

***Operating manual***

***Pilot-controlled pressure regulators***

# 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
7	Initial start-up .....	9
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 pilot-controlled pressure-reducing or overflow valve during installation, operation and maintenance. Read the manual thoroughly before installing or putting this valve into service.

 <b>caution</b>	<b>Failure to follow the following instructions – particularly the cautionary and warning notes – may lead to hazards</b> 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 <a href="http://www.mankenber.de">www.mankenber.de</a>
---	---

## 1 Intended use

A **pilot-controlled MANKENBERG pressure-reducing valve DM..** 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 pilot valve. This controls the main valve so that if the outlet pressure falls below the target value, the main valve opens further (or entirely) until the target value has been re-established. If the outlet pressure rises above the target value, the main valve reduces or closes.

The pilot valve is integrated onto the main valve together with a restrictor assembly. The restrictor assembly contains 2 or 3 restrictors for optimizing the regulation characteristics and 1 strainer. The desired target value for the setting range must be set on the adjusting screw of the pilot valve.

A **pilot-controlled MANKENBERG backpressure regulator UV..** 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 pilot valve. This controls the main valve so that if the inlet pressure falls below the target value, the main valve is reduced (or closed) until the target value has been re-established. If the inlet pressure increases above the target value, the main valve opens.

The pilot valve is integrated onto the main valve together with a restrictor assembly. The restrictor assembly contains 2 or 3 restrictors for optimizing the regulation characteristics and 1 strainer. The desired target value for the setting range must be set on the adjusting screw of the pilot valve.

 <b>note</b>	A pilot-controlled pressure-reducing or backpressure regulator does not begin to operate until $\Delta p > 2\text{bar}$ ; the valve does not react if the difference from the target value is lower than this. If the control function is to operate at a lower differential pressure, special models or normal pressure-reducing and overflow valves should be used.
 <b>note</b>	A pilot-controlled pressure-reducing or backpressure regulator is not a safety valve. A suitable valve must be present in the pipe section to limit any excess pressure.
 <b>note</b>	After installation, the pilot valve must be adjusted to the desired inlet or outlet pressure. The pressure gauges needed for this must not be mounted directly on the valve and are therefore not included in the supply schedule. Suitable pressure display devices are needed on the plant side.

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 RP.8...>

with technical data and tables of the setting ranges and the dimensions.

 <b>danger of fatalities</b>	<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:          Leakage class II (metal sealing double seat cone) = 0.5% <math>K_{VS}</math> value          Leakage class III (metal sealing cone) = 0.1 % <math>K_{VS}</math> value          Leakage class IV (PTFE seal cone) = 0.01 % <math>K_{VS}</math> value          Leakage class V (soft seal cone) = <math>1.8 \times 10^{-5} \times \Delta p \times D^*</math> [l/h]          *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:          - 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>
 <b>caution</b>	<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><b>Failure to observe this regulation means danger to life and limb and may cause damage to the pressure-regulating valve.</b></p>
	<p>Pressure-regulating valves are generally supplied with an open spring cap to facilitate maintenance.</p> <p>Valves with a <b>sealed spring cap and leakage line connection</b> 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 is permanently marked on each fitting supplied.

In the following sections the two valve types DM and UV are combined under the heading of “Fitting” or “Pressure-regulating valves” apart from a few sections that only apply to the valve types mentioned.

## 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 + type or backpressure regulator + 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]. Unless otherwise indicated, all data give the overpressure above atmospheric.
Druckbereich	Druckbereich und Zahlenwerte	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	CrNiMo = high-alloy austenitic steel
Flow direction	Indicated by an arrow	

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 <DM 8...> or <UV 8...>, must be used for the pipeline section into which the pilot-controlled 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

 <b>danger of fatalities</b>	<p>Before a fitting is removed from the system or before a fitting is dismantled but partially remains in place, <b>the pressure in the system on both the inlet and outlet side must be completely reduced</b> so that there is no uncontrolled flow of the medium out of the system.</p> <p>In the case of toxic or hazardous media, the system must be completely drained before the fitting is removed.</p> <p><b>Caution is required with residues that might continue flowing.</b></p>
 <b>danger of being crushed</b>	<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), <b>that effective protection is afforded against objects catching on an exposed spring</b> in the pressure-regulating valve.</p> <p>If required, MANKENBERG will assist in selecting a suitable type with closed spring cap.</p>

 <b>danger of fatalities</b>	<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><b>When doing so, be sure to follow the notes in Section 7 &lt;Initial start-up&gt;!</b></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>
 <b>caution</b>	<p>If a fitting is removed from a system with a toxic medium and is taken out of the plant: <b>it must be properly decontaminated before repair.</b></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.

 <b>caution</b>	<p>The fitting has moving internal parts.</p> <p><b>Even packaged fittings should be transported smoothly without any shocks.</b></p>
 <b>caution</b>	<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><b>Under no circumstances may the lifting gear be affixed to any attachments (adjusting screw, handwheel or accessories).</b></p>
 <b>caution</b>	<p>Pilot-controlled pressure-regulating valves in a sandwich design with slotted discs, in particular, are especially sensitive to transport damage and dirt.</p> <p><b>The protective packaging on the body must not be damaged during transport and storage.</b></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.

 <b>note</b>	<p>ISO 2230 describes the storage conditions for elastomers in detail and specifies the permissible storage period.</p> <p><b>Functional and sealing parts must be replaced well before the storage period expires.</b> They are available from MANKENBERG as a “service set”. See also Section 10 &lt;Troubleshooting help&gt;.</p>
 <b>note</b>	<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 <b>must be protected against ferritic dust</b> to avoid corrosion.</p>

 <b>note</b>	<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><b>Handle with care so that the fitting does not tip over during transport/storage.</b></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, exposed springs) remain capable of moving freely and are not blocked.

- The fitting must not be coated with thermal insulation.

 <b>caution</b>	<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><b>Failure to observe this instruction may cause damage to the fitting and hence in the pipeline system as well.</b></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.

 <b>note</b>	<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><b>Failure to observe this instruction may impair the function of the fitting and lead to damage.</b></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.

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

- 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.

 <b>danger of being crushed</b>	<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><b>Failure to observe this instruction: danger of crushing for the operating personnel</b></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.

 <b>note</b>	<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.</p> <p>Please note:</p> <ul style="list-style-type: none"> <li>- only use control lines made of metal, not of plastic!</li> <li>- distance of pressure-reducing valve/connection of control line to the pipeline 1 x DN upstream of the valve and G10x DN downstream of the valve</li> <li>- distance of backpressure regulator/connection of control lines to the pipeline K 5x DN upstream and downstream of the valve</li> <li>- distance of vacuum control valve/connection to control line as for a pressure-reducing valve DM or an backpressure regulator UV, according to design</li> <li>- when the medium is steam, lay the control line at an angle, with the gradient falling towards the valve, see (catalogue) section &lt;Know How Pressure-reducing valves&gt;.</li> <li>- The control line should match the connection on the fitting.</li> <li>- Adjustable restrictors are integrated in the restrictor assembly to avoid vibrations.</li> </ul>
--	--

- 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.

 <b>important note</b>	<p>As a general rule, pressure-regulating valves should be installed in horizontal lines so that the pilot valve points upwards.</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.

 <b>caution</b>	<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.

 <b>note</b>	<p>It is necessary to ensure that even under operating conditions <b>no tension from the pipeline is transferred to the fitting.</b></p>
 <b>note</b>	<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>

- A pressure-regulating valve should first be adjusted during the initial start-up by setting the adjusting screw on the pilot valve to the operating conditions – see Section 7 <Initial start-up>.

In addition, the following applies to the pipeline connection:

with flanges:

 <b>note</b>	<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 <b>not included in the MANKENBERG supply schedule.</b></p>
---	--

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

with screw-mountings:

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

 <b>caution</b>	<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 <b>the body should be kept cool with a damp cloth.</b></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 <b>may render the fitting unserviceable.</b></p>
---	---

## 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.
- **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.

**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**

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.

## 7 Initial start-up

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

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).

 <b>caution</b>	<p><i>When looking onto the adjusting screw:</i></p> <p><b>Never fully remove the adjusting screw</b> (by rotating it anticlockwise).</p> <p><b>Do not block the adjusting screw in the position of maximum tension</b> (when rotating it clockwise).</p>
 <b>danger</b>	<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>
 <b>caution</b>	<p><i>After the initial start-up:</i></p> <p>Check the seals on screw-mounted parts of the body and reseal if necessary. If required, ask MANKENBERG for the tightening torques.</p> <p>Observe the relevant notes in Section 10 &lt;Troubleshooting help&gt;.</p>

To speed up the filling and emptying of the control chamber during start-up, restrictors D1, D2 and D3 should be fully opened. To vent the pressure-reducing valve, slightly undo the venting screw on the restrictor assembly. Do not unscrew it completely. Tighten the venting screw again when no more air comes out.

Restrictors D1, D2 and D3 are for adjusting the control valve to the operating conditions of the system.

Basic setting (factory-set):

- control restrictor D1 opened by approx. 1 revolution
- damping restrictors D2, D3 opened by approx. 2 revolutions

 <b>caution</b>	<p><b>Never fully close the restrictors!</b></p>
---	--

## 8 Normal operation

A properly designed pressure-regulating valve works automatically and does not need any form of auxiliary energy.

 <b>note</b>	<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 &lt;Further information&gt; for addresses.</p>
 <b>danger of fatalities</b>	<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><b>Failure to observe this regulation may mean danger to life and limb and may cause damage to the pipeline system and to the fitting.</b></p>
 <b>caution</b>	<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><b>Failure to observe this instruction may cause damage to the pipeline system and to the fitting.</b></p>
 <b>danger</b>	<p>In some series a control line is laid between the pressure-regulating valve and the pipeline – see Section 5.1 &lt;Installation / General notes&gt;.</p> <p><b>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.</b></p>
 <b>danger</b>	<p>Pilot-controlled pressure-regulating valves are designed for the operating location in accordance with the order. The restrictor assembly has 2 or 3 integrated restrictors with which the operating response to pressure fluctuations can be influenced.</p> <p><b>Incorrect setting of the restrictors can cause damage in the system.</b></p>
 <b>note</b>	<p>Pilot-controlled 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 valve actuator)..</p> <p><b>Failure to observe this instruction may cause damage to the pressure-regulating valve.</b></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 <sup>1)</sup>
Check function	Check whether function is fulfilled as per Section 1) <Intended use>	At least 1x per week
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 <sup>2)</sup>	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 of diaphragm and functional parts. Replace all parts of the maintenance set <sup>3)</sup>	At least 1x per year
Check safety valve	According to the manufacturer's instructions	At least 1x per year
<sup>1)</sup> 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. <sup>2)</sup> Caution danger of crushing: shut down the valve for cleaning purposes! <sup>3)</sup> Request maintenance set and replacement instructions from MANKENBERG.		

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

 <b>note</b>	<p><i>If functional or corrosion damage is detected during maintenance or after a fault:</i></p> <p>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.</p>
--	--

Type of fault	Action
<p>Leakage at a connection body parts (flange or clamping ring):</p> <p><b>reseal connection</b></p>	<p>Tighten the screws <b>clockwise</b> (tighten flange screws crosswise).</p> <p><i>If the screws of the body connection have to be loosened or removed (= unscrewing in the <b>anticlockwise</b> direction):</i></p> <p style="text-align: center;">   <b>danger of fatalities</b> </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 &lt;Special hazards&gt; and then Section 5 &lt;Installation in the pipeline&gt;.</p>
<p>Leakage on the spring cap</p> <p><b>The valve must be repaired</b></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;">   <b>danger of fatalities</b> </p> <p><b>The pretensioned spring must be fully relaxed before a fitting is dismantled!</b></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 &lt;Special hazards&gt;.</p>

<p>Functional fault</p> <p>Leakage at the seat means the set inlet or outlet pressure is not correctly regulated:</p> <p><b>Clean the functional parts</b></p>	<p><i>A foreign object may be jammed in the seat and be preventing proper 1sealing:</i></p> <ul style="list-style-type: none"> <li>- fully release the tension on the DM pressure-reducing valve spring</li> <li>- fully release the tension on a UV backpressure regulator spring</li> <li>- on a vacuum control valve, observe the above remarks according to the design</li> </ul> <p>so that the valves open and foreign objects can be flushed out.</p> <p><i>If the functional fault cannot be rectified in this way:</i> cleaning is necessary: the valve must be dismantled</p> <div style="text-align: center;">  <p><b><u>Danger of fatalities</u></b></p> </div> <p><b>The pretensioned spring must be fully relaxed before a fitting is dismantled!</b></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 &lt;Special hazards&gt;.</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 &lt;Initial start-up&gt;.</p>
<p>Functional fault</p> <p>Cleaning alone – see above – cannot rectify the fault:</p> <p><b>The fitting must be repaired</b></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> <i>Repair necessary:</i></p> <p>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 &lt;Further information&gt; for addresses.</p> <p>or:</p> <p>Send the fitting to the manufacturer for repair. See Section 11 &lt;Further information&gt; 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**

**Tel. +49-451 -8 79 75 0**  
**Fax +49-451 -8 79 75 99**  
**Email gm@mankenberg.de**  
**www.mankenberg.de**

