

Control Valve

MIL 41000



Installation/Operating Manual





CONTROLS SUPPLY CHAIN
VALVES ACTUATORS INSTRUMENTATIONS

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Installation/Operating Manual MIL 41000

Original operating manual

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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 2014/68/EU (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.

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

1.2 Target group

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


1.3 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Type series booklet	Description of the valve
Data sheet	Description of the technical data for the automatic recirculation valve
General assembly drawing	Sectional drawing of the valve
List of components	Description of all components




1.4 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

1.5 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
 DANGER	DANGER This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
 WARNING	WARNING This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.



Symbol	Description
	Explosion protection This symbol identifies information about avoiding explosions in potentially explosive atmospheres in accordance with EU Directive 2014/34/EU (ATEX).
	General hazard In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	Electrical hazard In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	Machine damage In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.



2 Safety

2.1 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:
 - Manufacturer
 - Type designation
 - Pressure class
 - Nominal size
 - Flow direction arrow
 - Year of construction
 - 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 regulations and directives for pressure equipment.
- 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 any eventualities or incidents which may occur during installation performed by the customer, operation and maintenance.

2.2 Intended use

- Only operate valves which are in perfect technical condition.
- Do not operate the valve in partially assembled condition.
- 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.
- The valve's design and rating are based on predominantly static loading in accordance with the codes applied. Consult the manufacturer if the valve is subjected to dynamic loads or any other additional influences.
- Consult the manufacturer about any other modes of operation not described in the product literature.
- Do not use the valve as a foothold.



2.3 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.
- Training on the valve must always be supervised by specialist technical personnel.

2.4 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

2.5 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

2.6 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 accessible to 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 touch rotating parts.
- 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.)



2.7 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.
- Use suitable tools for maintenance, inspection and installation.
- Carry out work on the valve during standstill only.
- 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.
- Decontaminate valves which handle fluids posing a health hazard.
- Protect the valve body and the bonnet 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. (⇒ Section 6.1, Page 23)

2.8 Unauthorised modes of operation

- The valve is operated outside the limits stated in the operating manual.
- The valve is not operated in accordance with the intended use.



(⇒ Section 2.2, Page 8)

3 Transport/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

	<div style="background-color: red; color: white; padding: 5px;">⚠ DANGER</div> <p>The valve/actuator unit could slip out of the suspension arrangement. Danger to life from falling parts!</p> <ul style="list-style-type: none"> ▷ Only transport the valve/actuator unit in the specified position. ▷ Never attach lifting accessories to the actuator. ▷ Observe the information on weights, centre of gravity and fastening points. ▷ Observe the applicable local accident prevention regulations. ▷ Use suitable, permitted lifting accessories, e.g. self-tightening lifting tongs.
	<div style="background-color: yellow; padding: 5px;">CAUTION</div> <p>Improper transport Damage to the valve!</p> <ul style="list-style-type: none"> ▷ Protect the valve and components against external forces (e.g. impacts, blows, vibrations).

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



A



B



C

Fig. 1: Transporting the valve


Table 4: Transporting the valve

Photo	Weight [kg]	Transport
A	< 500	Attach the lifting accessory to the actuator's eye-bolt.
B	> 500 to < 1200	Run the lifting accessories through the actuator yoke.
C	> 1200	Attach the lifting accessories to the flanges. Use four ropes for transport. Tie them together directly under the upper section of the actuator to prevent the valve from tilting.

1. Upon receipt, unpack the valve and check it for in-transit damage.
2. Report any in-transit damage to the manufacturer immediately.
3. Dispose of packaging material in accordance with local regulations.

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>CAUTION</p> <p>Damage due to frost, humidity or dirt Corrosion/contamination of the valve!</p> <ul style="list-style-type: none"> ▷ Store the valve in a dry, dust-free and vibration-free, frost-proof room where the atmospheric humidity is as constant as possible. ▷ Protect the valve against contamination, e.g. with suitable caps or film.
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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.


For storing a valve which has already been operated, observe the measures to be taken for shutdown. (⇒ Section 6.3, Page 24)

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>NOTE</p> <p>If required, a blank certificate of decontamination can be downloaded from the following web site: www.ksb.com/certificate_of_decontamination</p>
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3.5 Disposal

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

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 Description of the Valve

4.1 General description

- Cage-guided single-seated control valve

Valve for controlling fluids in industry, power stations, process engineering, chemical and petrochemical engineering.

4.2 Product information

4.2.1 Product information as per Pressure Equipment Directive 2014/68/EU (PED)

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.

4.2.2 Product information as per Regulation No. 1907/2006 (REACH)

For information as per European chemicals regulation (EC) No. 1907/2006 (REACH) see <https://www.ksb.com/en-global/company/corporate-responsibility/reach>.

4.3 Designation

Table 5: Designation example

Position						
1	2	3	4	5	6	7
3	7	4	1	1	0	4

Table 6: Designation key

Position	Code	Description
1-2	Actuator type	
	20	Manual actuation
	37	Diaphragm actuator (air-to-close)
	38	Diaphragm actuator (air-to-open)
	67	Piston actuator (air-to-close)
	68	Piston actuator (air-to-open)
	90	Electric actuator
3-4	Design	
	41	Cage-guided single-seated control valve in straight-way pattern
	71	Cage-guided single-seated control valve in angle pattern
5	Valve disc design	
	0	Undefined
	1	Low flow, unbalanced
	2	With pressure-energised polymer seal ring (static)
	3	With pressure-energised polymer seal ring (dynamic)
	4	With pilot plug
	5	With metal seal ring
	6	With polymer seal ring
	7	High flow, unbalanced
	8	With pilot plug, soft-seated
	9	With graphite seal ring
6	Trim characteristic	
	0	Undefined
	1	Linear
	2	Equal-percentage

Position	Code	Description
6	3	Modified equal-percentage
	X	On/off
7	Seat type	
	0	Undefined
	1	Standard
	2	Single-stage, anti-cavitation / low-noise version
	3	Multistage, version with diffuser seat
	4	Multistage, low-noise version
	5	Multistage, directional diffuser
	6	Multistage, anti-cavitation version, flow-to-open
	7	Multistage, anti-cavitation version, flow-to-close
	8	Low-flow control
	9	High pressure, micro flow
	X	Multistage, with valve disc control

4.4 Marking

Table 7: General marking

Parameter	Values
Nominal size [inch]	NPS ...
Nominal pressure class	Class ...
Manufacturer's mark	KSB
Type series/Model	MIL ...
Year of construction	20..
Material
Flow direction arrow	→
Traceability of the material
CE conformity marking(if required and possible)	CE
Identification number of the notified body	0045
Customer's marking	E.g. plant/system No., etc.

In accordance with the current regulations and directives for pressure equipment the valves are marked as shown in the following table:

Fluids in Groups 1 and 2

Class	< 1"	1 ¼"	1 ½"	2"	> 2"
	25	32	40	50	> 50
150					
> 300					

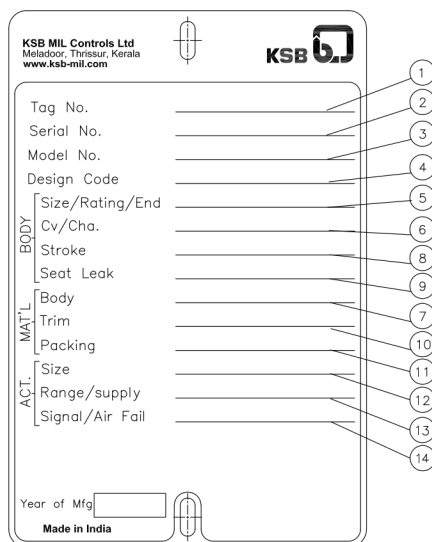
Fig. 2: CE conformity marking: Fluids in Groups 1 and 2

Fluid groups In accordance with the current regulations and directives for pressure equipment, Group 1 comprises all fluids posing physical or health hazards, e.g. fluids defined as

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

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

4.5 Name plate



KSB MIL Controls Ltd
 Meladour, Thrissur, Kerala
 www.ksb-mil.com

Tag No. _____
 Serial No. _____
 Model No. _____
 Design Code _____
 Size/Rating/End _____
 Cv/Cha. _____
 Stroke _____
 Seat Leak _____
 Body _____
 Trim _____
 Packing _____
 Size _____
 Range/supply _____
 Signal/Air Fail _____

Year of Mfg _____
 Made in India

1: Tag No.
 2: Serial No.
 3: Model No.
 4: Design Code
 5: Size/Rating/End
 6: Cv/Cha.
 7: Body
 8: Stroke
 9: Seat Leak
 10: Trim
 11: Packing
 12: Size
 13: Range/supply
 14: Signal/Air Fail

Fig. 3: Valve name plate (example)

1	TAG number	2	Serial number
3	Model number	4	Design
5	Nominal valve size	6	Cv value
7	Valve body material	8	Actuator stroke
9	Leakage class	10	Trim material
11	Gland packing material	12	Actuator size
13	Spring range	14	Actuating signal

4.6 Design details

Design

- Cage-guided single-seated control valve
- PTFE gland packing $\leq 180^\circ\text{C}$
- Graphite gland packing $> 180^\circ\text{C}$
- Clamped seat ring
- Rangeability 100:1 for version with standard trim
- Standard bonnet: temperature range -29°C to 566°C
- Leakage classes III and IV to ANSI FCI 70.2

Variants

- Two-stage design with anti-cavitation / low-noise plug
- Balanced valve disc with spring-loaded, metal, polymer or graphite seal ring
- Balanced valve disc with pilot plug
- Unbalanced valve disc without seal ring
- Eco-Lock gland packing to ISO 15848-1 fugitive emission requirements
- Spring-loaded gland packing (live loading)
- Rangeability 50:1 for version with anti-cavitation / low-noise trim
- Extended bonnet: temperature range -100°C to -30°C
- Cryogenic bonnet: temperature range -196°C to -100°C
- Flanged body with raised-face flanges (RF)
- Flanged body with ring joint flanges (RTJ)



- Butt weld ends (BW)
- Angle pattern with polymer seal ring MIL 71000
- Leakage class V to ANSI FCI 70.2

4.7 Function

Design Rugged, heavy valve disc guiding section provides maximum support and valve disc stability. The valve disc is guided to its seat by the cage. This valve disc guiding feature prevents trim vibrations and offers various options of reducing noise and preventing cavitation.

Stem sealed by gland packing The gland packing is tightened at the gland follower (4) by studs (2) and nuts (3).

Function The valve is operated by a pneumatic actuating element (actuator).

4.8 Scope of supply

Depending on the model, the following items are included in the scope of supply:

- Valve
- Actuator
- Valve operating manual
- Actuator operating manual


4.9 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

Responsibility for positioning and installing the valve lies with the consultant, the engineering contractor or the operator. Planning errors and installation errors can prevent the reliable function of the valves and pose a substantial safety hazard.

	<div style="background-color: #f4a460; padding: 5px; border: 1px solid black; margin-bottom: 5px;"> ⚠ WARNING </div> <p>Damage to pressure enclosure or add-on parts</p> <p>Leakage from or rupture of the valve</p> <p>Valve/add-on parts not functional</p> <ul style="list-style-type: none"> ▷ Check the valve for in-transit damage prior to installation. ▷ Check any add-on parts for in-transit damage. ▷ Do not install damaged valves.
---	---

5.2 Installation position

Control valves with actuators should preferably be installed vertically in horizontal pipes (position 1). Installation with the stem in an inclined or horizontal position, e.g. in vertical pipes (positions 2 and 5), is also permitted. Site-supplied supports must be provided for actuators installed in a horizontal position (position 5a). Avoid any installation positions with the actuator hanging downward (positions 3 and 4, risk of malfunction).

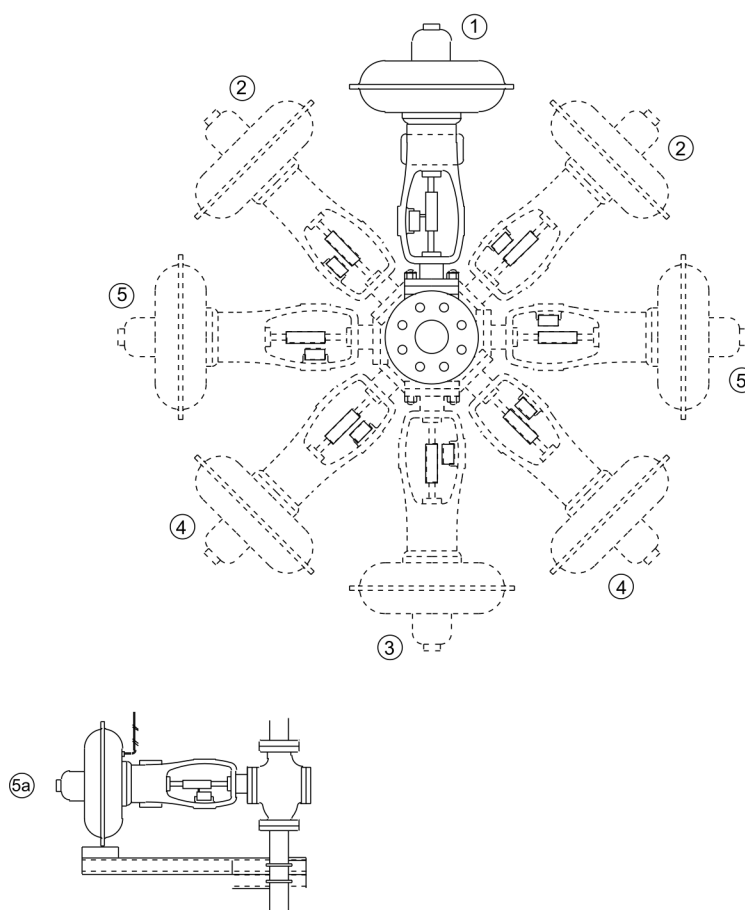



Fig. 4: Installation positions

The valve bodies are marked with an arrow indicating the flow direction.


Install the valves in such a way that the actual flow direction of the fluid matches the arrow on the valve body.


5.3 Preparing the valve


	CAUTION
	Outdoor installation Damage due to corrosion! ▷ Provide weather-proof protection to protect the valve against moisture.

1. Thoroughly clean, flush and blow through all vessels, pipes and connections.
2. Remove the protective covers on both body ends before installing the valve in the pipe.
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 pipe.

5.4 Piping

	WARNING
	Impermissible piping forces Leakage from or rupture of the valve body! ▷ Connect the pipes to the valve without transmitting any stresses or strains. ▷ Take structural measures to prevent any piping forces from being transmitted to the valve. ▷ Avoid mechanical loads beyond normal levels, e.g. piping forces, moments and vibrations.

	CAUTION
	Weld beads, scale and other impurities Damage to the valve! ▷ Take suitable measures to protect the valve against impurities. ▷ Remove any impurities from the piping. ▷ If necessary, install a strainer.

	CAUTION
	Painting of the piping Valve function impaired! Loss of important information provided on the valve! ▷ Protect stem and plastic components prior to applying paint. ▷ Protect printed name plates prior to applying paint.

5.4.1 Flange connection

Fasteners Only use fasteners and sealing elements of approved materials. Always use all flange bolt holes provided when connecting the valve to the pipe.

Flange connection

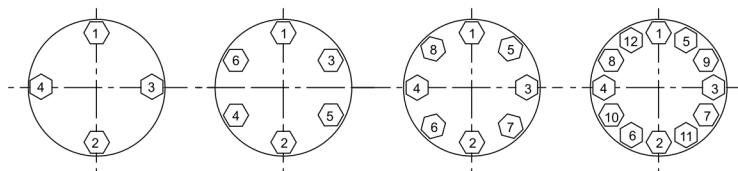





Fig. 5: Sequence for flange bolt tightening

- ✓ The mating flange faces are clean and undamaged.
- ✓ Fasteners and sealing elements are available.
- ✓ Verify that the pipe is correctly aligned and the flanges are parallel.
 1. Align the valve between the pipe flanges.
 2. Use an appropriate tool to evenly tighten the fasteners in the specified tightening sequence.

5.4.2 Welding the valve into the pipe


Responsibility for welding the valve into the pipe and for any heat treatment required lies with the commissioned construction company or the plant operator.

	<p>CAUTION</p> <p>Weld beads, scale and other impurities Damage to the valve!</p> <ul style="list-style-type: none"> ▷ Take suitable measures to protect the valve against impurities. ▷ Remove any impurities from the piping. ▷ If necessary, install a strainer.
	<p>CAUTION</p> <p>Incorrect earthing during welding work on the piping Damage to the valve (scorching)!</p> <ul style="list-style-type: none"> ▷ Never earth the electric welding equipment on the valve's functional parts.

	<p>CAUTION</p> <p>Non-compliance with the max. permissible application temperature</p> <p>Damage to the valve!</p> <ul style="list-style-type: none"> ▷ Complete the weld seam in several steps to ensure that the temperature in the middle of the body does not exceed the max. permissible application temperature.
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- The welding process, filler metals as well as welding data are defined by the responsible welding authority.
- Provide sufficient clearance for removal of the valve and, if necessary, the actuator.
- Maintain cleanliness when welding the valve into the pipe. No contaminants must enter the inside of the valve body; otherwise the seat/disc interface and/or the stem may become damaged.
- ✓ The valve is installed in accordance with the appropriate piping isometry.
- ✓ Comply with the welding processes, filler metals and welding data laid down in the documented welding procedure.
- ✓ The weld ends of valve and pipe have been centred.
 1. Verify that the butt weld ends are clean and undamaged.
 2. Prior to welding the valve into the pipe, run the valve disc to the middle position.
 3. Weld the valve into the pipe in such a way that the valve/pipe welds are not subjected to stresses, strains or torsion. During the welding process, make sure the gap towards the pipe is uniform and without any radial offset.

5.5 Valves with actuator

	<p>NOTE</p> <p>If the valves are fitted with actuators, ensure that the actuator's operating manual is also observed.</p>
---	--

Pneumatic actuators

Connecting the control air supply

	<p>⚠ DANGER</p> <p>Work on valves with energy storage, e.g. spring mechanisms or compressed air storage</p> <p>Danger to life resulting from incorrect assembly</p> <ul style="list-style-type: none"> ▷ Ensure that work on the actuator is performed by qualified specialist personnel. ▷ Observe the actuator's operating manual.
---	--

For pneumatic actuators, the control pressures specified on the name plate must be observed. Non-observance may damage the actuator.

If required, consult the manufacturer for closing torques and opening torques or actuating forces.


Changing the stroke

The stroke can be changed on site.

- Shortening stroke: Extend the stem by the respective difference.
- Extending stroke: Shorten the stem by the respective difference.

For a new stem, contact the manufacturer.

5.6 Insulation

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



For any insulation fitted on the valve observe the following:

- The valve's function must not be impaired.
- The bonnet must remain freely accessible and visible.

6 Commissioning/Start-up/Shut-down

6.1 Commissioning/Start-up

6.1.1 Prerequisites for commissioning/start-up



	 DANGER
	<p>Risk of pressure surges / water hammer Danger to life caused by burns or scalds!</p> <ul style="list-style-type: none"> ▷ Do not exceed the valve's maximum permissible pressure. ▷ The operator shall provide general safety measures for the system.

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. (⇒ Section 6.2, Page 23)
- The material's chemical resistance and stability under load have been checked.

6.1.2 Actuation/operation

The valve is operated by means of a pneumatic actuator.

	 WARNING
	<p>Improper handling of pneumatic actuator Crushing of fingers! Damage to the actuator or the valve!</p> <ul style="list-style-type: none"> ▷ Ensure that any objects and parts of the body are removed from the actuator coupling area prior to starting the actuator.

6.2 Operating Limits

6.2.1 Pressure/temperature ratings

Table 8: Permissible operating pressure [bar] (to ASME B16.34)

Class	[°C]															
	-29 to 38	50	100	150	200	250	300	325	350	375	400	425	450	475	500	538
150	19,8	19,5	17,7	15,8	13,8	12,1	10,2	9,3	8,4	7,4	6,5	5,5	4,6	3,7	2,8	1,4
300	51,7	51,7	51,5	50,2	48,6	46,3	42,9	41,4	40,0	37,8	34,7	28,8	23,0	17,1	11,6	5,9
600	103,4	103,4	103,0	100,3	97,	92,7	85,7	82,6	80,0	75,7	69,4	57,5	46,0	34,2	23,2	11,8
900	155,1	155,1	154,6	150,5	145,8	139,0	128,6	124,0	120,1	113,5	104,2	86,3	69,0	51,3	34,7	17,7
1500	258,6	258,6	257,6	250,8	243,2	231,8	214,4	206,6	200,1	189,2	173,6	143,8	115,0	85,4	57,9	29,5
2500	430,9	430,9	429,4	418,1	405,4	386,2	357,1	344,3	333,5	315,3	289,3	239,7	191,7	142,4	96,5	49,2

6.2.2 Ambient temperature

Observe the following parameters and values during operation:

Table 9: Permissible ambient temperatures

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

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 pneumatic actuator as specified in the actuator's operating manual.


6.4 Returning to service

For returning the equipment to service, observe the sections on commissioning/start-up (⇒ Section 6.1, Page 23) and the operating limits (⇒ Section 6.2, Page 23) .


In addition, carry out all servicing/maintenance operations before returning the valve to service. (⇒ Section 7, Page 25)


7 Servicing/Maintenance

7.1 Safety regulations


	⚠ DANGER
	<p>Valve under pressure Risk of injury! Leakage of hot and/or toxic fluids! Risk of burns!</p> <ul style="list-style-type: none"> ▷ Depressurise the valve and its surrounding system prior to any maintenance work and installation work. ▷ If there is fluid leakage, depressurise the valve. ▷ Allow the valve to cool down until the temperature of the fluid in all valve areas in contact with the fluid is lower than the fluid's vaporisation temperature. ▷ Use original spare parts and appropriate tools, even in emergencies.

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

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

	⚠ WARNING
	<p>Actuator parts moving due to pre-loaded springs when auxiliary energy supply fails Risk of injury!</p> <ul style="list-style-type: none"> ▷ Observe the actuator's operating manual.

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.


	NOTE
	<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>

	NOTE
	<p>All maintenance work, service work and installation work can be carried out by KSB Service or authorised workshops. Find your contact in the attached Addresses booklet or visit https://www.ksb.com/en-global/contact.</p>

Never use force when dismantling and reassembling the valve.

7.2 Servicing/inspection

7.2.1 Supervision of operation

	⚠ DANGER
	Leakage at gland packing Fluid escaping into the environment! <ul style="list-style-type: none"> ▷ Tighten the gland packing until no more fluid escapes. ▷ If re-tightening of the screwed/bolted connection does not restore seal integrity, the gland packing must be replaced.

- Monitor the gland packing.
If any leakage occurs at the gland packing, re-tighten the bolts/screws to ensure the valve is sealed to atmosphere.

7.2.2 Maintenance and inspection with the valve installed

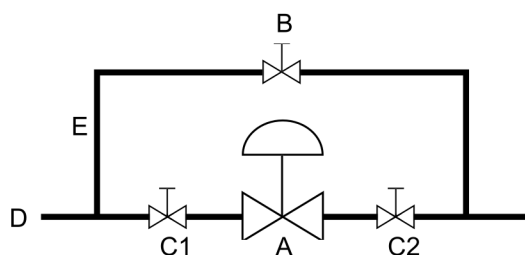



Fig. 6: Piping schematic

A	Control valve
B	Bypass shut-off valve
C1	Shut-off valve
C2	Shut-off valve
D	Main pipe
E	Bypass line

1. Close shut-off valve C1.
 2. Open bypass shut-off valve B.
 3. After the control valve has been drained, close shut-off valve C2.
- ⇒ The fluid flows through the bypass line.

7.2.3 Inspection work

7.2.3.1 Lapping the seat

	CAUTION
	Improper lapping of seating surfaces Damage to the seating surfaces of seat ring and valve disc! <ul style="list-style-type: none"> ▷ Always have lapping performed by trained personnel. ▷ Use a suitable paste for lapping. ▷ Ensure that line contact is maintained. Maintain the different seating surface angles of pilot plug, valve disc and seat ring.

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NOTE

If tight shut-off cannot be restored by lapping, the seat ring and valve disc must be replaced.

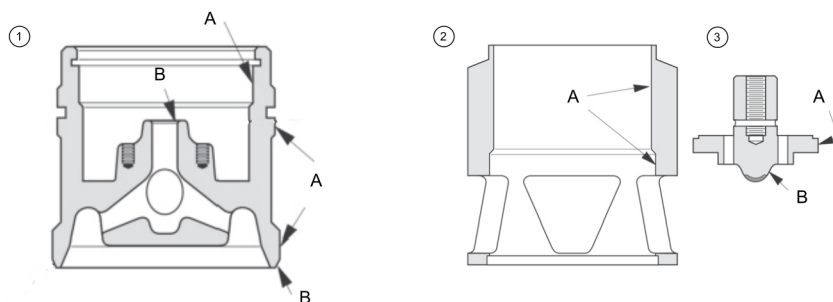


Fig. 7: Guiding surfaces and seating surfaces

①	Valve disc	A	Guiding surface
②	Cage	B	Seating surface
③	Pilot plug		

Maximum material removed from valve disc:

- < 0.25 mm (0.010 in.) for sizes of 50 mm, 80 mm to 100 mm (2 in., 3 in. and 4 in.)
- < 0.4 mm (0.015 in.) for sizes of 150 mm to 800 mm (6 in. to 32 in.)

Maximum material removed from pilot plug:

- < 0.25 mm (0.010 in.) for sizes of 50 mm, 80 mm to 100 mm (3 in. and 4 in.)
- < 0.4 mm (0.015 in.) for sizes of 150 mm to 500 mm (6 in. to 20 in.)

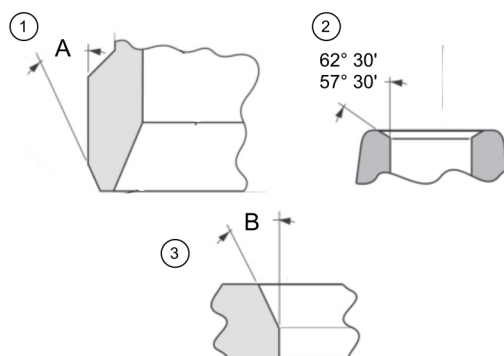


Fig. 8: Seating surface angles

①	Valve disc
②	Pilot plug
③	Seat ring

Table 11: Seating surface angles

Version	Angle A [°]	Angle B [°]
MIL 41100	45	47
MIL 41200	45	47
MIL 41300	32	30
MIL 41400	32	30
MIL 41500	32	30

Version	Angle A	Angle B
	[°]	[°]
MIL 41600	32	30
MIL 41900	32	30

7.2.3.1.1 Lapping the pilot plug seat

MIL 41400

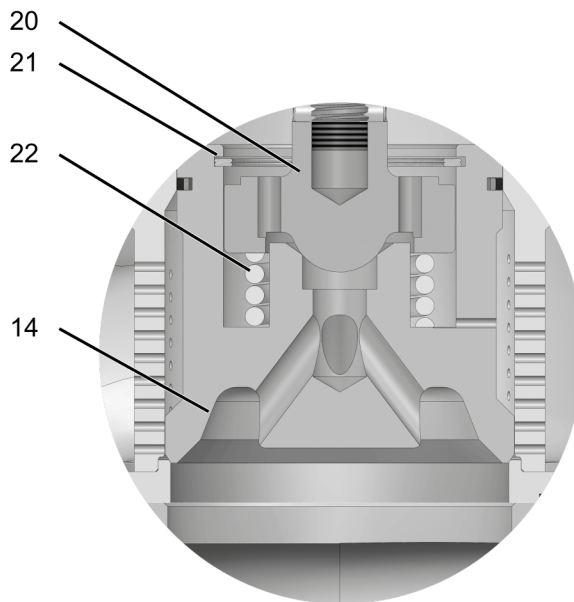



Fig. 9: Version MIL 41400 - detailed view of pilot plug

Part No.	Description
14	Valve disc
20	Pilot plug
21	Circlip
22	Spring

- ✓ The pilot plug (20) and its seat are free from major scratches and any other damage.
- ✓ Suitable pastes are available.
 1. Clean the seating surfaces.
 2. Apply a suitable lubricant to the seating area of the pilot plug (20).
 3. Guide the stem/pilot plug assembly (1/20) without the spring (22) into its seat in the valve disc (14).
 4. Place a drilled and tapped rod with a T-handle onto the stem (1) and secure it with a locknut. As an alternative: Drill a hole through a flat steel plate and fasten the plate to the stem using two locknuts.
 5. Apply slight pressure and rotate the stem (1) in short back and forth turns (approx. 8 to 10 times).

6. Lift the stem/pilot plug assembly (1/20) and turn it by 90°. If necessary, repeat the procedure.


	<p>CAUTION</p> <p>Avoid excessive lapping Damage to the seating surfaces of the pilot plug and its seat in the valve disc!</p> <ul style="list-style-type: none"> ▷ Always have lapping performed by trained personnel. ▷ Use a suitable paste for lapping. ▷ Make sure that the pilot plug and its seat in the valve disc are concentric.
---	---

7. Carefully pull out the stem/pilot plug assembly (1/20).
8. Thoroughly clean the seating surfaces.

7.2.3.1.2 Lapping the valve disc seat

MIL 41100, MIL 41200,
MIL 41300, MIL 41400,
MIL 41500, MIL 41600,
MIL 41700, MIL 41900,



- ✓ The valve disc (14) and the seat ring (16) are free from major scratches and any other damage.
 - ✓ Suitable pastes are available.
1. Clean the seating surfaces.
 2. Apply lapping paste to the seating surfaces of the valve disc (14) and the seat ring (16).
 3. Insert the cage (15) into the body (18).
 4. Carefully slide the stem/valve disc assembly (1/14) into the body (18) until it will not go any further.
 5. Place the bonnet (8) onto the body (18).
 6. Align the seat ring (16), the cage (15) and the stem/valve disc assembly (1/14).
 7. Connect the body (18) and the bonnet (8) using studs (9) and nuts (10).
 8. Evenly tighten the nuts (10) crosswise exerting slight pressure.
 - ⇒ Do not tighten the nuts (10) to the final tightening torque.
 9. Insert two or three packing rings of the gland packing (7) into the gland packing chamber.
 - ⇒ The stem/valve disc assembly (1/14) will be guided during the lapping process.
 10. Place a drilled and tapped rod with a T-handle onto the stem (1) and secure it with a locknut. As an alternative: Drill a hole through a flat steel plate and fasten the plate to the stem using two locknuts.
 11. Apply slight pressure and rotate the stem (1) in short back and forth turns (approx. 8 to 10 times).
 12. Lift the valve disc (14) and rotate it by 90°. If necessary, repeat the procedure.

	<p>CAUTION</p> <p>Avoid excessive lapping Damage to the seating surfaces of seat ring and valve disc!</p> <ul style="list-style-type: none"> ▷ Always have lapping performed by trained personnel. ▷ Use a suitable paste for lapping. ▷ Ensure the valve disc and seat ring are concentric.
---	---

13. Undo the nuts (10).
14. Remove the bonnet (8).
15. Carefully pull out the stem/valve disc assembly (1/14).
16. Thoroughly clean the seating surfaces of the seat ring (16) and valve disc (14).
17. Remove the cage (15), the seat ring (16) and the spiral wound gasket (11) from the body (18).

7.2.4 Dismantling the valve

7.2.4.1 General information/Safety regulations

	<p>⚠ WARNING</p> <p>Hot surface Risk of injury!</p> <ul style="list-style-type: none"> ▷ Allow the valve to cool down to ambient temperature.
	<p>⚠ WARNING</p> <p>Unqualified personnel performing work on the valve Risk of injury!</p> <ul style="list-style-type: none"> ▷ Always have repair work and maintenance work performed by specially trained, qualified personnel.

Always observe the safety instructions and information. (⇒ Section 7, Page 25)


In the event of damage you can always contact KSB Service.

7.2.4.2 Preparing the valve

1. Interrupt the power supply and make sure it cannot be switched on again unintentionally.
2. Depressurise and drain the valve. (⇒ Section 7.2.2, Page 26)
3. Remove the actuator as specified in the actuator's operating manual.
4. Remove the accessories as described in the operating manual.

7.2.4.3 Removing the bonnet

- ✓ The steps and notes stated in (⇒ Section 7.2.4.1, Page 30) to have been observed or carried out.
1. Undo and remove the nuts (3) of the gland follower (4).
 2. Pull off the gland follower (4) and the thrust insert (5).
 3. Undo and remove the nuts (10) that connect the body (18) to the bonnet (8).
 4. Clean the exposed part of the stem (1).
 5. Push the stem (1) downwards until the valve disc (14) sits in its seat (16).

	<p>CAUTION</p> <p>Improper removal of the bonnet Damage to the stem or cage!</p> <ul style="list-style-type: none"> ▷ Avoid jamming of the bonnet during removal. ▷ To facilitate dismantling, insert two pieces of tapered flat stock, offset from each other by 180°, into the joint between bonnet and body. Alternatively, two heavy screwdrivers, offset from each other by 180°, can be used. ▷ Apply even pressure.
---	---

6. Evenly and squarely lift off the bonnet (8).
⇒ The stem/valve disc assembly (1/14) and cage (15) remain in the body (18).
7. Remove the gland packing (7), spacer ring / lantern ring (6) and guide bush (23) from the bonnet (8).
8. **Valves > 6 in. (150 mm):** Remove the disc spring (19).
9. Remove the spiral wound gasket (11).

7.2.4.4 Removing the gland packing

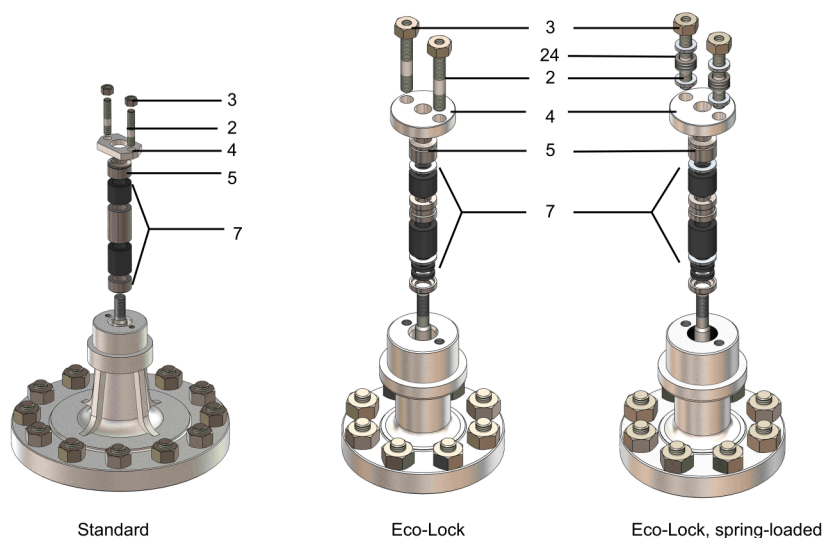



Fig. 10: Exploded view of gland packings

Part No.	Description
7	Gland packing
5	Thrust insert
4	Gland follower
3	Nut
2	Stud
24	Disc spring

✓ The steps stated in (⇒ Section 7.2.4.1, Page 30) to (⇒ Section 7.2.4.2, Page 30) have been carried out.

1. Undo and remove the nuts (3) of the gland follower (4).
2. Pull off the gland follower (4) and the thrust insert (5).
3. Remove the gland packing (7) using a hooked tool.
⇒ Do not damage the gland packing chamber and the stem (1)!
4. Completely remove the gland packing (7).
5. Clean the gland packing chamber and the stem (1).

7.2.4.5 Removing the valve disc and cage from the body

	<p>CAUTION</p> <p>Damage to the seat ring and guiding surfaces of valve disc, seat ring and cage Leakage at the seat/disc interface</p> <ul style="list-style-type: none"> ▷ Work very carefully to avoid damage during assembly/dismantling. ▷ Never strike the seating surfaces.
---	--

MIL 41400, MIL 41500, MIL 41600, MIL 41900

1. Pull the stem/valve disc assembly (1/14) upwards and out of the body (18).
⇒ This removes the valve disc (14) and cage (15) from the body (18).
2. Lift the cage (15) off the stem (1).

MIL 41100, MIL 41200, MIL 41300, MIL 41700

1. Pull the stem/valve disc assembly (1/14) upwards and out of the body (18).
⇒ This removes the valve disc (14) from the body (18). The cage (15) remains in the body (18).
2. Pull the cage (15) out of the body (1).
3. **For MIL 41200 only:** On versions with clamped cage, remove the sealing element (13).
⇒ For MIL 41100 and MIL 41700 the sealing element (13) does not need to be removed.

MIL 41900

1. On versions with valve disc (14) with sealing element (13) made of graphite, carefully remove the cage from the valve disc.
⇒ Take care not to damage the sealing element (13) made of graphite.

7.2.4.6 Removing the seat ring

1. Remove the seat ring (16) and spiral wound gasket (17) from the body.

7.2.4.7 Removing the stem/valve disc assembly

7.2.4.7.1 Removing the stem from the valve disc

MIL 41100, MIL 41200,
 MIL 41300, MIL 41400,
 MIL 41500, MIL 41600,
 MIL 41700, MIL 41900,

Unscrewing the stem from the valve disc

- ✓ The pin (12) and the stem (1) have been removed.

 1. Hold the valve disc (14) in place using a vice with protective jaws.
 2. Lock two nuts against each other at the end of the stem.
 3. Use a spanner to hold the lower nut and unscrew the stem (1) from the valve disc (14) in anti-clockwise direction.

7.2.4.7.2 Removing the pilot plug

MIL 41400

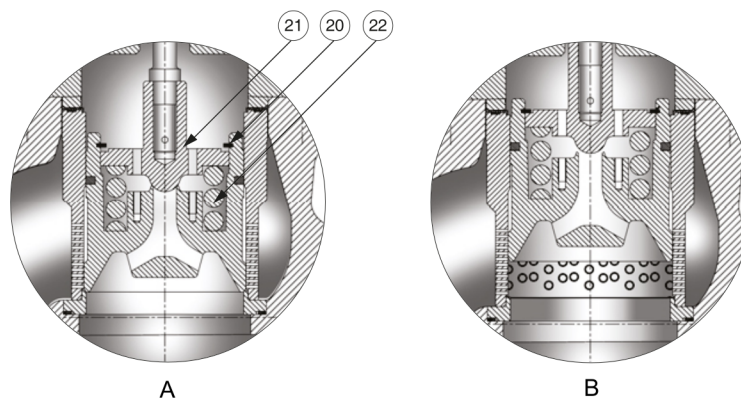


Fig. 11: Pilot plug

A	Pilot plug closed
B	Pilot plug open

Valve sizes 3 in. or 4 in. (80 mm or 100 mm)

1. Apply pressure on the pilot plug (20).
2. Remove the circlip (21).
3. Pull the pilot plug (20) and spring (22) off the valve disc (14).

Valve sizes 6 in. to 20 in. (150 mm to 500 mm)

Table 12: Pilot plug dismantling screws


Valve size		Qty	Length		Size
[inch]	[mm]		[inch]	[mm]	
6	150	2	2,25	57	$\frac{1}{4}$ - 20 UNC - 2 A
8	200	2	2,75	70	$\frac{3}{8}$ - 16 UNC - 2 A
10	250	2	2,5	63,5	$\frac{3}{8}$ - 16 UNC - 2 A
12	300	3	4,00	101,5	$\frac{3}{8}$ - 16 UNC - 2 A
16	400	3	2,50	63,5	$\frac{3}{8}$ - 16 UNC - 2 A
20	500	3	6	150	$\frac{3}{8}$ - 16 UNC - 2 A

✓ The hexagon socket head cap screws specified in the table are available.

1. Insert hexagon socket head cap screws through the drilled holes provided in the pilot plug (20).
2. Screw in the hexagon socket head cap screws in several increments until the circlip (21) can be removed.
3. Undo the hexagon socket head cap screws in several increments.
4. Pull the pilot plug (20) and spring (22) off the valve disc (14).

7.2.5 Assembling the valve


7.2.5.1 General information/Safety regulations

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

Spiral wound gaskets Always use new spiral wound gaskets. Ensure that the new gaskets have the same geometric characteristics as the old ones.

Lubricant The lubricant and sealing elements are compatible with the process fluid.

7.2.5.2 Fitting the gland packing

	NOTE
	<p>Always replace the complete gland packing.</p> <p>In an emergency, string packing may be used as a temporary repair measure only. A new gland packing as specified must be installed as soon as possible.</p>

The gland packing comprises a lower and an upper packing set:

- Standard gland packing: Height of packing sets is identical.
 - Eco-Lock gland packing: The upper packing set is higher than the lower packing set. Can only be replaced as a set.
 - ✓ The required spare parts are available.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The stem and the gland packing chamber are dry and free from grease.
 - ✓ The gland packing chamber is free from foreign matter, burrs and rust.
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 the packing rings into the gland packing chamber individually. The joints of the individual packing rings must be staggered by 120°. Observe the sequence indicated in the exploded view. (⇒ Fig. 10)
 3. Fit the thrust insert (5).
 4. Fit the gland follower (4).
 5. If applicable, fit the disc springs (24) on the studs (2) for spring-loaded gland packings.
 6. Fit the nuts (3) on the studs (2).
 7. Do not tighten the nuts (3) excessively.
 8. Install the actuator as specified in the actuator's operating manual.
 9. Return the valve to service.
 10. Tighten the gland packing (7) such that fluid no longer escapes.

7.2.5.3 Installing the stem/valve disc assembly

Securing the stem with a locking pin is required when:

- Replacing the stem and valve disc
- Replacing the stem

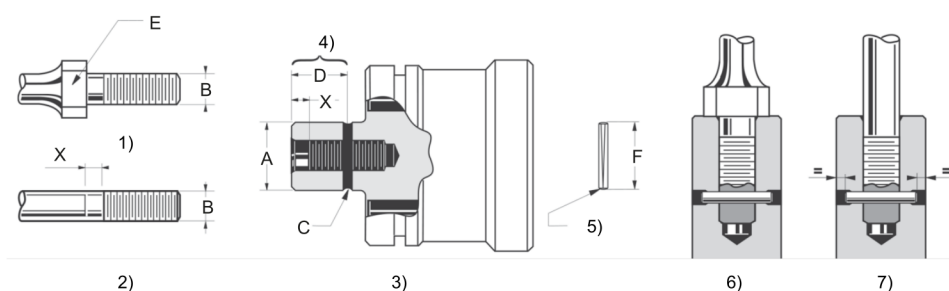


Fig. 12: Sectional drawings of valve disc guiding section, vice

1)	Shouldered stem	A	Valve disc shank diameter
2)	Standard stem	B	Stem thread diameter
3)	Drilled hole in valve disc guiding section	C	Pin diameter
4)	Valve disc shank	D	Drilled hole position
5)	Pin	E	Spanner size
6)	Shouldered stem: correct pin position	F	Pin length
7)	Standard stem: correct pin position	X	Distance of reference marking


Table 13: Dimensions for connecting the stem and valve disc

B		A		C		F		D		X		E	
[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]	[inch]	[mm]
$\frac{1}{2}$	12,7	0,79	20	0,14	323,5	0,70	18	0,91	23	0,24	6	$\frac{11}{16}$	17
$\frac{5}{8}$	15,87	0,98	25,5	0,2	5,0	0,95	24	1,1	28	0,30	8	$\frac{5}{8}$	22
$\frac{3}{4}$	19,05	1,38	35	0,2	5,0	1,2	30	1,77	45	0,75	19	$\frac{11}{16}$	27
1	24,4	1,66	44,5	0,2	5,0	1,58	40	1,88	47,5	0,98	25	$\frac{11}{4}$	30
2	50,8	4	100	0,5	12,0	3,8	96	3,8	96	2,0	50	2,3	60

Table 14: Tightening torques for connecting the stem and valve disc

Standard stem		Shouldered stem	
[Ft.lbs]	[Nm]	[Ft.lbs]	[Nm]
37	5	44	6
118	16	118	16
118	16	118	16
118	16	184	25
-	-	250	34

7.2.5.3.1 Connecting a new valve disc to the stem

	CAUTION
	<p>Damage to the stem/valve disc assembly</p> <p>Leakage at the valve!</p> <ul style="list-style-type: none"> ▷ Work very carefully to avoid damage during assembly/dismantling. ▷ Use a vice for cylindrical components or protective vice jaws made of plastic or soft metal.

Connecting the stem to the valve disc

- ✓ A vice for cylindrical components or with protective jaws made of plastic or soft metal is available.
 - ✓ A V-block is available.
 - ✓ The new stem is available.
 - ✓ The valve disc (14) and drilled hole are neither damaged nor deformed.
1. **Standard stem:** Measure the depth of the thread recess in the valve disc (14) (dimension X) and make a reference mark on the stem (1) at the same distance from the thread.
 2. Hold the valve disc (10) in place using a vice with protective jaws.
 3. **Standard stem:** Lock two nuts against each other at the end of the stem.
 4. **Standard stem:** Screw the stem (1) firmly into the valve disc (14) using a spanner to hold the upper nut in place.
 - ⇒ The reference mark should be flush with the end of the valve disc guiding section.
 5. **Shouldered stem:** Screw the stem (1) tightly into the valve disc (14), observing the specified tightening torque.

Drilling a hole into the new stem



NOTE

If the drilled hole in the valve disc guiding section has been slightly damaged when removing the pin, use a drill bit and pin with a slightly larger diameter than that of the normal pin.

- ✓ The stem (1) and the valve disc (14) have been screwed together.
 1. Place the valve disc guiding section into the V-block.
 2. Drill the stem (1) to the same diameter as that of the hole in the valve disc guiding section.
 3. Use the drilled hole in the valve disc (14) as a guide. Drill through the stem/valve disc assembly (1/14) using a suitable drill bit.

Fixing the stem/valve disc assembly with a pin

- ✓ A suitable pin (12) is available.
 1. Apply a lubricant to the pin.
 2. Insert the pin (12) into the drilled hole of the valve disc by hand.
 3. Press-fit the pin (12) into the drilled hole using a hammer.
 - ⇒ Check the correct position of the pin (12).
 4. Clamp the valve disc (14) into a lathe and check that the valve disc is concentric with the stem (1).
 5. If necessary, place the stem/valve disc assembly (1/14) in a collet chuck and align the valve disc (14).
 6. If necessary, adjust the position of the stem (1) using a soft-face mallet.

7.2.5.3.2 Connecting the new stem to the valve disc

Connecting the stem to the valve disc

- ✓ A vice for cylindrical components or with protective jaws made of plastic or soft metal is available.
- ✓ A V-block is available.
- ✓ The new stem is available.
- ✓ The valve disc (14) and drilled hole are neither damaged nor deformed.
 1. **Standard stem:** Measure the depth of the thread recess in the valve disc (14) (dimension X) and make a reference mark on the stem (1) at the same distance from the thread.
 2. Hold the valve disc (14) in place using a vice with protective jaws.
 3. **Standard stem:** Lock two nuts against each other at the end of the stem.
 4. **Standard stem:** Screw the stem (1) firmly into the valve disc (14) using a spanner to hold the upper nut in place.
 - ⇒ The reference mark should be flush with the end of the valve disc guiding section.
 5. **Shouldered stem:** Screw the stem (1) tightly into the valve disc (14), observing the specified tightening torque.

Drilling a hole into the new stem



NOTE

If the drilled hole in the valve disc guiding section has been slightly damaged when removing the pin, use a drill bit and pin with a slightly larger diameter than that of the normal pin.

- ✓ The stem (1) and the valve disc (14) have been screwed together.
 1. Place the valve disc guiding section into the V-block.
 2. Drill the stem (1) to the same diameter as that of the hole in the valve disc guiding section.
 3. Use the drilled hole in the valve disc (14) as a guide. Drill through the stem/valve disc assembly (1/14) using a suitable drill bit.

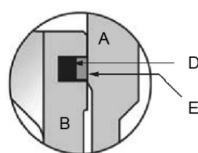
Fixing the stem/valve disc assembly with a pin

- ✓ A suitable pin (12) is available.
 1. Apply a lubricant to the pin.
 2. Insert the pin (12) into the drilled hole of the valve disc by hand.
 3. Press-fit the pin (12) into the drilled hole using a hammer.
 - ⇒ Check the correct position of the pin (12).
 4. Clamp the valve disc (14) into a lathe and check that the valve disc is concentric with the stem (1).
 5. If necessary, place the stem/valve disc assembly (1/14) in a collet chuck and align the valve disc (14).
 6. If necessary, adjust the position of the stem (1) using a soft-face mallet.

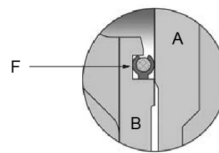
7.2.5.4 Fitting the seat ring

- ✓ The required spare parts are available.
- ✓ The seating surfaces and guiding surfaces are free from dirt, burrs or scale.
- ✓ Any damaged or worn parts have been replaced by original spare parts.
 1. Clean the seating surfaces and guiding surfaces.
 2. Fit a new spiral wound gasket (17).
 3. Insert the seat ring (16) into the body (8).

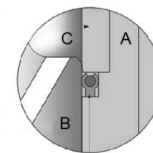
7.2.5.5 Fitting the valve disc and cage



MIL 41400
 MIL 41500
 MIL 41600
 MIL 41900




MIL 41300



G
 MIL 41200

Fig. 13: Detailed views of sealing elements


A	Cage	B	Valve disc
C	Clamping cage	D	Backing ring
E	Seal ring	F	Tec Seal ring
G	Static pressure-energised seal ring (PTFE + Ekonol)		

	<p style="text-align: center;">CAUTION</p> <p>Damage to the seat ring and guiding surfaces of valve disc, seat ring and cage Leakage at the seat/disc interface</p> <ul style="list-style-type: none"> ▷ Work very carefully to avoid damage during assembly/dismantling. ▷ Never strike the seating surfaces.
---	--

- ✓ The required spare parts are available.
 - ✓ All dismantled parts have been cleaned and checked for wear.
 - ✓ Any damaged or worn parts have been replaced by original spare parts.
 - ✓ The seating surfaces and guiding surfaces have been cleaned.
 - ✓ The seat ring has been installed. (⇒ Section 7.2.5.4, Page 37)
1. Select the version.

MIL 41100, MIL 41700: Fitting the valve disc and cage without seal ring

1. Slide the cage (15) over the stem/valve disc assembly (1/14) from above.
 2. Lower the stem/valve disc assembly (1/14) and cage (15) into the body (8).
- ⇒ Contact with the seat ring (16) has been established.

	<p style="text-align: center;">NOTE</p> <p>MIL 41200 and MIL 41300: For valves with Tec Seal ring, do not guide the cage (15) over the valve disc (14).</p>
---	---

MIL 41200: Fitting the valve disc and cage with static pressure-energised polymer seal ring

1. Insert the cage (15) into the body (8) and onto the seat ring (16).
 2. Insert the seal ring (13) with its sealing lip pointing upwards.
 3. Place the clamping cage over the cage (15).
 4. Lower the stem/valve disc assembly (1/14) into the cage (15).
- ⇒ Contact with the seat ring (16) has been established.

MIL 41300: Fitting the valve disc and cage with dynamic pressure-energised polymer seal ring

1. Guide the seal ring (13) with its sealing lip pointing upwards over the stem/valve disc assembly (1/14) from above.
 2. Evenly press the seal ring (13) downwards until it reaches the groove provided.
- ⇒ The seal ring (13) is seated in the groove in the valve disc (14).
3. Insert the cage (15) into the body (8) and onto the seat ring (16).
 4. Lower the stem/valve disc assembly (1/14) into the cage (15).
- ⇒ Contact with the seat ring (16) has been established.

MIL 41400: Fitting the valve disc, cage with metal seal ring and pilot plug

Version with metal seal ring. The inner ring has got a straight cut, the outer ring a staggered cut.

1. To insert the rings into the valve disc groove, open the rings by hand and guide them along the valve disc (14), taking care not to damage the parts. Fit the inner and outer rings separately.
2. The joints of the seal rings are arranged offset from each other by 180 °.
3. Insert the cage (15) into the body (8) and onto the seat ring (16).
4. Insert the valve disc (14) into the cage (15).

5. Insert the spring (22).
6. Insert and press down the stem/pilot plug assembly (1/20).
7. Insert the circlip (21).

MIL 41500: Fitting the valve disc and cage with metal seal ring

Version with metal seal ring. The inner ring has got a straight cut, the outer ring a staggered cut.

1. To insert the rings into the valve disc groove, open the rings by hand and guide them along the valve disc (14), taking care not to damage the parts. Fit the inner and outer rings separately.
2. The joints of the seal rings are arranged offset from each other by 180 °.
3. Slide the cage (15) over the stem/valve disc assembly (1/14) from above. Take care not to damage the seal ring.
4. Lower the stem/valve disc assembly (1/14) with the cage (15) into the body (8).
⇒ Contact with the seat ring (16) has been established.

MIL 41600: Fitting the valve disc and cage with polymer seal ring

Version with an inner elastomer backing ring and an outer PTFE seal ring.

1. Insert the backing ring into the groove provided in the valve disc (14).
2. Guide the PTFE seal ring along the valve disc (14) until it slides into the groove in the valve disc (14).
3. Slide the cage (15) over the stem/valve disc assembly (1/14) from above. Take care not to damage the seal ring.
4. Lower the stem/valve disc assembly (1/14) with the cage (15) into the body (8).
⇒ Contact with the seat ring (16) has been established.



NOTE

New graphite seal rings are available as closed seal rings. Cut the seal ring in one place at an angle of 45° with a sharp knife to facilitate inserting the seal ring into the valve disc groove.

MIL 41900: Fitting the valve disc and cage with graphite seal ring

Version with an outer seal ring made of graphite and an inner backing ring made of metal (D3). The inner ring has got a straight cut.

1. Insert the backing ring into the groove provided in the valve disc (14).
2. Place the graphite ring on top of the backing ring.
3. The joints of the seal rings are arranged offset from each other by 180 °.
4. Slide the cage (15) over the stem/valve disc assembly (1/14) from above. Take care not to damage the seal ring.
5. Lower the stem/valve disc assembly (1/14) with the cage (15) into the body (8).
⇒ Contact with the seat ring (16) has been established.

7.2.5.6 Installing the bonnet

- ✓ The required spare parts are available.
- ✓ All dismantled parts have been cleaned and checked for wear.
- ✓ Any damaged or worn parts have been replaced by original spare parts.

- ✓ The sealing surfaces have been cleaned.
 - ✓ The seat ring has been installed. (⇒ Section 7.2.5.4, Page 37)
 - ✓ The valve disc and cage have been installed. (⇒ Section 7.2.5.5, Page 37)
1. **Valves > 6 in. (150 mm):** Insert the disc spring (19).
 2. Verify that the gland packing (7), spacer ring / lantern ring (6) and guide bush (23) have been removed from the bonnet (8).
 3. Position the bonnet (8) with the gland packing studs at a right angle to the flow path.
 4. Slowly lower the bonnet (8) over the stem (1) and studs (9).
 5. Lightly grease the studs (9) and the contact faces of the nuts (10) with a lubricant.
 6. Tighten the nuts to the specified tightening torque (⇒ Section 7.3, Page 40) and tightening sequence (⇒ Section 5.4.1, Page 19) .
 7. Slide the guide bush (23) over the upper end of the stem (1) and lower it down until it reaches the bottom end of the gland packing chamber.
 8. Fit the gland packing. (⇒ Section 7.2.5.2, Page 33)
 9. Mount the actuator and adjust the stem as per the operating manual of the actuator.

7.3 Tightening torques

Tightening torques for MIL 41100

Table 15: Tightening torques for bolts/screws

Number	NPS [inch]	Class	Size [inch]	Quantity [Qty]	Tightening torque [Nm]
1	1	900 - 2500	$\frac{5}{8}$ - 11 UNC - 2 A	8	30
2	1	≤ 600	$\frac{1}{2}$ - 13 UNC - 2 A	8	30
3	2	900 - 1500	$\frac{5}{8}$ - 11 UNC - 2 A	8	80
4	2	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	160
5	2	≤ 600	$\frac{1}{2}$ - 13 UNC - 2 A	8	30
6	3	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	8	40
7	2,5	900 - 1500	$\frac{5}{8}$ - 11 UNC - 2 A	8	80
8	2,5	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	60
9	2,5	≤ 600	$\frac{1}{2}$ - 13 UNC - 2 A	8	30
10	0,75	900 - 2500	$\frac{5}{8}$ - 11 UNC - 2 A	8	130
11	1,5	900 - 2500	$\frac{5}{8}$ - 11 UNC - 2 A	8	130
12	1,5	≤ 600	$\frac{1}{2}$ - 13 UNC - 2 A	8	30
13	4	3100	M 64 x 3	8	3100

Tightening torques for MIL 41104 (Cv > 10)

Table 16: Tightening torques for bolts/screws

Number	NPS [inch]	Class	Size [inch]	Quantity [Qty]	Tightening torque [Nm]
1	2	≤ 600	$\frac{1}{2}$ - 13 UNC - 2 A	8	30
2	2	900 - 1500	$\frac{5}{8}$ - 11 UNC - 2 A	8	110
3	2	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	210
4	3	900 - 1500	$\frac{3}{4}$ - 10 UNC - 2 A	8	210
5	3	2500	$1\frac{1}{8}$ - 8 UN - 2 A	8	720
6	4	2500	$1\frac{1}{2}$ - 8 UN - 2 A	8	1480
7	2,5	900 - 1500	$\frac{5}{8}$ - 11 UNC - 2 A	8	110
8	1,5	2500	$\frac{5}{8}$ - 11 UNC - 2 A	8	170



Tightening torques for MIL 41200

Table 17: Tightening torques for bolts/screws

Number	NPS [inch]	Class	Size [inch]	Quantity [Qty]	Tightening torque [Nm]
1	2	900 - 1500	$\frac{7}{8}$ - 9 UNC - 2 A	8	190
2	2	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	280
3	3	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	8	160
4	4	900 - 1500	$1\frac{1}{2}$ - 8 UN - 2 A	8	950
5	4	2500	$1\frac{1}{2}$ - 8 UN - 2 A	8	1480
6	4	≤ 600	$\frac{7}{8}$ - 9 UNC - 2 A	8	230
7	2,5	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	280
8	6	900 - 1500	$1\frac{3}{4}$ - 8 UNS - 2 A	8	1300
9	6 x 3 6 x 4	≤ 300	$\frac{7}{8}$ - 9 UNC - 2 A	8	140

Tightening torques for MIL 41300/41400/41500/41600/41900

Table 18: Tightening torques for bolts/screws



Number	NPS [inch]	Class	Size [inch]	Quantity [Qty]	Tightening torque [Nm]
1	1,5	≤ 600	$\frac{5}{8}$ - 11 UNC - 2 A	6	80
2	2	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	6	14
3	2	900 - 1500	$\frac{7}{8}$ - 9 UNC - 2 A	8	190
4	3	2500	1 - 8 UNC - 2 A	8	400
5	2,5	2500	$\frac{3}{4}$ - 10 UNC - 2 A	8	160
6	3	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	8	160
7	3	900	1 - 8 UNC - 2 A	8	280
8	3	1500	$1\frac{1}{4}$ - 7 UNC - 2 A	8	590
9	3	2500	$1\frac{1}{8}$ - 8 UN - 2 A	8	630
10	4	≤ 600	$\frac{7}{8}$ - 9 UNC - 2 A	8	240
11	4	900 - 1500	$1\frac{1}{2}$ - 8 UN - 2 A	8	950
12	4	2500	$1\frac{1}{2}$ - 8 UN - 2 A	8	1480
13	6	≤ 300	1 - 8 UNC - 2 A	8	150
14	6	600	1 - 8 UNC - 2 A	12	200
15	6	900 - 1500	$1\frac{3}{4}$ - 8 UNS - 2 A	8	1300
16	6	2500	$1\frac{5}{8}$ - 8 UN - 2 A	8	1430
17	8	≤ 300	$1\frac{1}{4}$ - 8 UN - 2 A	8	270
18	8	900 - 1500	$1\frac{3}{4}$ - 8 UNS - 2 A	8	1890
19	8	2500	$2\frac{1}{2}$ - 8 UN - 2 A	8	4860
20	10	≤ 300	$1\frac{1}{2}$ - 8 UN - 2 A	8	450
21	10	900	$1\frac{3}{4}$ - 8 UNS - 2 A	12	1030
22	10	1500	$1\frac{3}{4}$ - 8 UNS - 2 A	12	1720
23	12	≤ 300	$1\frac{1}{2}$ - 8 UN - 2 A	12	450
24	12	600	$1\frac{1}{2}$ - 8 UN - 2 A	12	900
25	12	900	$1\frac{1}{2}$ - 8 UN - 2 A	16	1010
26	12	1500	$\frac{1}{2}$ - 8 UN - 2 A	12	2990
27	14	600	$1\frac{1}{2}$ - 8 UN - 2 A	12	1470
28	14	3000	M 56 x 4,5	12	4300
29	16	≤ 300	$1\frac{1}{2}$ - 8 UN - 2 A	12	670
30	20	≤ 300	M 36 x 4	20	730
31	20	600	M 42 x 4,5	20	1680

8529.8/02-EN



Number	NPS	Class	Size	Quantity	Tightening torque
	[inch]		[inch]	[Qty]	[Nm]
32	3 x 2	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	8	110
33	3 x 2	900 - 1500	$\frac{7}{8}$ - 9 UNC - 2 A	8	190
34	4 x 3	≤ 600	$\frac{3}{4}$ - 10 UNC - 2 A	8	160
35	4 x 3	900 - 1500	$1\frac{1}{4}$ - 7 UNC - 2 A	8	590
36	6 x 4	≤ 300	$\frac{7}{8}$ - 9 UNC - 2 A	8	160
37	6 x 4	900 - 1500	$1\frac{1}{2}$ - 8 UN - 2 A	8	950
38	6 x 4	2500	$1\frac{1}{2}$ - 8 UN - 2 A	8	1480
39	10 x 8	≤ 300	$1\frac{1}{4}$ - 7 UNC - 2 A	12	180
40	10 x 8	600	$1\frac{1}{4}$ - 7 UNC - 2 A	12	360
41	12 x 10	2500	$2\frac{3}{4}$ - 8 UN - 2 A	8	5750
42	12 x 8	2500	$2\frac{1}{2}$ - 8 UN - 2 A	8	4790
43	14 x 10	2500	$2\frac{1}{2}$ - 8 UN - 2 A	12	4090
44	24	300	M 48 x 5	16	1800
45	32	300	M 56 x 4,5	24	1900

8 Trouble-shooting

	 WARNING
	<p>Improper remedial work on the valve</p> <p>Risk of injury!</p> <p>► 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.</p>

If problems occur that are not described in the following table, consultation with the KSB service is required.

Table 19: Trouble-shooting

Fault	Possible cause	Remedy
Leakage at the seat/disc interface	Incorrect calibration	1. Check the coupling. 2. Re-calibrate.
	Incorrect assembly / coupling	1. Undo the coupling connection. 2. Check actuator stroke and valve travel independently of each other. 3. Re-establish the coupling connection. 4. Match valve travel with actuator stroke scale.
	Damaged trim	Replace trim (contact the manufacturer).
	Foreign matter in the valve body	1. Dismantle the valve. 2. Clean internal parts. 3. Assemble the valve.
	Incomplete valve travel	Check actuator pressure supply and spring range.
Hunting / unstable operation	Malfunction of the accessories	Check that the accessories are correctly adjusted as per catalogue / operating manual.
	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Leakage in the pneumatic circuit	Eliminate the leakage in the pneumatic circuit.
	Mismatch in nominal tubing size	The nominal size of the external tubing (system's control air connection) must correspond to the nominal size of the internal tubing.
Insufficient flow	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Flow passage is blocked.	Dismantle, clean and re-assemble the valve.
Noise / vibrations	Cavitation	1. Check the trim for any damage. 2. Check the flow parameters. 3. Contact the manufacturer if necessary.
	Improper installation	Check the flow direction against the flow direction arrow. (Note: Linear actuators are best suited for vertical installation.)



Fault	Possible cause	Remedy
Excessive flow	Change in operating flow parameters	Check the valve specification sheet. In the event of any deviations, contact the manufacturer.
	Damage to the valve internals	<ol style="list-style-type: none">1. Check the trim for any damage.2. Contact the manufacturer if necessary.
Jerky stem movement	Excessively tightened gland packing	<ol style="list-style-type: none">1. Loosen the nuts at the gland follower.2. Tighten the nuts to the specified tightening torque .
	Misalignment of actuator and valve	<ol style="list-style-type: none">1. Undo the coupling connection.2. Check actuator stroke and valve travel independently of each other.3. Re-establish the coupling connection.
	Signs of rubbing contact in the valve disc guiding area	<ol style="list-style-type: none">1. Check the valve internals.2. Contact the manufacturer in the event of damage.
Leakage at the gland packing	Gland packing wear	<ol style="list-style-type: none">1. Replace gland packing.2. Insert additional packing ring.
	Material and fluid temperature are not compatible.	Check the gland packing materials against the valve specification sheet (graphite for high temperature).
	Poor surface finish / scoring on stem	Replace valve disc/stem assembly and gland packing.
	The gland packing has become loose.	Tighten the gland packing to the specified tightening torque .
The valve does not respond properly to the control command.	Problem with the interaction of actuator and fitted accessories	Check actuator and accessories.

9 Related Documents

9.1 General assembly drawing with list of components

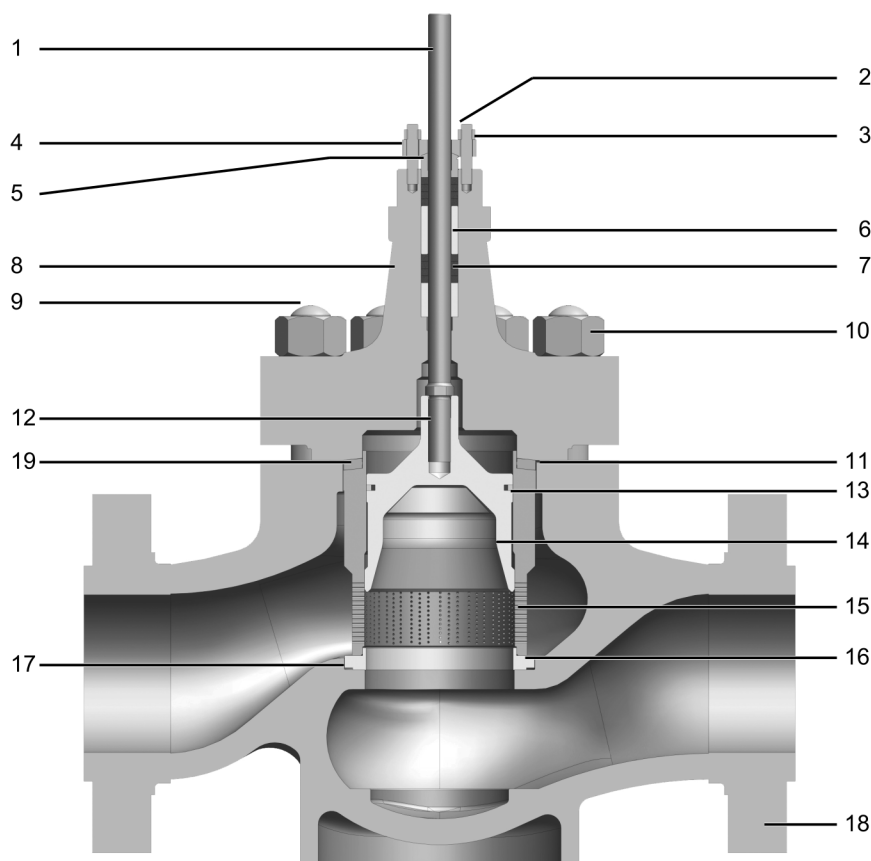



Fig. 14: Sectional drawing of MIL 41500 / MIL 41600 / MIL 41900, balanced

Table 20: Parts list

 The materials listed in the table are for orientation only. Other materials are available on request depending on the application.

Part No.	Description	Material	Note
1 ¹⁾	Stem	17.4 PH SST H 1075	≤ 343 °C
		ASTM A638 Gr. 660	> 343 °C
2	Stud	ASTM A193 Gr. B8	-
3	Nut	ASTM A194 Gr. 8	-
4	Gland follower	ASTM A105	-
5	Thrust insert	304 SST	-
6	Gland packing	PTFE	≤ 180 °C
		Graphite	> 180 °C
7 ¹⁾	Spacer ring / lantern ring	304 SST	-
8	Bonnet	ASTM A216 Gr. WCC	-
		ASTM A217 Gr. WC6	-
		ASTM A217 Gr. WC9	-
		ASTM A217 Gr. C5 / C12 / C12A	-

¹ Recommended spare parts



Part No.	Description	Material	Note
8	Bonnet	ASTM A351 Gr. CF8 / CF8M / CF8C / CF3 / CF3M	-
9	Stud	ASTM A193 Gr. B7	≤ 454 °C
		ASTM A193 Gr. B16	454 °C - 538 °C
		ASTM A453 Gr. 660	> 538 °C
10	Nut	ASTM A194 Gr. 2H	≤ 454 °C
		ASTM A194 Gr. 7	454 °C - 538 °C
		ASTM A194 Gr. 8C	> 538 °C
11 ¹⁾	Spiral wound gasket	316L SST + graphite	-
12 ¹⁾	Pin	316 SST	-
13 ¹⁾	Sealing element	Spring-loaded Ekonol + PTFE	MIL 41200
		Spring-loaded Ekonol + PTFE	MIL 41300
		Ni Resist D3	MIL 41400
			MIL 41500
		PTFE	MIL 41600
14 ¹⁾	Valve disc	Graphite	MIL 41900
14 ¹⁾	Valve disc	17.4 PH SST H 1075	≤ 343 °C
		CA6NM, nitrided	> 343 °C
15 ¹⁾	Cage	ASTM A351 Gr. CF8M, chrome-plated	≤ 343 °C
		CA6NM, nitrided	> 343 °C
16 ¹⁾	Seat ring / diffuser seat ring	440 SST	≤ 343 °C
		316 SST + stellited	> 343 °C
17 ¹⁾	Spiral wound gasket	316L SST + graphite	-
18	Body	ASTM A216 Gr. WCC	-
		ASTM A217 Gr. WC6	-
		ASTM A217 Gr. WC9	-
		ASTM A217 Gr. C5 / C12 / C12A	-
		ASTM A351 Gr. CF8 / CF8M / CF8C / CF3 / CF3M	-
19 ¹⁾	Disc spring	17.4 PH SST H 1075	≤ 343 °C
		Inconel X 750	> 343 °C
20 ¹⁾	Pilot plug	CA6NM + Stellite No. 6, chrome-plated	≤ 343 °C
		CA6NM + Stellite No. 6, nitrided	> 343 °C
21 ¹⁾	Circlip	Spring steel	≤ 343 °C
		Inconel X 750	> 343 °C
22 ¹⁾	Spring	Spring steel	≤ 343 °C
		Inconel X 750	> 343 °C
23	Guide bush		-

10 EU Declaration of Conformity for MIL 41000

Control valve

MIL 41000

Class 150 - 3000

NPS ½ - 32 inches

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

Other standards/codes:

ASME B16.34, EN 12516-2, ASME SEC VIII Div 1

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 NORD Systems GmbH & Co. KG
22525 Hamburg (Germany)

Identification number of the notified body:

0045

11 Certificate of Decontamination

Type:
 Order number/
 Order item number²⁾:
 Delivery date:
 Field of application:
 Fluid handled²⁾:

Please tick where applicable²⁾:


☐

Corrosive


☐

Oxidising


☐

Flammable


☐

Explosive


☐

Hazardous to health


☐

Seriously hazardous to health


☐

Toxic


☐

Radioactive


☐

Hazardous to the environment


☐

Safe

Reason for return²⁾:

Comments:

The product/accessories have been carefully drained, cleaned and decontaminated inside and outside prior to dispatch/placing at your disposal.

We herewith declare that this product is free from hazardous chemicals and biological and radioactive substances.

- ☐ No special safety precautions are required for further handling.
- ☐ The following safety precautions are required for flushing fluids, fluid residues and disposal:

.....

We confirm that the above data and information are correct and complete and that shipping is effected in accordance with the relevant legal provisions.

.....
 Place, date and signature

.....
 Address

.....
 Company stamp

² Required fields

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