rexroth
A Bosch Company

Directional spool valves, direct operated, with solenoid actuation

Area of application in accordance with the explosion protection directive NEC505 Class I, Zone 1

Type WE6..6X/...VE1...

Operating instructions
RE23178-VE1-B/03.22

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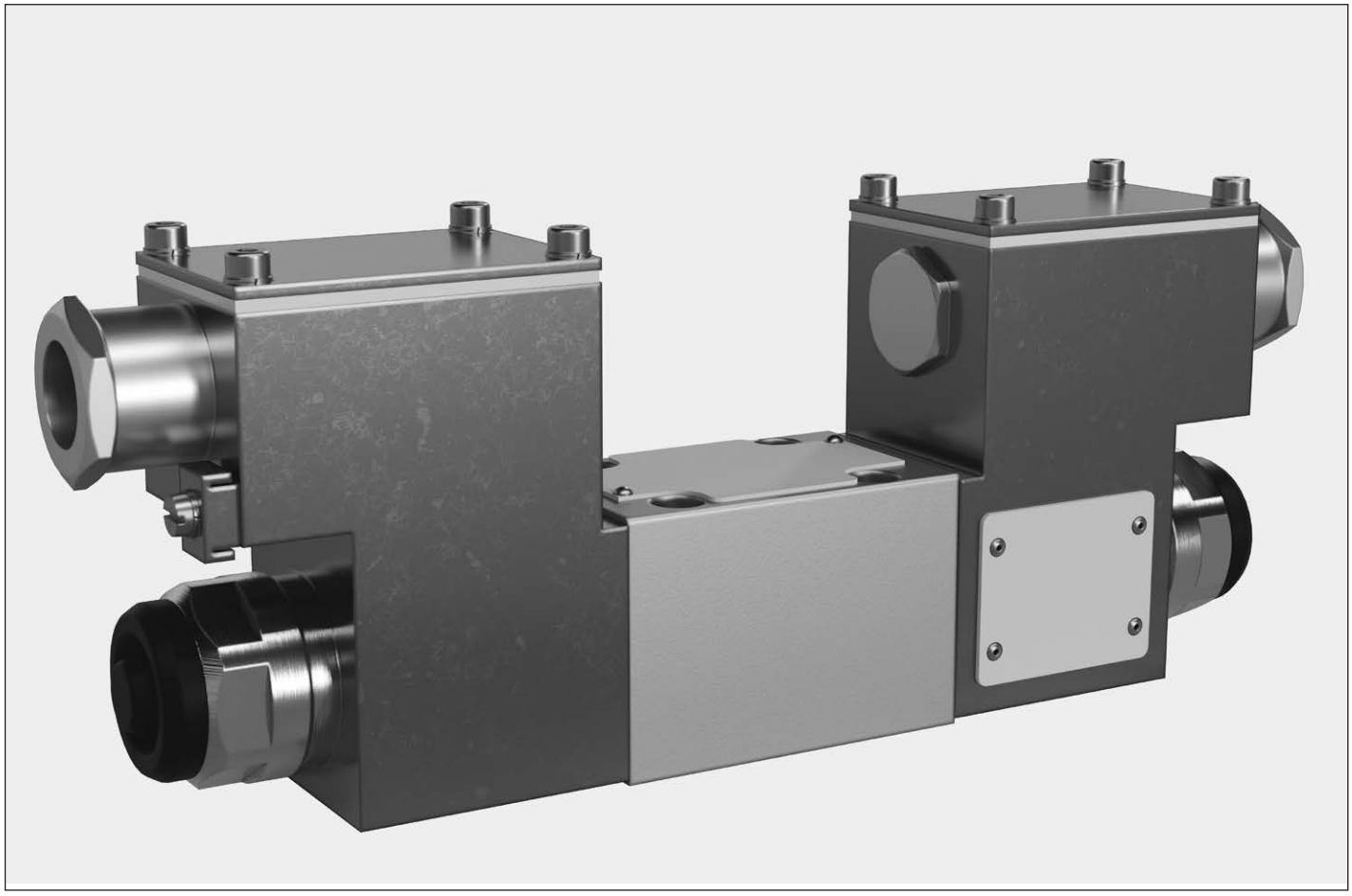
English



The data specified serves to describe the product. If information on the use of the product is given, it is only to be regarded as application examples and recommendations. Catalog information does not constitute warranted properties. The information given does not release the user from the obligation of own judgment and verification. Our products are subject to a natural process of wear and aging.

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The cover shows an example configuration. The product supplied may therefore differ from the figure shown.

The original operating instructions were prepared in German.

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1 About this documentation

1.1 Validity of the documentation

This documentation applies to the following products:
• WE6..6X/...VE1...

This documentation is intended for assemblers, operators, service engineers, system end-users, machine and system manufacturers.
This documentation contains important information on the safe and proper assembly, transport, commissioning, operation, use, maintenance, disassembly and simple troubleshooting of the product.

- ▶ You should read this documentation thoroughly and in particular chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product", before working with the product.

The documentation version with which the product was supplied is valid.

1.2 Required and amending documentation

- ▶ The product must not be commissioned until you have been provided with the documentation marked with the book symbol 🕮 and you have understood and observed it.

Table 1: Required and amending documentation

	Title	Document number	Document type
🕮	Directional spool valves, direct operated, with solenoid actuation	23178-VE1	Data sheet
🕮	General product information on hydraulic products	07008	Data sheet
	Subplates	45100	Data sheet

1.3 Representation of information

Uniform safety instructions, symbols, terms and abbreviations are used so that you can quickly and safely work with your product using this documentation.
For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions

In this documentation, safety instructions are included in chapter 2.6 "Product-specific safety instructions" and in chapter 3 "General information on damage to property and damage to product" and whenever a sequence of actions or instructions is explained which bear the danger of personal injury or damage to property. The measures described for hazard avoidance must be observed.

Safety instructions are set out as follows:

⚠ SIGNAL WORD

Type and source of danger!
Consequences in case of non-compliance
- ▶ Hazard avoidance measures
- ▶ <Enumeration>

- **Warning sign:** Draws attention to the danger
- **Signal word:** identifies the degree of danger
- **Type and source of danger!:** specifies the type and source of danger
- **Consequences:** describes the consequences in case of non-compliance
- **Precaution:** Specifies how the danger can be prevented

Table 2: Risk classes according to ANSI Z535.6-2011

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a dangerous situation which will cause death or severe injury if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe injury if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor or medium injuries if not avoided.
NOTICE	Damage to property: The product or the environment could be damaged.

1.3.2 Symbols

The following symbols indicate notes which are not safety-relevant but increase the comprehensibility of the documentation.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is not observed, the product cannot be used and/or operated optimally.
▶	Individual, independent action
1. 2. 3.	Numbered instruction: The numbers indicate that the actions must be carried out one after the other.

1.3.3 Abbreviations

The following abbreviations are used in this documentation:

Table 4: Abbreviations

Abbreviation	Meaning
NEC	*National Electrical Code*
EN	European Standard
ISO	International Organization for Standardization

Abbreviation	Meaning
IEC	International Electrotechnical Commission
RE	Rexroth document
IP	Ingress protection rating of electric operating equipment
A, B	Hydraulic connections (actuators)
T	Hydraulic connection (tank)
P	Hydraulic connection (pump)
ANSI	American National Standards Institute

2 Safety instructions

2.1 General information on this chapter

The product has been manufactured according to the generally accepted codes of practice. However, there is still the danger of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation completely and thoroughly before working with the product.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when you pass the product on to third parties.

2.2 Intended use

The product is a hydraulic component.
You may use the product as follows:
- as direct operated directional spool valve with solenoid actuation for intended use in explosive atmospheres.

The product is only intended for professional use and not for private use.
Intended use includes having read and understood this documentation completely, especially chapter 2 "Safety instructions".
The valve is designed and constructed for the control of oil flows.
The solenoid system fulfills the requirements according to NEC 505.
You can find details about the marking according to NEC 505 and the derived standards in *"Data sheet 23178-VE1"* under *"Information on explosion protection"*.
Moreover observe the specifications in chapter 5.1.1 "Explosion protection marking".

The valve may only be operated in a technically perfect condition and used as described in these operating instructions. The connection conditions, application conditions and performance data defined in these operating instructions must not be changed.
If you intend to use the valve with other connection, application or performance data than those defined by Bosch Rexroth AG in these operating instructions, please contact Bosch Rexroth AG beforehand. The valve must not be used with other connection, application and performance data than those defined in these operating instructions without the written approval by Bosch Rexroth AG.

2.3 Improper use

Any use deviating from the intended use is improper and thus inadmissible.
The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states when being used which in turn could cause personal injuries and/or damage to property. Therefore, please only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product. For example, in explosion-protected areas or in safety-related control components (functional safety).
Improper use of the product includes:
- Faulty assembly
- Incorrect transport
- Lack of cleanliness during storage and assembly
- Incorrect installation
- Use of inappropriate/non-admissible hydraulic fluids
- Non-compliance with the specified performance limits

Changes and/or modifications on the valve are not admissible, refer to chapter 13 "Extension and modification".
Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics, hydraulics and pneumatics as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge of how to handle lifting gear and the necessary attachment devices is required. In order to ensure safe use, these activities may only be carried out by an expert in the respective field or an instructed person under the direction and supervision of an expert.
Experts are those who can recognize potential dangers and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant conditions pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary expert knowledge.
Expert knowledge means for example for hydraulic products:

- Reading and completely understanding hydraulic schemes,
- in particular, completely understanding the relationships regarding the safety equipment and
- Having knowledge of the function and set-up of hydraulic components.

Qualification of personnel for installation and commissioning of valves in an explosion-proof area

Personnel shall be qualified as follows in the extent necessary to fulfill their tasks:

- Understanding of the general principles of explosion protection, protection classes and device identification
- Understanding of corresponding aspects affecting the protection concept
- Understanding of the contents of certificates and relevant parts of this standard
- General understanding of the test, maintenance and repair requirements from IEC 60079-17
- Familiarity with the specific methods to be used for selection and construction of devices referenced in this standard
- Understanding of the additional importance of work authorization systems and safe electrical isolation with regard to the explosion protection

Staff requirements regarding classification into zones and device groups

According to paragraph 505 NEC, the classification into zones and device groups must always be supervised by a "Qualified Registered Professional Engineer".

The following applies to works on the electric system

According to paragraph 505 NEC, wiring must always be supervised by a "Qualified Registered Professional Engineer". Works on the electronic equipment may only be carried out according to the electrical regulations by a specialized electrician or an instructed person who is supervised by an authorized electrician.

Bosch Rexroth offers measures supporting training in specific fields.
Please find an overview of the training contents on the Internet at:
`http://www.boschrexroth.de/didactic`

2.5 General safety instructions

- Observe the valid regulations on accident prevention and for environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used/applied.
- Only use Bosch Rexroth products in a technically perfect condition.
- Observe all notes on the product.
- Persons assembling, operating, disassembling or maintaining Bosch Rexroth products must not be under the influence of alcohol, other drugs or medications influencing the ability to react.
- Only use original Bosch Rexroth accessories and spare parts in order to prevent any hazard to persons due to unsuitable spare parts.
- Comply with the technical data and environmental conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating states when being used which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, e.g. in explosion protection zones or in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a machine or system) where the Bosch Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Product-specific safety instructions

The following safety instructions apply to chapters 6 to 14.

⚠ WARNING

Explosion hazard due to ignitable atmosphere during all work on the valve!
During all work on the valve (assembly, disassembly etc.), there must not be an explosive atmosphere. Otherwise, an ignition may be triggered which may lead to an explosion.

- Before working with the valve, ensure that no explosive atmosphere can occur during the work.

Easily inflammable liquid!
In connection with an explosive atmosphere or other heat sources,
the use of liquids (e.g. hydraulic fluids, coolants etc.) may lead to explosions.

- Only use the valve in the intended explosion protection area.
- The ignition temperature of the liquid used must be 50 K higher than the maximum surface temperature.

Exceeding of maximum temperatures!
Use of the valve outside the approved temperature ranges may lead to functional failures like overheating of the solenoid coil. Explosion protection is therefore no longer ensured.

- Only use the valve within the intended environmental and hydraulic fluid temperature range.

Hot valve surface!
Risk of burning!

- Provide a suitable touch guard.
- During operation, only touch the valve with heat-protective gloves.
  Allow the valve to cool down to room temperature before touching it directly with your hands during maintenance works.

Pressurized system parts and leaking hydraulic fluid!
When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after switching off the pressure supply. During assembly and disassembly works, the valve or parts may fly around and cause personal injuries and/or damage to property. There is more over the danger of serious injury caused by a powerful leaking hydraulic fluid jet.

- Ensure before working at the hydraulic product that the hydraulic system is depressurized and the electrical control de-energized.
- Completely unload the pressure at machines and systems before working at the valve.

⚠ WARNING

Non-compliance with functional safety!
The valve controls movements in machines or systems. In case of mechanical and electric faults, e.g. failure of the energy supply, persons may be caught by the system, slung away or bruised.

- During set-up of your circuit, observe functional safety e.g. according to ISO 13849.

Penetrating water and humidity!
In case of use in humid or wet environments, water or humidity may penetrate electrical connections or the valve electronics. This case may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property.

- Only use the valve within the intended protection class according to NEMA 250 or lower. A corresponding cable entry satisfying protection class type 4 according to NEMA 250 is to be provided by the machine end-user.
- Ensure before the assembly that all seals and caps of the plug-in connections are tight and intact.

⚠ CAUTION

Contaminated hydraulic fluid!
Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of nozzles of the valve. In the worst case, this may result in unexpected system movements and thus constitute a risk of injury for persons.

- Ensure adequate hydraulic fluid cleanliness according to the specifications in the data sheet over the entire operating range.

Leakage in case of incorrect working temperatures!
Use of the valve outside the approved temperature range may lead to permanent leakage at the valves. Thus, hydraulic fluid in the form of a leaking hydraulic fluid jet may injure persons, lead to damage to property and endanger the environment.

- Only use the valve within the intended environmental and hydraulic fluid temperature range.
- In case of leakage, immediately exchange damaged seal rings or the valve.

Corrosion!
The valve described has surface protection (refer to *Data sheet "23178-VE1"*). Use of the valve in humid environments still holds the danger of corrosion on the valve and on the valve mounting screws and thus a reduction of the preload force of the screw connection. To avoid loosening of the valve and mitigate the associated risk:

- Exchange the valves with corrosion damages as soon as possible.
- Check the surface protection on the valve and the valve mounting screws at regular intervals.

Contact with salt water leads to increased corrosion on the valve.
This can lead to chemical corrosion of individual components of the valve.
Take suitable corrosion protection measures.

2.7 Notes on the valve use

- The valve must always be filled with hydraulic fluid.
- To ensure proper functioning, the valve must be vented.
- Pressure peaks in the joint return line of more than one valve may cause unintended movements of the control spool and thus unintended switching processes. It is recommended to use separate return lines.

2.8 Personal protective equipment

The machine end-user must provide the personal protective equipment (such as gloves, working shoes, safety goggles, working clothes, etc.).

2.9 Obligations of the machine end-user

The machine end-user is obligated to check in the order confirmation whether the delivered valve corresponds to the required class and zone.
The machine end-user of the Bosch Rexroth valve is responsible for ensuring that

- the valve is only being used according to the intended use as defined in these operating instructions.
- the valve is only stored, operated and maintained according to the technical data, operating and environmental conditions indicated in the *"Data sheet 23178-VE1"*, in particular that the limit values indicated in the *"Data sheet 23178-VE1"* are not exceeded.
- the applicable provisions, rules and directives on explosion protection are being complied with.
- the operating personnel are instructed at regular intervals.
- a danger zone is marked, if required.
- the safety measures for their specific area of application of the valve are complied with.

IT security

The operation of installations, systems and machines basically requires the implementation of a holistic IT security concept which is state-of-the-art in terms of technology. Accordingly, Bosch Rexroth products and their properties must be considered as components of installations, systems and machines for their holistic IT security concept.
Unless otherwise documented, Bosch Rexroth products are designed for operation in local, physically and logically secured networks with access restrictions for authorized persons, and they are not classified according to IEC 62443-4-2.

3 General information on damage to property and damage to product

The warranty only applies to the delivered configuration.

- The claim to warranty expires if the product is assembled, commissioned and operated incorrectly, not used as intended and/or handled improperly.
- The following safety instructions apply to chapters 6 to 14.

NOTICE

Inadmissible mechanical load!

Impact or shock forces on the valve may damage or even destroy it.

- Never use the valve as handle or step. Do not place/put any objects on top of it.

Dirt and foreign particles in the valve!

Penetrating dirt and foreign particles in the valve lead to wear and malfunctions. Safe function of the valve can no longer be ensured.

- During installation, ensure utmost cleanliness in order to prevent foreign particles such as welding beads or metal chips from getting into the hydraulic lines.
- Before commissioning, ensure that all hydraulic connections are tight and that all seals and caps of the plug-in connections are correctly installed and undamaged.
- Do not use linting fabric for cleaning.
- Ensure that no cleaning agents are able to penetrate the hydraulic system.

Environmentally harmful hydraulic fluid

Leaking hydraulic fluid leads to environmental pollution.

- Immediately remedy possible leakage.
- Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

4 Scope of delivery

The scope of delivery includes:
- Directional spool valve, direct operated, with solenoid actuation Type WE6..6X/...VE1...
- Product documentation (operating instructions and data sheet)

- ▶ Check the scope of delivery for completeness.
- ▶ Check the scope of delivery for possible transport damage, see chapter 6 "Transport and storage".

In case of complaints, please contact Bosch Rexroth AG, see chapter 16.1 "List of addresses".

Accessories such as valve subplates and valve mounting screws are not included in the scope of delivery and must be ordered separately. See chapter 7.6 "Required accessories"

5 Product information

For information on the performance and product description please refer to *"Data sheet 23178-VE1"* of your valve.

5.1 Product identification

The meaning of the information on the name plate can be read in the correspondingly numbered fields of the following table.

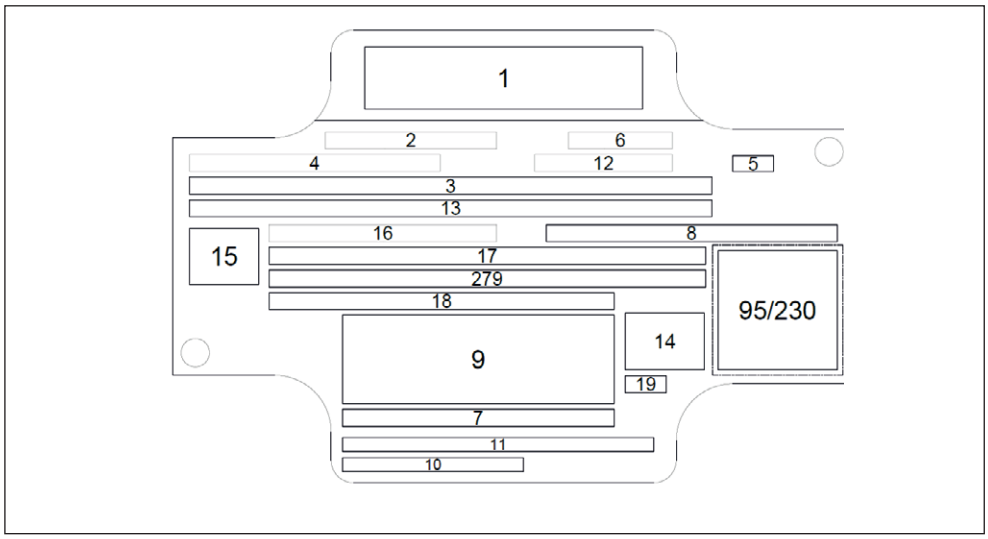

Fig. 1: Name plate of valve

Table 5: Information on the name plate

No.	Type of information
1	Manufacturer's logo
2	Material no. of the valve
3	Type designation, valve
4	Serial number of the valve
5	Manufacturer's factory number
6	Date of manufacture (year and week)
7	Maximum operating pressure
8	Ambient temperature range
9	Hydraulic symbol according to ISO 1219
10	Designation of origin
11	Name and address of the manufacturer
12	Customer's or production order number
13	Customer material number or additional information
14	---
15	---
16	---
17	---
18	---
19	---
230	Bosch Rexroth QR code
279	---

The meaning of the information on the name plateof the solenoid coil can be read in the correspondingly numbered fields of the following table.

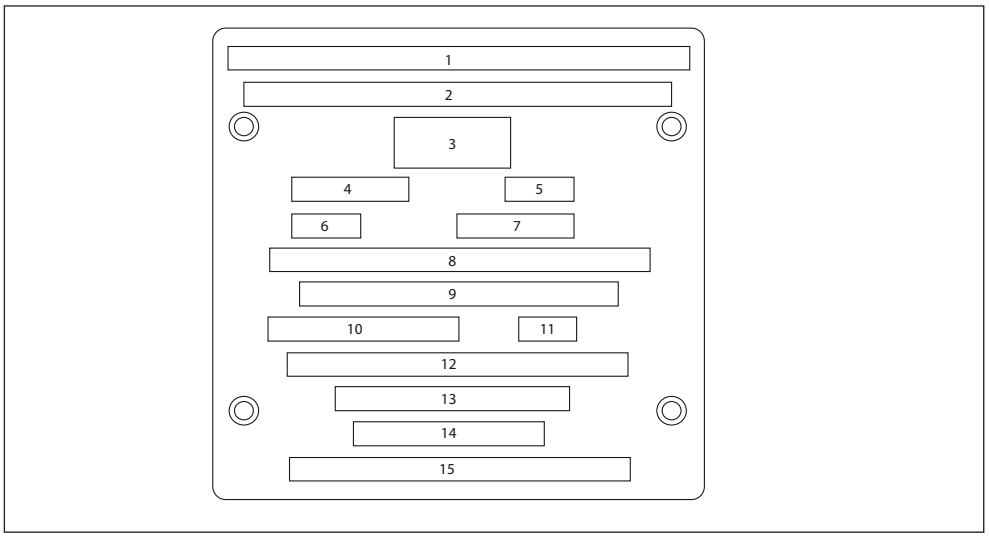

Fig. 2: Name plate, solenoid coil

Table 6: Information on the name plate

No.	Type of information
1	Name/logo of the solenoid coil manufacturer
2	Address of the solenoid coil manufacturer
3	Approval mark
4	Internal identification number
5	Nominal voltage
6	Rated current
7	Internal material number
8	Ex marking according to NEC 505
9	FM certificate no.
10	Admissible ambient temperature range
11	Electrical characteristic values: Duty cycle according to IEC 34-1 (VDE 0580) and frequency
12	Serial number of the valve solenoid and date of production
13	Protection class according to NEMA 250
14	Application note
15	Warning

5.1.1 Explosion protection marking

The solenoid system is intended for use in areas with gases, vapors and mist:
- Group IIC for explosive gas atmospheres except mine workings susceptible to firedamp.
- Encapsulation protection class "mb": ANSI / ISA 60079-18
- Equipment protection by increased safety "e": ANSI / ISA 60079-7
- Marking NEC 505: Class I, Zone 1, AEx e mb IIC T4 Gb

6 Transport and storage

6.1 Transporting the valve

⚠ CAUTION

Danger of damage to property and personal injuries!
With improper transport, the valve can fall and lead to damages and/or injuries since the parts are e.g. sharp-edged, oily, instable, loose or bulky.
- ▶ Use the original packaging for transport.
- ▶ Use personal protective equipment (such as gloves, working shoes, safety goggles, working clothes, etc.).
- ▶ Comply with the national laws and regulations regarding occupational health and safety and transport.
- ▶ Do not transport the valve using components with low stability, e.g. valve solenoids, connectors or cables.

Sharp edges!
Danger of cut injuries!
- ▶ Wear suitable protective equipment for the transport of the safety valve.

Further information regarding the transport is available from Bosch Rexroth, see chapter 16.1 "List of addresses".

Notify your responsible sales contact person of transport damage within one week. The addresses of the sales subsidiaries can be found on the Internet on: `http:/www.boschrexroth.com/adressen`

6.2 Storing the hydraulic valve

Valves are delivered in a perfect state.

For transport and storage of the product, always observe the environmental conditions specified in the *"Data sheet 23178-VE1"*. Improper storage may damage the valve.

Valves can be stored for up to 12 months under the following conditions:

- Ensure a storage temperature range as specified in the *"Data sheet 23178-VE1"*.
- The relative air humidity must not exceed 65%.
- The storage rooms must provide 100% UV protection.
- No ozone formation may occur near the storage facility.
- The storage facilities must be free from etching substances and gases.
- Do not store the valve outdoors but in a well-ventilated room.
- Protect the valve against humidity, particularly ground humidity. Store the valve on a shelf or on a pallet.
- Store the valve protected against impacts and sliding and do not stack it.
- Store the valve in the original packaging or comparable packaging in order to protect it from dust and dirt.
- All connections at the valve must be closed with cap elements.
- After opening the transport packaging, it must be closed properly again for storage. Use the original packaging for storage.

Procedure after the expiration of the maximum storage time of 12 months

1. Check the complete valve for damages and corrosion prior to installation.
2. In a test run, check the valve for correct function and leak-tightness.

After expiry of the maximum storage time, we recommend having the valve checked by your competent Bosch Rexroth service. In case of questions regarding spare parts, please contact the Bosch Rexroth service responsible for your valve, see chapter 10.6 "Spare parts".

Following disassembly

If a dismounted valve is to be stored, it has to be preserved for protection against corrosion for the duration of storage.
Bosch Rexroth recommends the following procedure:

1. Clean the valve; refer to chapter 10.1 "Cleaning and care".
2. Close all connections so that they are airtight.
3. Pack the valve with a desiccant air-tightly in corrosion protection film.
4. Store the valve protected against shocks.

- In each case, please observe any applicable provisions and laws regarding the handling of substances hazardous to water or to health.

7 Assembly

⚠ CAUTION

High pressure!
Risk of injury due to parts shooting out during works at hydraulic accumulators which have not been unloaded.
- Only carry out work on the valve, after the system has been depressurized.
- Unload accumulators which may have been mounted at the system.
- Check the system with test pressure according to ISO 4413.
- Assembly and commissioning may only be carried out by specialists.

7.1 Unpacking

⚠ CAUTION

Falling parts!
Risk of injury! If the packaging is opened improperly, parts may fall out and cause injuries or damage of the parts.
- Put the packaging on level, bearing ground.
- Only open the packaging from the top.

- Dispose of the packaging in accordance with the currently applicable national provisions in your country.

7.2 Changes at the surface protection of the valve

⚠ WARNING

Explosion hazard due to modifications on the valve!
Any change at the surface protection of the valve solenoid will lead to loss of the explosion protection!
- The valve solenoid must not be painted or otherwise coated with non-conductive substances.

7.3 Installation conditions

- For installing the product always observe the environmental conditions specified in *"Data sheet 23178-VE1"*.
- It is imperative to provide for absolute cleanliness. The valve must be protected from dirt during installation. Contamination of the hydraulic fluid may considerably reduce the life cycle of the valve.
- Observe the installation position specified in *"Data sheet 23178-VE1"*.

7.3.1 Requirements on the valve subplate

WARNING

Explosion hazard caused by overheating!
Non-compliance with the requirements for the valve subplate will void the explosion protection.
- Observe the prescribed minimum distance in case of assembly of several valves to a valve battery.
- Observe the prescribed minimum size and minimum thermal conductivity of the valve connection surface.

Recommended subplates, see chapter 7.6 "Required accessories".

7.4 Prior to assembly

WARNING

Explosion hazard due to wrong area of application!
A valve which is not approved for the area of application can cause explosions!
- Check whether all the explosion protection marks on the name plate of the solenoid coil comply with the information in these operating instructions.
- Please check if you have the right valve type by means of the type designation on the name plate of the valve.
- Check whether class, zone and the temperature classes correspond to the area of application of the valve.

- Check the scope of delivery for completeness and possible transport damage.
- Also observe the safety instructions in chapter 2.6 "Product-specific safety instructions".
- Transport protection elements (e.g. cover plates, protective plugs) must be removed prior to use in an explosive atmosphere.

7.5 Required tools

You only require standard tools to assemble the valve.

7.6 Required accessories

The following accessories are recommended for the connection of the valve. These accessories are not included in the scope of delivery, and can be ordered separately from Bosch Rexroth:

Valve mounting screws

The information regarding the valve mounting screws can be found in *"Data sheet 23178-VE1"*.

Subplates

Subplates with dimensions for valves with porting pattern according to ISO 4401 are listed in the *"Data sheet 45100"*.

Ordering address for accessories and valves

The address of our responsible sales organizations can be found on the Internet at `www.boschrexroth.com` and in the appendix 16.1 "List of addresses".

7.7 Assembling the valve

7.7.1 Installing the valve in the system

⚠ WARNING

Faulty installation of plug screws and lines!
Improperly fastened plug screws and lines may become loose during subsequent operation and fly around due to the pressure. This may cause serious injuries!

- Only pressurize your system after all plug screws and lines have been completely and properly mounted according to the specification.

Faulty mounting!
Mounting of the valve with valve mounting screws of reduced stability, insufficient mounting or fastening at blocks and plates with insufficient stability may lead to the valve becoming loose and falling down. Consequently, hydraulic fluid may leak and lead to personal injuries and/or damage to property.
Particular caution applies to valves with suspended installation.

- Completely assemble the valve according to the assembly specifications by means of suitable assembly aids.
- Only assemble the valve at blocks or plates suitable for the weight of the valve.
- Observe the tightening torques, screw stability and the minimum length of the valve mounting screws.

⚠ CAUTION

Insufficient installation space!
Insufficient installation space may lead to jamming or abrasions in case of actuation and adjustment work at the valve.
- Provide for sufficient installation space.
- Ensure that actuation, adjustment elements and plug-in connectors are easily accessible.

Leaking hydraulic fluid!
Hydraulic fluid may leak during assembly and disassembly of the valve.
This might cause persons to slip or fall.
- Do not remove the protective caps of the valve until assembly.
- After disassembly, seal the hydraulic fluid bores with suitable cap elements.
- Immediately remove hydraulic fluid that has leaked out.

NOTICE

Wear, tear and malfunctions!
The cleanliness of the hydraulic fluid has a considerable impact on the cleanliness and life cycle of the valve. Any contamination of the hydraulic fluid will result in wear and malfunctions. Particularly foreign particles may damage the valve.
- Always ensure absolute cleanliness.
- Install the valve in clean condition.
- Make sure that all connections, hydraulic lines and attachment parts are clean.
- Ensure that no cleaning agents are able to penetrate the hydraulic system.
- Only use seal kits as listed in chapter 10.6 "Spare parts".

1. Before any assembly and disassembly work starts, the environment must be cleaned so that no dirt can get into the oil circuit. Use a fiber-free cloth or special paper for the cleaning.
2. Remove existing preservative agent.
3. Check the valve contact surface for the required surface quality (see *"Data sheet 23178-VE1"*). Remove the protective plate from the valve and keep it safe for returns in case any repairs become necessary later.
4. Dry the valve connection surface using suitable cleaning materials.
5. Check the seal rings at the valve connection surface for completeness. Other sealants are not admissible.
6. Check whether the pressure connecting line is connected with P and the return line with T at the subplate.

Exchanging P and T may cause damage at the valve in case of pressurization.

7. Place the valve on the contact surface.

Only use valve mounting screws with the thread diameters, screw lengths and strength properties indicated in the *"Data sheet 23178-VE1"*!
Always fasten the valve with all 4 valve mounting screws as otherwise, leak-tightness is not guaranteed.

8. When using the subplates mentioned under 7.6 "Required accessories" or in case of assembly on comparable cast iron installation surfaces, tighten all four valve mounting screws with a tightening torque of 7 Nm ± 0.7 Nm (with a friction coefficient of μ_{total} = 0.09...0.14). This tightening torque refers to the maximum admissible operating pressure.

If the valve is to be used at a reduced maximum pressure and in this connection is to be mounted on mounting surfaces of a different material, it might be necessary to use a lower tightening torque in order to exclude any damage.

7.7.2 Hydraulic connection of the valve

⚠ CAUTION

Damage of the valve!
During operation, hydraulic lines and hoses installed under mechanical stress create additional mechanical forces, which reduces the life cycle of the valve and the complete machine or system.
▶ Assemble lines and hoses without stress.

1. Depressurize the relevant system part.
2. Establish all connections observing the operating instructions of the system.
3. Make sure that pipes and/or hoses are connected to all ports and/or that the ports are closed with plug screws.
4. Carry out a special check to make sure that the cap nuts and flanges are correctly tightened at the pipe fittings and flanges.

Mark all checked fittings, e.g. using a permanent marker.

5. Make sure that all pipes and hose lines and every combination of connection pieces, couplings or connection points with hoses or pipes are checked for their operational safety by a person with appropriate knowledge and experience.

7.7.3 Establishing the electrical connection

⚠ WARNING

High electrical voltage!
Danger to life, risk of injury caused by electric shock due to incorrect connection and faulty pin assignment.

- The valve may only be connected by or under the supervision of a specialized electrician.
- De-energize the system before the assembly, pulling and connecting plug-in connectors and all other installation works. Secure the electrical equipment against restarting.
- Provide for proper, safe connection for protective grounding conductor.
- Before switching on, check whether the protective grounding conductors at all electric devices are firmly connected according to the connection diagram.
- Close the terminal box according to the guidelines in these operating instructions.

Explosion hazard due to missing equipotential bonding!
Electrostatic processes, an incorrect grounding concept or missing equipotential bonding may lead to an explosion. Apart from this, malfunctions or uncontrolled movements at the machine may be caused!

- Provide for correct grounding and provide for proper equipotential bonding.

Explosion hazard caused by overheating!
A wrongly dimensioned fuse protection may lead to overheating and thus explosion!

- Corresponding to the rated current, a fuse according to IEC 60127 and/or UL 248-14 has to be connected upstream of every solenoid coil (6.3 x 32 mm). The shut-off threshold of the fuse has to match the prospective short-circuit current of the supply source.
- The prospective short-circuit current of the supply source may amount to a maximum of 1500 A.
- This fuse may only be installed outside the explosive area or must be of an explosion-proof design.

Explosion hazard due to improper installation!
No precautions are taken for safe connection of the shielding or sheathing in the connection compartment of the valve solenoid and on the entry for pipelines (NPT 1/2"). The use of connection lines with shielding or sheathing can lead to potential backfeeding and is thus an explosion hazard!

- Only use connection lines without shielding or sheathing.

For information on the prescribed pre-fuse, see *"Data sheet 23178-VE1"*.

⚠ CAUTION

Danger of damage to property and personal injuries!
Faulty energy supply may lead to uncontrolled valve movements.
These could result in possible malfunctions or failure of the valve and cause injuries.
- Only use a power supply unit with safe separation.
- Always comply with the country-specific regulations.

Danger of short circuit due to missing seals and caps!
Fluids may enter the valve and cause a short-circuit.
- Before commissioning, ensure that all seals and caps of the plug-in connections are leak-proof.

At the factory, the valve is fitted with an adapter for a cable and line entry and it guarantees type 4 according to protection class NEMA 250. The cable and line entry is provided by the customer and also has to comply with type 4 according to protection class NEMA 250.
When mounting the customer's cable and line entry, the adapter is to be held in place with a suitable tool (hexagon wrench, wrench size 30).

- Only the adapter included in the scope of delivery and the installed blind plug may be used.
- When selecting the connection line, see *"Data sheet 23178-VE1"*, please observe the requirements regarding the temperature rating and/or avoid contact of the connection line with the surface of the solenoid coil.
- Ensure that there are no bends in the connection line and braided wires to avoid short-circuits and interruptions.
- The sealing elements of the adapter are only intended for single use.
- Use finely stranded conductors only if they have pressed-on wire end ferrules.
- Use only lines satisfying the requirements on the terminal areas of the connection terminals, see *"Data sheet 23178-VE1"*.
- A rigid metal conduit (RMC) is not admissible directly at the valve, only a liquid-tight flexible metal conduit (LFMC) not exerting any transverse and longitudinal forces on the valve.
- During the assembly, ensure leak-tightness between adapter and customer-side cable and line entry. Route the connection line in a strain-relieved form.
  The first mounting point must be within 15 cm of the cable and line entry.
- It is prohibited to change between blind plug and adapter.

The connection of the solenoid coil is polarity-independent. With solenoid coils for connection to alternating voltage, a bridge rectifier is integrated in the solenoid coil.

Upon delivery of the valve, the adapter is already screwed into the terminal box.

1. De-energize and depressurize the relevant system part.
2. Open the terminal box (internal hexagon, wrench size 3)
3. Remove the outer sheath of the connection line and the insulation of the individual conductors. Press the wire end ferrules to the individual conductors.

Strip the wires of the connection lines and the protective grounding conductor with 5 + 1 mm. Strip the wires of the external equipotential bonding with 9 + 1 mm.

4. Guide the individual conductor into the connection terminal and screw this into place with the clamping screws.
   Tightening torques for the clamping screws:

Table 7: Tightening torques

Operating voltage connection	0.4...0.5 Nm
Connection for protective grounding conductor	1.0...1.2 Nm
Connection for potential equalization conductor	2.0...2.4 Nm

5. Assemble the cover with the seal underneath.
   Tighten the mounting screws with their spring washers diagonally, one after the other; tightening torque of the cover screws: 1...1.1 Nm.

Table 8: Adapter connection data

Internal connection thread	NPT 1/2"

7.7.4 Rotating the solenoid coil by ± 90°

⚠ WARNING

Explosion hazard due to improper installation!

Improper assembly will result in loss of the explosion protection!

- Strictly observe the following modification instructions for rotating the solenoid coil.
- When turning the solenoid coil, make sure that it does not project over the valve connection surface.
- Make sure that the solenoid coil moves freely and does under no circumstance rest on the base plate.
- A gap between the valve housing and the solenoid coil is not admissible.
- Ensure that each solenoid coil is reassigned to the original valve.
- After rotating the solenoid coil, the coil pin must engage in the bore of the valve housing.

Solenoid coils can be assembled around the pole tube, i.e. the longitudinal axis of the valve, displaced by ± 90°.

The pole tube of the valve solenoid is completely sealed towards the oil circuit. The solenoid coil can therefore still be twisted if the valve has already been installed.

1. Detach the mounting nut of the valve solenoid at the pole tube (hexagon nut, wrench size 32).
2. Remove the solenoid coil and the O-ring from the valve and rotate it by 90° in the desired direction.
3. Reattach the solenoid coil in the desired position. After rotating the solenoid coil, the coil pin must engage in the bore of the valve housing.
4. Assemble the O-ring onto the pole tube and push it to the solenoid coil.
5. Re-tighten the mounting nut of the valve solenoid (hexagon nut, wrench size 32, tightening torque 4+1 Nm). There must not be any visible gap between solenoid coil and valve housing.

8 Commissioning

⚠ WARNING

Faulty assembly!
If the valve is not correctly mounted, persons might be injured and the valve or system could be damaged when commissioning the valve.

- Only commission your system after all hydraulic connections and the valve have been completely and properly mounted according to the specifications.
- Look out for defective sealing points and exchange defective seal rings immediately.
- Wear personal protective equipment during the initial commissioning.
- The solenoid coil may only be put into operation in combination with a pole tube and mounting nut assembled at the valve connected to a protective grounding conductor and connection for potential equalization conductor.

Inadmissibly high operating pressure!
In hydraulic applications with different area ratios, the hydraulic pressure is fortified and may - in case of incorrect design - lead to exceedance of the maximum admissible operating pressure. Thus, valves may burst, or the cap elements may fly around and cause serious injuries.

- Ensure before the commissioning of the hydraulic system that the maximum admissible pressure of the valve in the system is not exceeded by any means.
- Ensure that in your system, the maximum admissible operating pressure is secured by means of a pressure limitation element.

Damage to persons and property!
Commissioning of the valve requires basic hydraulic and electrical knowledge.

- Only qualified personnel (see chapter 2.4 "Qualification of personnel") is authorized to commission the valve.

NOTICE

Risk of short-circuit!
Condensed water can build up in the terminal box and cause a short-circuit!

- Allow the valve to acclimatize for some hours prior to commissioning as the electronics might be damaged by the generation of condensed water.

In order to commission the valve, proceed as described in the sections below:

Checking the connection line

The following applies to all valves irrespective of the type of connection:

- The connection line must be checked for proper condition by or under the guidance and supervision of a specialized electrician before the initial or any re-commissioning.
- Replace damaged connection lines.

Check electrical connections

- Check the inside of the terminal box for corrosion. In case of visible corrosion, do not install the valve.
- Electrical connections in the terminal box must be checked for proper condition by or under the guidance and supervision of a specialized electrician before the initial or any re-commissioning.
- Seals are subject to a natural process of aging and for this reason, check seals for damages every time the terminal box is opened and replace them if required.

Bleeding the hydraulic system

Observe the operating instructions of the device and/or system into which the valve is installed.

- Before the actual operation, switch the valve several times with reduced pressure (50% operating pressure). This will press out any remaining air from the valve. Thus, mechanical damage being caused by inadmissibly high acceleration of the fluid and the valve control spool is avoided and the life cycle of the valve is extended.

Do not switch the valve under operating pressure as this may cause damage.

- You can also achieve the switching movement of the valve control spool necessary for the bleeding procedure by manually actuating the manual override. For further information, refer to chapter 9.2 "Operating the manual override".

Performing the leak test

- Ensure that no hydraulic fluid leaks at the valve and the connections during operation.
- Check whether there is an internal leakage. The check must be carried out according to the possibilities present at the hydraulic system.

An internal leakage can be valve-specific but does not necessarily affect the functionality of the valve.

9 Operation

9.1 General information

⚠ WARNING

Explosion hazard caused by overheating!
Loss of explosion protection due to overheating.
- In case of valves with two solenoid coils, maximally one of the solenoid coils may be energized at a time!

⚠ CAUTION

Loud noise!
Unfavorable arrangement of valves results in resonance or fluid noises, such as whistling. In continuous operation, these noises may cause hearing damage in persons or damage at the valves.
- In this case, contact a service engineer.

Only use the valve within the performance range provided in the *"Data sheet 23178-VE1"*. The machine and/or system manufacturer is responsible for the correct project planning of the hydraulic system and its control. Modifications of settings on the valve are not admissible.

For information on the operation, please refer to the operating instructions for the hydraulic system into which the valve is installed.

If errors occur, refer to chapter 14 "Troubleshooting".

9.2 Operating the manual override

NOTICE

Danger of damage to property!
Uncontrolled operation of the manual override bears the danger of damaging the system!

- Only operate the manual override if it is ensured that this will not trigger any dangerous working movement of the connected actuator.
- Only operate the manual override when the pressure in the tank channel does not exceed 50 bar. Above this pressure value, the actuating force to be applied is too large.
- Do not use sharp-edged tools to operate the manual override.

The valves are equipped with a manual override. Using this manual override, the switching function of the valve can also be triggered if the solenoid coil is not energized.
The manual override is only intended for manual operation. It is not suitable for frequently recurring manual operations!
The manual override is located on the side of the valve solenoid facing away from the valve.

10 Maintenance and repair

10.1 Cleaning and care

NOTICE

Penetrating dirt and fluids will cause faults!
When dirt and fluids penetrate, safe function is no longer ensured.

- Always ensure absolute cleanliness when working at the valve.

Solvents and aggressive, highly inflammable cleaning agents!
Aggressive cleaning agents may damage the seals and the surface of the valve and let them age faster.

- Never use solvents or aggressive or highly inflammable cleaning agents.

Damage to the hydraulic system and seals!
A high-pressure washer's water pressure could damage the hydraulic system and the seals of the valve. The water displaces the hydraulic fluid from the hydraulic system and seals.

- Do not use a high-pressure washer for cleaning.

For cleaning and care of the valve, observe the following:

- Close all openings with appropriate protective caps/devices.
- Check that all seals and caps of the plug-in connections are firmly fitted so that no humidity can penetrate the valve during cleaning.
- Remove external dirt and keep sensitive and important parts like valve solenoids clean.

10.2 Inspection and maintenance

⚠ WARNING

Uncontrolled machine movements!

Risk of injury due to maintenance work at an activated machine.

- Unless expressly prescribed otherwise, deactivate the machine via the main switch, lock it and remove the key before carrying out works.

The following inspection, testing and maintenance works are to be carried out regularly. The intervals for the same have to be selected in a way - also dependent on the operating conditions - that deficiencies that have to be anticipated are identified timely. The check must, however, at least be carried out every **three years from the date of manufacture of the valve.** The date of manufacture of the valve can be seen from the name plate.

Before initial commissioning or re-commissioning of the valve in a system, check whether the valve requires maintenance. If required, carry out maintenance. For order details for seal kits, please refer to chapter 10.6 "Spare parts".

In order to ensure a long life cycle and functionality, include the following activities in your maintenance schedule for the overall system:

1. De-energize and depressurize the relevant system part.
2. Remove coarse dirt from the exterior.

CAUTION! Damage to persons and property caused by electrostatic charging!

- In order to avoid electrostatic charging, clean the valve using a damp cloth only.

3. Check all external fittings for completeness and tight seat.
4. Check the adapter, blind plug, external grounding connection and connection line for tight seat.
5. Check valve for external leakage and replace seals, if required, see chapter 10.5 "Rectifying external leakages".
6. Open the terminal box and replace any damaged seals.
7. Check the inside of the terminal box for corrosion. Corrosion is an indication of leakage. In case of visible corrosion, remove the valve and have it repaired.

8. Check the potting compound of the solenoid coil, internal lines and braided wires of the solenoid coil for visible damage. In case of visible damage, remove the valve and have it repaired.
9. Check all screws and connections for tight seat.
10. Check all connection lines for damage. Replace the connection line if there is any visible damage.
11. The sealing elements of the adapter and the blind plug are only intended for single use. Renew the adapter and the blind plug after every loosening.
12. Re-assemble the cover of the terminal box with the seal beneath it. Tighten the mounting screws with the spring washers diagonally, one after the other. Tightening torque of the cover screws: 1...1.1 Nm.

10.3 Maintenance schedule

Valves require low maintenance when you use them as intended.
For a long and reliable operation of the valve, Bosch Rexroth recommends to regularly check the hydraulic system and the valve.

10.3.1 Checking for leakage

Check the valve for leakage. Early detection of hydraulic fluid loss may help you to identify and remedy errors. Bosch Rexroth therefore recommends that you keep the valve and/or the system permanently clean.

10.3.2 Checking for noise development

Check the valve for noise development. Based on noise development or the increase of noise development, a possible failure of one or several components can be recognized in time and consequential damage can be avoided.

10.3.3 Checking the mounting elements

Check the mounting elements for tight seat. All mounting elements are to be checked with the system being switched off, depressurized and cooled down.

10.4 Repair

⚠ WARNING

Explosion hazard due to improper repair!
Improper repair will void the explosion protection!
- For repair works, the valve may only be disassembled to the extent described in these operating instructions.
- Defective parts may only be replaced by new, interchangeable components in original equipment quality.

10.5 Rectifying external leakages

External leakage at the valve connection surface can be rectified on site. Other leakages have to be rectified by specialists of the manufacturer.

10.5.1 Rectifying leakage at the valve connection surface

1. Remove the valve, see chapter 11 "Disassembly and removal".
2. Inspect the contact surfaces for seal rings at the valve for cleanliness and damage.
3. Inspect the seal rings and recesses on the connection flanges for cleanliness and damage.
4. Dry the mounting surface and the contact surface using suitable cleaning materials.
5. Assemble the new seals.
6. Re-assemble the valve at the contact surface, see chapter 7 "Assembly".

10.6 Spare parts

Seal kit for the valve connection surface

Table 9: Spare seal kit for the valve connection surface

Spare part	Material number
NBR seal kit for the valve connection surface	**R961000837**
FKM seal kit for the valve connection surface	**R961000838**

Ensure the suitability of the sealing materials for the hydraulic fluid used! See *"Data sheet 23178-VE1"*.

Terminal box spare part kit

Table 10: Terminal box spare part kit

Spare part	Material number
Terminal box spare part kit contains: 1 x adapter 1 x blind plug with O-ring 4 x hexagon socket head cap screws M4 for terminal box 4 x locking ring 1 x flat seal	**upon request**

For a valve with two solenoid coils, two spare part kits are required.

In case of questions about spare parts, please contact your responsible Bosch Rexroth Service:
Bosch Rexroth AG
Service Hydraulics
Bürgermeister-Dr.-Nebel-Str. 8
97816 Lohr am Main
Tel: +49 (0) 9352/40 50 60
service@boschrexroth.de

For the addresses of our sales and service network please refer to:
www.boschrexroth.com/adressen

11 Disassembly and removal

⚠ WARNING

Danger of damage to property and personal injuries at energized or pressurized system parts!

For works at pressurized or energized system parts, there is a danger of injury by escaping hydraulic fluid or electric energy.

- Before disassembly, ensure that the hydraulic system is depressurized, and the electrical control is de-energized.

⚠ CAUTION

Falling of an incompletely disassembled valve!

An incompletely disassembled valve may fall and cause injuries.

- During disassembly, secure the valve against falling.

Have sufficiently dimensioned collecting containers, sufficient cleaning cloths and medium-binding materials ready in order to collect or bind leaking hydraulic fluid.

1. De-energize and depressurize the relevant system part.
2. Disconnect the electrical connections professionally.
3. Prepare a container for collecting leaking hydraulic fluid.
4. Use suitable tools to loosen the valve mounting screws of the valve.
5. Remove the valve mounting screws and remove the valve from the mounting surface.
6. Collect escaping hydraulic fluid in the provided container and dispose of it properly.
7. If the valve is to be returned to the manufacturer for repair, please close the valve connection surface using the supplied protective plate or protect it using equivalent packaging in order to avoid contamination and damage.
8. Close the hydraulic channels of the subplate (on the customer side) to avoid contamination.

If the valve is exchanged, all further steps are analogous to mounting, see chapter 7 "Assembly".

12 Disposal

12.1 Environmental protection

Careless disposal of the valve and the hydraulic fluid could lead to environmental pollution.

- Thus, dispose of the product and the hydraulic fluid in accordance with the currently applicable national regulations in your country.
- Dispose of hydraulic fluid residues according to the applicable safety data sheets for these hydraulic fluids.
- Please observe the following notes for environmentally-friendly disposal of the valve.

12.2 Return to Bosch Rexroth AG

The hydraulic products manufactured by us can be returned to us for disposal purposes free of charge. There must be no inappropriate foreign substances or third-party components when products are returned. Valves must be drained before being returned. The components have to be delivered free to the following address:
Bosch Rexroth AG
Industrial Hydraulics Service
Bürgermeister-Dr.-Nebel-Straße 8
97816 Lohr am Main
Germany

12.3 Packaging

Upon request, reusable systems can be used for regular deliveries.
The materials for disposable packaging are mostly cardboard, wood, and expanded polystyrene. They can be recycled without any problems. Due to ecological reasons, disposable packaging should not be used for returning products to Bosch Rexroth.

12.4 Materials used

Hydraulic components from Bosch Rexroth do not contain any hazardous materials that could be released during intended use. Normally, no negative effects on human beings and on the environment have to be expected.
The valves basically comprise of:

- Cast iron
- Steel
- Aluminum
- Copper
- Plastics
- Electronics components and assemblies
- Elastomers

12.5 Recycling

Due to the high metal share, hydraulic products can mostly be recycled.
In order to achieve an ideal metal recovery, disassembly into individual assemblies is required. The metals contained in electric and electronic assemblies can be recovered by means of special separation procedures as well.

13 Extension and modification

⚠ WARNING

Explosion hazard due to inadmissible modification!
Every non-permitted modification will void the explosion protection.
- Modifications exceeding the extent described in these operating instructions are not permitted.

14 Troubleshooting

14.1 How to proceed for troubleshooting

- Always work systematically and purposefully, even when under time pressure. Random, thoughtless disassembly and changing of settings might in the worst case result in the inability to restore the original cause of error.
- First, get an overview of the functions of the valve in conjunction with the overall system.
- Try to find out whether the valve has worked properly in conjunction with the overall system before the error occurred.
- Try to determine any changes of the overall system in which the valve is integrated:
  - Were there any changes to the application conditions or area of application of the valve?
  - Have changes (e.g. refitting) or repair works been made at the overall system (machine/system, electrical systems, control) or at the valve?
    If so: What were they?
  - Was the valve and/or the machine used as intended?
  - How did the fault become apparent?

- Try to get a clear idea of the cause of error. If necessary, ask the actual (machine) operator.

Fault table The valve is not sensitive to faults as long as the specified application conditions are complied with, in particular the oil quality and the operating temperature.

Table 11: Fault table

Error	Possible cause(s)	Remedy
Valve does not switch on	Electrical connection interrupted, no current continuity	
	• Cable break	Replace connection line
	• Electrical defect in the solenoid coil	Remove valve and have it repaired
	• No pressure at P	Check and/or reapply pressure at port P
	• Control spool is jammed due to contamination	If possible, try to release the control spool by manually actuating the manual override. Refer to chapter 9.2 "Operating the manual override". In case of failure: Remove valve and replace it with a new one.
	Contact problems at the connection terminal	Check the mounting screws of the connection terminal and tighten using a manual torque wrench. Observe the instructions in chapter 7 "Assembly".
External leakage	Seal defective	
	• Seal at the connection surface is defective	Remove the valve and replace the seals
	• Other leakage	Remove valve and replace it with a new one

Following faults due to contamination, it is – in addition to the repair – essential to check the oil quality and improve it, if necessary, by suitable measures such as flushing or the additional installation of filters.

15 Technical data

For the technical data of your valve please refer to *"Data sheet 23178-VE1"*.

16 Appendix

16.1 List of addresses

Contacts for service and spare parts

Bosch Rexroth AG
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97816 Lohr am Main
Germany

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Email service@boschrexroth.de

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Email my.support@boschrexroth.de

The addresses of our sales and service network and sales organizations can be found at `www.boschrexroth.com/adressen`

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