Operating and maintenance instruction

Pressure relief valve DN1 2.0
(4150 bar / 60,000 psi & 6200 bar / 90,000 psi)

Operating and maintenance instruction

ALLFI AG - Riedenmatt 1 – CH-6370 Stans

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Scope of application

The present operating and maintenance instruction is valid for:

Pressure relief valve DN1 2.0 (4150 bar / 60,000 psi & 6200 bar / 90,000 psi)	
➢ 919015 ➢ 919115 ➢ 919215 ➢ 919015-I ➢ 919115-I ➢ 919215-I ➢ 919015-P ➢ 919115-P ➢ 919215-P ➢	

Table of contents

1 General

1.1 Information on use of the operation and maintenance instruction

This operation and maintenance instruction is a key part of the product. The information in this manual is mandatory and must be read and understood by all the persons before operating with the Pressure relief valve 3/8 2.0. The manual must be stored in distance as well as always accessible to the persons, working with the Pressure relief valve 3/8 2.0.

Should you have any questions regarding the content of the manual, please contact the manufacturer directly.

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1.2 Scope of delivery

The individual parts contained in the shipment can be gathered from the set list in the appendix A (technical drawing and part list). Upon receipt, the shipment has to be checked of integrity. Possible detected defectives must be reported immediately to the manufacturer.

1.3 Warranty claim

The ALLFI AG grants warranty for the shipped parts as followed:

- Material and manufacturer faults of 12 months from date of delivery or
- Defects within the first 2000 hours of operation

Following spare parts are excluded from the warranty:

- Seal Kit (consist of Valve needle, HP-seal 2.0, spring & Pressure plate 2.0)
- Valve Seat
- O-Ring
- Valve Case
- Restrictors

1.4 Disclaimer

ALLFI AG refuses any claims of liability (material damages, physical injury, as well as disruption of operation), that are a result of disregarding this operating and maintenance instruction.

For example, the damage as a result of:

- Inadmissible application of the Pressure relief valve
- Defective maintenance
- The disregard of operation instructions
- Chemical and electrolytical influences
- Use of parts, spare parts, or accessory from a third-party manufacturer
- Arbitrary modifications
- Not or insufficiently trained staff

The disregard of all these instructions happens on exclusive risk and exclusive responsibility of the client. The ALLFI AG is not liable for any production downtimes.

2 Security

2.1 Declaration of symbols

This operating and maintenance instruction manual contains important notes and symbols, which are to be considered and followed. These include:

DANGER

➢ **Danger emphasizes operating and service procedures that if not avoided, may lead to death or serious personal injuries.**

WARNING

➢ **Warnings emphasize operating or service procedures, or conditions that can result in serious personal injury or death.**

CAUTION

➢ **Cautions emphasize operating or service procedures, or conditions that can result in equipment damage or impairment of system operation. If not avoided, light or medium body injuries could be the consequence.**

NOTE

➢ **Notes provide additional information that can expedite or improve operating or service procedures.**

➢ Danger symbol without key word: Additional notes

2.2 General warning notes

Using of the Pressure relief valve, the following warnings are to be considered.

➢ The specified warnings are not only restricted to the operation with the maximal permissible operating pressure of 4150 bar / 60,000 psi. They are also valid on work with reduced operation pressures!

DANGER

- **Danger of cutting of extremities on contact with waterjet**
- The contact with the high kinetic energy performing waterjet can have the consequence of cutting of extremities or lead to other injuries.
- **Therefore:**
  - Operate the machine only, when nobody stands in the danger zone of the waterjet.
  - Never touch the waterjet, not even with personal protective equipment.
  - Always sufficient safety distance during operation of the cutting head.
  - Never guide the Pressure relief valve by hand during operation.

- Any injuries in connection with the waterjet, alarm the emergency doctor immediately.

CAUTION

- **Danger of breathing difficulties and irritation of the skin and eyes by released solid particles or dust.**
- During machining of certain material, solid particles and dust may float in the air, which could cause breathing difficulties and irritations to the skin and eyes.
- **Therefore:**
  - Ensure the proper ventilation of the room surrounding the machinery.
  - Ensure to wear the personal protective equipment (protection glasses, breathing mask, gloves, …)

- Additionally, the rules and regulations of the working place are to be followed to prevent injuries!

2.3 Intended use

The pressure relief valve is designed for pressure relief of a high-pressure system with max. 8 liters content. The pressure relief valve must be firmly connected in the machine. Only pure water may be used as the working fluid. The technical limits must always be observed. The specifications for connection assignment must be observed.

2.4 Inadmissible usage

Inadmissible usage of the Pressure relief valve includes:

- The usage of all other fluids other than water
- The addition of other substances to the water
- Closure of the pressure relief holes
- Excessive stress on the pressure relief valve
- Exceeding permitted limits
- Operating the pressure relief valve with demounted or disabled technical protection
- Use the pressure relief valve as a cutting head
- Use the pressure relief valve as a safety valve
- pressure relief of a high-pressure system with more than 8 liters content

Likewise, all other uses of the pressure relief valve deviating from the intended use are not permitted. All questions should be addressed directly to the manufacturer.

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2.5 Residual risks

The manufacturer and/or operator of the machine where the pressure relief valve is built in, has taken every precautionary measure possible to reduce residual risks, as far as possible reasonably practicably.

Operation phase	Damage	Danger	Reason	(possible) measures
Operation	Physical injuries	Liquids leaking under high pressure (e.g. at pressure relief holes)	Ignoring the torque	Follow the torque
			Damaged sealing surfaces	Regular supervision
			Busted/Cracked connections and high-pressure components as a result of defects	
				Protective wall as a technical protective measure
		Flying fragments	Ignoring the torque	Follow the torque
			Damaged sealing surfaces	Regular supervision
			Busted/Cracked connections and high-pressure components as a result of defects	
				Protective wall as a technical protective measure
		High kinetic energy of water jet	Intrusion of extremities in working area of water jet	Wearing safety goggles and other protective equipment
				Carry out regular checks
	Hearing damage	Rapidly discharging of fluid	Leakage	Wear ear protector
			Relieve pressure	Correctly dimensioned water collection system

2.6 Safety installations

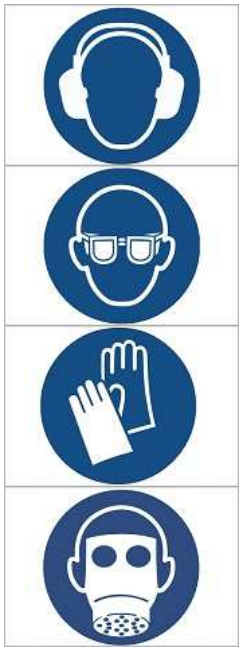
The manufacturer or the operator of the full machine, which the pressure relief valve is built in, has ensured the following safety arrangements:

- Safety devices to prevent flying fragments or liquids leaking under high pressure
- Emergency stoppage to immediately shut down the operating machine
  - ➔ Active: Manually triggered by operator
  - ➔ Passive: Automatically triggered by:
    - Failure of high pressure components or gross operating faults

- Danger for the operator will arise if safety protections are not functionally, not followed or evaded anytime. The operator has to ensure the functionality of the safety protections anytime.

2.7 Personal protection equipment

The operator must offer his staff following protection equipment while he's working:



Ear protector against:
- Noise emissions

Wear protection glasses against:
- Fluids and dust particles
- Flying fragments

Hand guards against:
- Sharp edges of components
- Intrusion of micro particles into the skin

Inhalation protection against:
- Dust particles, micro particles and spray mist

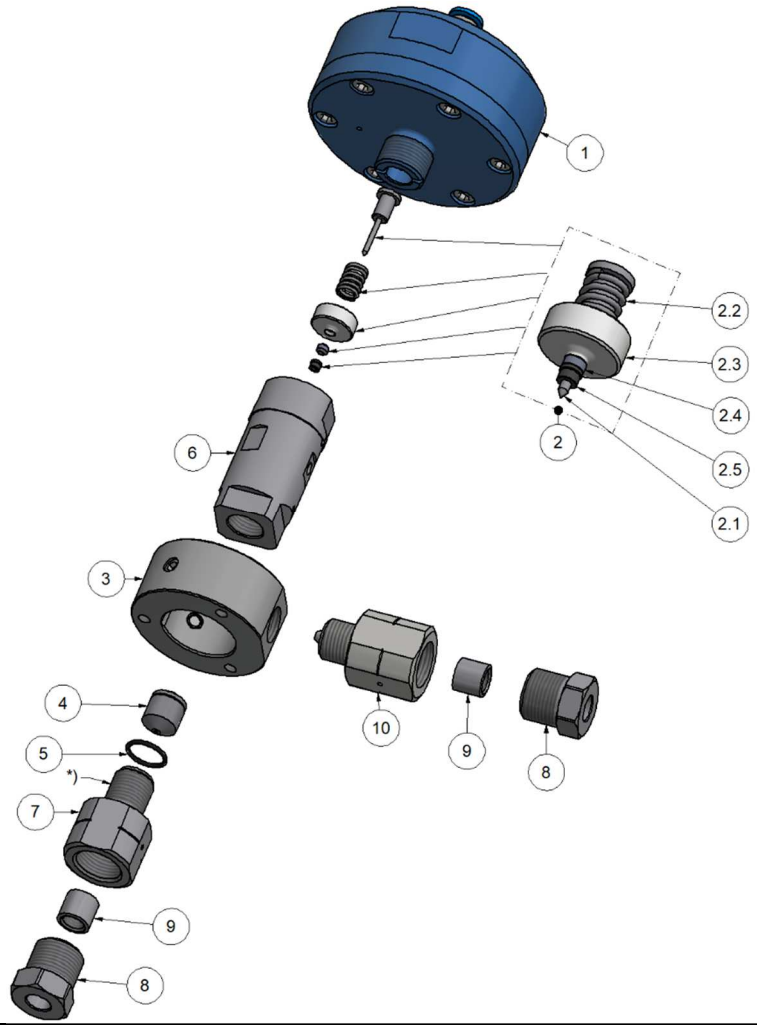
2.8 Qualification of the staff

The pressure relief valve may only be operated and maintained by certified, trained staff.

3 Structure and function

3.1 Structure

1. Pneumatic cylinder 2.0
2. Seal kit 2.0
   - 2.1. Valve needle
   - 2.2. Compression spring
   - 2.3. Pressure plate 2.0
   - 2.4. HP-seal 2.0
   - 2.5. Conus disc 2.0
3. Coupling ring
4. Valve seat
5. O-Ring
6. Valve case 2.0
7. Restrictor inlet
8. Gland nut
9. Collar
10. Restrictor outlet



3.2 Funktion

The pressure relief valve is a high-pressure needle valve and is actuated pneumatically. It is closed by compressed air and a pneumatic piston actuator and opened by spring force. The compressed air supply is switched on and off by a controlled valve (not included in the scope of delivery). For information on the maximum permissible operating pressure of the water, see chapter 4.

3.3 Accessories

			
Article:	Ejector mandrel	DX Paste	P-Paste
Article no:	900070	051055	051065
Function:	Replace Seal Kit and Valve Seat	Greasing screw connections and metallic contact areas for standard applications	Greasing screw connections and metallic contact areas for food safe

			
Article:	Torque wrench	Open end fitting	Mounting tool for O-ring
Article no:	000468	AF 5/8" - 000521 AF 17 – 000339 AF 13/16" - 000519 AF 22 – 000272 AF 24 – 000280 AF 27 – 000511	040011
Function:	Tightens screws with a specific torque		O-ring assembly and dis-assembly

All accessories for metric cutting heads are included in case set 882101
All accessories for imperial cutting heads are included in case set 882101-I

4 General technical data

Pneumatic pressure:	6 - 7bar / 87 – 102psi
Minimum working pressure:	0 bar / 0 psi
Maximal working pressure: see appendix A	4150bar / 60,000psi 6200bar / 90,000psi
Connection lines:	Appendix A
Nominal size (DN)	1mm
Pressure loss coefficient (l/min & bar)	0.2
Maximal working temperature:	50 °C
Maximum transport and storage temperature:	60 °C
Reaction time:	up to 2 cycles per minute
Weight:	ca. 1.5kg

Requested water quality:

Water parameter	Unit	Value
Electrical Conductivity	µS / cm	100 – 450
PH-value	-	7.0 - 8.5
Total hardness	°dH	2.0 - 10.0
Carbonate hardness (acid capacity pH 4.3)	°dH	2.0 - 10.0
Degree of alkalinity pH 8.2	mmol / l	0 - 0.25
Chloride	mg / l	≤ 50
Iron	mg / l	≤ 0.2
Manganese	mg / l	≤ 0.05
Copper	mg / l	≤ 2.0
Silicate	mg / l	≤ 5.0
(Filtrate-) solid content	mg / l	≤ 350

Technical data as dimensions can be found in the technical drawing in appendix A.

5 Installation and commissioning

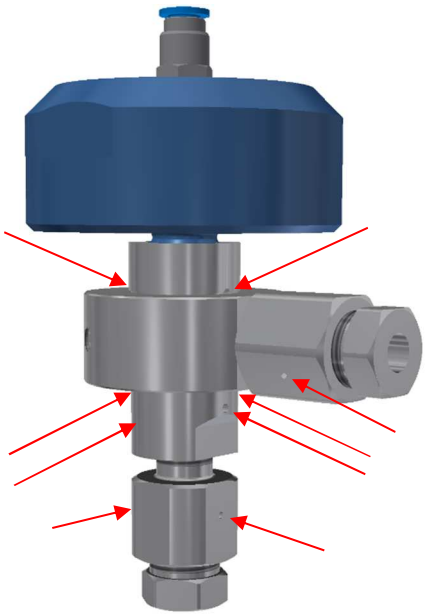
General installation tip:

- Use of a pneumatic oiler is forbidden.
- Compressed air filter with water separator must be installed.
- Compressed air filter and pneumatic valve must have a minimum nominal flow rate of 5 m^3/h.
- Absolute cleanliness of the pipes is important before connection.
- Follow the steps below for installation.
- If you are installing the program for the first time, follow the corresponding sub-chapters step by step.

⚠ WARNING

- **Risk of injury: It is forbidden to close the pressure relief holes.**
- By closing the pressure relief holes, the pressure relief valve or parts of it may explode.
- **Therefore:** Never close or cover any pressure relief hole.

Positions of the pressure relief holes:



NOTE
➢ **Material damage as a result of pitting** ➢ Not or insufficient greased threads or contact areas can pit. ➢ **Therefore:** ➢ Always grease threads and metallic contact areas. Check appendix A for additional information.

NOTE
➢ **Material damage or leakage as a result of fouling** ➢ Fouling components, especially at threads, can lead to leakages and damage. ➢ **Therefore:** ➢ Pay attention to the cleanliness of the components while maintaining.

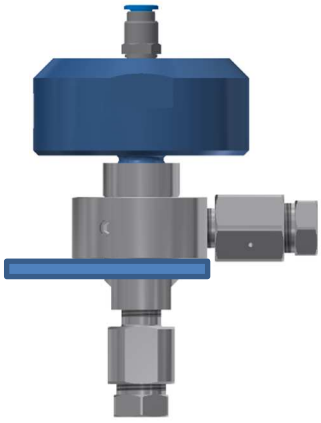
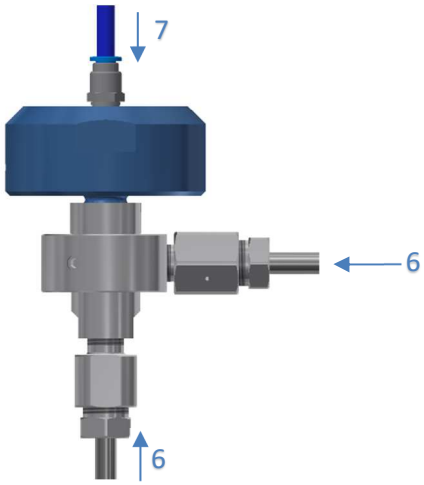
NOTE
➢ **Material damage as a result of leakages** ➢ Constant leakage may damage the product. ➢ **Therefore:** ➢ Immediately eliminate leakages (see chapter 8 „Faults and Troubleshooting”).

5.1 Fix pressure relief valve to the machine

The pressure relief valve must be connected to the machine at the mounting ring. Other fastening possibilities must be discussed with the manufacturer.

➢ During installation, ensure that none of the pressure relief holes are closed!

	1. Unscrew the gland nut from the coupling ring. 2. Remove collar from gland nut.

	3. Slide the gland nut over the HP tube.
	4. Screw the collar on the HP tube (left-handed thread). There must be 1 or 2 convolutions visible between the conus and the pressure ring.
Fix coupling ring on mounting plate with three M6 screws Hole pattern see appendix A  (Exemplary drawing)	5. Fix pressure relief valve on the machine.
	6. Connect the HP tube with the pressure relief valve torque see appendix A. 7. Plug in compressed air connection by snapping in.

5.2 Function check of the pressure relief valve

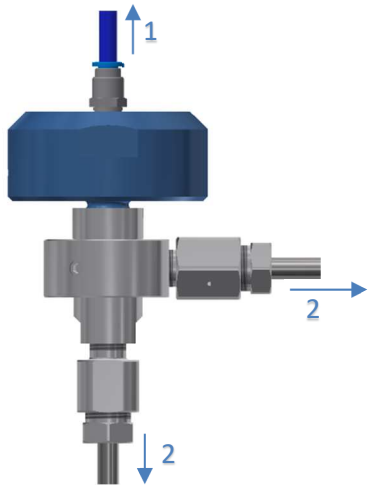
Close and open the pressure relief valve several times under operating conditions (water pressure = operating pressure). Check the following points:

- Error-free opening and closing
- No delays in opening and closing
- Tightness

If all the points checked are functioning correctly, the pressure relief valve is ready for normal operation. If any defects are found, please refer to chapter 8 "Malfunctions and troubleshooting".

6 Deinstallation

Before uninstalling the pressure relief valve, release pressure from the HP tubes and protect against unexpected re-pressurizing.



1. Remove pneumatic hose.
2. Remove HP tube.

Remove pressure relief valve from the machine

7 Maintenance, Service and Repair

- Before uninstalling the pressure relief valve, release pressure from the HP tube and protect against unexpected re-pressurizing.

All maintenance, service and repair work not written in this document has to be executed by the manufacturer.

NOTE

- **Material damage or leakage as a result of fouling**
- Dirty components, especially considering the threads, may lead to leakages and damage of the pressure relief valve.
- **Therefore:**
- Ensure a proper cleaning of the components.

NOTE

- **Property damage as a result of pitting**
- Threads that are not greased or insufficiently greased may pit.
- **Therefore:**

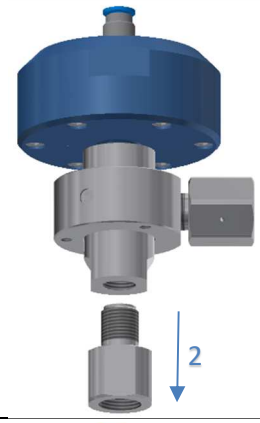
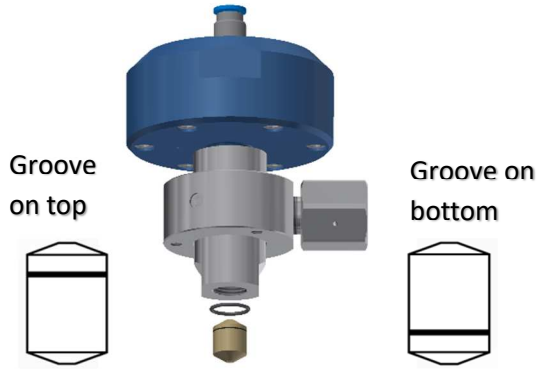
  Always grease threads and metallic contact areas. Check appendix A for additional information.

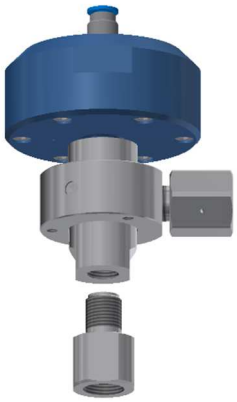
7.1 Regular maintenance

What	Through whom	When
Check tightness see also 8.1	Operator	daily
Check valve for heat generation See also 8.2	Operator	daily

7.2 Reversing (turning) the valve seat

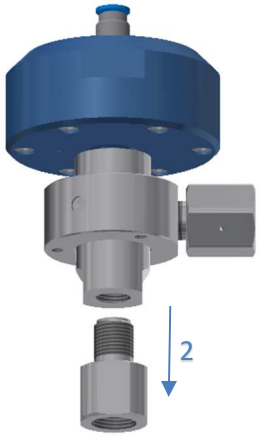
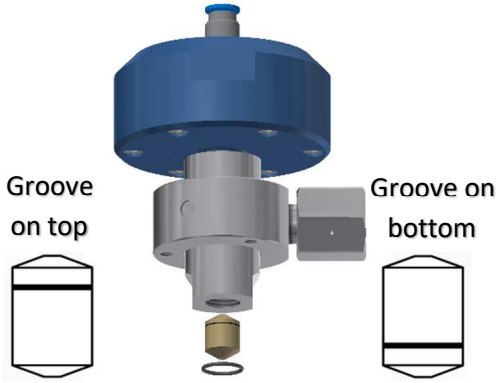
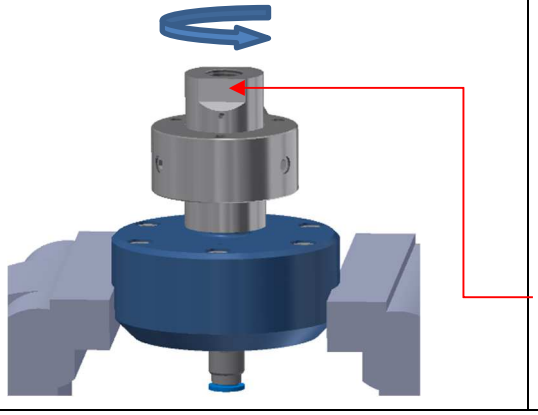
Reason: Valve seat leaking

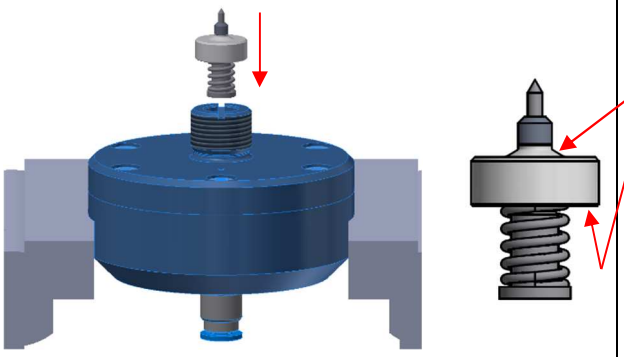
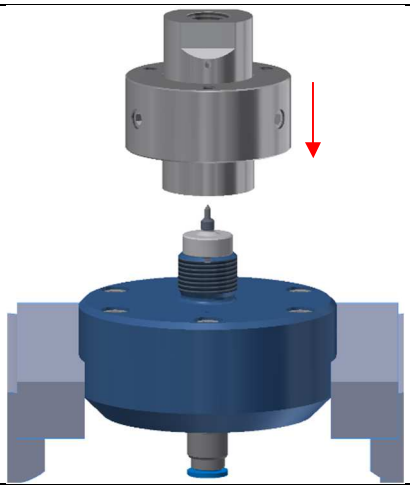
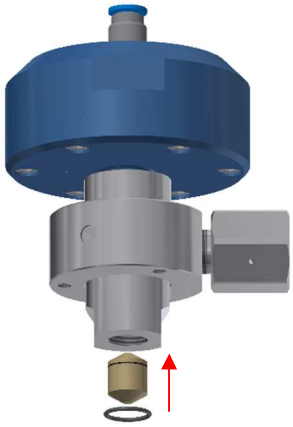
1		1. Removing the pressure relief valve from the machine is recommended (Chapter 6) 2. Screw restrictor out of valve case **Attention!** Counter hold the valve case AF 24
2		1. Remove the O-ring from valve case with help of tool 040011 2. Remove the valve seat from the valve case. Note the orientation of groove of the valve seat (top or bottom).
3		**When groove was on top:** Valve seat can be reinstalled with groove at the bottom. **When groove was on bottom:** Now that both seats are worn out, valve seat must be replaced with new one and installed with groove on top. It is recommended to change the seat kit as well. (See chapter 7.3)

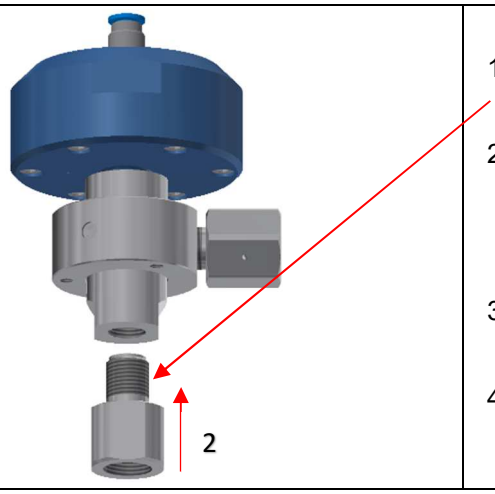
4		1. Insert O-ring into valve case using assembly tool 040011 2. Screw restrictor into valve case and tighten (torque see appendix A). **Attention!** Counterhold on valve case AF24. 3. Fix pressure relief valve to the machine. (Chapter 5.1) 4. Pressure relief valve function check (chapter 5.2).

7.3 Replace seal kit and valve seat

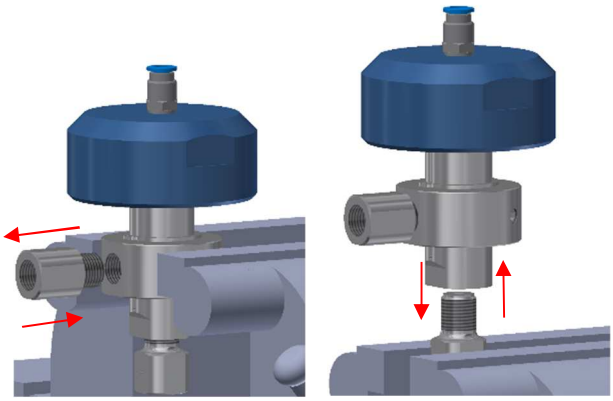
Reason: High pressure seal leaking

1		1. Removing the pressure relief valve from the machine is recommended (Chapter 6) 2. Screw restrictor out of valve case **Attention!** Counter hold the valve case AF 24
2		1. Remove the O-ring from valve case with help of tool 040011 2. Remove the valve seat from the valve case. Note the orientation of the groove of the valve seat for step 7 (top or bottom).
3		1. Clamp pneumatic cylinder at the width across flats in a bench vise. **Attention!** Do not over tighten, this would deform the cylinder. Use protective jaws. 2. Unscrew valve case at the AF 24.

4		1. Sit valve case on a solid surface according illustration (needle point face up). 2. Press the seal kit with the ejector mandrel 900070 out of the valve case. 3. Dispose/recycle the old seal kit.
5		1. Grease the outer cone and the pressure surface of the support disc of the new seal kit according to Appendix A. 2. Place the new seal kit on the pneumatic cylinder.
6		1. Grease the thread of the cylinder according to appendix A. 2. Screw valve case (AF24) on pneumatic cylinder and tighten (torque see appendix A).
7		1. If valve seat in step 2 with **groove on top**: - Turn the valve seat and install it with the groove at the bottom. 2. If valve seat in step 2 with **groove at bottom**: - Replace the valve seat and install the new one with groove at the top. 3. Insert the O-ring into the valve seat using mounting tool 040011

8		1. Grease the restrictor on the thread according to Appendix A. 2. Screw restrictor into valve case and tighten (torque see appendix A). **Attention!** Counterhold on valve case AF24. 3. Mount pressure relief valve to the machine (chapter 5.1). 4. Pressure relief valve function check (chapter 5.2).

7.4 Replace restrictor

1		1. Removing the pressure relief valve from the machine is recommended (Chapter 6) 2. Clamp pressure relief valve as shown in a bench vise. **Attention!** Use protective jaws. 3. Screw restrictor out of valve case 4. Grease new restrictor on the thread according to Appendix A. 5. Screw in new restrictor and tighten (torque see appendix A).

8 Faults and Troubleshooting

Before uninstalling the pressure relief valve, release pressure from the HP tube and compressed air tube.

Protect against unexpected re-pressurizing.

NOTE

Material damage as a result of leakages

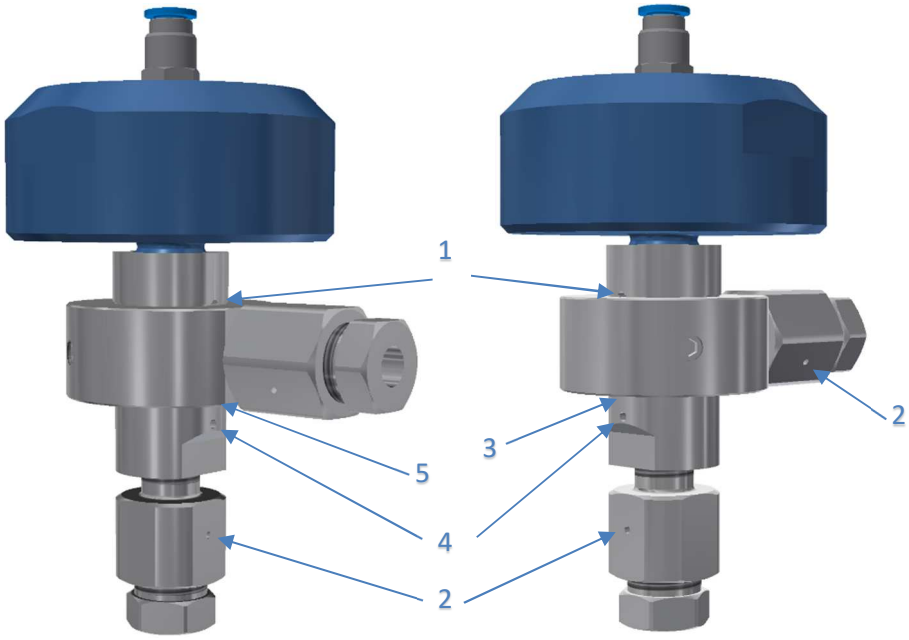
Constant leakage may damage the product.

Therefore:

Immediately eliminate leakages.

Warning! After any troubleshooting, pressure relief valve function check (chapter 5.2).

8.1 Leakage of the pressure relief valve:



Pos. of the leakage	Cause of the leakage	Action	Chapter
1 Seal kit (Check twice if the leakage is not at position 2)	HP-Seal damaged	Replace seal kit	7.3
	Seal cone in valve case or Pressure plate damaged	Replace damaged parts	
	Wrong torque for the pneumatic cylinder	Use correct torque according appendix A	
	Water pressure to high	Please note operating limits	4
2 HP screw connection	Wrong torque for HP screw connection	Tight HP screw connection according appendix A	5.1
	Seal cone of HP tube damaged	Recut the cone of the HP tube	
3 Seal cone valve case – valve seat	Wrong torque for restrictor inlet	Tight restrictor according appendix A	7.2
	Seal cone damaged	Replace valve seat and/or valve case	7.3
4 Seal cone restrictor - valve seat	Wrong torque for restrictor inlet	Tight restrictor according appendix A	7.2
	Seal cone damaged	Replace valve seat and/or valve case	
5 Seal cone restrictor – valve case	Wrong torque for restrictor outlet	Tight restrictor according appendix A	7.3 7.4
	Seal cone damaged	Replace restrictor and/or valve case	

8.2 Further troubleshooting

Error	Possible causes	Action	Chapter
Pressure relief valve does not close properly	Water pressure above the permissible operating pressure	Take into account operating limits	4
	To low air pressure	Take into account operating limits	4
	Valve seat or needle damaged	Replace seal kit	7.3
	Foreign body in the valve seat	Clean valve seat	7.2
	Pneumatic cylinder defect	Get pneumatic cylinder repaired (manufacturer)	7.3
Pressure relief valve becomes warm/hot	Valve does not close properly (leaking at needle seat) → possible causes see above (pressure relief valve does not close)		
Valve does not open	Valve needle jammed	Clean or replace seal kit	7.2
	Pneumatic cylinder defect	Get pneumatic cylinder repaired (manufacturer)	7.3

9 Recycling

The pressure relief valve is made of metal and plastic. All the metal parts can be recycled. The plastic parts are to be professionally recycled as per local specifications.