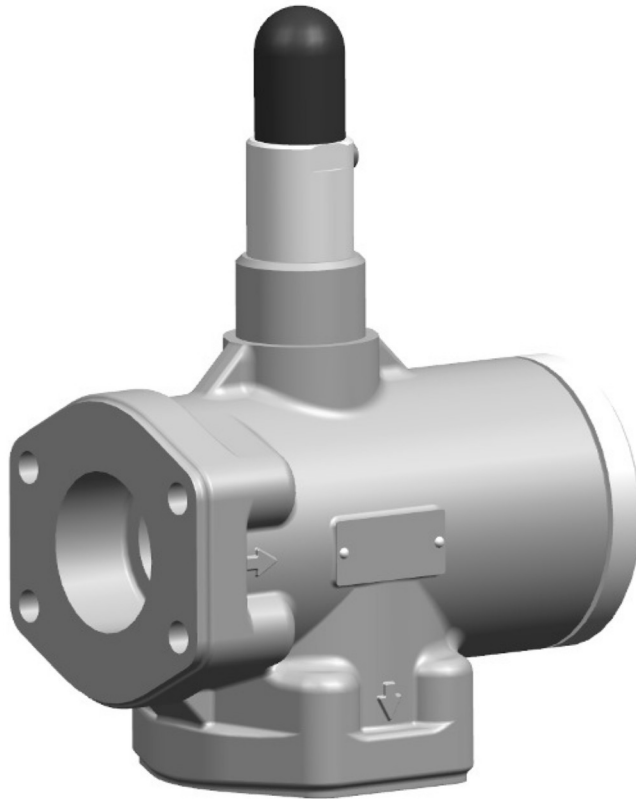


D.0045170002

Operating instructions (Translation)



Pressure relief valve HV / HVF (pilot operated)

88045170002-02

Englisch

2019-04-12

KRACHT

Table of Content

1	General	4
1.1	About the documentation	4
1.2	Manufacturer's address	4
1.3	Symbolism	4
2	Safety	6
2.1	Intended use	6
2.2	Personnel qualification and training	6
2.3	Basic safety instructions	6
2.4	Basic hazards	7
3	Device description	8
3.1	Functional principle	8
3.2	Basic design	9
3.3	Type key	10
3.3.1	Type key HV	10
3.3.2	Type key HVF	11
4	Technical data	12
4.1	General information	12
4.2	Hydraulic parameters	13
4.3	Weight	13
4.4	pE - Q characteristic curves (at 34 mm ² /s)	14
5	Transport and storage	15
5.1	General	15
5.2	Transport	15
5.3	Storage	15
6	Installation	17
6.1	Safety instructions for installation	17
6.2	Mechanical installation	17
6.2.1	General	17
6.2.2	Pressure relief valve	18
6.3	Connection lines	18
6.3.1	General	18

6.3.2	Mounting Connection lines	18
7	Operation start-up	20
7.1	Safety instructions for start-up	20
7.2	Pressure valve adjustment	21
7.3	Further operation start-up	22
8	Removal	24
8.1	Safety instructions for removal	24
8.2	General	25
9	Maintenance	26
9.1	Safety instructions for maintenance	26
9.2	Maintenance work	27
9.3	Maintenance instructions	27
10	Repairs	29
10.1	Safety instructions for repair	29
10.2	General	30
10.3	Detecting and eliminating failures	31

1 General

1.1 About the documentation

These operating instructions describe the installation, operation and maintenance of the following device:

Pressure relief valve HV / HVF

The device is manufactured in different versions. Information about the version concerned in the individual case can be found on the device's type plate.

These operating instructions are a component of the device and must be kept accessible for the personnel near the device at all times.

If you have any questions about these operating instructions, please contact the manufacturer.

1.2 Manufacturer's address

KRACHT GmbH
 Gewerbestraße 20
 DE 58791 Werdohl
 phone: +49 2392 935-0
 fax: +49 2392 935-209
 email: info@kracht.eu
 web: www.kracht.eu

1.3 Symbolism



Identification of an immediate hazard, which would result in death or severe bodily injury if not avoided.



Identification of a potential medium risk hazard, which would lead to death or severe bodily injury if not avoided.

 **CAUTION**

Identification of a low risk hazard, which could lead to minor or medium bodily injury if not avoided.

 **NOTICE**

Flagging of notices to prevent property damage.



Identification of basic safety instructions. Non-compliance can lead to hazards for people and the device.



Flagging of special user tips and other especially useful or important information.

2 Safety

2.1 Intended use

1. The device has been designed for operation with fluid. Dry operation is not permitted.
2. The device may be operated in filled condition only.
The medium must be compatible with the materials used in the device. The chemical competence is necessary for this. Be careful with ethylene oxide or other cathalytic or exothermic or self-decomposing materials. Please consult the manufacturer in cases of doubt.
3. The device may be operated only in usual industrial atmospheres. If there are any aggressive substances in the air, always ask the manufacturer.
4. Operation of the device is only permissible when complying with the operating instructions and applicable documents.
Deviating operating conditions require the express approval of the manufacturer.
5. In case of any use of the device not according to specification, any warranty is voided.

2.2 Personnel qualification and training

The staff designated to assemble, operate and service the device must be properly qualified. This can be through training or specific instruction. Personnel must be familiar with the contents of this operating instructions.



Read the operating instructions thoroughly before use.

2.3 Basic safety instructions



1. Comply with existing regulations on accident prevention and safety at work along with any possible internal operator regulations.
2. Pay attention to the greatest possible cleanliness.
3. Wear suitable personal protection equipment.
4. Do not remove, make illegible or obliterate type plates or other references on the device.
5. Do not make any technical changes on the device.
6. Maintain and clean the device regularly.
7. Use spare parts approved by the manufacturer only.

2.4 Basic hazards

 **DANGER****Hazardous fluids!**

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

 **WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

 **WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.

 **WARNING****Failure of load-carrying parts due to overload!**

Danger of injury from flying parts.

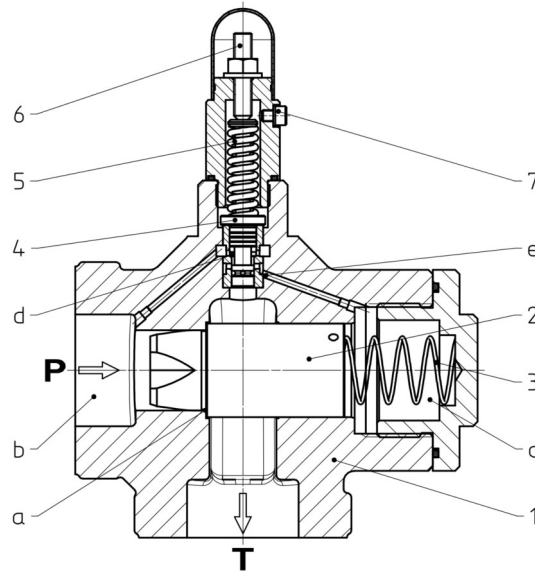
Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

3 Device description

3.1 Functional principle

Pressure relief valves of the HV / HVF series are pilot operated spool valves and serve to protect hydraulic circuits.



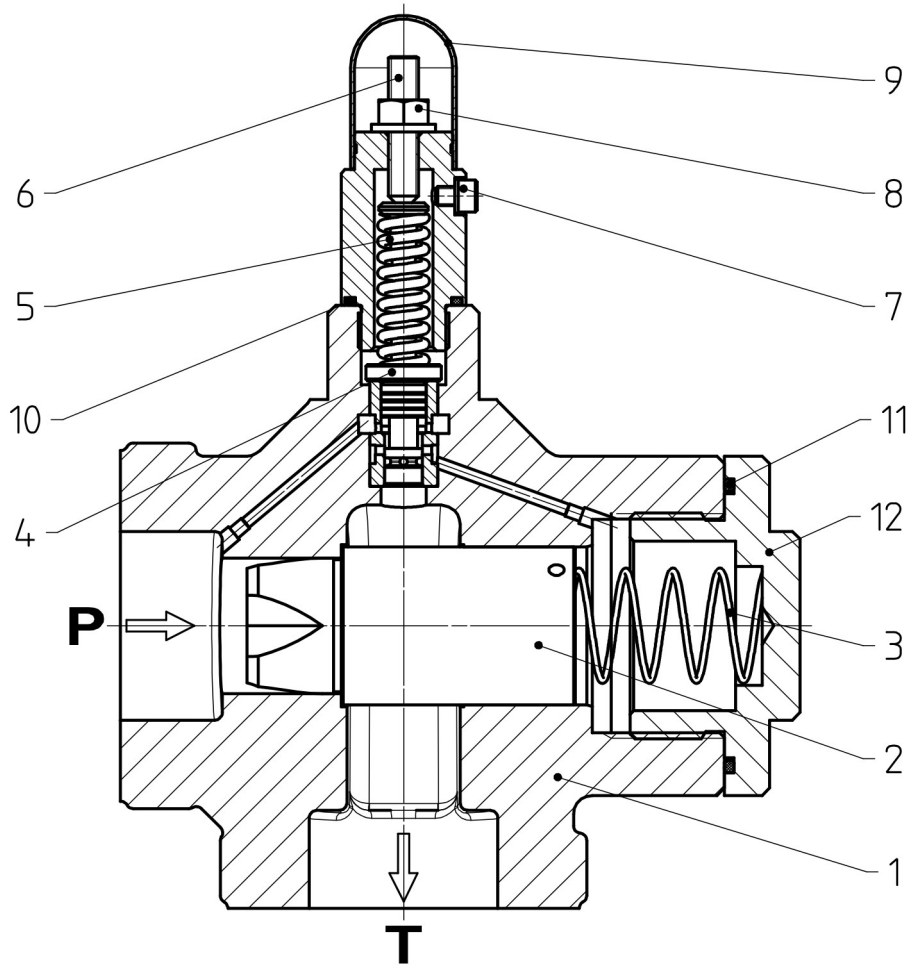
Explanation

- P Pressure connection
- T Tank connection
- a Ring surface
- b Valve chamber
- c Spring chamber
- d Ring surface
- e Bore
- 1 Housing
- 2 Valve piston
- 3 Compression spring
- 4 Pilot valve
- 5 Compression spring
- 6 Adjustment screw
- 7 Venting screw

Main control stage: The sleeve valve (2) is pressed through the compressed spring (3) against the ring surface (a), thus blocking the pressure port P from the tank connection (T). The valve chamber (b) upstream of the sleeve valve and the spring chamber (c) downstream of the sleeve valve are connected to the pilot stage.

Pilot stage: When the compression spring (5) is applied to the pilot valve (4), it is in equilibrium with the working pressure acting on the annular surface (d). If the spring force is exceeded by the working pressure, the connection behind the sleeve valve is shut off. The spring chamber is then connected to the tank connection via the bore (e) in the pilot valve. This ensures that the sleeve valve is released from the pressure connection to the tank connection when the operating pressure set by the adjusting screw (6) is reached. With vertical installation, i.e. with the adjusting screw at the top, the spring chamber can be freed from air accumulations by opening the vent screw (7). This is needed for vibration-free operation.

3.2 Basic design



Explanation

- | | |
|-----------------------|-------------------|
| 1. Housing | 7. Venting screw |
| 2. Valve piston | 8. Union nut |
| 3. Compression spring | 9. Protective cap |
| 4. Pilot valve | 10. O-Ring |
| 5. Compression spring | 11. O-Ring |
| 6. Adjustment screw | 12. End plug |

3.3 Type key

3.3.1 Type key HV

Ordering example HV									
HV	(M)	(E)	10	A	1G	1	B	160	
1.	2.	3.	4.	5.	6.	7.	8.	9.	

Explanation of type key HV				
1.	Product name			
2.	Installation			
	No specification	Pipeline installation	M	Console integration
3.	Connection for relief			
	No specification	Without relief connection	E	Connection G 1/4
4.	Nominal size			
	10	Q _{max.} = 50 l/min		
5.	Version			
	A	NBR-Version (Standard version)	C	FKM-Version
6.	Connection type			
	1G	Threaded connection G 1/2		
7.	Design serial number (specified by manufacturer)			
8.	Actuation type			
	A	Adjustment screw	B	Twist grip
9.	Pressure stage			
	003	0.5 - 3 bar	040	1 - 40 bar
	012	1 - 12 bar	160	10 - 160 bar

3.3.2 Type key HVF

Ordering example HVF									
HVF	(M)	(E)	25	A	1G	1	B	160	
1.	2.	3.	4.	5.	6.	7.	8.	9.	

Explanation of type key HVF				
1.	Product name			
2.	Installation			
	No specification	Pipeline installation	M	Console integration
3.	Connection for relief			
	No specification	Without relief connection	E	Connection G 1/4
4.	Nominal size			
	25	Q _{max.} = 120 l/min	50	Q _{max.} = 500 l/min
	40	Q _{max.} = 350 l/min	80	Q _{max.} = 750 l/min
5.	Version			
	A	NBR-Version (Standard version)	C	FKM-Version
6.	Connection type			
	1G	Threaded connection G 1/2	2F	SAE flange (3000 psi)
7.	Design serial number (specified by manufacturer)			
8.	Actuation type			
	A	Adjustment screw	B	Twist grip
9.	Pressure stage			
	003	0.5 - 3 bar	060	10 - 60 bar
	012	1 - 12 bar	160	10 - 160 bar
	040	1 - 40 bar		

4 Technical data

4.1 General information

General information		
Design	Sliding piston valve, pilot operated	
Fixing type	Pipeline installation, Console integration	
Actuation type	mechanical	Adjustment screw
		Twist grip
Mounting position	Upper pressure adjustment screw	
Housing connection ⁽¹⁾	HV 10	Whitworth pipe thread G1/2
	HVF 25	Whitworth pipe thread G1
		Flange connection SAE 1"
	HVF 40	Whitworth pipe thread G1 1/2
		Flange connection SAE 1 1/2"
	HVF 50	Whitworth pipe thread G2
Flange connection SAE 2"		
HVF 80	Whitworth pipe thread G3	
	Flange connection SAE 3"	
Housing material	HV 10	EN-GJL-250
	HVF 25	EN-GJS-400-15
	HVFM 25	EN-GJL-250
	HVF 40	EN-GJL-300
	HVF 50	
	HVF 80	
Sealing material	NBR, FKM	
Permissible media	Hydraulic fluids according to DIN 51524/25 (other fluids on request)	
⁽¹⁾ Pipe thread: ISO 288-1; Flange connection: ISO 6162-1 (SAE J518)		

4.2 Hydraulic parameters

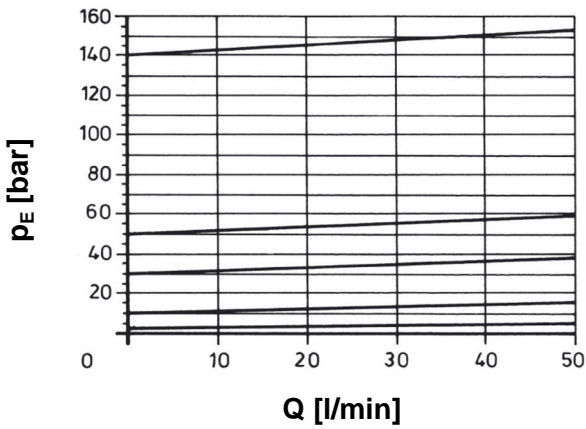
Hydraulic parameters					10	25	40	50	80
Nominal size									
Max. flow capacity			l/min	50	120	350	500	750	
Nominal pressure			bar	160	160	160	60	60	
Viscosity		v_{\min}	mm ² /s	13	13	13	13	13	
		v_{\max}		600	600	600	600	600	
Max. operating pressure			p_{\max}	bar	160	160	160	60	60
Fluid temperature range		NBR	$\vartheta_{m \min.}$	°C	-20	-20	-20	-20	-20
			$\vartheta_{m \max.}$		90	90	90	90	90
		FKM	$\vartheta_{m \min.}$	°C	-20	-20	-20	-20	-20
			$\vartheta_{m \max.}$		150	150	150	150	150
Ambient temperature		$\vartheta_{u \min.}$	°C	-20	-20	-20	-20	-20	
		$\vartheta_{u \max.}$		60	60	60	60	60	

4.3 Weight

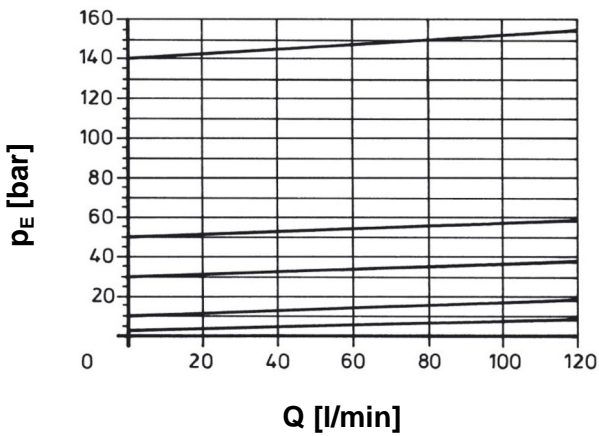
Nominal size	Weight [kg]	
	Adjustment screw	Twist grip
10	2.5	-
25	3.4	3.4
40	6.7	6.7
50	10.9	10.9
80	18.1	18.1

4.4 p_E - Q characteristic curves (at 34 mm²/s)

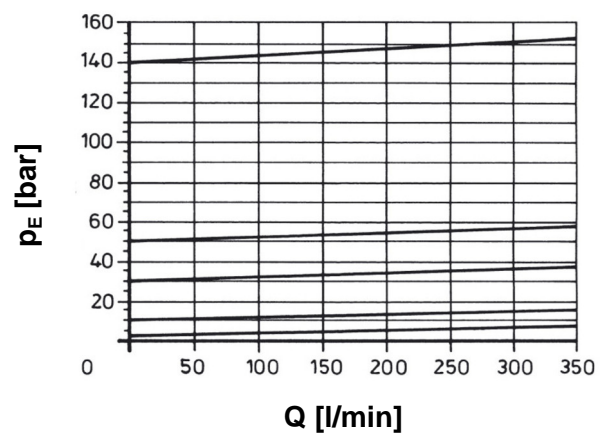
HV 10



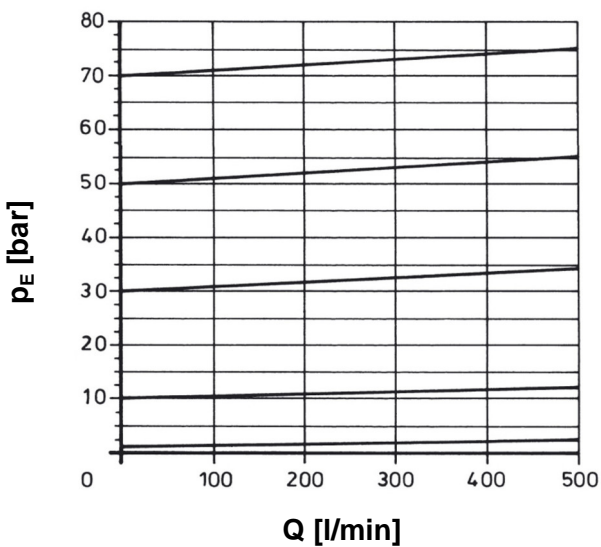
HVF 25



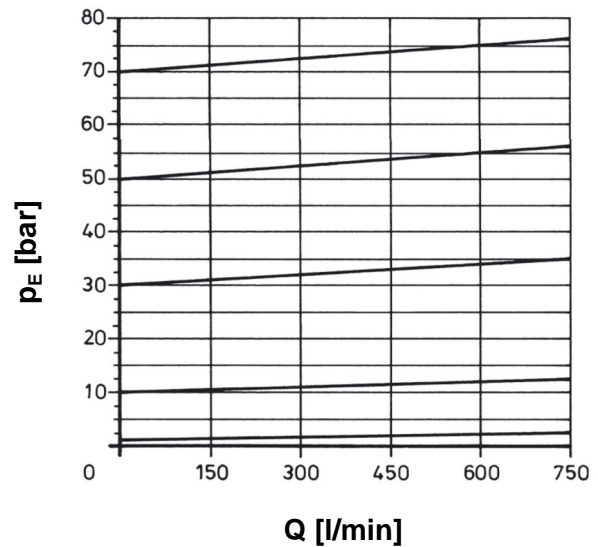
HVF 40



HVF 50



HVF 80



5 Transport and storage

5.1 General

- After receipt, check the device for transport damages.
- If transport damage is noticed, report this immediately to the manufacturer and the carrier. The device must then be replaced or repaired.
- Dispose of packing material and used parts in accordance with the local stipulations.

5.2 Transport

**Falling or overturning loads!**

Danger of injury while transporting large and heavy loads.

1. Use only suitable means of conveyance and lifting tackle with sufficient load-bearing capacity.
2. Attach lifting tackle only to suitable load points.
3. Attach the lifting tackle in such a manner that it cannot slip.
4. Pay attention to the load balance point.
5. Always avoid jerks, impacts and strong vibrations during transportation.
6. Never walk under suspended loads, never work under suspended loads.



To transport the device, eyebolts can be screwed into the flange connections.

5.3 Storage

The device's function is tested in the plant with mineral hydraulic oil. Then all connections are closed. The remaining residual oil preserves the interior parts for up to 6 months.

Metallic exposed exterior parts are protected against corrosion by suitable conservation measures, also up to 6 months.

In case of storage, a dry, dust-free and low-vibration environment is to be ensured. The device is to be protected against influences from weather, moisture and strong fluctuations of temperature. The recommended storage conditions are to be adhered to.

Below the permissible ambient temperature ϑ_u elastomer seals lose their elasticity and mechanical loading capacity, since the glass transition temper-

ature is fallen below. This procedure is reversible. A force action on the device is to be avoided in case of storage below the permissible ambient temperature ϑ_u .

Devices with EPDM seals are not mineral-oil resistant and are not tested for their function. There is no preservation of the interior parts. If the device is not taken into operation immediately, all corrosion-prone surfaces are to be protected by suitable conservation measures. The same applies for devices which are not tested for other reasons.

When storing for a long period of time (> 6 months), treat all surfaces at risk of corrosion again with suitable preserving agents.

If high air humidity or aggressive atmospheres are expected, take additional corrosion-preventing measures.



Storage in corrosion protection bags (VCI) maximum of 6 months.



NOTICE

Corrosion/chemical impact

Improper storage can render the device useless.

1. Protect endangered surfaces by means of suitable conservation measures.
2. Comply with recommended storage conditions.



Recommended storage conditions

1. Storage temperature: 5 °C - 25 °C
2. Relative air humidity: < 70 %
3. Protect elastomer parts from light, especially direct sunlight.
4. Protect elastomer parts from oxygen and ozone.
5. Comply with maximum storage times of elastomeric parts:
 - 5 Years: AU (Polyurethane rubber)
 - 7 Years: NBR, HNBR, CR
 - 10 Years: EPM, EPDM, FEP/PTFE, FEPM, FKM, FFKM, VMQ, FVMQ

6 Installation

6.1 Safety instructions for installation

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.

6.2 Mechanical installation

6.2.1 General

- Check the device for transport damage and dirt.
- Check the device for freedom of movement.
- Remove existing preservatives.

- Use only those cleaning agents that are compatible with the materials used in the device.
- Do not use cleaning wool.
- Compare the environmental and ambient conditions at the place of installation to the permissible conditions.
 - Expose the device only to small vibrations, see IEC 60034-14.
 - Secure sufficient access for maintenance and repair.

6.2.2 Pressure relief valve

- Preferably install the unit vertically, with the pressure adjustment screw pointing upwards.
- Take measures against accidental touching of hot surfaces (> 60 °C).

6.3 Connection lines

6.3.1 General



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Use only connections and lines approved for the expected pressure range.
2. Securely prevent exceeding the permissible pressure, e.g. by using pressure relief valves or rupture discs.
3. Design pipework so that no tensions, e.g. caused by changes in length due to fluctuations in temperature, are transmitted to the device.



Additional connections

1. Provide measurement connections for pressure and temperature as close as possible to device.
2. If necessary, provide a facility to fill or empty the device and the line system.
3. If necessary, provide a facility to vent the device and the line system.

6.3.2 Mounting Connection lines



Position of the device connections: See [chapter 3 "Device description"](#)

- Clean all lines.
 - Do not use cleaning wool.

- Pickle and flush welded pipes.
- Remove the protective plugs.
- Mount the lines.
 - Comply with the manufacturer's information.
 - Do not use any sealing materials such as hemp, Teflon tape or putty.

7 Operation start-up

7.1 Safety instructions for start-up



DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).



CAUTION

Hot surfaces!

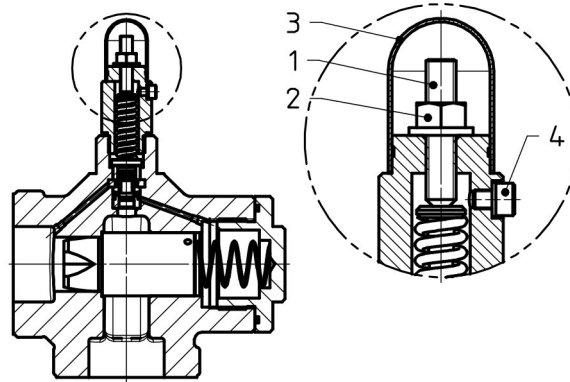
Burn injury to skin if touched.

1. Wear protective gloves at temperatures $\geq 48^{\circ}\text{C}$.

7.2 Pressure valve adjustment

The response pressure of the device is factory set to the mean value of each pressure stage. If applicable, the pressure setting must be adapted during commissioning.

Pressure setting for actuation type: A



- | | |
|---------------------|-------------------|
| 1. Adjustment screw | 3. Protective cap |
| 2. Union nut | 4. Venting screw |

Pressure setting

- Remove the protective cap
- Unscrew flange nut
- Set the response pressure using the adjusting screw
 - clockwise = Higher response pressure
 - counterclockwise = Lower response pressure
- Secure setscrew with union nut
- Put on the protective cap



WARNING

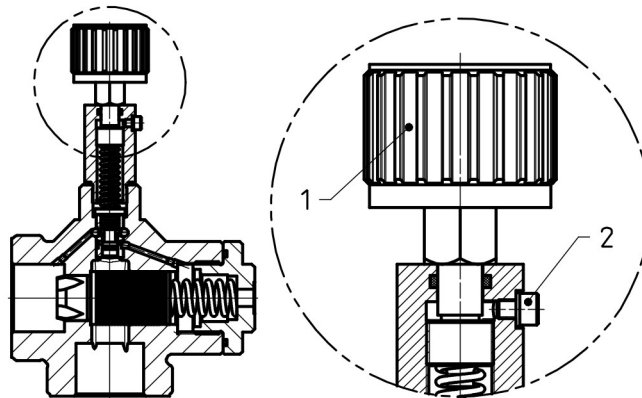
Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

Pressure setting for actuation type: B



1. Twist grip

3. Venting screw

Pressure setting

- Set the response pressure with the adjusting screw
 - clockwise = Higher response pressure
 - counterclockwise = Lower response pressure



The twist grip is not secured against accidental maladjustment.



WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Consider the permissible pressure setting range of the valve.
2. Check the pressure setting (the valve must not block).

7.3 Further operation start-up

- Open existing shut-off elements upstream and downstream of the device.
- Vent the system at the highest possible point.
- Check the operating data such as:
 - Response pressure
 - System pressure (as close as possible to device)
 - Fluid temperature (as close as possible to device)
 - ...
- Check the device for leaks.
- Check all threaded connections for leaks and retighten if necessary.



Existing venting and drain plugs must always be closed during operation according to specification.

8 Removal

8.1 Safety instructions for removal

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

8.2 General

- Depressurise and de-energize the system.
- Close existing shut-off elements upstream and downstream of the device.
- Open existing drain elements and loosen connection lines. Collect and dispose of discharging medium so that no hazard arises for persons or environment.
- Dismantle the device.
- Clean the device.
- Close the device connections and lines to prevent dirt penetration.

9 Maintenance

9.1 Safety instructions for maintenance

DANGER

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

WARNING

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

CAUTION

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

9.2 Maintenance work



Checking and documentation of the operating data

Regular checking and documentation of all operating data such as pressure, temperature, current consumption, degree of filter soiling, etc. contributes to early problem detection.

- Perform maintenance according to specification.
- Replace defective and worn components.
- If required, request spare parts lists and assembly drawings from the manufacturer.
- Document the type and scope of the maintenance work along with the operating data.
- Compare the operating data with the values of the first commissioning. Determine the cause in case of major non-compliances (> 10 %).
- Dispose of packing material and used parts in accordance with the local stipulations.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

9.3 Maintenance instructions

The following information provides recommendations on maintenance work and maintenance intervals for the device being used.

Depending on the actually occurring loads in operation, the type, scope and interval of the maintenance work can deviate from the recommendations. The equipment builder/operator shall write an obligatory maintenance plan.



Within the framework of preventive maintenance, it is appropriate to replace wear parts before reaching the wear limit.

With corresponding expertise and sufficient equipment, the replacement can be carried out by the equipment builder/operator. Please consult the manufacturer about this.



Warranty

In case of improper implementation, any warranty is voided.

Maintenance recommendations Pressure relief valve			
Interval	Maintenance work	Employees	Duration approx. [h]
Firstly: after max. 24 h	Inspection: Valve function	1	1
	Inspection: Response pressure		
	Inspection: System pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Check potential equalisation for firm seating and functionality (if existing)		
	Inspection: Condition of operating fluid		
Daily	Audiometric monitoring: Unusual noise	1	0.1
	Cleaning: Remove dust deposits and dirt with a moist cloth		
	Visual inspection: Leakages		
2000 Operating hours - - - Rotational direction monitoring of the motor, e.g. with a rotating field instrument. After 12 months	Inspection: Valve function	1	1
	Inspection: Response pressure		
	Inspection: System pressure		
	Inspection: Fluid temperature		
	Inspection: Device temperature		
	Inspection: Condition of operating fluid		
As required	Replace: Seals	1	1

10 Repairs

10.1 Safety instructions for repair

 **DANGER**

Hazardous fluids!

Danger of death when handling hazardous fluids.

1. Comply with the safety data sheets and regulations on handling hazardous fluids.
2. Collect and dispose of hazardous fluids so that no hazards arise for people or the environment.

 **WARNING**

Failure of load-carrying parts due to overload!

Danger of injury from flying parts.

Danger of injury from spurting fluids.

1. Depressurise the device and all connection lines before doing any work.
2. Securely prevent the restoration of pressure while working on the device.

 **CAUTION**

Hot surfaces!

Burn injury to skin if touched.

1. At temperatures $\geq 48^{\circ}\text{C}$ the device must be allowed to cool down first.

10.2 General

The repairs covers:

1. Troubleshooting
Determination of damage, pinpointing and localisation of the damage cause.
2. Elimination of damage
Elimination of the primary causes and replacement or repair of defective components. The repair is generally made by the manufacturer.

Repairs by manufacturer

- Before returning the device, fill in the *return notification* form. The form can be filled in online and is available as a pdf file download.



Device contains hazardous material

If the device was operated with dangerous liquids, it must be cleaned before the return. If this should not be possible, the safety data sheet of the hazardous material is to be provided beforehand.

Repair by equipment builder/operator

If corresponding expertise and sufficient equipment is available, the equipment builder/operator can also make the repairs. Please consult the manufacturer about this.

- If required, request spare parts lists and assembly drawings from the manufacturer.
- Use spare parts approved by the manufacturer only.
- Dispose of packing material and used parts in accordance with the local stipulations.



Warranty

In case of improper implementation, any warranty is voided.



Barriers and instructions

All barriers and warning signs removed during this must be attached to their original position on completing maintenance and/or repairs.

10.3 Detecting and eliminating failures

Failure	Potential causes	Possible measures
1 Increased noise <i>Mechanical vibrations</i>	Wobbling pressure relief valve	Increase valve opening pressure
	Air in the spring chamber	Vent the device
	Air in the spring chamber due to negative pressure at tank connection T	Adapt installation situation
2 Response pressure too high	Slide valve stiff (Contaminated medium)	Clean the device
		Replace the device
		Provide filtration
3 Leakages <i>Seal failure</i>	Poor maintenance	Comply with maintenance plan Replace seals
	Mechanical damage	Replace seals
	Thermal overload	Check the operating datas Replace seals
	Corrosion/chemical impact	Check the material compatibility Replace seals
Consult the manufacturer for all unidentifiable failures.		