

Operating manual
springloaded Pressure Control Valves

Contents

Chapter	Heading	Page
0	Introduction	1
1	Intended use	1 - 2
2	Marking of the fitting	2
3	Safety instructions	3 - 4
4	Transport and storage	4 - 5
5	Installation	5 - 7
6	Pressure testing the pipeline section	8 - 9
7	Initial start-up	9 - 10
8	Normal operation	10
9	Maintenance	11
10	Troubleshooting help	12 - 13
11	Further information	13

0 Introduction

This manual is intended to assist users of a MANKENBERG pressure-reducing, backpressure regulator, vacuum control valve, differential pressure control valve or flow control valve during installation, operation and maintenance. Read the manual thoroughly before installing or putting this valve into service.

 caution	Failure to follow the following instructions – particularly the cautionary and warning notes – may lead to hazards and may invalidate the manufacturer's warranty. MANKENBERG is at your service for any assistance and queries. See Section 11 <Further information> for the addresses. Technical information is also available at www.mankenberg.de
--	--

1 Intended use

A **MANKENBERG DM pressure-reducing valve** is a device that is intended exclusively for automatically regulating the **outlet pressure** of the medium (without any additional electrical/pneumatic energy) after it has been installed in a pipeline system.

The force of the outlet pressure acts on a control mechanism (diaphragm, piston or bellows) and is in balance with the preload of a spring that has to be adjusted by the user to the required value within the setting range of the valve.

A **MANKENBERG UV backpressure regulator** is a device that is intended exclusively for automatically regulating the **inlet pressure** of the medium (without any additional electrical/pneumatic energy) after it has been installed in a pipeline system.

The force of the inlet pressure acts on a control mechanism (diaphragm, piston or bellows) and is in balance with the preload of a spring that has to be adjusted by the user to the required value within the setting range of the valve.

A **MANKENBERG VV vacuum control valve** is a modification of the pressure-reducing or backpressure regulator, built to **regulate pressures in vacuo**. It only regulates the differential pressure to the atmosphere.

A **MANKENBERG DV differential pressure control valve** is a modification of the pressure reducing or backpressure regulator, built to regulate differential pressures.

A **MANKENBERG MR flow control valve** is a modification of the pressure – reducing or backpressure regulator, built to regulate flow rates.

 danger	A pressure-reducing valve / backpressure regulator / differential pressure control valve / flow control valve / vacuum control valve is not a safety valve. A suitable valve must be present in the system to limit any excess pressure.
 note	Pressure-regulating valves are generally supplied with a slackened spring and have to be adjusted to the required pressure after being installed. The required pressure measuring devices must be installed in an adequate distance in front of and behind the fitting. They are not included in the supply schedule of MANKENBERG.

MANKENBERG planning documents are available to give users precise assistance in selecting and designing the appropriate fitting, e.g.:

In the section <DM: Regulating valves for pressure>

<Design of pressure-regulating valves>

<Know-how on pressure-reducing valves / backpressure regulators >

<Type sheet DM... / UV... / VV... / DV... / MR...> with technical data and tables of the setting ranges and the dimensions.

In the following sections the valve types DM, UV, VV, DV and MR are combined under the heading of "Fitting" or "Pressure-regulating valves" apart from a few sections that only apply to the valve types mentioned.

 danger of fatalities	<p>These valves are no shut-off elements ensuring a tight closing of the valve. In accordance with DIN EN 60534-4 and/or ANSI FCI 70-2 they may feature a leakage rate in closed position in compliance with the leakage classes II – V:</p> <p>Leakage class II (metal sealing double seat cone) = 0.5% K_{VS} value</p> <p>Leakage class III (metal sealing cone) = 0.1 % K_{VS} value</p> <p>Leakage class IV (PTFE seal cone) = 0.01 % K_{VS} value</p> <p>Leakage class V (soft seal cone) = $1.8 \times 10^{-5} \times \Delta p \times D^*$ [l/h]</p> <p>*D=seat diameter</p> <p>Consequently, according to DIN EN ISO 2503 and DIN EN ISO 7291, a safety valve has to be installed on the control side, which is dimensioned and adjusted in such a way that the lower one of both pressure indications as mentioned below is relevant as response pressure:</p> <ul style="list-style-type: none"> - 1.5 times the maximum set pressure and/or (P out) of the valve (see nameplate), whichever is the lowest - PS out (see nameplate) <p>The response pressure of the safety valve should be abt. 40 % above the max. set pressure of the pressure control valve.</p> <p>Contrarily to the Pressure Equipment Directive, Annex 1, Paragraph 7.3, the short-term maximum excess pressure is limited to 5 % of the max. allowable pressure (see above).</p> <p>Failure to observe this regulation means danger to life and limb and may cause damage to the pressure-regulating valve.</p>
 caution	<p>Pressure-regulating valves are generally supplied with an open spring cap to facilitate maintenance.</p> <p>Valves with a sealed spring cap and leakage line connection can be supplied for toxic or hazardous media. In this case the user must make sure that a suitable leakage line is installed.</p>

MANKENBERG valves are supplied as standard for screw-mounted or flange-mounted pipeline/tank connections – also for special connections if required.

The upper limit of the permitted operating data for pressure and temperature is permanently marked on each fitting supplied.

2 Marking of the fitting

Each fitting bears the following markings as a minimum:

For	Marking	Remark
Manufacturer	MANKENBERG	See Section 11 <Further information> for the address
Fitting design	Pressure-reducing valve+ type or backpressure regulator + type or differential pressure control +type or flow control valve + type or vacuum control valve + type	Design name as per accompanying MANKENBERG data sheet.
Nominal diameter	e.g. DN or G and numerical value	Numerical value for DN in [mm], for G in [inches]
Nominal pressure	PN or Class and numerical value	Numerical value for PN in [bar], for Class in [lbs/square inch]
Pressure range	Pressure range and numerical values	Unless otherwise indicated, all data give the overpressure above atmospheric. If 2 numerical values are given, these apply to the inlet and outlet pressure.
Max. permitted temp.	Temperature and numerical value	Temperatures above 50 °C entail a reduced pressure resistance. This must be considered for the corresponding material in accordance with the DIN EN 1092 standard
Body material	e.g. CrNiMo steel	CrNiMo steel = high-alloy austenitic steel
Flow direction	Indicated by an arrow	
ATEX protection class	e.g. Ex II 2G IIB TX -10°C<Ta<+80°C	only for devices with conformity certification according to ATEX

The markings (in the case of fittings made of deep-drawn stainless steel, they are etched into the body) should neither be covered nor painted over, so that the fitting remains identifiable.

3 Safety instructions

3.1 General precaution

The same safety regulations apply to a fitting as to the system into which it is installed. These instructions only give those safety recommendations that have to be **additionally** observed for the fitting.

3.2 Special safety instructions for the plant operator

The following requirements for the intended use of a fitting are not the responsibility of the manufacturer but have to be guaranteed by the user:

- The fitting may only be employed for the purpose described in Section 1 <Intended use>.
- Only competent specialist personnel may install, operate and service the fitting. Competent as defined in these instructions refers to persons who, because of their training, specialist knowledge and professional experience, are capable of correctly assessing and properly executing the work with which they are entrusted and of recognizing and rectifying hazards.
- The pipeline system must be properly designed and installed so that the fitting can be mounted and operated without any tension.
- The fitting must be properly installed in the correct mounting position.
- The recommended installation, as described in the relevant MANKENBERG data sheet, must be used for the pipeline section into which the pressure-regulating valve is installed. All control and/or leakage lines that are required on the pressure-regulating valve must be laid properly, in accordance with the accompanying MANKENBERG data sheet.
- A pressure-regulating valve with an open spring must be installed in such a way that it presents no risk of crushing to the operating personnel.
- The usual flow rates should not be exceeded in the pipeline section during continuous operation, and abnormal operating conditions such as vibrations, unusually high flow rates, etc. should be avoided or – if unavoidable – clarified with the manufacturer in advance.
- The prevailing operating conditions must comply with the limits of the design data stated in the MANKENBERG order confirmation.
- The corrosion protection for the fitting must be adapted to the local environmental conditions.
- The fitting must not be coated with thermal insulation.

Detailed notes are provided on some of these prerequisites in the following sections.

3.3 Special hazards

 danger of fatalities	<p>Before a fitting is removed from the system or before a fitting is dismantled but partially remains in place, the pressure in the system on both the inlet and outlet side must be completely reduced so that there is no uncontrolled flow of the medium out of the system. In the case of toxic or hazardous media, the system must be completely drained before the fitting is removed.</p> <p>Caution is required with residues that might continue flowing.</p>
 danger of being crushed	<p><i>Only valves with open spring:</i></p> <p>It is necessary to ensure on site, by an appropriate installation or by providing safety devices and/or positioning a clearly visible warning sign in accordance with the regulations of EN 292 (formerly accident prevention regulations), that effective protection is afforded against objects catching on an exposed spring in the pressure-regulating valve. If required, MANKENBERG will assist in selecting a suitable type with closed spring cap.</p>

 danger of fatalities	<p><i>If a pressure-regulating valve has to be dismantled:</i></p> <p>The following must be observed at all costs: First release the tension fully on the spring by turning the setting screw on the spring module anticlockwise.</p> <p>When doing so, be sure to follow the notes in Section 7 <Initial start-up>!</p> <p>Then either seal off the two shut-off valves installed before and after the fitting in accordance with the MANKENBERG installation recommendation and vent the pressure-regulating valve or remove the pressure from the section of the system and then remove the fitting from the pipeline.</p>
 caution	<p>In case of pressure control valves with hydraulic brake the brake fluid (normally mineral oil) should be discharged from the brake and disposed of properly prior to removing the valve from the plant.</p>
 caution	<p>If a fitting is removed from a system with a toxic medium and is taken out of the plant: it must be properly decontaminated before repair.</p>

4 Transport and storage

A fitting must be handled, transported and stored with care:

- The fitting must be transported and stored in its protective packaging until it is installed.

 caution	<p>The fitting has moving internal parts.</p> <p>Even packaged fittings should be transported smoothly without any shocks.</p>
 caution	<p>In the case of a fitting that can no longer be transported by hand, the lifting gear must be attached to a suitable position on the housing (branches).</p> <p>Under no circumstances may the lifting gear be affixed to any attachments (adjusting screw, handwheel or accessories).</p>
 caution	<p>Pressure control valves in a sandwich design with slotted discs (i.e. DM 307/308 and UV 6.7/6.8), in particular, are especially sensitive to transport damage and dirt.</p> <p>The protective packaging on the body must not be damaged during transport and storage.</p>

- When the fitting is stored prior to installation, it should be kept in closed rooms and protected against harmful influences such as dirt, moisture and frost.
- In special cases, the fitting is supplied free of oil, grease or silicone and is marked accordingly. A fitting such as this must not come into contact with oil/grease/silicone during storage and handling (particularly when subsequently unpacked).
- A MANKENBERG fitting generally has functional and/or sealing parts made of elastomer materials. These cannot be stored for an unlimited period.

 note	<p>ISO 2230 describes the storage conditions for elastomers in detail and specifies the permissible storage period.</p> <p>Functional and sealing parts must be replaced well before the storage period expires. They are available from MANKENBERG as a “service set”. See also Section 10 <Troubleshooting help>.</p>
 note	<p>MANKENBERG fittings of small and medium nominal diameters are largely made of stainless steel (high-alloy CrNiMo steel).</p> <p>If, under exceptional circumstances, fittings are stored in a unpacked state, they must be protected against ferritic dust to avoid corrosion.</p>

 note	<p><i>The fitting is generally not capable of standing alone:</i></p> <p>The spring module may have a greater weight/volume than the basic body with its pipe connections.</p> <p>Handle with care so that the fitting does not tip over during transport/storage.</p>
--	---

- Pressure-regulating valves are generally supplied with a slackened spring. The spring must not be pretensioned by means of the adjusting screw until after it has been installed, during initial start-up.

5 Installation

5.1 General notes

The same installation regulations apply to a fitting as to the system into which it is installed. The following additional notes apply:

- Section 4 <Transport and storage> should also be observed during transport to the installation site.
- The installation site to allow perfect functioning of a fitting should be a section of pipe without any flow disruptions, without any angles and without any restrictors or shut-off devices close to the fitting, either upstream or downstream (optimum distance = 10 x DN). If this does not apply, the installation situation should be checked with the plant operator and/or MANKENBERG.
- The statics of the pipeline must be designed so as to take account of the weight of the fitting – particularly those with an eccentric mass. If required, the pipeline may have to be properly supported on both sides next to the fitting (or at the fitting itself) – particularly in the case of fittings with a substantial mass and especially if vibrations are to be expected in the system.
When the fitting is supported, it is important to check that all functioning parts (adjusting screws, springs) remain capable of moving freely and are not blocked.
- The fitting must not be coated with thermal insulation.

 caution	<p>A fitting that is operated at a medium temperature above 130°C needs undisrupted removal of heat if it is to function perfectly.</p> <p>Failure to observe this instruction may cause damage to the fitting and hence in the pipeline system as well.</p>
---	---

- To protect internal functional parts (e.g. the seat) against damage and/or blockages, it may be necessary to install a strainer and/or filter upstream of the fitting.

 note	<p>The mesh size of the sieve/filter for protecting against aggregates in the pipe section should be selected by the plant operator according to the operating conditions.</p> <p>Failure to observe this instruction may impair the function of the fitting and lead to damage.</p>
--	---

5.2 Installation preparations

- It is necessary to ensure that a fitting is not installed unless it matches the operating conditions in terms of function, pressure and temperature, range, body material as well as connection type and dimensions.

 danger of fatalities	<p>No fitting may be operated that does not have a sufficient pressure and temperature range for the operating conditions – see Section 1 <Intended use> and markings on the fitting. The manufacturer MANKENBERG should be consulted in the case of any applications outside of this range.</p> <p>Failure to observe this regulation may mean danger to life and limb and may cause damage to the pressure-regulating valve.</p>
--	---

- Newly installed tanks and pipeline sections must be thoroughly rinsed and cleaned before commissioning.
- The corrosion protection for the fitting must be adapted to the local conditions.

- A pressure-regulating valve with an exposed spring must be installed in such a way that it presents no risk of crushing to the operating personnel.

 <p>danger of being crushed</p>	<p><i>Only valves with open spring:</i></p> <p>It is necessary to ensure on site, by an appropriate installation (e.g. not freely accessible) or providing safety devices and/or positioning a clearly visible warning sign in accordance with the regulations of EN 292 (formerly accident prevention regulations), that effective protection is afforded against objects catching on an exposed spring in the pressure-regulating valve.</p> <p>If required, MANKENBERG will assist in selecting a suitable type with closed spring cap.</p> <p>Failure to observe this instruction: danger of crushing for the operating personnel</p>
---	--

- Before installing a pressure-regulating valve, it is necessary to make sure that the pipeline section complies with the recommended installation, as described in the relevant MANKENBERG data sheet. In particular, a safety valve and a suitable strainer should be installed upstream of the fitting.
- Pressure-regulating valves are supplied with a slackened spring:
 - in this state of delivery, a pressure reducing valve DM is fully opened and immediately shuts at minimum outlet pressure.
 - in this state of delivery, an backpressure regulator UV is fully closed and immediately opens at minimum inlet pressure.
 - in this state of delivery, a differential pressure control valve, a flow control valve or a vacuum control valve responds as a pressure reducing valve or backpressure regulator, according to design.

 <p>note</p>	<p>In some model series, a control line has to be laid between the pressure-regulating valve and the pipeline by the customer – this is described in the above-mentioned recommended installation. Please note: Only use control lines made of metal, not of plastic!</p> <ul style="list-style-type: none"> - distance of pressure-reducing valve/connection of control line to the pipeline $\geq 10x$ pipe-\varnothing - distance of backpressure regulator/connection of control line to the pipeline $\leq 5x$ pipe-\varnothing - distance of pressure control valve, flow control valve or vacuum control valve/connection as for a pressure-reducing valve DM or an overflow valve UV, according to design - when the medium is steam, lay the control line at an angle, with the gradient falling towards the valve, see (catalogue) section <Know How Pressure-reducing valves>. <p>The control line should match the connection on the fitting.</p> <ul style="list-style-type: none"> - if required, install a throttle to avoid vibration.
--	---

 <p>danger of fatalities</p>	<p>In the case of toxic or hazardous media, a leakage line must be installed, that discharges leaking medium safely and pressureless in case of a damaged control device, thus avoiding dangerous situations.</p> <p>The diameter should match the connection of the leakage line at the spring cap.</p>
--	--

- The pressure-regulating valve should first be adjusted during the initial start-up by setting the adjusting screw on the spring module to the operating conditions – see Section 7 <Initial start-up>. However, it is necessary to ensure before installation that there is sufficient room for the appropriate socket or open-jawed spanner above/below the adjusting screw.

 <p>important note</p>	<p>As a general rule, pressure-regulating valves should be installed in horizontal lines so that the spring module (with open spring or with spring cap) points vertically down.</p> <p>Only for gaseous media installation with the spring pointing vertically up is permissible.</p> <p>In case the valve must be emptied completely during operation (angle valves), it must be installed with the spring cap pointing upwards.</p> <p>If the valve must be installed in a vertical or diagonal line, increased friction of the functional parts leading to increased abrasion and impaired regulation are to be expected.</p>
--	---

5.3 Installation steps

- Fittings should only be finally unpacked at the installation site and inspected for damage prior to assembly. Damaged fittings must not be installed.
- It is necessary to ensure that the covers have been removed from all the connection branches before installation.
- The fitting should be inspected to ensure that it is clean. Interior parts must be free of liquid (e.g. condensate): if necessary, connecting branches should be cleaned before installation with clean compressed air.
- The type and dimensions of the line or tank connections must match the fitting to be installed and be flush with the connecting surfaces of the fitting as well as in a parallel plane to the fitting itself.
- If the fitting is marked with an arrow on the housing, the flow in the pipe section must match the marked direction of flow.

 caution	<p>If installed in the opposite direction to the arrow, the fitting will not perform its intended function.</p>
---	---

- The fitting must be installed without any tension. In the case of an already installed system, the geometry of the pipeline must match the face-to-face length of the fitting.

 note	<p>It is necessary to ensure that even under operating conditions no tension from the pipeline is transferred to the fitting.</p>
 note	<p>A MANKENBERG fitting made of "high grade" or "high grade pure" stainless steel (austenite, e.g. 1.4404 or 1.4435) does not need any surface protection for normal environmental atmosphere and for normal weather conditions.</p> <p>External parts of the fitting made of low-alloy or non-alloy materials that are supplied ex-works with a primer have to be provided with a suitable coating by the customer.</p> <p>Caution: Never paint over the marking(s) of the fitting (either etched into the body or on nameplate).</p>

In addition, the following applies to the pipeline connection:

with flanges:

 note	<p>The sealing surfaces on the body of the fitting are formed in accordance with the MANKENBERG order confirmation. The accompanying flange seals are generally not included in the MANKENBERG supply schedule.</p>
--	--

- During installation, centre the fitting by means of the flange screws on the mating flange before the screws are tightened.

with screw-mountings:

 note	<p>The connecting surfaces on the body of the fitting are formed in accordance with the MANKENBERG order confirmation. The required seals are generally not included in the MANKENBERG supply schedule.</p>
--	--

with welding ends:

- Properly performed welding must ensure that no significant tension is transferred to either the section of pipeline or the body of the fitting.
- Under no circumstances may the body of the fitting exceed the temperature marked on it; otherwise the sealing and functional parts will be damaged and **the whole fitting will become unserviceable.**

 caution	<p>When a fitting with a body made of "high grade" or "high grade pure" deep-drawn parts (visible on the body connection with clamp rings) is welded, the welding joint must be carried out with special care; it is recommended that the body should be kept cool with a damp cloth.</p> <p>Failure to observe this instruction may cause distortion of the fitting body: even 0.1 mm of permanent distortion in the seat region may render the fitting unserviceable.</p>
---	---

If available, connect control and/or leakage line.

6 Pressure testing the pipeline section

The fitting has already been pressure-tested by the manufacturer. The following points should be observed when conducting a pressure test on a pipeline section with a pressure-regulating valve installed:

- **Pressure-reducing valve:**
the test pressure must not exceed 1.5 times the max. adjustable outlet pressure, e.g. a setting range of 4 to 8 bar gives a max. permitted test pressure of 8 bar x 1.5 = 12 bar.
The test pressure on the **inlet pressure side** is determined by the pressure marked on the body, in addition, the permitted reducing rate has to be observed (see order confirmation).
- **Backpressure regulator:**
the test pressure must not exceed 1.5 times the max. adjustable inlet pressure, e.g. a setting range of 4 to 8 bar gives a max. permitted test pressure of 8 bar x 1.5 = 12 bar.
- **Vacuum control valve:**
the test pressure must not exceed 1.5 times the max. adjustable pressure. The information described above should be observed according to **whether a pressure-reducing or backpressure regulator forms the basis** for the vacuum control valve.
- **Differential pressure control valve:**
the test pressure must not exceed 1.5 times the max. adjustable pressure. The information described above should be observed according to whether a pressure-reducing or backpressure regulator forms the basis for the differential pressure control valve.
- **Flow control valve:**
the test pressure must not exceed 1.5 times the max. adjustable pressure. The information described above should be observed according to whether a pressure-reducing or backpressure regulator forms the basis for the flow control valve.

Under no circumstances may the test pressure exceed 1.5 times the value indicated on the body with "PN" or "Class".

If any leakage occurs on the fitting, Section 10 <Troubleshooting help> should be observed.

 note	<p>If the pipe section is flushed and/or dried after assembly or pressure testing, it is necessary to make sure that the fitting has not been damaged by corrosion or excessively high temperature.</p>
--	---

7 Initial start-up

 danger of fatalities	<p>No fitting may be operated that does not have a sufficient pressure and temperature range for the operating conditions – see Section 1 <Intended use> and markings on the fitting. The manufacturer MANKENBERG should be consulted in the case of any applications outside of this range.</p> <p>Failure to observe this regulation may mean danger to life and limb and may cause damage to the pressure-regulating valve.</p>
--	---

The fitting is supplied with no tension on the spring – hence no defined operating pressure has been set in the factory. During initial start-up, the valve must be adjusted to the system parameters.

The adjusting screw on the spring module should be tensioned for this purpose: Clockwise rotation (when looking onto the adjusting screw) has the following effect:

- **on the pressure-reducing valve:** the outlet pressure increases.
- **on the backpressure regulator:** the inlet pressure increases.
- **on the vacuum control valve:** the set pressure increases
- **on the differential pressure control valve:** the operating pressure increases
- **on the flow control valve:** the flow increases

Annotation to the differential pressure control valve:

*a differential pressure control valve based on a pressure-reducing valve closes at increasing differential pressure
a differential pressure control valve based on a backpressure regulator opens at increasing differential pressure*

Annotation to the flow control valve:

*a flow control valve based on a pressure-reducing valve closes at increasing flow rate
a flow control valve based on a backpressure regulator opens at increasing flow rate*

Annotation to the vacuum control valve:

*a vacuum control valve based on a pressure-reducing valve closes at increasing vacuum
(differential pressure to the atmosphere)
a vacuum control valve based on a backpressure regulator opens at increasing vacuum
(differential pressure to the atmosphere)*

The target value to be set by means of the adjusting screw shall be defined by the operator of the system and must be calibrated with the aid of a pressure gauge on the plant side (or some other pressure monitoring device).

 caution	<p><i>When looking onto the adjusting screw:</i></p> <p>Never fully remove the adjusting screw (by rotating it anticlockwise).</p> <p>Do not block the adjusting screw in the position of maximum tension (when rotating it clockwise).</p>
 danger	<p>At the beginning of or shortly after the initial start-up, the sieve or the filter insert of any installed strainer/filter should be cleaned in order to avoid blocking the strainer/filter.</p>
 caution	<p><i>After the initial start-up:</i></p> <p>Check the seals on screw-mounted parts of the body and reseal if necessary. Ask MANKENBERG for tightening torque, if necessary. Observe the relevant notes in Section 10 <Troubleshooting help>.</p>
 caution	<p><i>After the initial start-up:</i></p> <p>Control the leakage line for leaking medium. Observe the relevant notes in Section 10 <Troubleshooting help>.</p>

8 Normal operation

A properly designed and correctly adjusted pressure control valve works automatically within its pressure control range and does not need any form of auxiliary energy.

 note	<p>To obtain optimum regulating accuracy, the desired operating pressure should be in the upper part of the setting range of the pressure-regulating valve. This is described in detail in the “DM” Section of the MANKENBERG catalogue under “Calculation of Pressure Regulators”.</p> <p>In case of doubt, contact MANKENBERG Service – see Section 11 <Further information> for addresses.</p>
 danger of fatalities	<p>It is necessary to ensure that the materials selected for the parts of the fitting in contact with media are suitable for the media in use. The manufacturer accepts no liability for any damage due to corrosion by aggressive media on parts made of unsuitable materials.</p> <p>Failure to observe this regulation may mean danger to life and limb and may cause damage to the pipeline system and to the fitting.</p>
 caution	<p>The fitting has functional parts that have to remain capable of moving easily. Make sure that both the external springs and inner parts in contact with the medium cannot freeze nor become blocked by dirt. Observe the maintenance intervals.</p> <p>Failure to observe this instruction may cause damage to the pipeline system and to the fitting.</p>
 danger	<p>In some series a control line is laid between the pressure-regulating valve and the pipeline – see Section 5.1 <Installation / General notes>.</p> <p>Damage to this control line may result in danger to life and limb and may impair the function of the pressure-regulating valve or even lead to complete failure.</p>
 note	<p>Pressure-regulating valves are designed for the operating point in accordance with the order. This operating point may occasionally be changed by the customer by means of the adjusting screw. However, the setting of the adjusting screw must not be permanently altered (e.g. by adding a motorized actuator).</p> <p>Failure to observe this instruction may cause damage to the pressure-regulating valve.</p>

It is recommended that the fitting should be inspected to ensure that it is functioning correctly after each new start-up.

9 Maintenance

The automatic function of the fitting requires maintenance to ensure that it continues to operate perfectly. It is important for maintenance work to take place **in a planned manner at periodic intervals**. The maintenance plan in Table 1 is a recommendation by the manufacturer MANKENBERG, which should be supplemented by practical experience gained by the user under the prevailing operating conditions. MANKENBERG shall assume no liability **resulting from improper maintenance and/or repairs**.

Table 1: Sample plan for maintenance work

Type of maintenance	Work to be performed	Period ¹⁾
Check function	Check whether function is fulfilled as per Section 1 <Intended use>	at least 1x per week
Function / check free movement of the spindle	With a non-rising adjusting screw (without conternut), cone movement in the valve seat can be detected by checking the movement of the adjusting screw.	at least 2x per year
Check seal on the body, the pipe connection and the control lines	Visual inspection	at least 1x per month
Grease sliding points	Grease external sliding points with a corrosion-protection lubricant	at least 4x per year
Monitor exposed spring	Visual inspection: if necessary, remove any dirt/corrosion ²⁾	at least 2x per year
<i>If installed upstream of the fitting:</i> clean strainer	According to the manufacturer's instructions	Depends on the contamination of the medium
Preventive maintenance	Dismantle fitting, see Section 10 <Troubleshooting help>. Visual inspection diaphragm and functional parts Replace all parts of the maintenance set ³⁾	at least 1x per year
Check safety valve	According to the manufacturer's instructions	at least 1x per year

¹⁾ See comment at the beginning of this section: The time intervals are guides which should be adapted to match the prevailing operating conditions, the properties of the medium in the system and the user's experience.
²⁾ Caution danger of crushing: shut down the valve for cleaning purposes!
³⁾ Request maintenance set and replacement instructions from MANKENBERG.

 danger	<p>During maintenance work (apart from visual inspections) the relevant recommendations and warning notes in Section 10 <Troubleshooting help> should be observed.</p> <p>Failure to observe this warning may mean danger to life and limb and may cause damage to the pipeline system and to the fitting.</p>
--	---

When a fitting that has previously been dismantled is being put back into service, the fitting should be checked for proper sealing capacity and function as well as correct adjustment of the adjusting and functional components!

10 Troubleshooting help

Be sure to observe Section 3 <Safety instructions> when rectifying faults.

Spare parts must be ordered with all the details on the nameplate

Only original parts from the manufacturer MANKENBERG may be installed.

MANKENBERG experts are available to help in rectifying faults as quickly as possible.

See Section 11 <Further information> for the addresses.

 note	<p><i>If functional or corrosion damage is detected during maintenance or after a fault: consult MANKENBERG to find out whether a more suitable fitting is available or whether the damaged part can be supplied in a better-suited material.</i></p>
 note	<p><i>special tools required:</i></p> <p>To dismantle the following pressure control valves, a special tool is required (can be requested at MANKENBERG if required):</p> <ul style="list-style-type: none"> - pressure reducing valve DM 662 - backpressure regulator UV 5.1 up to and including DN25 / G1“ - and vacuum control valve deducted from these, e.g. VV 5.1

Type of fault	Action
<p>Leakage at a connection body parts (flange or clamp ring):</p> <p>reseal connection</p>	<p>Tighten the screws clockwise (tighten flange screws crosswise).</p> <p><i>If the screws of the body connection have to be loosened or removed (= unscrewing in the anticlockwise direction):</i></p> <p style="text-align: center;"></p> <p style="text-align: center;"><u>Danger of fatalities</u></p> <p>To prevent any risk for operating personnel, make sure that this repair measure is only carried out on a section of pipe that is not under pressure. Take note of Section 3.3 <Special hazards> and then Section 5 <Installation in the pipeline>.</p>
<p>Leakage on the spring cap:</p> <p>the valve must be repaired</p>	<p><i>The control mechanism (diaphragm, piston or bellows) is defective and has to be replaced:</i></p> <p>Repair necessary, as described further below.</p> <p style="text-align: center;"></p> <p style="text-align: center;"><u>Danger of fatalities</u></p> <p>The pretensioned spring must be fully relaxed before a fitting is dismantled!</p> <p>To prevent any risk for operating personnel, make sure that this repair measure is only carried out when the fitting is not under pressure. Take note of Section 3.3 <Special hazards>.</p>

<p>Functional fault</p> <p>Leakage at the seat means the set inlet or outlet pressure is not correctly regulated:</p> <p>clean the functional parts</p>	<p><i>A foreign object may be jammed in the seat and be preventing proper sealing:</i></p> <ul style="list-style-type: none"> - <i>Pressure reducing valve DM:</i> fully tighten spring - <i>backpressure regulator UV:</i> fully release the tension of the spring - <i>Differential pressure control valve:</i> according to design, the abovementioned has to be observed. - <i>Flow control valve:</i> according to design, the abovementioned has to be observed. - <i>Vacuum control valve:</i> according to design, the abovementioned has to be observed so that the valves open and foreign objects can be flushed out. <p><i>If the functional fault cannot be rectified in this way:</i> Cleaning is necessary: the pressure-reducing valve must be dismantled</p> <div style="text-align: center;">  <p><u>Danger of fatalities</u></p> </div> <p>The pretensioned spring must be fully relaxed before a fitting is dismantled!</p> <p>To prevent any risk for operating personnel, make sure that this repair measure is only carried out when the fitting is not under pressure. Take note of Section 3.3 <Special hazards>.</p> <p>When the valve is not under pressure, take off the spring module by releasing the clamp rings (or the screw connection) and dismantle the diaphragm (or piston/bellows) and functional parts for cleaning. Here all parts of the maintenance set should be renewed.</p> <p>Afterwards, assemble the fitting and readjust it, as described under Section 7 <Initial start-up>.</p>
<p>Functional fault</p> <p>Cleaning alone – see above – cannot rectify the fault:</p> <p>the fitting must be repaired</p>	<p><i>If during cleaning it is found that the control mechanism (diaphragm, piston or bellows), the cone or other functional parts are damaged:</i></p> <p>Repair necessary: damaged parts have to be replaced.</p> <p><i>If the repair is to be carried out in the customer's workshop:</i> make a note of all data according to the markings on the fitting and order the spare parts and necessary instructions from MANKENBERG. See Section 11 <Further information> for addresses.</p> <p>or:</p> <p>Send the fitting to the manufacturer for repair. See Section 11 <Further information> for the addresses.</p>

11 Further information

You can obtain these instructions, the MANKENBERG data sheets quoted as well as further information – including English language versions – from the following addresses:

Mankenberg GmbH
Spenglerstrasse 99
D-23556 Lübeck

Phone +49-451 -8 79 75 0
Fax +49-451 -8 79 75 99
Email info@mankenberg.de
www.mankenberg.de

