

MODE OF OPERATING

The outlet pressure which is to be controlled acts on the diaphragm. Under normal operating conditions the force of the diaphragm and of the spring are in equilibrium. When the outlet pressure exceeds the set value, the valve closes; when the outlet pressure drops below the set value, the valve opens. When the line is not pressurized, the valve is open.

INSTALLATION

Before the valve is installed, the line has to be flushed carefully. If foreign bodies and impurities cannot be avoided during operation, it is advisable to install a strainer. Remove package material, including plastic plugs, and install the valve in the non pressurized line in such a way that the arrow on the body points in the direction of flow. The spring cap can point either upwards or downwards, if it is not specified otherwise. When the valve is used for fluids or steam, it has to be installed with the spring cap pointing downwards and the air has to be released by means of a manual air valve. The place of installation should be a horizontal section of the line, where the flow is undisturbed. Avoid elbows, shut-off valves or other throttle-like places close to the valve. The control line has to be connected at a distance of at least 10 times the nominal diameter behind the pressure reducing valve. The diameter of the control line should correspond to the connection of the valve. With steam < 0.1 bar the control line has to be provided with a compensation vessel.

SAFETY DEVICES

Pressure reducing valves are not shut-off valves, which guarantee a tight seal. According to VDI/VDE rule 2174 a leakage rate of 0.05% of the Kvs-value is permissible. For that reason a safety device has to be provided - acc. to the Rules for the Prevention of Accidents, VBG 17 - to prevent the pressure within the system from exceeding the maximum permissible value. If it is not specified otherwise, the pressure reducing valve itself has to be secured in such a way that 1.5 times the maximum set value is not exceeded - e. g. with a setting range of 2 - 5 bar: the blow-off pressure of the safety valve can amount to a maximum of 7.5 bar. It must not exceed the nominal pressure of the body.

It has to be ensured that the fluid which escapes from the spring cap in case of a broken diaphragm does not cause any danger. If toxic or hazardous media are used the valve must feature a sealed spring cap (including setting screw seal) fitted with a leakage line connection. A leakage line must be fitted capable of safely and pressureless draining the escaping medium in case the control valve should become defective.

START UP

Functioning and tightness of the valve have been checked at the works. The valve is delivered with released spring. To put the valve into operation the inlet side of the valve has to be opened slowly; at the same time it must be ensured that the fluid is lead away on the outlet side. Avoid pressure shocks. Then the inlet pressure which is to be controlled must be set by means of the adjusting screw.

Please do not tension the spring beyond the specified maximum pressure to avoid restricting valve travel or jamming the valve in open position. The outlet pressure can be temporarily increased by lightly axial pressing on the setting screw.

MAINTENANCE

Depending on the characteristics of the medium and the operating conditions within the system, a maintenance has to be carried out once a year or also at shorter intervals, or the functioning of the valve has to be checked.

In order to carry out a maintenance and also in case of troubles act in the following way: depressurize the valve, release the spring, remove spring cap, check mobility of the control parts. Smooth jamming parts with fine emery cloth.

Leakage or damage of the diaphragm are indicated by medium flowing from the spring cap port (vent hole or leakage line). If leakage cannot be repaired by slightly tightening the screws on the profile clamp e.g. the spring cap, check diaphragm.

To this end release spring. Remove spring cap. Tighten spindle nut firmly. Reassemble all parts and check tightness.

If the leakage is not yet repaired, the diaphragm has to be replaced.

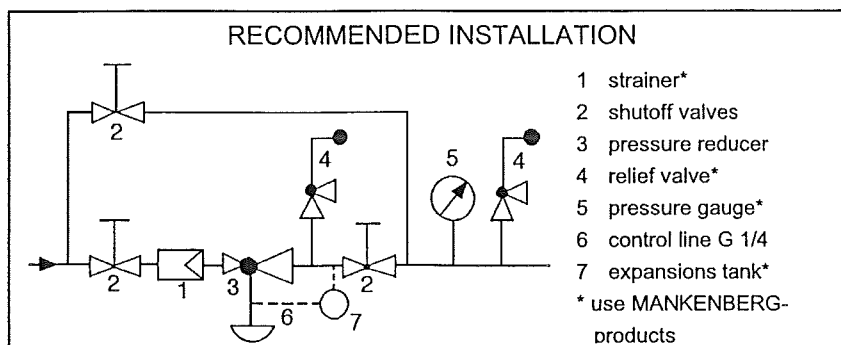
To this end release spring, remove spring cap, loosen spindle nut on the diaphragm disk, remove diaphragm disk and withdraw diaphragm plus sealing or O-ring. After inserting the new diaphragm plus sealing o.e. O-ring tighten spindle nut and screws of the profile clamp firmly, but tighten screws on spring cap (pressure range 0,02 - 0,12 bar) only slightly, because diaphragm would be damaged otherwise.

Strongly increasing outlet pressure with low flow rate indicates a defect of the cone gasket. Remove the spring cap as described before, screw off the plug, release diaphragm and piston from the spindle and pull off spindle with cone. Screw off nut and remove cone. Exchange cone sealing, grind sealing surfaces carefully with metallic seal. Reassembling in opposite succession.

ATTENTION: Don't lubricate or grease EPDM. Use Parker "Super-Lube" for EPDM-O-rings.

SPARE PARTS

When ordering spare parts give the serial number of the valve, article number and designation, as well as the item numbers of the parts.





BETRIEBSANLEITUNG
DRUCKMINDERVENTIL
TYP 652 G 1 1/4 - 2, DM 652F DN 32 - 50

Blatt Nr
DM 652/5.0.011.1.1

WIRKUNGSWEISE

Der zu regelnde Hinterdruck erzeugt an der Membrane eine Kraft, die im normalen Betriebszustand mit der Federkraft im Gleichgewicht steht. Bei Anstieg des Hinterdruckes über den mit der Stellschraube eingestellten Sollwert schließt das Ventil, bei Absinken unter den Sollwert öffnet es. Bei druckloser Leitung ist das Ventil offen.

EINBAU

Vor Einbau des Ventils ist die Rohrleitung sorgfältig durchzuspülen. Falls Fremdkörper und Schmutzpartikel während des Betriebes nicht vermeidbar sind, muß ein Schmutzfänger vorgesehen werden. Verpackungsmaterial einschließlich Plastikstopfen entfernen und Ventil spannungsfrei so in die Leitung einbauen, daß der Pfeil am Gehäuse in Durchflußrichtung zeigt. Die Federhaube kann - sofern nicht ausdrücklich anders angegeben - unten oder oben liegen. Wird das Ventil für Dampf eingesetzt, so ist es mit der Federhaube nach unten einzubauen. Der Einbauort sollte sich in einem strömungstechnisch ungestörten horizontalen Leitungsabschnitt befinden. Krümmer, Absperrventile oder sonstige Drosselstellen dicht vor oder hinter dem Ventil sind zu vermeiden. Die Steuerleitungen sind in einem Abstand von mindestens 10 x Nennweite hinter dem Druckminderer anzuschließen. Der Durchmesser soll dem Anschluß am Ventil entsprechen. Bei Dampf • 0,1 bar ist die Steuerleitung mit einem Ausgleichsgefäß zu versehen.

SICHERHEITSEINRICHTUNGEN

Druckminderer sind keine Absperrorgane, die einen dichten Ventilabschluß gewährleisten. Nach VDI/VDE- Richtlinie 2174 ist eine Leckrate von 0,05 % des Kvs-Wertes zulässig. Daher muß nach der Unfallverhütungsvorschrift VBG 17 eine Sicherheitseinrichtung vorgesehen werden, die ein Überschreiten des im System zulässigen Druckes verhindert. Der Druckminderer selbst ist - sofern nicht anders angegeben - so abzusichern, daß das 1,5-fache des maximalen Einstelldruckes nicht überschritten wird - z.B. bei Einstellbereich bis 5 bar: Der Abblasedruck des Sicherheitsventiles darf maximal 7,5 bar betragen. Er darf jedoch nicht höher als der Nenndruck des Gehäuses sein.

Ferner ist sicherzustellen, daß das Fluid, das bei Membranbruch aus der Federhaube austritt, zu keiner Gefährdung führt. Gegebenenfalls muß an der Atmungsbohrung der Federhaube eine Abführleitung angeschlossen werden.

INBETRIEBNAHME

Funktion und Dichtheit des Druckminderers wurden im Werk geprüft. Er wird mit entspannter Feder geliefert. Bei Inbetriebnahme ist die eingangsseitige Armatur langsam zu öffnen, wobei gewährleistet sein muß, daß das Fluid ausgangsseitig abgeführt wird. Druckstöße müssen vermieden werden. Anschließend ist der zu regelnde Hinterdruck mit der Stellschraube einzustellen. Die Feder nicht über den angegebenen max. Einstelldruck anspannen, so daß der Hub eingeschränkt bzw. das Ventil in Offenstellung blockiert wird. Durch leichten axialen Druck auf die Stellschraube kann der Hinterdruck kurzzeitig erhöht werden.

WARTUNG

Abhängig von den Eigenschaften des Mediums und den Betriebsumständen in der Anlage ist eine Wartung jährlich oder auch in kürzeren Abständen durchzuführen bzw. die Funktion des Ventils zu überprüfen.

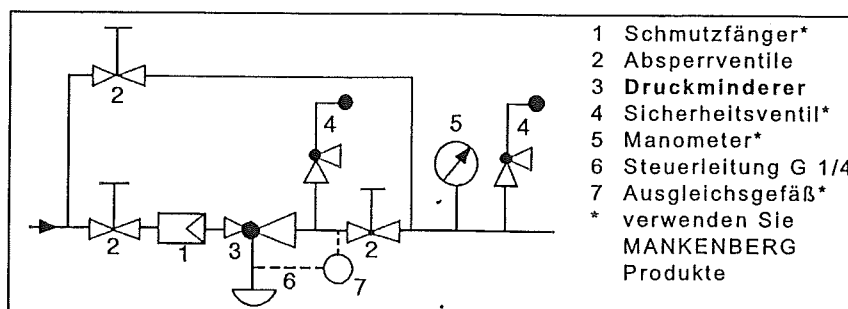
Bei Wartungen oder Störungen ist wie folgt vorzugehen: Ventil drucklos machen, Feder entspannen, Federhaube abnehmen, Steuerteile auf Gängigkeit prüfen. Klemmstellen mit feinem Schmirgellein abziehen. Undichtheit oder Schäden an der Membrane werden durch aus der Federhaubenöffnung austretendes Fluid angezeigt. Ist die Undichtheit durch leichtes Nachziehen der Schrauben an der Schelle bzw. an der Federhaube nicht zu beheben, Membrane überprüfen. Hierzu Feder entspannen. Federhaube demontieren. Spindelmutter fest anziehen. Alle Teile wieder montieren und auf Dichtheit prüfen. Ist die Undichtheit noch nicht behoben, muß die Membrane erneuert werden. Hierzu Spindelmutter an Membrane lösen, Membranscheibe abziehen und Membrane mit Dichtring bzw O-Ring herausnehmen. Nach Einlegen der neuen Membrane mit Dichtring bzw. O-Ring müssen die Spindelmutter und die Schrauben an der Schelle fest angezogen werden, aber Schrauben an Federhaube (Hinterdruck • 1,1 bar) nur leicht, da sonst die Membrane zerquetscht wird.

Stark ansteigender Hinterdruck bei geringer Entnahme weist auf eine defekte Kegeldichtung hin. Beim Ausbau des Ventils Federhaube wie vor beschrieben abnehmen, Verschlussschraube abschrauben, Membrane und Kolben von der Spindel demontieren und die Spindel mit Kegel rausziehen. Nach dem Lösen der Mutter Kegel abziehen und bei Weichdichtung die Kegeldichtung austauschen bzw. bei Harddichtung die Dichtfläche abziehen und neu einschleifen. Der Zusammenbau erfolgt in umgekehrter Reihenfolge.

WICHTIG: EPDM nicht ölen oder fetten. EPDM-O-Ringe mit Parker "Super-Lube" einsetzen (Achtung: silikonhaltig).

ERSATZTEILE

Bei Bestellung von Ersatzteilen Fabrik-Nummer bzw. Artikel-Nummer des Ventils und Bezeichnung sowie Pos.-Nummern der Teile angeben.



20.02.2001

Technische Änderungen vorbehalten

MANKENBERG Armaturenfabrik GmbH • D-23504 Lübeck • Postfach - P/O-Box 1533 • Tel. 0451 - 87975 - 0 • Fax 0451 - 8797599

Know How • Pressure reducing valves

Pressure reducing valves reduce a high and frequently fluctuating pressure to an adjustable constant pressure downstream of the valve. A spring keeps the valve open and this closes as the outlet pressure rises.

Selecting valve type and nominal diameter

Using your maximum operating data and the smallest differential pressure Δp , you should calculate the characteristic performance figure K_v (see leaflet Calculation of Pressure Regulators). Select a valve whose K_{vs} value is 30% greater than the calculated K_v figure. Additional allowances must be made for high-viscosity liquids or liquids which vaporise when depressurised.

You should also note the reduction ratio i.e. inlet pressure p_1 divided by outlet pressure p_2 . The inlet pressure acting on the cone causes the valve to open whereas the outlet pressure acting on the diaphragm/spring system causes it to close. If the reduction ratio calculated from the operating data is greater than the quoted ratio, the valve will not close.

Pressure reducing valves should not be overdimensioned. Their optimum working range is within 10% to 70% of their K_{vs} value.

Selecting rated pressure and valve material

The rated pressure must exceed the maximum system pressure, irrespective of safety allowances. Please note also the effect of the temperature (see DIN 2401).

Selecting the setting range

For good control accuracy you should select a setting range which places the required outlet pressure near its upper limit. If, for example, the controlled outlet pressure is to be 2.3 bar, you should select the 0.8 to 2.5 bar setting range, not 2 to 5 bar. If the available setting range is not wide enough you may go below the bottom limit of the setting range provided that the valve loading is kept low and a high control accuracy not required.

Selecting elastomer materials

You should select elastomers according to the operating temperature and the requirements of the medium. High-pressure gases, for example, can diffuse into the elastomer and cause damage when being depressurised.

Flow velocity

Depending on pressure drop and permitted maximum noise level, we recommend the following flow velocities:

Liquids	1 - 5	m/s
Saturated steam	10 - 40	m/s
Superheated steam	15 - 60	m/s
Gases up to 2 bar	2 - 10	m/s
Gases above 2 bar	5 - 40	m/s

Sense line (control line)

You should install a sense line if the selected pressure reducer is designed for sense line operation. The sense line should be connected at a distance of not less than 10 times nominal di-

ameter downstream of the pressure reducing valve. No isolating valves should be installed in the sense line to avoid an excessive pressure differential between valve body and diaphragm.

To attenuate any oscillations occurring in the pipeline system, the sense line may be fitted with a restrictor which must never be fully closed during operation.

In the case of steam and liquids the sense line must be installed so as to fall towards the valve. Under special operating conditions, for example intermittent operation with dry steam, a compensation vessel must be installed. The sense line must be rigid as elastic hoses can induce oscillations.

Protecting your system

To protect your system you should install a safety valve downstream of the pressure reducer to prevent the maximum permitted operating pressure (normally 1.5 x maximum set pressure) being exceeded. The safety valve operating pressure should be set approximately 40% above the maximum set pressure of the pressure reducer to avoid blow-off during slight pressure fluctuations. For example: if the pressure reducer setting range is 2 - 5 bar the safety valve operating pressure must be 1.4 x 5 bar = 7 bar.

Protecting the pressure reducing valve

To protect the pressure reducer against damage from solid particles carried in the pipeline, a strainer or filter should be fitted and serviced at regular intervals.

Valve seat leakage

Pressure reducers are control valves which are not required to provide a leak-proof seal (VDI/VDE Guideline 2174). Normally pressure reducers leave the factory with perfectly leakproof valve seats. During operation, however, solid particles often cause damage and seat leakage. Any low leakage requirement must be expressly specified when ordering. Valve leakage can be considerably reduced by special measures such as lapping the valve seat, using special cone seals and increasing the control (diaphragm) surfaces.

Cut-off

For the purpose of installation, servicing and isolation of the valve, shut-off valves should be installed upstream and downstream of the pressure reducer. When closing the shut-off valves the upstream valve must always be closed first. A bypass line may be necessary to maintain emergency operation.

Stellited seat and cone

In the case of abrasive media or liquids with pressure drops (inlet pressure minus outlet pressure) of more than 25 bar the valve cone must be stellited; for pressure drops above 150 bar the seat must be stellited as well.

Know How • Pressure reducing valves

Pressure reducing valves reduce a high and frequently fluctuating pressure to an adjustable constant pressure downstream of the valve. A spring keeps the valve open and this closes as the outlet pressure rises.

Selecting valve type and nominal diameter

Using your maximum operating data and the smallest differential pressure D_p , you should calculate the characteristic performance figure K_v (see leaflet Calculation of Pressure Regulators). Select a valve whose K_{vs} value is 30% greater than the calculated K_v figure. Additional allowances must be made for high-viscosity liquids or liquids which vaporise when depressurised.

You should also note the reduction ratio i.e. inlet pressure p_1 divided by outlet pressure p_2 . The inlet pressure acting on the cone causes the valve to open whereas the outlet pressure acting on the diaphragm/spring system causes it to close. If the reduction ratio calculated from the operating data is greater than the quoted ratio, the valve will not close.

Pressure reducing valves should not be overdimensioned. Their optimum working range is within 10% to 70% of their K_{vs} value.

Selecting rated pressure and valve material

The rated pressure must exceed the maximum system pressure, irrespective of safety allowances. Please note also the effect of the temperature (see DIN 2401).

Selecting the setting range

For good control accuracy you should select a setting range which places the required outlet pressure near its upper limit. If, for example, the controlled outlet pressure is to be 2.3 bar, you should select the 0.8 to 2.5 bar setting range, not 2 to 5 bar. If the available setting range is not wide enough you may go below the bottom limit of the setting range provided that the valve loading is kept low and a high control accuracy not required.

Selecting elastomer materials

You should select elastomers according to the operating temperature and the requirements of the medium. High-pressure gases, for example, can diffuse into the elastomer and cause damage when being depressurised.

Flow velocity

Depending on pressure drop and permitted maximum noise level, we recommend the following flow velocities:

Liquids	1 - 5 m/s
Saturated steam	10 - 40 m/s
Superheated steam	15 - 60 m/s
Gases up to 2 bar	2 - 10 m/s
Gases above 2 bar	5 - 40 m/s

Sense line (control line)

You should install a sense line if the selected pressure reducer is designed for sense line operation. The sense line should be connected at a distance of not less than 10 times nominal di-

ameter downstream of the pressure reducing valve. No isolating valves should be installed in the sense line to avoid an excessive pressure differential between valve body and diaphragm.

To attenuate any oscillations occurring in the pipeline system, the sense line may be fitted with a restrictor which must never be fully closed during operation.

In the case of steam and liquids the sense line must be installed so as to fall towards the valve. Under special operating conditions, for example intermittent operation with dry steam, a compensation vessel must be installed. The sense line must be rigid as elastic hoses can induce oscillations.

Protecting your system

To protect your system you should install a safety valve downstream of the pressure reducer to prevent the maximum permitted operating pressure (normally 1.5 x maximum set pressure) being exceeded. The safety valve operating pressure should be set approximately 40% above the maximum set pressure of the pressure reducer to avoid blow-off during slight pressure fluctuations. For example: if the pressure reducer setting range is 2 - 5 bar the safety valve operating pressure must be 1.4 x 5 bar = 7 bar.

Protecting the pressure reducing valve

To protect the pressure reducer against damage from solid particles carried in the pipeline, a strainer or filter should be fitted and serviced at regular intervals.

Valve seat leakage

Pressure reducers are control valves which are not required to provide a leak-proof seal (VDI/VDE Guideline 2174). Normally pressure reducers leave the factory with perfectly leakproof valve seats. During operation, however, solid particles often cause damage and seat leakage. Any low leakage requirement must be expressly specified when ordering. Valve leakage can be considerably reduced by special measures such as lapping the valve seat, using special cone seals and increasing the control (diaphragm) surfaces.

Cut-off

For the purpose of installation, servicing and isolation of the valve, shut-off valves should be installed upstream and downstream of the pressure reducer. When closing the shut-off valves the upstream valve must always be closed first. A by-pass line may be necessary to maintain emergency operation.

Stellited seat and cone

In the case of abrasive media or liquids with pressure drops (inlet pressure minus outlet pressure) of more than 25 bar the valve cone must be stellited; for pressure drops above 150 bar the seat must be stellited as well.

Notes on Safety

relating to the installation, operation, maintenance and repair of Mankenberg products

Basic requirements

The equipment must be installed, repaired and operated only by skilled personnel familiar with the installation, commissioning and operation of the products. "Skilled personnel" in the meaning of these Installation and Operating Instructions are such persons who, thanks to their professional training, knowledge and experience and their knowledge of the applicable standards, are capable of assessing the work they are asked to carry out and recognising the possible dangers. Suitable precautions must be taken to avoid any risks which may be associated with the medium contained in the pipelines and equipment, with the set pressure or the moving parts.

Preparatory work

First you should make sure that your worksite is safe. Organise the required tools and equipment such as working platform, lifting tackle etc. and make sure that the lighting of the site is adequate. Find out whether protective clothing, ear protectors etc. are needed or mandatory. Check whether you have suitable tools and any replacement parts you may need. Use only original MANKENBERG parts. Read the operating instructions carefully and note all the instructions and points.

Medium contained in pipelines and valves

Check which medium is or was in the pipeline and find out what safety precautions you have to take. Be especially careful if the medium is toxic, flammable, hot or a health hazard.

Connecting a leak line

In the case of toxic or hazardous media the valve must be equipped with a sealed spring cover (incl. sealed setting screw) with leak line connection. In such cases a leak line must be installed which can drain the medium safely in case the valve becomes defective.

Hazards at the installation site

Please note any areas designated as explosion hazard sites. Make sure that there is sufficient ventilation where a shortage of oxygen may occur e.g. in tanks, vessels or shafts. Allow hot surfaces to cool. Use welding gear only if the worksite is sufficiently ventilated and there is absolutely no danger of fire or explosion or a release of agents dangerous to health.

Effects on the entire plant or machine

Check the possible effects which your work may have: How will your work affect the total system? Is there a possibility of danger if, for example, you close isolating valves, switch off the power supply or switch off/ remove/disable safety equipment and ventilation systems or monitoring and alarm equipment?

Pipeline and valve operating pressure

Make sure that the pipeline section on which you will be working has been completely depressurised and is under atmospheric pressure. Do not believe that the system is depressurised only because your pressure gauge reads Zero. Make safe and label any valves you have closed.

Electrical connections

Work on electrical systems must be carried out only by suitably qualified experts. Make sure that the electrical power supply has been switched off and that the system cannot be repowered.

Dismantling

The equipment may contain a preloaded spring which must be relaxed before the equipment can be dismantled. Please follow the operating and servicing instructions.

Completing the work

Make sure that the plant or system or machine is fully operational again. Test all monitoring, safety and alarm equipment.

Testing the plant/system

When pressure-testing the plant the equipment or valve may be pressurised only up to its maximum rated pressure.

Commissioning

Check the equipment/valve for leaks before commissioning. Do not tighten the pressure setting screw to such an extent that it limits the valve lift or jams the valve in open position. Do not slacken the pressure setting screw too far. The valve is no longer operational when the spring is completely relaxed.

Only with valves free of oil and grease or silicone.

Please pay attention to order an fit only spares free of oil and grease resp. free of silicone.

Always follow the operating instructions.

Please consult our engineering department in case of severe operating conditions or if you have any doubt.

Notes on Safety

relating to the installation, operation, maintenance and repair of Mankenberg products

Basic requirements

The equipment must be installed, repaired and operated only by skilled personnel familiar with the installation, commissioning and operation of the products. "Skilled personnel" in the meaning of these Installation and Operating Instructions are such persons who, thanks to their professional training, knowledge and experience and their knowledge of the applicable standards, are capable of assessing the work they are asked to carry out and recognising the possible dangers. Suitable precautions must be taken to avoid any risks which may be associated with the medium contained in the pipelines and equipment, with the set pressure or the moving parts.

Preparatory work

First you should make sure that your worksite is safe. Organise the required tools and equipment such as working platform, lifting tackle etc. and make sure that the lighting of the site is adequate. Find out whether protective clothing, ear protectors etc. are needed or mandatory. Check whether you have suitable tools and any replacement parts you may need. Use only original MANKENBERG parts. Read the operating instructions carefully and note all the instructions and points.

Medium contained in pipelines and valves

Check which medium is or was in the pipeline and find out what safety precautions you have to take. Be especially careful if the medium is toxic, flammable, hot or a health hazard.

Connecting a leak line

In the case of toxic or hazardous media the valve must be equipped with a sealed spring cover (incl. sealed setting screw) with leak line connection. In such cases a leak line must be installed which can drain the medium safely in case the valve becomes defective.

Hazards at the installation site

Please note any areas designated as explosion hazard sites. Make sure that there is sufficient ventilation where a shortage of oxygen may occur e.g. in tanks, vessels or shafts. Allow hot surfaces to cool. Use welding gear only if the worksite is sufficiently ventilated and there is absolutely no danger of fire or explosion or a release of agents dangerous to health.

Effects on the entire plant or machine

Check the possible effects which your work may have: How will your work affect the total system? Is there a possibility of danger if, for example, you close isolating valves, switch off the power supply or switch off/ remove/disable safety equipment and ventilation systems or monitoring and alarm equipment?

Pipeline and valve operating pressure

Make sure that the pipeline section on which you will be working has been completely depressurised and is under atmospheric pressure. Do not believe that the system is depressurised only because your pressure gauge reads Zero. Make safe and label any valves you have closed.

Electrical connections

Work on electrical systems must be carried out only by suitably qualified experts. Make sure that the electrical power supply has been switched off and that the system cannot be repowered.

Dismantling

The equipment may contain a preloaded spring which must be relaxed before the equipment can be dismantled. Please follow the operating and servicing instructions.

Completing the work

Make sure that the plant or system or machine is fully operational again. Test all monitoring, safety and alarm equipment.

Testing the plant/system

When pressure-testing the plant the equipment or valve may be pressurised only up to its maximum rated pressure.

Commissioning

Check the equipment/valve for leaks before commissioning. Do not tighten the pressure setting screw to such an extent that it limits the valve lift or jams the valve in open position. Do not slacken the pressure setting screw too far. The valve is no longer operational when the spring is completely relaxed.

Only with valves free of oil and grease or silicone.

Please pay attention to order an fit only spares free of oil and grease resp. free of silicone.

Always follow the operating instructions.

Please consult our engineering department in case of severe operating conditions or if you have any doubt.