

Automated Globe Valves

## BOA-H Mat E

### Operating Manual



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Operating Manual BOA-H Mat E

Original operating manual

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**Contents**

	<b>Glossary .....</b>	<b>5</b>
<b>1</b>	<b>General.....</b>	<b>6</b>
	1.1 Principles .....	6
	1.2 Installation of partly completed machinery.....	6
	1.3 Target group.....	6
	1.4 Other applicable documents.....	6
	1.5 Symbols .....	6
<b>2</b>	<b>Safety .....</b>	<b>7</b>
	2.1 Key to safety symbols/markings.....	7
	2.2 General.....	7
	2.3 Intended use .....	8
	2.4 Personnel qualification and training.....	8
	2.5 Consequences and risks caused by non-compliance with this manual .....	8
	2.6 Safety awareness .....	9
	2.7 Safety information for the operator/user .....	9
	2.8 Safety information for maintenance, inspection and installation .....	9
	2.9 Unauthorised modes of operation .....	9
<b>3</b>	<b>Transport/Temporary Storage/Disposal.....</b>	<b>10</b>
	3.1 Checking the condition upon delivery .....	10
	3.2 Transport.....	10
	3.3 Storage/preservation .....	11
	3.4 Return to supplier.....	11
	3.5 Disposal .....	12
<b>4</b>	<b>Valve Description .....</b>	<b>13</b>
	4.1 General description .....	13
	4.2 Marking.....	13
	4.3 Name plate.....	14
	4.4 Design details.....	14
	4.5 Function .....	15
	4.6 Scope of supply.....	15
	4.7 Noise characteristic.....	15
<b>5</b>	<b>Installation at Site .....</b>	<b>16</b>
	5.1 General information/Safety regulations .....	16
	5.2 Installation position.....	16
	5.3 Preparing the valve .....	17
	5.4 Piping .....	18
	5.5 Insulation .....	18
<b>6</b>	<b>Commissioning/Start-up/Shutdown.....</b>	<b>20</b>
	6.1 Commissioning/start-up .....	20
	6.2 Operating limits.....	21
	6.3 Shutdown.....	21
	6.4 Returning to service .....	22
<b>7</b>	<b>Servicing/Maintenance.....</b>	<b>23</b>
	7.1 Safety regulations.....	23
	7.2 Servicing/Inspection.....	24
	7.3 Dismantling the valve.....	25
	7.4 Assembling the valve.....	26
	7.5 Tightening torques.....	29

<b>8</b>	<b>Trouble-shooting.....</b>	<b>30</b>
<b>9</b>	<b>Related Documents .....</b>	<b>31</b>
9.1	General assembly drawing with list of components .....	31
9.2	Maximum permissible closing pressures .....	32
9.3	Actuating times .....	32
9.4	Dimensions and weights of BOA-H Mat E globe valve .....	33
9.5	Dimensions and weights of electric actuator types EA-C 20 to EA-C 140 .....	34
<b>10</b>	<b>EU Declaration of Conformity for BOA-H Mat E, BOA-H Mat P.....</b>	<b>35</b>
<b>11</b>	<b>Certificate of Decontamination.....</b>	<b>36</b>
	<b>Index .....</b>	<b>37</b>

## Glossary

### **Certificate of decontamination**

A certificate of decontamination is enclosed by the customer when returning the product to the manufacturer to certify that the product has been properly drained to eliminate any environmental and health hazards arising from components in contact with the fluid handled.

### **Pressure Equipment Directive (PED)**

The 2014/68/EU Directive sets out the requirements to be met by pressure equipment intended to be placed on the market in the European economic area.

## 1 General

### 1.1 Principles

This operating manual is valid for the type series and variants indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

The name plate indicates the type series and size, the main operating data, the order number and the order item number. The order number and order item number uniquely identify the valve and serve as identification for all further business processes.

In the event of damage, immediately contact your nearest KSB sales organisation responsible to maintain the right to claim under warranty.

### 1.2 Installation of partly completed machinery

To install partly completed machinery supplied by KSB refer to the sub-sections under Installation at Site. (⇒ Section 5, Page 16)

### 1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

### 1.4 Other applicable documents

**Table 1:** Overview of other applicable documents

Document	Contents
Type series booklet	Description of the technical data of the valve
Actuator operating manual	Proper and safe use of the actuator in all phases of operation
Flow characteristics <sup>1)</sup>	Information on Kv and zeta values
General assembly drawing <sup>2)</sup>	Sectional drawing of the valve
Sub-supplier product literature <sup>3)</sup>	Operating manuals and other product literature for the accessories

Observe the relevant manufacturer's product literature for the accessories.

### 1.5 Symbols

**Table 2:** Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇒	Result of an action
⇔	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1) If any

2) If inclusion in the scope of supply has been agreed; otherwise refer to the type series booklet.

3) If inclusion in the scope of supply has been agreed.



## 2 Safety

All the information contained in this section refers to hazardous situations. In addition to the present general safety information the action-related safety information given in the other sections must be observed.

### 2.1 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 <b>DANGER</b>	<b>DANGER</b> This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	<b>CAUTION</b> This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	<b>General hazard</b> In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	<b>Electrical hazard</b> In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	<b>Machine damage</b> In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.

### 2.2 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Information and markings attached directly to the product must always be complied with and kept in a perfectly legible condition at all times. This applies to, for example:
  - Flow direction arrow
  - Name plate
  - Valve body material
- The operator is responsible for ensuring compliance with all local regulations not taken into account.
- The design, manufacture and testing of the valve are subject to a QM system to DIN EN ISO 9001 as well as the current European Pressure Equipment Directive.
- Bear in mind that valves exposed to creep-rupture conditions have a limited service life and have to meet the applicable regulations stipulated in the technical codes.

- In the case of customised special variants, further restrictions may apply with regard to the operating mode and service life. Refer to the relevant sales documentation for applicable limitations.
- The operator is responsible for ensuring compliance with all local regulations not taken into account.
- The operator is responsible for any eventualities or incidents which may occur during installation performed by the customer, operation and maintenance.

### **2.3 Intended use**

- Only operate valves and actuators which are in perfect technical condition.
- Do not operate partially assembled valves or actuators.
- Only use the valve for fluids specified in the product literature. Take the design and material variant into account.
- Only operate the valve within the operating limits described in the other applicable documents.
- Only operate the actuator within the permissible ambient temperature limits.
- Consult the manufacturer about any other modes of operation not described in the product literature.
- Do not use the valve or actuator as a foothold.

#### **2.3.1 Prevention of foreseeable misuse**

- Never exceed the permissible application and operating limits specified in the product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.

### **2.4 Personnel qualification and training**

- All personnel involved must be fully qualified to transport, install, operate, maintain and inspect the product this manual refers to and be fully aware of the interaction between the valve and the system.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Hands-on training at the valve and the actuator must always be supervised by specialist technical personnel.

### **2.5 Consequences and risks caused by non-compliance with this manual**

- Non-compliance with these operating instructions will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazards to persons due to electrical, thermal, mechanical and chemical effects and explosions
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices
  - Hazard to the environment due to leakage of hazardous substances

### 2.6 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

### 2.7 Safety information for the operator/user

Actuator-operated valves are intended for use in areas which cannot be accessed by unauthorised persons. Operation of these valves in areas which can be accessed by unauthorised persons is only permitted if appropriate protective devices are fitted at the site. This must be ensured by the operator.

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Provide the personnel with protective equipment and make sure it is used.
- Contain any leakage of hazardous fluids (e.g. explosive, toxic, hot) so as to avoid any danger to persons and the environment. Adhere to all relevant laws.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)

### 2.8 Safety information for maintenance, inspection and installation

- Modifications or alterations of the valve require the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Only carry out work on the valve during standstill of the entire system.
- The valve body must have cooled down to ambient temperature.
- The pressure in the valve body must have been released and the valve must have been drained.
- When taking the valve out of service always adhere to the procedure described in the manual.
- The actuator must be disconnected from the external source of energy.
- Decontaminate valves which handle fluids posing a health hazard.
- Protect the valve body and body bonnet/cover from any impacts.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning.

### 2.9 Unauthorised modes of operation

Never operate the automated globe valve outside the limits stated in the operating manual.

The warranty relating to the operating reliability and safety of the automated globe valve supplied is only valid if the valve is used in accordance with its intended use .

### 3 Transport/Temporary Storage/Disposal

#### 3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify KSB or the supplying dealer and the insurer about the damage in writing immediately.

#### 3.2 Transport

	 <b>DANGER</b>
	<p><b>The valve/actuator unit could slip out of the suspension arrangement.</b>            Danger to life from falling parts!</p> <ul style="list-style-type: none"> <li>▷ Only transport the valve/actuator unit in the specified position.</li> <li>▷ Never attach lifting accessories to the actuator.</li> <li>▷ Observe the information on weights, centre of gravity and fastening points.</li> <li>▷ Observe the applicable local accident prevention regulations.</li> <li>▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.</li> </ul>

To transport the valve, suspend it from the lifting tackle as illustrated.

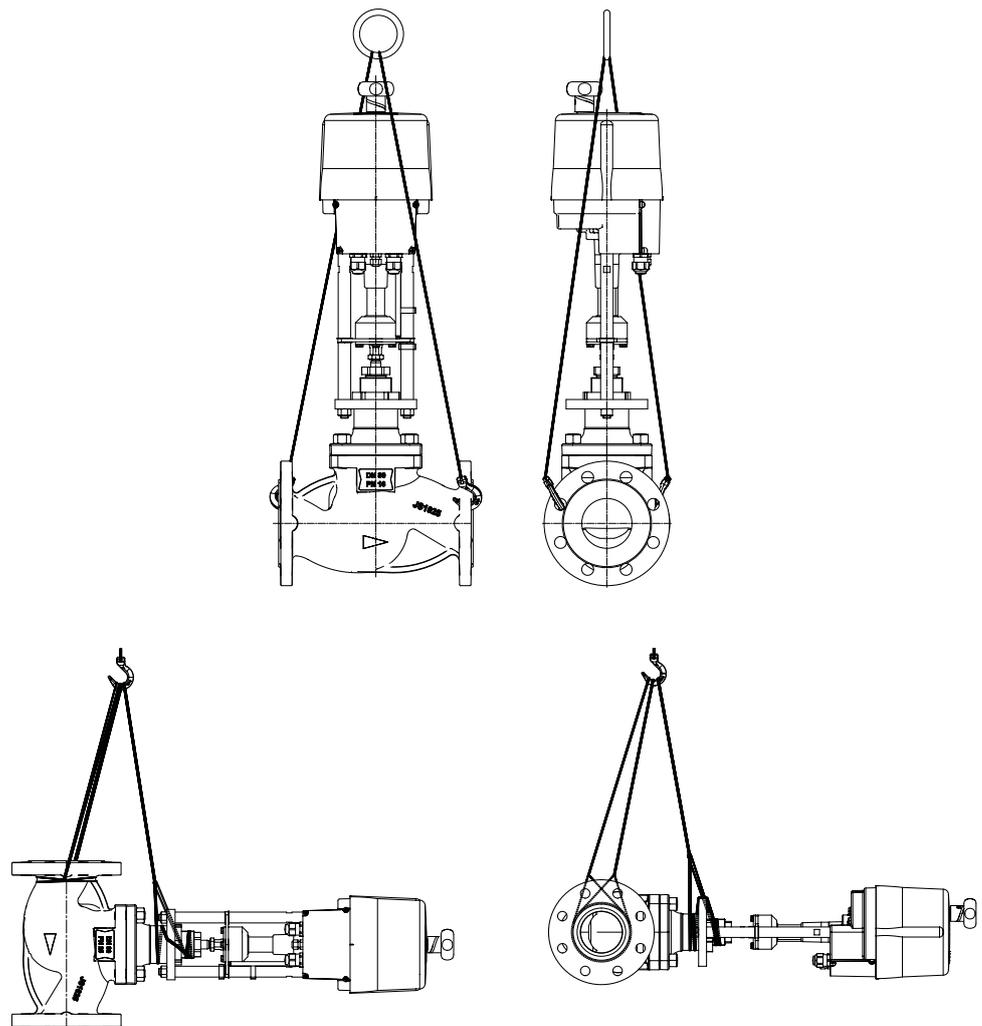


Fig. 1: Transporting a valve with electric actuator

### 3.3 Storage/preservation

If commissioning is to take place some time after delivery, we recommend that the following measures be taken for storing the valve:

	<p style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></p> <p><b>Damage due to frost, humidity or dirt</b> Corrosion/contamination of the valve!</p> <ul style="list-style-type: none"> <li>▷ Store the valve in a dry, dust-free and vibration-free, frost-proof room where the atmospheric humidity is as constant as possible.</li> <li>▷ Protect the valve against contamination, e.g. with suitable caps or film.</li> </ul>
	<p style="background-color: #FFD700; padding: 5px;"><b>CAUTION</b></p> <p><b>Damage due to excessive valve closing force</b> Damage to the seat/disc interface!</p> <ul style="list-style-type: none"> <li>▷ Store the valve in the closed position.</li> <li>▷ For soft-seated valves, ensure that the valve is closed using little force only. This will prevent premature cold flow (compression set) of the thermoplastic material.</li> </ul>

Storage and/or temporary storage of the valves must ensure that even after a prolonged period of storage the valves' function is not impaired.

The temperature in the storage room must not exceed +40 °C.

Cover the actuators to protect them from dust and dirt, and protect them from mechanical damage.

If properly stored indoors, the equipment is protected for a maximum of 12 months. New valves are supplied by our factory duly prepared for storage.

For storing a valve which has already been operated, observe the measures to be taken for shutdown. (⇒ Section 6.3, Page 21)

### 3.4 Return to supplier

1. Drain the valve as described in the manual.
2. Flush and clean the valve, particularly if it has been used for handling noxious, explosive, hot or other hazardous fluids.
3. If the valve has handled fluids whose residues could lead to corrosion damage in the presence of atmospheric humidity or could ignite upon contact with oxygen also neutralise the valve and blow through with anhydrous inert gas to ensure drying.
4. When returning valves used for handling Fluids in Group 1 always complete and enclose a certificate of decontamination.  
Indicate any safety measures and decontamination measures taken.

	<p style="background-color: #0070C0; color: white; padding: 5px;"><b>NOTE</b></p> <p>If required, a blank certificate of decontamination can be downloaded from the following web site: <a href="http://www.ksb.com/certificate_of_decontamination">www.ksb.com/certificate_of_decontamination</a></p>
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## 3.5 Disposal

	 <b>WARNING</b>
	<p><b>Fluids handled, consumables and supplies which are hot or pose a health hazard</b> Hazard to persons and the environment!</p> <ul style="list-style-type: none"><li>▷ Collect and properly dispose of flushing fluid and any residues of the fluid handled.</li><li>▷ Wear safety clothing and a protective mask if required.</li><li>▷ Observe all legal regulations on the disposal of fluids posing a health hazard.</li></ul>

1. Dismantle the valve.  
Collect greases and other lubricants during dismantling.
2. Separate and sort the valve materials, e.g. by:
  - Metals
  - Plastics
  - Electronic waste
  - Greases and other lubricants
3. Dispose of materials in accordance with local regulations or in another controlled manner.

## 4 Valve Description

### 4.1 General description

- Automated globe valve with electric actuator

Valve for shutting off fluids in industrial plant, process engineering, plant engineering, cooling circuits and heating systems.

### 4.2 Marking

**Table 4:** General marking

Nominal size	DN ...
Nominal pressure class	PN ...
Manufacturer	KSB
Type series/Model	BOA-...
Year of construction	20..
Material	.....
Flow direction arrow	→
Traceability of the material	.....
CE marking	<b>CE</b>
Identification number of the notified body	0036
Customer's marking	e.g. plant/system No., etc.
Factory marking	Inspector's stamp mark on the flange following the successful final inspection and testing of the valve

In accordance with the current European Pressure Equipment Directive (PED) the valves are marked as shown in the following table:

Fluids in Groups 1 and 2

PN	DN									
	≤25	32	40	50	65	80	100	125	150	≥200
10										
16										
25										
≥40										

**Fig. 2:** Fluids in Groups 1 and 2

**Fluid groups** In accordance with Article 13 Para. 1 of the European Pressure Equipment Directive (PED) 2014/68/EU, Group 1 comprises all fluids posing physical or health hazards, e.g. fluids defined as Fluids in Group 1

- Explosive
- Extremely flammable
- Highly flammable
- Very toxic
- Toxic
- Oxidising

Group 2 comprises all other fluids not referred to in Group 1.

### 4.3 Name plate

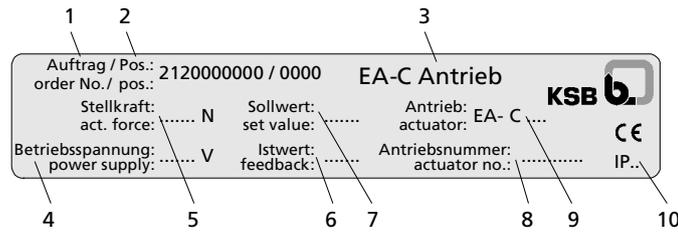


Fig. 3: Actuator name plate (example)

1	Order number	2	Order item number
3	Product name	4	Supply voltage [V]
5	Actuating force [N]	6	Actual value
7	Setpoint	8	Actuator number
9	Actuator size	10	Enclosure

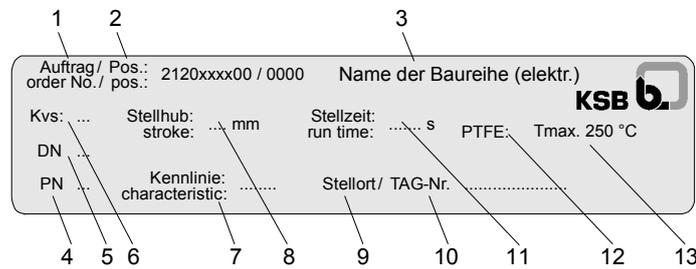


Fig. 4: Valve name plate (example)

1	Order number	2	Order item number
3	Product name	4	Nominal pressure class
5	Nominal size (DN)	6	Kvs value
7	Characteristic curve	8	Actuator stroke
9	Point of control	10	TAG number
11	Actuating time [s]	12	Stem seal
13	Maximum application temperature [°C]		

### 4.4 Design details

#### Design

Globe valve:

- Straight-way pattern with horizontal seat
- Throttling plug ≤ DN 100
- On/off disc ≥ DN 125
- Spring-loaded PTFE V-packing ≤ 250 °C
- Graphite gland packing ≤ 350 °C
- Flanges to DIN EN 1092-2 Type 21
- Leakage rate A
- Exterior coating: blue, RAL 5002
- The valves satisfy the safety requirements of Annex I of the European Pressure Equipment Directive 2014/68/EU (PED) for fluids in Groups 1 and 2.

Actuators (technical data refers to basic configuration):

- 3-point (Open/Stop/Closed) actuators  
 Supply voltage: 230 V AC  
 Actual-position feedback: 2 limit switches (switching via limit switches in closing and opening direction)  
 Supply voltage: 24 V AC/DC  
 Actual-position feedback: 0-10 V
- After a power failure, operation is resumed in accordance with the operating data (24 V actuator).

### Variants

Globe valve:

- Valve disc with PTFE gasket ( $\leq 200$  °C)
- Other flange designs
- High-temperature resistant paint (grey aluminium)
- Certification to customer specification

Actuators:

- Power back-up unit for 24 V actuators
- Heating of the motor space
- Other supply voltages on request
- Other actuators (e.g. AUMA) on request.

### 4.5 Function

**Design** The automated globe valve with electric actuator consists of the pressure-retaining parts, i.e. body 100 and body bonnet 161, and the functional unit (stem 200 and valve disc 350).

**Function** It is operated by an electric actuating element (actuator).

**Sealing** Body 100 and body bonnet 161 are joined by studs 902, and the joint is sealed to atmosphere by joint ring 411.

On the standard valve design, the passage of stem 200 is sealed by means of either a PTFE V-packing or a graphite gland packing 461. The PTFE V-packing stem seal is maintenance-free.

### 4.6 Scope of supply

The following items are included in the scope of supply:

- Automated globe valve
- Valve operating manual
- Actuator operating manual

### 4.7 Noise characteristic

When operated within the operating conditions documented in the order confirmation and/or characteristic curves booklets, the valve will not exceed a sound pressure level of 80 dB in acc. with IEC 60534-8-4. Unfavourable piping layouts or off-design operating conditions may give rise to physical phenomena like cavitation, resulting in significantly higher sound pressure levels.

## 5 Installation at Site

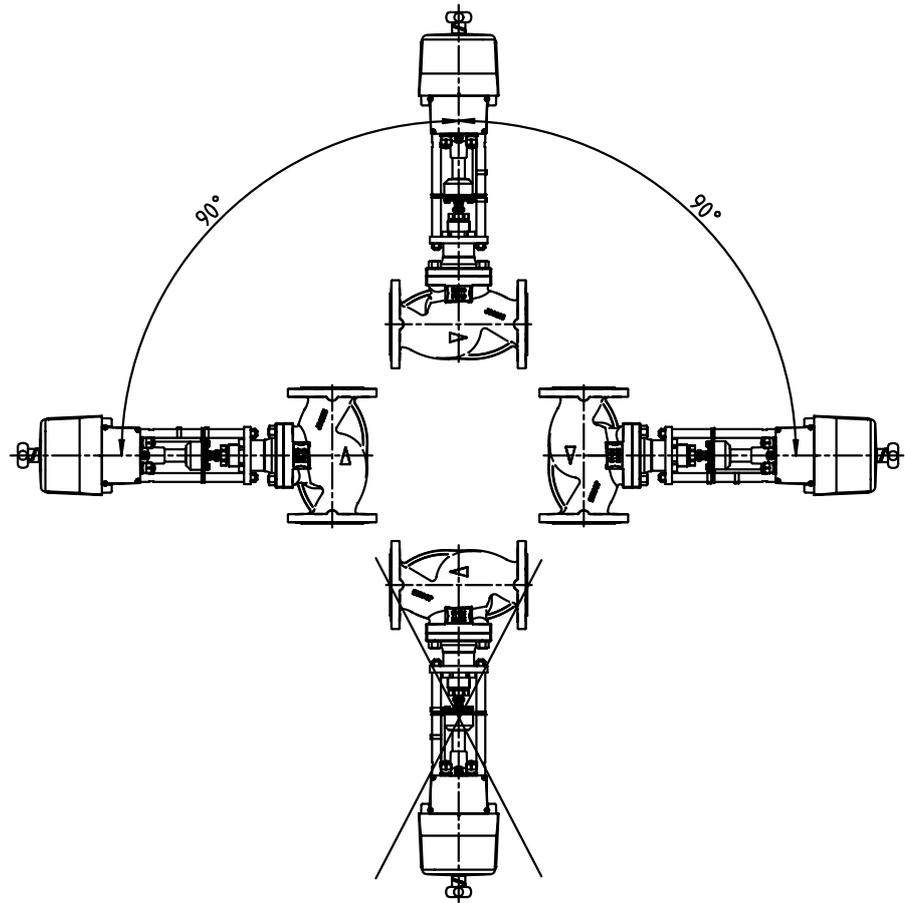
### 5.1 General information/Safety regulations

The consultant, construction company or operator are responsible for positioning and installing the valves. Planning errors and installation errors may impair the reliable function of the valves and pose a substantial safety hazard.

	<p style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Damage to pressure enclosure or add-on parts</b>            Leakage from or rupture of the valve            Valve/add-on parts not functional</p> <ul style="list-style-type: none"> <li>▸ Check the valve for in-transit damage prior to installation.</li> <li>▸ Check any add-on parts for in-transit damage.</li> <li>▸ Do not install damaged valves.</li> </ul>
	<p style="background-color: #f4c440; padding: 5px;"><b>CAUTION</b></p> <p><b>Welding in close proximity to soft-seated valves</b>            Damage to the seat/disc interface!</p> <ul style="list-style-type: none"> <li>▸ Ensure that the valve is not heated beyond the specified temperature limits.</li> </ul>

### 5.2 Installation position

	<p style="background-color: #f4a460; padding: 5px;"><b>⚠ WARNING</b></p> <p><b>Installation of the valve with the stem pointing downwards in steam applications</b>            Damage to the valve through steam hammer!</p> <ul style="list-style-type: none"> <li>▸ Install the valve with the stem pointing upwards or to the side.</li> <li>▸ Observe the permissible installation position.</li> </ul>
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**Fig. 5:** Installation position of valve with electric actuator  
Install the actuator with sufficient clearance for removal.

	<b>NOTE</b>
	<p>For the valves to reach the documented Kv values, the flow direction must correspond to the flow direction arrow.</p>

### 5.3 Preparing the valve

	<b>CAUTION</b>
	<p><b>Outdoor installation</b> Damage due to corrosion!</p> <ul style="list-style-type: none"> <li>▸ Provide weather-proof protection to protect the valve against moisture.</li> </ul>

1. Thoroughly clean, flush and blow through all vessels, piping and connections.
2. Remove the valve's flange covers before installing it in the piping.
3. Check that the inside of the valve is free from any foreign objects. Remove any foreign objects.
4. If required, install a strainer in the piping.

5.4 Piping

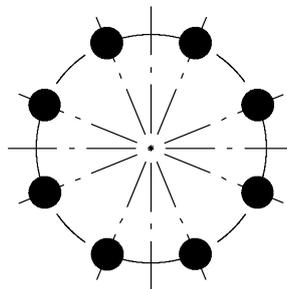
	<b>WARNING</b>
	<p><b>Impermissible piping forces</b> Leakage from or rupture of the valve body!</p> <ul style="list-style-type: none"> <li>▷ Connect the pipes to the valve without transmitting any stresses or strains.</li> <li>▷ Take constructional measures to prevent any piping forces from being transmitted to the valve.</li> </ul>
	<b>CAUTION</b>
	<p><b>Painting pipes and actuator</b> Valve function impaired!</p> <ul style="list-style-type: none"> <li>▷ Protect stem, plastic components and actuator elements prior to applying paint.</li> </ul>

5.4.1 Flanged connection

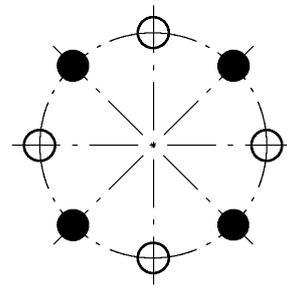
**Fasteners** Only use fasteners (e.g. to DIN EN 1515-4) and flange gaskets (e.g. to DIN EN 1514) made of materials approved for the respective nominal valve size. Always use all flange bolt holes provided when connecting the valve to the pipe.

	<b>NOTE</b>
	<p><b>Exception: DN 65 PN 16</b> When using steel flanges to DIN EN 1092-1 in conjunction with cast iron valves with flanges machined to DIN EN 1092-2, ensure that for nominal size DN 65 classed PN 16 the mating flanges are fitted offset by 22.5°.</p>

Flange connection



DN 65 PN 10/16 (steel/steel):  
DIN EN 1092-1 with DIN EN 1092-1:  
Bolts through 8 holes



DN 65 PN 10/16 (steel/cast iron):  
DIN EN 1092-1 with DIN EN 1092-2:  
Bolt hole circle to DIN EN 1092-1 turned through 22.5°, bolts through 4 holes, 4 holes free

Fig. 6: Flange connections

- ✓ The mating flange faces are clean and undamaged.
- 1. Use an appropriate tool to evenly tighten the fasteners crosswise.

5.5 Insulation

	<b>WARNING</b>
	<p><b>Cold/hot piping and/or valve</b> Risk of thermal injury!</p> <ul style="list-style-type: none"> <li>▷ Insulate the valve.</li> <li>▷ Fit warning signs.</li> </ul>

	<b>CAUTION</b>
	<p><b>Condensation forming in air-conditioning systems, cooling systems and refrigerating systems</b></p> <p>Ice forming!</p> <p>Actuating element blockage!</p> <p>Damage due to corrosion!</p> <p>▷ Insulate the valve to prevent diffusion.</p>

## 6 Commissioning/Start-up/Shutdown

### 6.1 Commissioning/start-up

	<b>CAUTION</b>
	<p><b>Welding beads, scale and other impurities in the piping</b>            Damage to the valve!</p> <ul style="list-style-type: none"> <li>▷ Remove any impurities from the piping, e.g. by flushing the pipe with the valve in fully open position.</li> <li>▷ If necessary, install a strainer.</li> </ul>

	<b>! DANGER</b>
	<p><b>All work performed on the actuator:</b>            Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe the actuator's operating manual.</li> </ul>

#### 6.1.1 Prerequisites for commissioning/start-up

	<b>! DANGER</b>
	<p><b>Surge pressure/water hammer potentially occurring at high temperatures</b>            Danger to life caused by burns or scalds!</p> <ul style="list-style-type: none"> <li>▷ Do not exceed the valve's maximum permissible pressure.</li> <li>▷ Use valves made of nodular cast iron or steel.</li> <li>▷ The operator shall provide general safety measures for the system.</li> </ul>

Before commissioning/start-up of the valve ensure that the following requirements are met:

- The valve has been connected to the piping at both ends.
- The actuator has been connected to the power supply in accordance with the actuator's operating manual.
- The piping has been flushed.
- For valves with electric or pneumatic actuators travel limits have been set.
- The material, pressure data and temperature data of the valve are compatible with the operating conditions of the piping.
- The material's chemical resistance and stability under load have been checked.

#### 6.1.2 Actuation

The valve is operated by an electric actuator.

	<b>! WARNING</b>
	<p><b>Improper handling of electric actuator</b>            Crushing of fingers!            Damage to the actuator or the valve!</p> <ul style="list-style-type: none"> <li>▷ Never touch the rotating components.</li> <li>▷ Ensure that any objects and parts of the body are removed from the actuator coupling area prior to starting the actuator.</li> </ul>

#### 6.1.3 Functional check

**Visual inspection** The following functions must be checked:

After the valve has been subjected to load conditions or heated up for the first time check the joint between the body and the bonnet/cover established by bolting 902/920 and joint ring 411 for tightness.

If leakage occurs or bonnet/cover bolting 902/920 is loose, evenly re-tighten it crosswise. (⇒ Section 7.5, Page 29)

	<b>DANGER</b>
	<p><b>Failure to re-tighten bonnet/cover bolting after first loading</b> Leakage of hot and/or toxic fluids!</p> <ul style="list-style-type: none"> <li>▷ Re-tighten bonnet/cover bolting 902/920 of valves operated at temperatures exceeding 200 °C.</li> </ul>

### 6.2 Operating limits

	<b>CAUTION</b>
	<p><b>Impermissible system parameters</b> Excessive wear and/or damage to the valve by vibration and cavitation!</p> <ul style="list-style-type: none"> <li>▷ Change the system parameters.</li> <li>▷ Consult KSB if special solutions need to be selected.</li> </ul>

#### 6.2.1 Ambient temperature

Observe the following parameters and values during operation:

**Table 5:** Permissible ambient temperatures

Ambient condition	Value
Ambient temperature	-10 °C to +60 °C
Humidity	5 % to 95 % rH

#### 6.2.2 Pressure/temperature ratings

**Table 6:** Test pressure and operating pressure

PN	Material	Shell test	Leak test (seat)	Permissible operating pressure [bar] <sup>4)5)</sup>				
		With water		[°C]				
		Tests P10 and P11 to DIN EN 12266-1 [bar]	Test P12, leakage rate A to DIN EN 12266-1 [bar]	-10 to +120	200	250	300	350
16	EN-GJS-400-18-LT	24	Δp	16	14,7	13,9	12,8	11,2
25	EN-GJS-400-18-LT	37,5	Δp	25	23	21,8	20	17,5

### 6.3 Shutdown

#### 6.3.1 Measures to be taken for shutdown

During prolonged shutdown periods, ensure that the following conditions are met:

1. Drain fluids which change their physical condition due to changes in concentration, polymerisation, crystallisation, solidification, etc. from the piping.
2. If required, flush the piping with the valves fully opened.
3. Shut down the electric actuator as specified in the actuator's operating manual.

4) Intermediate temperatures can be derived by linear interpolation.

5) Static load

#### **6.4 Returning to service**

For returning the equipment to service, observe the sections on commissioning/start-up and the operating limits .

In addition, carry out all servicing/maintenance operations before returning the valve to service. (⇒ Section 7, Page 23)

## 7 Servicing/Maintenance

### 7.1 Safety regulations

	<b>DANGER</b>
	<p><b>Valve under pressure</b>            Risk of injury!            Leakage of hot and/or toxic fluids!            Risk of burns!</p> <ul style="list-style-type: none"> <li>▷ Depressurise the valve and its surrounding system prior to any maintenance work and installation work.</li> <li>▷ If there is fluid leakage, depressurise the valve.</li> <li>▷ Allow the valve to cool down until the temperature of the fluid in all the valve's chambers is lower than the fluid's vaporisation temperature.</li> <li>▷ Never vent the valve by removing the bonnet bolting or gland packing.</li> <li>▷ Use original spare parts and appropriate tools, even in emergencies.</li> </ul>

The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.

	<b>WARNING</b>
	<p><b>Fluids handled, consumables and supplies which are hot and/or pose a health hazard</b>            Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ Observe all relevant laws.</li> <li>▷ When draining the fluid take appropriate measures to protect persons and the environment.</li> <li>▷ Decontaminate valves used in fluids posing a health hazard.</li> </ul>

A regular maintenance schedule will help avoid expensive repairs and contribute to trouble-free, reliable operation of the valve with a minimum of servicing/ maintenance expenditure and work.

	<b>NOTE</b>
<p>Before removing the valve from the piping, ensure that the pipe has been taken out of service and released for repair/maintenance work.</p>	

	<b>NOTE</b>
<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. For contact details please refer to the enclosed "Addresses" booklet or visit "<a href="http://www.ksb.com/contact">www.ksb.com/contact</a>" on the Internet.</p>	

Never use force when dismantling and reassembling the valve.

Original spare parts are only ready for operation following assembly/installation and subsequent shell and leak testing of the valve.

## 7.2 Servicing/Inspection

### 7.2.1 Supervision of operation

The service life can be extended by taking the following measures:

- Checking the function by actuating the valve at least twice a year
- Re-tightening the stuffing box screw to the specified in-service torque in good time (⇒ Section 7.5, Page 29)

### 7.2.2 Inspection work

#### 7.2.2.1 Checking the PTFE V-packing

A PTFE V-packing set 416 comprises a base ring, three V-rings and a top ring.

The PTFE V-packing set is fitted together with a compression spring 950. It is self-adjusting, i.e. maintenance-free. If leakage is detected at the stem, the V-packing set is worn and must be replaced with a new one.

#### 7.2.2.2 Checking the graphite gland packing

The graphite gland packing 461 comprises two packing rings fitted between two packing end rings. This stem seal design is not maintenance-free.

If regular inspection reveals leakage at stem 200 or a reduction in the tightening torque of stuffing box screw 45-6, the stuffing box screw must be re-tightened to the in-service torque specified (⇒ Section 7.5, Page 29) .

If re-tightening to the in-service torque does not restore seal integrity, the gland packing must be replaced. The same applies once stuffing box screw 45-6 rests on the neck of the bonnet, i.e. when the packing has already been re-tightened to maximum compression.

### 7.2.3 Valves with actuator

	<b>⚠ DANGER</b>
	<p><b>Unqualified personnel performing work on valves with actuator</b>            Danger of death from electric shock!</p> <ul style="list-style-type: none"> <li>▸ Ensure that the connection to the power supply and the process control system is performed by a trained electrician.</li> <li>▸ Observe regulations IEC 60364 and, for explosion-proof models, EN 60079.</li> </ul>
	<b>⚠ WARNING</b>
	<p><b>Work on the electric actuator by unqualified personnel</b>            Risk of injury!</p> <ul style="list-style-type: none"> <li>▸ Always have repair and maintenance work performed by specially trained, qualified personnel.</li> </ul>
	<b>NOTE</b>
	<p>If the valves are fitted with actuators, ensure that the actuator's operating manual is also observed.</p>

### 7.3 Dismantling the valve

#### 7.3.1 General information/Safety regulations

	<p><b>! WARNING</b></p>
	<p><b>Hot surface</b> Risk of injury!</p> <p>▷ Allow the valve to cool down to ambient temperature.</p>
	<p><b>! WARNING</b></p>
	<p><b>Unqualified personnel performing work on the valve</b> Risk of injury!</p> <p>▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.</p>

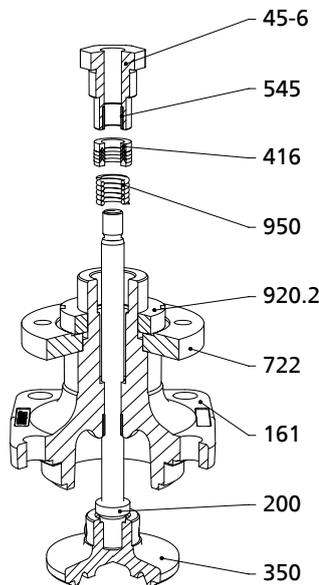
Always observe the safety instructions and information. (⇒ Section 7, Page 23)  
In the event of damage you can always contact our service departments.

#### 7.3.2 Preparing the valve

1. Interrupt power supply and make sure it cannot be switched on again unintentionally.
2. Depressurise and drain the valve.
3. Shut down the electric actuator as specified in the actuator's operating manual.

#### 7.3.3 Removing the stem seal

##### 7.3.3.1 Removing the PTFE V-packing

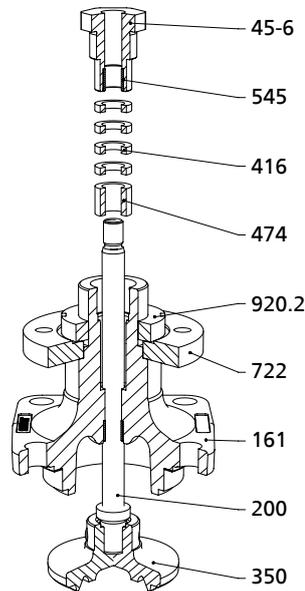


**Fig. 7: Removing the PTFE V-packing**

- ✓ The electric actuator has been removed.
- 1. Undo and remove stuffing box screw 45-6.
- 2. Undo bonnet nuts 920.3.
- 3. Lift bonnet 161 off body 100.

4. Pull stem/valve disc assembly 200/350 out of the bonnet.
5. Remove the old stem seal 416 and spring 950.

**7.3.3.2 Removing the graphite gland packing**



**Fig. 8:** Removing the graphite gland packing

✓ The electric actuator has been removed.

1. Undo and remove stuffing box screw 45-6.
2. Undo bonnet nuts 920.3.
3. Lift bonnet 161 off body 100.
4. Pull the stem/valve disc assembly out of the bonnet.
5. Remove the old stem seal 416 and thrust ring 474.

**7.3.4 Removing the trim components**

**7.4 Assembling the valve**

**7.4.1 General information/Safety regulations**

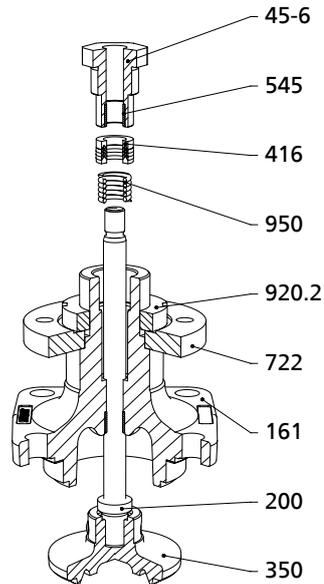
	<b>CAUTION</b>
	<p><b>Improper reassembly</b> Damage to the valve!</p> <ul style="list-style-type: none"> <li>▷ Reassemble the valve in accordance with the general rules of sound engineering practice.</li> <li>▷ Use original spare parts only.</li> </ul>

**Bonnet gasket** Always fit a new bonnet gasket 411.2 whenever a stem seal or a trim component is replaced. The bonnet gasket must be inserted into the body with the bonnet dismantled.

**Tightening torques** Use an appropriate tool to tighten the fasteners crosswise.

## 7.4.2 Fitting the stem seal

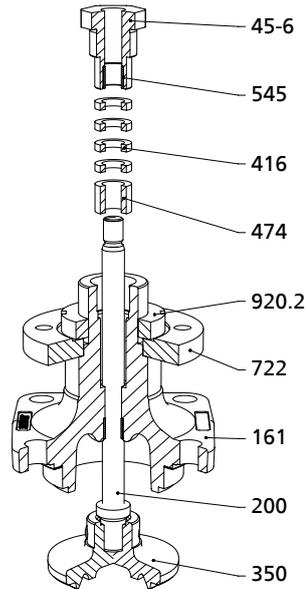
### 7.4.2.1 Fitting the PTFE V-packing



**Fig. 9:** Fitting the PTFE V-packing

- ✓ The spare parts required are available.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
1. Check the stem surface. If the surface is damaged, the stem also needs to be replaced; otherwise the stem seal will soon start leaking again.
  2. Insert stem 200 into bonnet 161 from below.
  3. Place new spring 950 and V-packing set 416 onto stem 200 and insert into the gland packing chamber.
  4. Use stuffing box screw 45-6 to insert the complete V-packing set into the seal chamber and tighten by hand.
  5. Insert new bonnet gasket 411.2.
  6. Place assembled bonnet 161 onto the valve body.
  7. Tighten hexagon nuts 920.3 crosswise to the specified (⇒ Section 7.5, Page 29) tightening torque.
  8. Tighten stuffing box screw 45-6 up to the stop, applying a torque of 20 to 30 Nm.
  9. Mount the actuator.

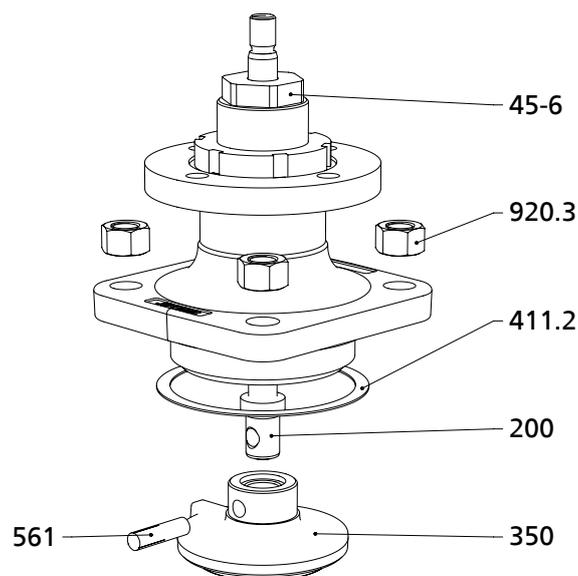
### 7.4.2.2 Fitting the graphite gland packing



**Fig. 10:** Fitting the graphite gland packing

- ✓ The spare parts required are available.
  - ✓ All dismantled parts have been cleaned and checked for wear.
  - ✓ Any damaged or worn parts have been replaced by original spare parts.
1. Check the stem surface. If the surface is damaged, the stem also needs to be replaced; otherwise the stem seal will soon start leaking again.
  2. Insert stem 200 into bonnet 161 from below.
  3. Place sleeve 520 and gland packing 461 onto stem 200 and insert into the gland packing chamber.
  4. Use stuffing box screw 45-6 to insert the complete V-packing set into the seal chamber and tighten by hand.
  5. Insert new bonnet gasket 411.2.
  6. Place assembled bonnet 161 onto the valve body.
  7. Tighten bonnet nuts 920.3 crosswise to the specified tightening torque (⇒ Section 7.5, Page 29) .
  8. Tighten stuffing box screw 45-6 to the assembly torque (⇒ Section 7.5, Page 29) . After approx. one minute undo the stuffing box screw again and move the stem up and down several times. Then tighten the stuffing box screw to the in-service torque (⇒ Section 7.5, Page 29) .
  9. Mount the actuator.

### 7.4.3 Fitting the trim components



**Fig. 11:** Fitting the valve disc and stem

1. Insert the new stem/valve disc assembly carefully into bonnet 161 from below.
2. Insert new bonnet gasket 411.2.
3. Place bonnet 161 onto the valve body.
4. Tighten bonnet nuts 920.3 crosswise to the specified tightening torque.
5. Tighten stuffing box screw 45-6, depending on the valve design.
6. Mount the actuator.

### 7.5 Tightening torques

#### Bonnet nuts and actuator pillars

**Table 7:** Tightening torques for hexagon nuts [Nm]

Thread size	Tightening torque
M10	32
M12	56
M16	135
M20	250

#### Flange nuts

**Table 8:** Torques for hexagon nuts and slotted round nuts [Nm]

Thread size	Tightening torque
M39	750
M50	1100

#### Graphite gland packing

**Table 9:** Tightening torques for stuffing box screw [Nm]

DN	Assembly torque	In-service torque
20 - 50	10	3
65 - 100	15	4
125 - 150	18	5

## 8 Trouble-shooting

	 <b>WARNING</b>
	<p><b>Improper remedial work on the valve</b></p> <p>Risk of injury!</p> <ul style="list-style-type: none"> <li>▷ For any work performed in order to remedy faults on the valve observe the relevant information given in this operating manual and/or the product literature provided by the accessories manufacturers.</li> </ul>

Malfunctions e.g. caused by incorrect operation, lack of maintenance or improper use cannot be ruled out completely. All repair work and maintenance work must be performed by skilled, properly trained personnel using suitable tools and original spare parts.

	<b>NOTE</b>
	<p>If problems occur that are not described in the Trouble-shooting table of the individual operating manuals, consultation with KSB is required.</p>

Table 10: Trouble-shooting

Fault	Possible cause	Remedy
Leakage at the bonnet/cover	Defective bonnet/cover gasket	Replace bonnet/cover gasket.
	Unevenly tightened bonnet/cover bolts	Undo the bonnet/cover bolts, fit a new gasket and re-tighten the bolts as specified in the manual. <ul style="list-style-type: none"> <li>▪ Undo bonnet/cover bolting 902/920.</li> <li>▪ Replace joint ring 411.</li> <li>▪ Tighten bonnet/cover bolting 902/920 to the specified tightening torque.</li> </ul>
Leakage at the stem	PTFE V-packing set is damaged.	Replace V-packing set.
	Insufficient stuffing box screw pressure on graphite gland packing	<ul style="list-style-type: none"> <li>▪ Tighten stuffing box screw 45-6 to the specified tightening torque.</li> <li>▪ If leakage continues, replace the gland packing.</li> </ul>
No throughflow	Valve is closed.	Open the valve.
	Closed shut-off valve in the piping	Open the shut-off valve.
Little throughflow	Piping clogged	Check piping.
Leakage at seat/disc interface	Worn seating surfaces on the valve disc	Fit a new valve disc.
	Worn seating faces on valve seat	Replace the body.
	Sealing elements of design variants are worn.	Fit new sealing elements.
	Actuator too weak	Check closing torque of actuator; use a stronger actuator if necessary.
	Contamination between valve disc and seat	Clean valve trim.
Jerky and/or extremely sluggish stem movement	Stuffing box screw tightened too hard on graphite packings	Check tightening torque, loosen if required.
	Bearing damage	Replace defective parts.

## 9 Related Documents

### 9.1 General assembly drawing with list of components

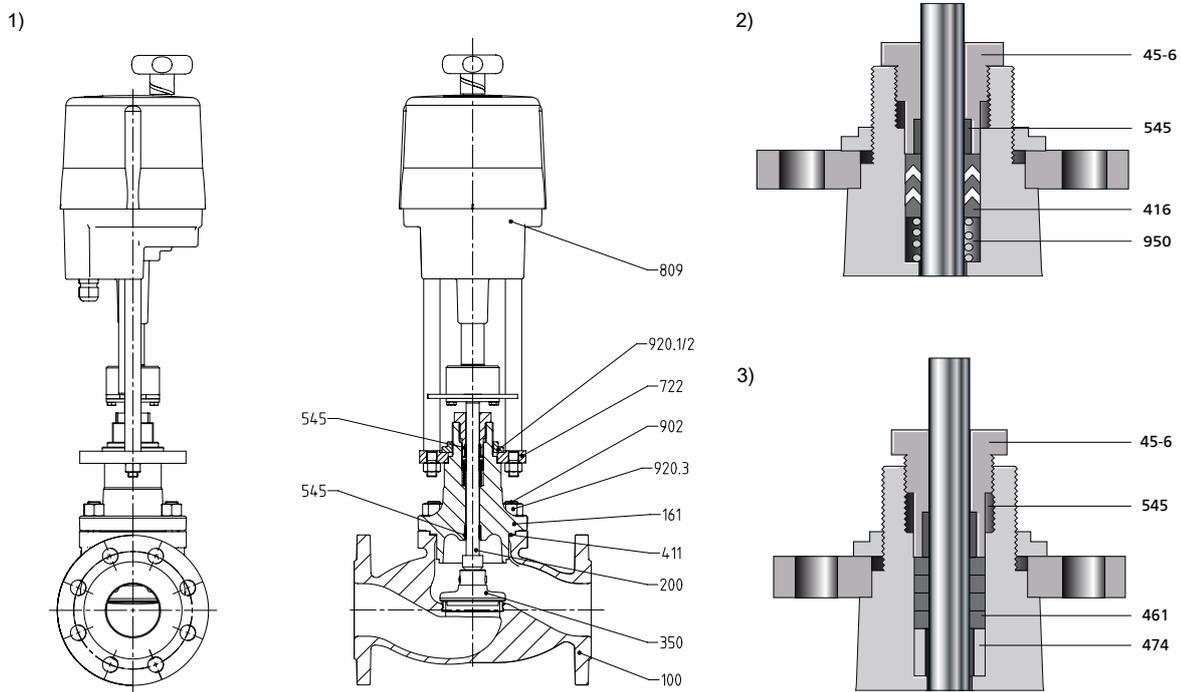


Fig. 12: Sectional drawings

1)	Automated globe valve
2)	PTFE V-packing
3)	Graphite gland packing

Table 11: Overview of available materials

Part No.	Description	Material	Material number
100	Body	EN-GJS-400-18-LT	5.3103
161	Body bonnet	EN-GJS-400-18-LT	5.3103
200	Stem	X20Cr13	1.4021+QT
350	Valve disc	X20Cr13	1.4021+QT
411	Bonnet gasket	CrNiSt/graphite	-
416	V-packing	Carbon PTFE	-
45-6	Stuffing box screw	X5CrNi18-10	1.4301
461	Gland packing	Graphite	-
474	Thrust ring	X5CrNi18-10	1.4301
545	Bearing bush	Sint A50	-
722	Actuator flange	Steel	-
809	Actuator	-	-
902	Stud	CK 35 V	-
920.1	Hexagon nut	Galvanised steel	-
920.2	Slotted round nut	Galvanised steel	-
920.3	Hexagon nut	C35	-
950	Spring	X5CrNi18-10	1.4301

## 9.2 Maximum permissible closing pressures

### Stem sealed by PTFE V-packing

**Table 12:** Closing pressures if fluid approaches the valve disc from the opposite direction of valve closure; p<sub>2</sub> = 0 bar  
Values in bar

DN	Travel [mm]	Kvs value [m <sup>3</sup> /h]	Actuator (actuating forces)			
			EA-C 20 (2 kN)	EA-C40 (4,5 kN)	EA-C80 (8 kN)	EAC-140 (14 kN)
20	7,5	8,3	25,0	-	-	-
25	7,5	13	22,9	-	-	-
32	11	19,9	13,7	25,0	-	-
40	12	27,1	8,3	25,0	-	-
50	13,5	42	4,8	15,9	25,0	-
65	17	75,1	2,2	9,0	18,4	25,0
80	20,5	116,7	1,1	5,6	12,0	22,9
100	25,5	172,3	-	3,3	7,4	14,6
125	33	270	-	1,8	4,5	9,1
150	38	393	-	1,1	2,9	6,2

### Stem sealed by graphite gland packing

**Table 13:** Closing pressures if fluid approaches the valve disc from the opposite direction of valve closure; p<sub>2</sub> = 0 bar  
Values in bar

DN	Travel [mm]	Kvs value [m <sup>3</sup> /h]	Actuator (actuating forces)			
			EA-C 20 (2 kN)	EA-C40 (4,5 kN)	EA-C80 (8 kN)	EAC-140 (14 kN)
20	7,5	8,3	24,5	-	-	-
25	7,5	13	15,7	25,0	-	-
32	11	19,9	9,3	25,0	-	-
40	12	27,1	5,6	22,3	-	-
50	13,5	42	3,2	14,3	25,0	-
65	17	75,1	1,0	7,8	17,3	25,0
80	20,5	116,7	0,4	4,9	11,3	22,2
100	25,5	172,3	-	2,9	7,1	14,2
125	33	270	-	1,5	4,2	8,9
150	38	393	-	0,9	2,8	6,1

## 9.3 Actuating times

**Table 14:** Actuating times [s]

DN	Stroke [mm]	Actuator		
		EA-C 20 to 80 24 V/230 V	EA-C 140 230 V	EA-C 140 24 V
20	7,5	15,0	-	-
25	7,5	15,0	-	-
32	11	22,0	-	-
40	12	24,0	-	-
50	13,5	27,0	-	-
65	17	34,0	26,2	37,8
80	20,5	41,0	31,5	45,6
100	25,5	51,0	39,2	56,7

DN	Stroke [mm]	Actuator		
		EA-C 20 to 80 24 V/230 V	EA-C 140 230 V	EA-C 140 24 V
125	33	66,0	50,8	73,3
150	38	76,0	58,5	84,4

#### 9.4 Dimensions and weights of BOA-H Mat E globe valve

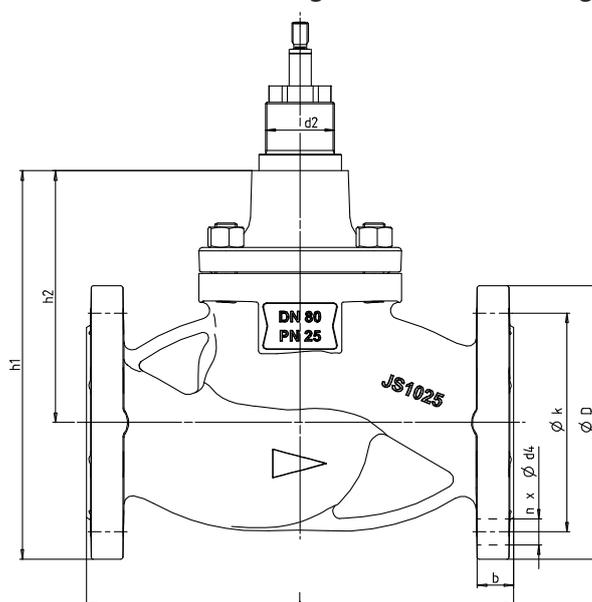


Fig. 13: BOA-H Mat E without actuator

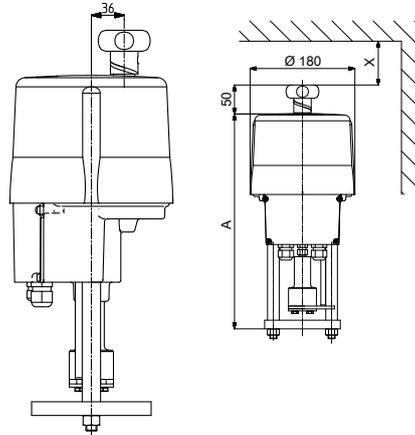
Table 15: Dimensions and weights

PN	DN	l	h <sub>1</sub>	h <sub>2</sub>	d <sub>2</sub>	D	b	k	n	d <sub>4</sub>	[kg]
		[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	
16	20	150	153,5	101,0	M39	105	16	75	4	14	6,3
	25	160	164,5	107,0	M39	115	16	85	4	14	6,9
	32	180	216,0	146,0	M39	140	18	100	4	19	10,4
	40	200	226,0	151,0	M39	150	18	110	4	19	11,6
	50	230	227,0	144,5	M39	165	20	125	4	19	13,8
	65	290	272,5	180,0	M50	185	20	145	4	19	22,3
	80	310	284,0	184,0	M50	200	22	160	8	19	28,4
	100	350	328,0	218,0	M50	220	24	180	8	19	38,4
	125	400	384,5	259,5	M50	250	26	210	8	19	60,5
25	150	480	403,5	261,0	M50	285	26	240	8	23	83,0
	20	150	153,5	101,0	M39	105	16	75	4	14	6,3
	25	160	164,5	107,0	M39	115	16	85	4	14	6,9
	32	180	216,0	146,0	M39	140	18	100	4	19	10,4
	40	200	226,0	151,0	M39	150	18	110	4	19	11,6
	50	230	227,0	144,5	M39	165	20	125	4	19	13,8
	65	290	272,5	180,0	M50	185	20	145	8	19	22,3
	80	310	284,0	184,0	M50	200	22	160	8	19	32,4
	100	350	335,5	218,0	M50	235	24	190	8	23	42,4
125	400	394,5	259,5	M50	270	26	220	8	28	67,5	
150	480	411,0	261,0	M50	300	26	250	8	28	91,5	

**Mating dimensions as per standard**

Face-to-face lengths: DIN EN 558/1, ISO 5752/1  
 Flanges: DIN EN 1092-2, flange type 21-2  
 Flange facing: DIN EN 1092-2, type B

**9.5 Dimensions and weights of electric actuator types EA-C 20 to EA-C 140**



Actuator, side view

Actuator with clearance for removal

Actuator	Actuating force	A	X	3-point 24 V AC/DC	3-point 230 V AC/DC
	[N]	[mm]	[mm]	[kg]	[kg]
EA-C 20	2000	425	120	6,0	7,0
EA-C 40	4500	425	120	6,0	7,0
EA-C 80	8000	455	120	9,0	10,0
EA-C 140	14000	520	120	10,0	10,0

## 10 EU Declaration of Conformity for BOA-H Mat E, BOA-H Mat P

Herewith we,

**KSB SE & Co. KGaA**  
Johann-Klein-Straße 9  
67227 Frankenthal (Germany)

declare that **the product:**

<b>BOA-H Mat E</b>	PN 16/25	DN 20 - 150
<b>BOA-H Mat P</b>	PN 16/25	DN 20 - 150

satisfies the safety requirements laid down in the Pressure Equipment Directive 2014/68/EU.

In addition, the essential safety requirements of Machinery Directive 2006/42/EC, Annex 1, have been taken into account, and suitable action has been taken to prevent any hazards identified.

**Applied harmonised European standards:**

Globe valves  
DIN EN 60534, DIN EN 12516-2, DIN EN 12516-3,  
DIN EN 12266-1, DIN EN 13789, DIN EN 1092-2,  
DIN EN 1092-1, AD 2000 code

**Other standards/codes:**

DIN 3840

**Suitable for:**

Fluids in Groups 1 and 2

**Conformity assessment procedure:**

Module H

**Name and address of the notified body responsible for approval and surveillance:**

TÜV SÜD Industrie Service GmbH  
Westendstraße 199  
80686 München (Germany)

**Identification number of the notified body:**

0036

**Other applicable directives:**

Electromagnetic compatibility: Directive 2014/30/EU  
Low-voltage Directive: Directive 2014/35/EU

Valves  $\leq$  DN 25 fall under Article 4, Section 3, of the Pressure Equipment Directive 2014/68/EU. They must bear neither the CE marking nor the identification number of a notified body.

The EU Declaration of Conformity was issued in/on:

Frankenthal, 1 February 2018



Wolfgang Glaub  
Vice President Integrated Management Germany



Dieter Hanewald  
Head of Development, Low-pressure Valves



## Index

### C

CE marking 13  
Certificate of Decontamination 36  
Commissioning/start-up 20

### D

Design 14  
Dismantling 25  
Dismantling the valve 25  
Disposal 12

### E

Event of damage 6

### F

Faults  
    Causes and remedies 30  
Fluids in Group 2 13  
Function 15

### I

Intended use 8

### K

Key to safety symbols/markings 7

### M

Maintenance 23  
Marking 13  
Maximum permissible closing pressures 32

### O

Operating limits 8  
Order number 6  
Other applicable documents 6

### P

Partly completed machinery 6  
Piping 18  
Preservation 11  
Pressure/temperature ratings 21

### R

Return to supplier 11  
Returning to service 22

### S

Safety 7  
Safety awareness 9  
Scope of supply 15  
Shutdown 21  
Storage 11

### T

Tightening torques  
    Actuator pillars 29  
    Bonnet nuts 29  
    Flange nuts 29  
    Gland packing 29  
Transport 10

### W

Warnings 7  
Warranty claims 6







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