301
	311	1	Clamping shoe	278033	1.4301
	312	1	Retaining plate	426636	1.4571
	313	1	Screw	041156	A2-70
	322	1	Sealing element	276190	PTFE
	323	1	Sealing element	276189	PTFE
	401	1	Drive shaft	430445	1.4541
	403	1	Pivot	436583	1.4541
*	404	1	Thrust bearing	275719	DU
*	405	1	Thrust bearing	275579	DU
	411	1	Bearing bushing	436587	1.4541
	412	4	Screw	276342	A2-70
	413	4	Stud bold	434246	A2-70
	414	4	Nut	003764	A2-70
	415	4	Retaining plate	440812	A2
*	420	1	Bearing shell with collar	416240	PTFE Compound
*	424	1	Bearing bushing	277676	DU
*	425	1	Bearing bushing	445510	DU
	440	2	Fitting key	277160	1.4571
	445	1	Nut	277822	A2-70
	447	1	Retaining plate	275710	1.4301
	450	1	Gland	432975	1.4541
*	451	1	Packing	416167	PTFE
	452	1	Bottom ring	424547	1.4571

*= spare parts

Linde AG Geschäftsbereich Linde Engineering Werk MAPAG

Von-Holzapfel-Strasse 4, 86497 Horgau - Telefon 08294 / 8695-0 - Fax 08294 / 8695-81, www.Linde.com

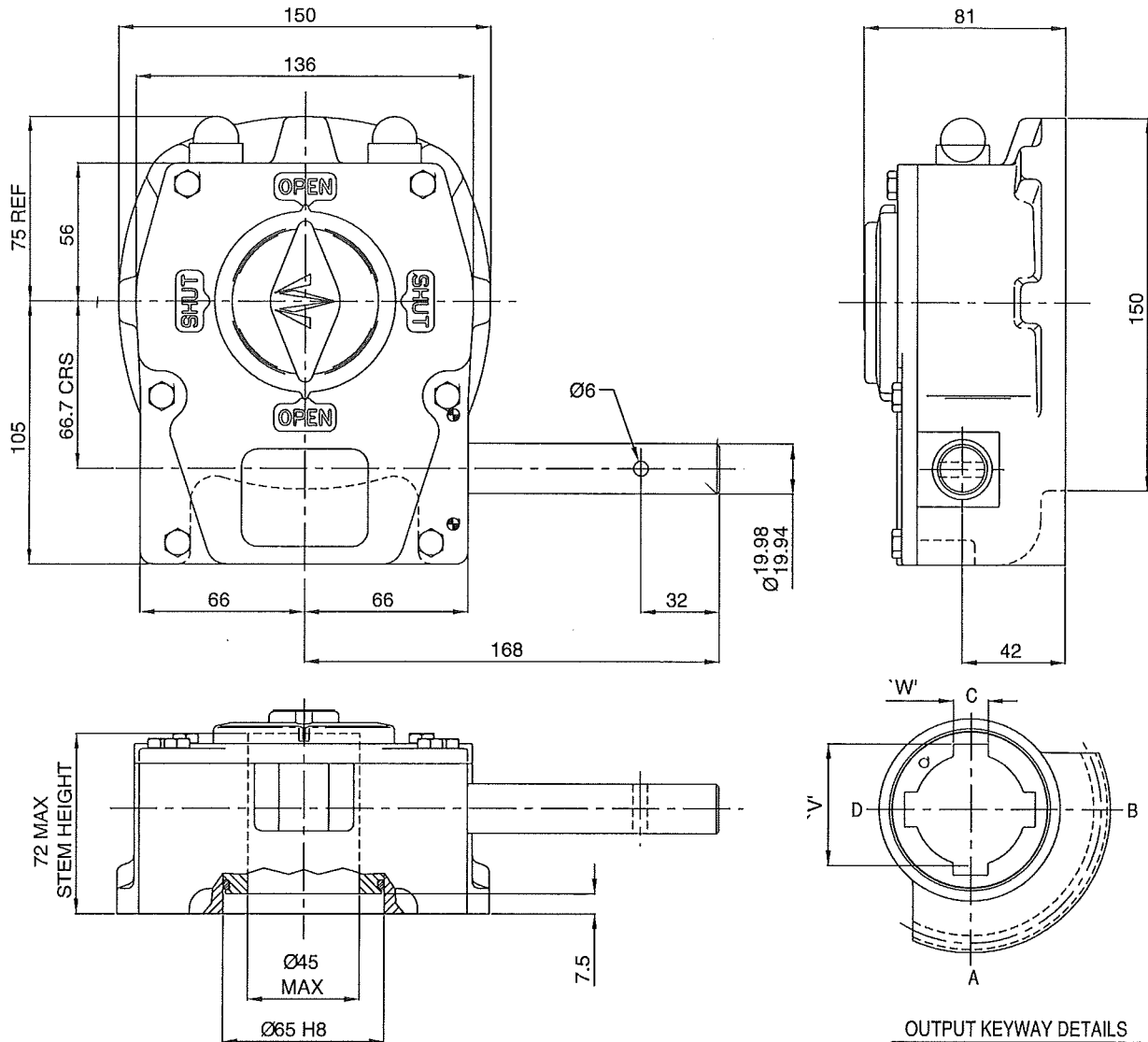
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	Pos.	Qty.	Description	It. - No.	Material
	455	2	Nut	434725	1.4301
	456	2	Disc	276270	A2
	457	8	Plate spring	213588	1.4310
	458	2	Stud bold	277748	A2-70
*	471	1	O-ring	277617	PTFE
	501	1	Adapter	428834	1.0037-ZN
	502	4	Screw	041181	A2-70
	503	4	Screw	041190	A2-70
	504	1	Coupling	428789	1.0037-ZN
	512	1	Screw	066999	1.0401-ZN
	513	1	Nut	003784	A2-70
	600	1	Gearbox Mastergear	437401	M 12/SR10 SW27

*=spare parts

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ACTUATOR TYPE - M12



GENERAL INFORMATION

TRAVEL.....90° +/- 5° AT BOTH ENDS
 RATIO.....42:1
 TURNS TO CLOSE.....10.5

MECHANICAL ADVANTAGE.....11.3 +/- 10%
 MAXIMUM OUTPUT TORQUE.....1000 Nm
 MAXIMUM INPUT TORQUE.....88.5 Nm

MOUNTING HOLE DETAIL: PREFERRED.....F12 (4 x M12 ON 125 PCD)
 MAXIMUM.....F14 (4 x M16 ON 140 PCD)
 MINIMUM.....F10 (4 x M10 ON 102 PCD)

APPROXIMATE WEIGHT.....8.2 Kg (excluding handwheel)

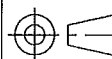
OUTPUT KEYWAY DETAILS SHOWN IN OPEN POSITION

HANDWHEEL DATA	
TYPE	DIA
SR10	250
SR12	300
SR14	350
R18	450
R24	600



OPPERMAN MASTERGEAR

Hambridge Road, Newbury, Berkshire, RG14 5TS. ENGLAND
 Telephone: (01635) 811500 Telefax: (01635) 811501



DIMENSIONS
IN

SCALE

DRAWING
No.

MM INCHES

1:2.5

ME-15303

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REV. B
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