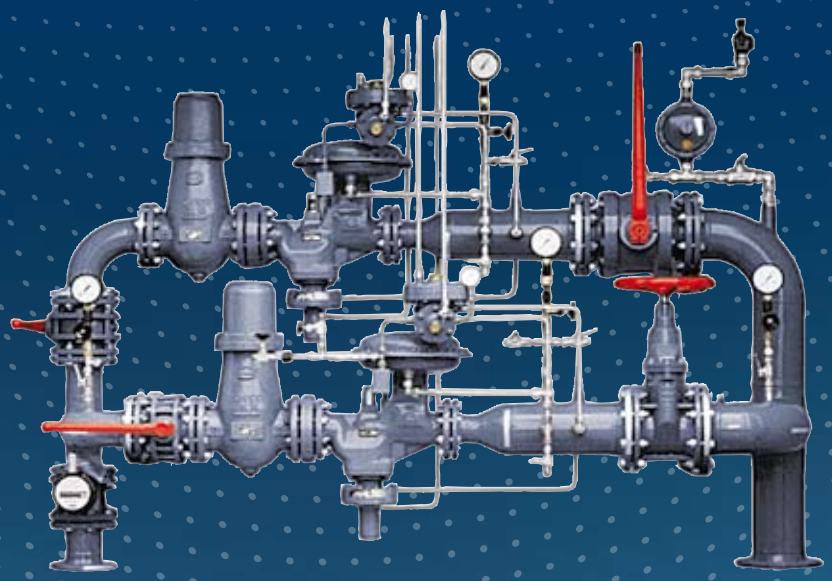
General Operating Instructions for RMG Gas Pressure Regulators and Safety Devices



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CONTENTS

Hazard Warning Signs

Safety advice in these operating instructions is indicated by the following **signs** and **symbols**:

Hazard warning signs, general

Sign	Meaning:
⚠ Danger	Risk of personal injury
⚠ Warning	Risk of damage to property and the environment
Note	Additional information

1. General

These General Operating Instructions describe the installation, removal and operation of gas pressure regulators (GPR) for outlet pressure control, safety shut-off valves (SSVs) and safety relief valves (SRVs). Please refer to the relevant guidelines, particularly DVGW technical rules G 491 and G 495, for information regarding design, finish, supervision and maintenance.

Warning For technical data and special features of a particular product, please refer to the relevant product brochures, test certificates and type plates.

Warning Gas pressure regulators may be commissioned, decommissioned and serviced by qualified personnel only.

Warning Pressure outside the specified range may result in internal and external damage to the gas pressure regulators.

Danger Gas pressure regulators and components may be opened only in an unpressurised state.

2. Installation

Gas pressure regulators and safety devices must be installed without pipe distortion. The arrow on the main valve housing must indicate the flow direction (except RMG 790 in the return section). Pressure regulators are usually installed in an upright position with horizontal gas flow (see installation examples and technical product information for the relevant regulator). Pilots and actuators of indirect-acting pressure regulators must always be installed in the normal position. The installation position may affect the function and therefore specific technical data, e.g. setting range W_d, accuracy class AC, lock-up pressure class SG and accuracy group AG.
Please refer to the relevant manual and maintenance instructions for information about alternative installation positions.

2.1 Design of outlet measuring pipe

Choose a pipe section with stabilised flow for the measuring point. Make sure that no installations that could disrupt the flow are installed immediately upstream or downstream of the measuring point, e.g. orifice plates, expansions, bends, branches, shut-off valves etc.

RMG general recommendation for outlet measuring pipe:

- Maximum flow rate at the measuring point up to approx. 25 m/s depending on station operating conditions.
- Flow rates in excess of 25 m/s may be possible with certain station arrangements, e.g. gas regulating lines for gas motors and gas burners. Please contact RMG for further information.
- In the low-pressure range up to approx. 250 mbar we recommend approx. 15 to 20 m/s maximum. Even lower flow rates may be used in certain cases.

Upstream of the measuring point, general

Depending on the design of the station, the length L_{uR} of the uninterrupted pipe must be 2.5 to 5 x DN of the pipe, subject to the design of the gas pressure regulator or any downstream pipe expansion.

- If a gas pressure regulator with built-in expansion is used and:
  - •the nominal width of the pipe is the same as the downstream nominal width of the gas pressure regulator
    → **L_{uR} min. 2.5 x DN**
  - •the nominal width of the pipe is the next largest standard nominal width
    → **L_{uR} min. 3 x DN**
  - •the nominal width of the pipe is twice the standard nominal jump
    → **L_{uR} min. 4 x DN**
  - •the nominal width of the pipe is more than twice the standard nominal jump
    → **L_{uR} min. 5 x DN**

- If the outlet pipe size of a gas pressure regulator is the same as the inlet pipe size and:
  - •the nominal width of the pipe is the next largest standard nominal width
    → **L_{uR} min. 4 x DN**
  - •the nominal width of the pipe is twice the standard nominal jump
    → **L_{uR} min. 5 x DN**

Downstream of the measuring point

→ **L_{uR} min. 1.5 x DN** for thermometer immersion sleeves
→ **L_{uR} min. 1.5 x DN** for reductions and expansions, depending on the station operating conditions
→ **L_{uR} min. 3 x DN** for shut-off valves (gate valves, controlling flaps, ball valves with reduced bore)
→ **L_{uR} min. 4 x DN** for T-pieces

Further recommendations

- Shut-off valves with uninterrupted flow (e.g. ball valves with full bore) and, where appropriate, pipe bends (depending on design) are not regarded as disruptive to measuring line connections.
- No restrictions apply to gas meters (turbine gas meters including flow meters, ultrasonic flow meters, vortex gas meters, but not rotary meters) with regard to the positioning of measuring lines; they are not regarded as flow-impeding for measuring line configurations.
- For rotary gas meters the minimum distance between the gas pressure regulator or reducer/expansion and the gas meter must be → **L_{uR} min. 3 x DN**.

Measuring line connections downstream of gas meters must be separated by a distance of → **L_{uR} min. 2 x DN**.

- When using shut-off valves (reduced bore), we recommend a distance of → **L_{uR} min. 3 x DN** downstream of a measuring line connection.
- Allowances must be made for pressure losses from gas meters where applicable, depending on the station operating conditions.

<u>All these statements are RMG recommendations</u>
These recommendations also relate to guidance on measuring line connection conditions in standards (DIN) EN 334 and (DIN) EN 14382. Responsibility lies strictly with the station operator.
The following plant schematics illustrate the basic design types.

2.2 Leak testing (testing for external leak tightness)

Gas pressure regulators (GPR) and safety shut-off valves (SSV) are pressure and leak tested by the manufacturer in accordance with (DIN) EN 334 (GPR, SBV) and (DIN) EN 14382 (SSV).
In compliance with DVGW technical rules G 491, the fully assembled station must be leak tested in situ with air or with inert gas at 1.1 times the maximum permitted operating pressure (MIP_u, MIP_d).
$MIP=1.1 \cdot MOP_{u,d}$

Inlet chamber

- Chamber up to the main valve of the gas pressure regulator
  Test pressure $MIP_u = 1.1 \cdot MOP_u$

Outlet chamber

- Chamber between the main valve of the gas pressure regulator (GPR) and the first downstream shut-off valve.
  We recommend using 1.1 times the maximum response pressure p_{dso} specified on the safety shut-off valve (SSV).
  Recommended test pressure $MIP_d = 1.1 \cdot p_{dso}$ (but max. $MIP_d = 1.1 \cdot MOP_d$).
  (MIP_d must not be exceeded, even allowing for the accuracy group AG of the SSV(s).)

Outlet chamber downstream of the valves

- Chamber downstream of the first shut-off valve downstream of the gas pressure regulator
  Test pressure $MIP_d = 1.1\ MOP_d$.

Note Always apply the test pressure slowly and evenly.

Please note:
Pressure in the outlet chamber ≤ pressure in the inlet chamber
Pressure increase always from the inlet side (inlet chamber)
Pressure decrease always from the outlet side (outlet chamber)

⚠ Warning With direct-acting pressure regulators (without auxiliary power), the outlet pressure acting on the main valve must never be more than 0.5 bar above the setpoint.
Therefore with a setpoint spring adjustment of 0.2 bar, for example, the test pressure in the outlet chamber must not exceed 0.5 + 0.2 = 0.7 bar.

2.3 Installation examples

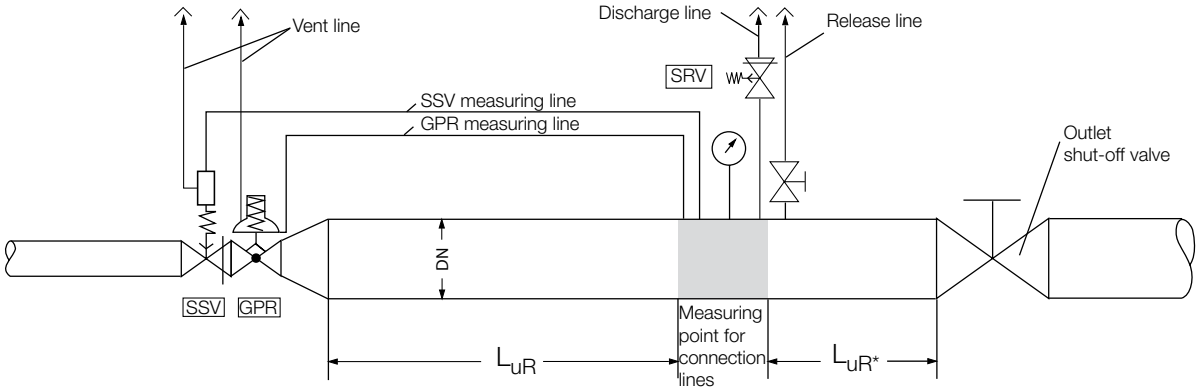


Fig. 1: Gas pressure regulator
- direct-acting GPR (without auxiliary power)
- with expansion without noise attenuation downstream of the GPR

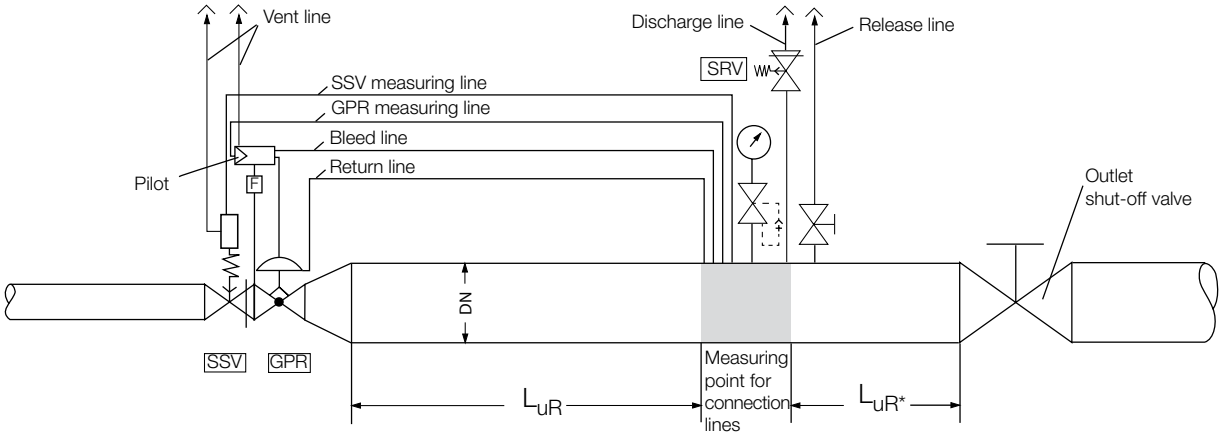


Fig. 2: Gas pressure regulator
- indirect-acting GPR (pilot-operated)
- with expansion without noise attenuation downstream of the GPR
- outlet pressure gauge with overpressure protection

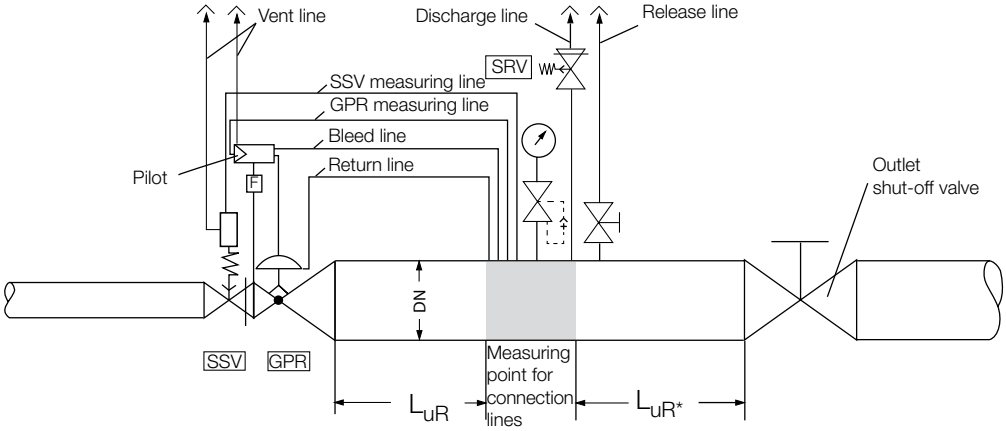


Fig. 3: Gas pressure regulator
- indirect-acting GPR (pilot-operated)
- with expansion and integrated noise attenuation
- outlet pressure gauge with overpressure protection

*) Can include shut-off valve with unimpeded flow (ball valve)

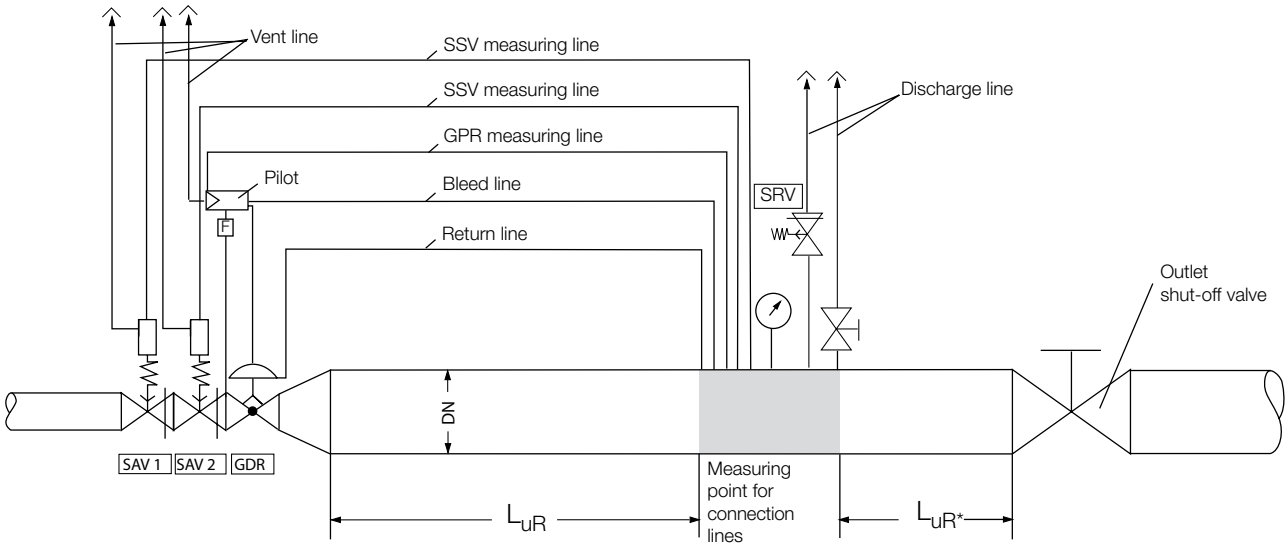


Fig. 4: Gas pressure regulator

- indirect-acting GPR (pilot-operated)
- indirect-acting SSV (pilot-operated) (2-fold)
- with expansion without noise attenuation downstream of the GPR

*) Can include shut-off valve with unimpeded flow (ball valve)

2.4 Impulse lines

Please refer to the relevant technical product information for the dimensions of lines and thread connections for specific pressure regulators. The lines must be arranged and dimensioned so as to ensure that the pressure regulators function correctly. The measuring line transmits the actual value of the pressure from the measuring point to the measuring diaphragm of a regulating assembly, the pilot of a GPR or SRV or the measuring diaphragm of an SSV actuator. It is connected to the side or the top of the pipework, depending on the device. With safety devices, the measuring line must always be connected without shut-off mechanism upstream of the first shut-off valve on the outlet side. If a measuring line is also connected downstream of the first shut-off valve on the outlet side, 3-way ball valves with negative-value overlap must be used for switching (these ball valves do not have a valve position which allows both measuring lines to be fully closed at the same time).
The vent line serves to connect a measuring diaphragm to the atmosphere; in the event of damage to the measuring element (e.g. diaphragm rupture), it can carry gas. Vent lines may be dispensed with under certain operating conditions if vent valves (RMG 915) or safety diaphragm types can be used as an alternative.
→ Please contact RMG for further information.
The discharge line of a safety relief valve (SRV) is used to discharge volumes of gas (e.g. leakage gas) into the atmosphere.
The vent lines or discharge lines may be grouped together in a collecting line, provided that this does not impair the functioning of the individual devices. The recommended profile of the collecting line is at least 5x greater than the total profiles of the individual lines. Stand-alone SSV vent lines are recommended for main safety shut-off valves (SSV). Vent lines must not be combined with discharge lines in the same collecting line.
With indirect-acting gas pressure regulators (pilot-operated), the bleed line is used to discharge outflow gas from the pilot into the outlet chamber of the pressure regulator. In some pressure regulators the bleed line is combined with the return line.
With pilot-operated gas pressure regulators, the return line feeds the outlet pressure back to the main valve.

	Safety shut-off valve (SSV)	Indirect-acting gas pressure (GPR) direct-acting (without auxiliary power)	Indirect-acting gas pressure (GPR) regulator (pilot-operated)	Safety relief valve (SBV)
3.1	**Pressurising the station**			
	⚠ Warning Make sure that the outlet shut-off valve is closed when pressurising the system. Always pressurise slowly. After carrying out maintenance, pressurise the system and perform operational testsas described in 3.2.			
	•Slowly open the by-pass valve or pressure compensating valve of the SSV This will equalise pressure in the main valve →	A lock-up pressure corresponding to the preset value is generated in the outlet chamber		
	•Open and engage the SSV, keeping it in the open position until it is securely engaged. Note Maintain the re-engagement differential (see general brochure and section 3.5) An SSV with underpressure release can only be engaged if the pressure at the measuring point corresponds to the operating pressure p. •Close the by-pass valves	⚠ Warning Since the pressure regulator is in an unpressurised state, **slowly** pressurise the inlet pressure.	•Set the load limiting pressure Reference values: - RMG 610 (RS 10d) approx. 0.5 to 1 bar above p_d - Pilot RMG 650 approx. 0.5 to 10 bar above p_d - Pilot RMG 630 approx. 0.5 to 10 bar above p_d For further information, please refer to the operating hints and tips for the relevant product in the spare parts catalogue	
		•Slowly increase the outlet pressure to the desired value (see sections 3.2.2 and 3.3)		
3.2	**Operation and performance tests**			
3.2.1	Testing internal leak tightness	Testing the lock-up pressure		Testing internal safety
	•Close SSV •Depressurise the outlet chamber as far as the outlet shut-off valve •Pressurise the inlet pressure •Test for leaks **With two SSVs:** •Close the first SSV, open the by-pass valves of the second SSV and test for leaks •Close the by-pass valves on the second SSV Open the first by-pass valve. Test the second SSV for leaks	•Pressurisation in accordance with 3.1 •Discharge a small volume of gas via the roof •Slowly close the discharge line A constant lock-up pressure must be maintained within the lock-up pressure group		•Increase the pressure in the outlet chamber until the response pressure is reached •Reduce pressurein the outlet chamber to 0.9 times the response pressure •Test for leaks
3.2.2	Testing the response pressure	Testing the controlled pressure		Testing the response pressure
	•Slowly increase or decrease the pressure until the response pressure is reached •Repeat the test several times at the same pressure change rate ⚠ Warning Please observe the re-engagement differentials when performing the test (see general brochure and section 3.5) •Adjust the response pressure setting on the actuator if necessary	•For the first operational test, discharge the gas to air via the discharge line The set controlled pressure can be read off from the outlet pressure gauge •Adjust the setpoint of the outlet pressure if necessary Note We recommend setting the setpoint of the outlet pressure to slightly below the pressure of the downstream line system		•Slowly increase the pressure until the response pressure p_S is reached. The SRV must open •Adjust the response pressure setpoint if necessary
3.3	**Setpoint adjustment**			
	•To increase setpoint, turn the setpoint adjustment screw clockwise		• To decrease the setpoint, tum the setpoint adjustment screw anticlockwise	
3.3.1	**Changing the setting range**			
	The setting range can beswitched to a different setpoint spring when the pressure regulator is pressurised			
	Note When the station is under pressure, the SSV closes when the setpoint spring for overpressure is removed	⚠ Warning Please note the final section on Page 7		Do not insert a different setpoint spring when the safety relief valve is pressurised

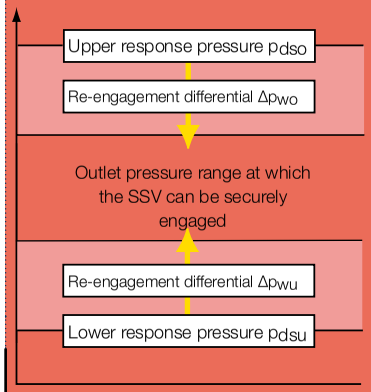
3.4 **Commissioning the system**

⚠ Warning Stop screws for releasing samples must be removed;
End caps, which serve as an opening aid, must be removed from the valve stem

- After completing sections 3.1 and 3.2: Slowly open the outlet shut-off valve
- Slowly increase the setpoint with the adjustment screw until the pressure regulator has taken over the gas supply and the desired outlet pressure p_{ds} is set

3.5 **Setting instructions**

Re-engagement differential
The re-engagement differential specifies the amount
Δp_W by which the pressure must be reduced after an overpressure release or increased after an underpressure release to enable the SSV to be safely
re-engaged. The re-engagement differentials are specified in the general brochures or in the RMG booklet.
If the SSV actuator is designed to simultaneously protect against over- and underpressure, the minimum
pressure difference between p_{dso} and p_{dsu} must additionally be observed. This is specified in the general brochures. Decommissioning the station



Fitting the regulating device to the regulating line
When gas is taken up (outside the lock-up pressure zone or the low flow range), the control response of the GPR must remain stable within the given accuracy class

Setting the throttle valve in the measuring line
- In the event of control oscillations, turn the

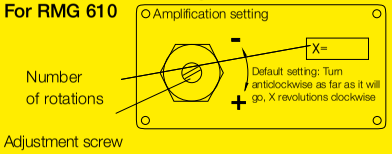
Note kwise to restrict the flow
The throttle valve should remain open as far as possible to achieve sufficient actuating speed

Setting the load limiting pressure
- In the event of control oscillations: reduce the load limiting pressure
- In the event of excess control deviations: increase the load limiting pressure

Note A load limiting pressure changemay require setpoint adjustment

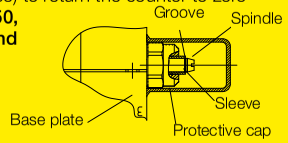
Setting the outflow: Avoid changing the factory default setting if possible
- In the event of control deviations, turn the spindle anticlockwise (adjustment screw). Do not exceed
4 turns for RMG 610

Default setting of bleed valve (RMG 610 and RMG 650) **and throttling valve** of RMG 630
For RMG 610



Turn the adjustment screw to "-" (anticlockwise) as far as it will go; turn the adjustment screw to "+" (clockwise) to return the counter to zero

For RMG 650, RMG 630 and RMG 630-1 (formerly 640)



Factory setting:
Throttle is rotated 6 times (anticlockwise).

3.6 **Decommissioning the system**

1. Slowly close the outlet shut-off valve
or 2. Slowly reduce the outlet pressure via the setpoint adjustment screw until the back-up line has taken over the gas supply
or 3. Slowly increase the setpoint of the back-up line until the operating line is decommissioned

4. Troubleshooting

4.1Direct-acting gas pressure regulators (without auxiliary power)

Please refer to the maintenance manuals/spare parts catalogue for maintenance instructions for specific products

⚠ Danger Depressurise all housing chambers and associated station parts before installing or removing a device.

Troubleshooting			
Fault	**Fault detection**	**Possible cause**	Action
Excess lock-up pressure no lock-up pressure	Main valve	Compensating diaphragm faulty	Replace diaphragm
		Main valve soiled or damaged	Check valve seat and sealing rings for damage and dirt
		Structural sealing element faulty	Replace sealing rings
Unstable outlet pressure pattern (oscillations)	Main valve	Pressure regulator operating in the lock-up pressure range	Tighten the adjustable throttle in the measuring line by turning clockwise (if available) **Note:** Excess damping reduces the actuating speed. Insert the setpoint spring for the next higher setting range (harder setpoint spring)
	Regulating assembly	Oscillating resonance in the regulating line	
Excess control deviation	Measuring point	Unsuitable measuring line connection	Choose measuring point with stable flow, check measuring point
	Gas pressure regulator	Binding of the regulator due to soiling	Service the regulator
		Measuring or compensating diaphragm faulty or incorrectly installed	Check diaphragm
Incorrect pressure peak, excess dynamic lock-up pressure	Gas pressure regulator	Excess damping of the pressure regulator, too dynamic regulating line	Open the adjustable throttle further in the measuring line (turn anticlockwise), check vent lines if necessary, increase the pipe width if the lines are very long. replace vent valve RMG 915 with vent line
	Regulating line	Excess lock-up speed of downstream shut-off devices	Reduce lock-up speed of shut-off device

4.2 Pilot-operated gas pressure regulators (with auxiliary power)

Please refer to the maintenance manuals/spare parts catalogue for maintenance instructions for specific products

⚠ Danger Depressurise all housing chambers and associated station parts before installing or removing a device.

Troubleshooting			
Fault	**Fault detection**	**Possible cause**	**Action**
Excess lock-up pressure	Pilot	Amplifying valve soiled or damaged	Service pilot
No lock-up pressure	Pilot	Amplifying valve faulty	Service pilot
	Main valve	Main valve leaking due to soiling or damage	Service main valve
Main valve does not open during commissioning or loadtransfer	Pilot	Too little amplification	Increase load limiting pressure, reduce outflow
		Diaphragm in pilot faulty	Replace diaphragm
GPR does not respond to setpoint adjustment	Filter	Filter soiled	Clean or replace filter set
Sudden or slow outlet pressure loss	Main valve	Diaphragm in main valve faulty	Replace diaphragm
		Pressure compensation valve open (with RMG 402/RMG 502)	Close valve
		Valve seat diameter too small	Check design data
Sudden or slow outlet pressure loss or increase	Pilot	Diaphragm in pilot faulty	Replace diaphragm
	Main valve	Main valve binding	Service the regulator
Unstable outlet pressure pattern (oscillations)	Pilot	Excess amplification	Reduce load limiting pressure, increase gas outflow; insert setpoint spring for the next setting range up (harder setpoint spring)
	Main valve	Main valve operates in lock-up pressure range	Check design data
	Measuring point	Unsuitable measuring line connection	Choose measuring point with stabilised flow, see section 2.1 “Design of outlet measuring pipe”
Excess control deviation	Pilot	Too little amplification	Increase load limiting pressure, reduce gas outflow
			Reduce throttle setting (with RMG 630/650-1 (formerly 640))

4.3 Safety shut-off valves

Please refer to the maintenance manuals/spare parts catalogue for maintenance instructions for specific products

⚠ Danger Depressurise all housing chambers and associated station parts before installing or removing a device.

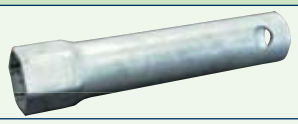
Troubleshooting			
Fault	**Fault detection**	**Possible cause**	**Action**
No internal tightness in the closing position	Main valve	Main valve not tight	Check valve seat and sealing rings for damage and dirt
	By-pass valve	By-pass valves open or not tight	Check by-pass valves
Main valve will not open	By-pass valve	No pressure compensation at the main valve	Create pressure compensation by opening the by-pass valve
Main valve will not engage	Actuator	Difference between response pressure and operating pressure or between upper and lower response pressure too small	Correct response pressure setting (see brochure or RMG booklet for required re-engagement differential)
		Measuring diaphragm in the actuator faulty (only with underpressure release)	Replace diaphragm
	Measuring point	Pressure at measuring point too high	Reduce pressure at measuring point to operating pressure
		No pressure at measuring point only with underpressure release	Increase pressure at measuring point to operating pressure
	Vent valve	Vent valve discharges insufficient gas from the spring chamber to engage	Unscrew top of spring housing; engage SSV and screw top back down
	Tripping device	Release mechanism binding due to soiling	Service tripping device
Permitted response pressure deviation exceeded	Actuator	Difference between response pressure and operating pressure or between upper and lower response pressure too small	Observe prescribed re-engagement differential during engagement (see brochure or RMG booklet)
		Measuring diaphragm twisted	Check diaphragm
Irregularities in response behaviour	Tripping device	Release mechanism binding due to soiling	Service tripping device
		Elements of the release mechanisms worn	Replace damaged parts
	Checking device	Significant variation in pressure changes rates during testing	Apply test pressure slowly and evenly
Gas leak via vent lines	Actuator	Measuring diaphragm faulty	Replace diaphragm

5. Lubricants

Lubricants		
Application	**Lubricant**	**Remarks**
O-ring seals stationary or moving	Silicone grease Partsno.: 00 027 081 Tube	Apply sparingly to parts
Diaphragm clamping area		
Screwed connections and fastening screws in the housing		
Sliding surfaces of valve stems, sliding guides, spindle bushes		
Moving parts in SSV actuators and tripping devices, Switching bushes, Switching balls and drums, Ball bearings		
Valve sleeves and valves sleeve seals in gas pressure regulators	Unisilicone grease TK 44 N2 Part no.: 00 027 052 Pack	
Setpoint adjustment screws (drive screws) Thread material combination: AL/AL	Anti-seize AS450 Parts no.: 00 027 091 Pack	
Devices for oxygen	Lubricating oil Parts no.: 00 026 562 Lubricating paste Parts no.: 00 026 563	
Devices for ammonia	Fluorosilicone grease Parts no.: 00 027 660	Apply sparingly to parts

Note Please refer to specific details in the maintenance instructions!

6. Installation Tools

Installation Tools			
Device type	**Tool**	**Stock no.**	
RMG 330 Regulating assembly 1 RMG 361 Regulating assembly 1	Outlet pressure adjustment 0.02 to 0.5 bar	00 02 65 02	
	Outlet pressure adjustment 0.5 to 1.0 bar	10 00 49 11	
RMG 300 RMG 835	Outlet pressure adjustment SRV adjustment	10 00 42 54	
RMG 408	Installation tools	10 00 78 95	
Safety shut-off device for RMG 300, RMG 330, RMG 332, RMG 340, RMG 345, RMG 361, RMG 370, RMG 408 Safety shut-off valve (SSV) RMG 720	SSV adjusting wrench	10 00 49 12	
SSV RMG 720 K4, K5, K6	Tee wrench	10 00 85 82	
SSV RMG 720 DN 150 SSV RMG 721 DN 50 - 150	Tee wrench	10 00 87 90	
RMG 361/RMG 370 DN 25 and DN 50	Bolt + installation tool SSV	15 80 14 21	
RMG 361/RMG 370 DN 80 and DN 100	Bolt + installation tool SSV	15 80 14 22	
RMG 361 Regulating assembly 1 RMG 370 regulating assembly 1	Leakage gas adjusting wrench	15 80 12 46	
RMG 402	Installation tool for SSV o-ring	10 03 00 34	
RMG 402	SSV wrench	10 02 63 50	

Installation Tools			
Device type	**Tool**	**Stock no.**	
RMG 265 RMG 267, RMG 268 RMG 630 to RMG 630-1 (640) RMG 650 to RMG 659 RMG 670, RMG 671	Installation tools	19 08 33 19	
RMG 710 DN 25 to DN 150 RMG 711 DN 200 to DN 300 RMG 721 DN 50 to DN 150	Checking device with adapter for manual release adjustment	10 00 19 35	
	Mounting screw M4 (2x)	10 00 07 16	
	Jig for manual release adjustment and solenoid release setting	10 00 19 43	
RMG 672 K10, K10a, K11, K11a K12, K13, K14	Jig for actuators	10 00 19 47	
RMG 672 K12, K13, K14	Allan key for SSV adjustment	00 02 62 66	
RMG 790	Adjusting wrench	10 00 82 99	
	Test vessel	87 90 90 00	
RMG 530 DN 200 to DN 300	Mounting sleeve for sealing ring	10 02 44 34	
RMG 530 DN 50 to DN 300	Slip-on bushing for motor shaft	18 35 71 99	
RMG 512 b	Installation cone DN 25 DN 50 DN 80 DN 100	10 00 22 18 10 01 35 47 19 08 18 43 10 01 36 47	

Note: This list does not claim to be exhaustive!

Additional RMG publications

For further information about gas pressure regulators and safety devices, please refer to the following publications in addition to the general operating instructions:

General brochure

- Technical product information -

Contents: TECHNICAL DATA
Dimensions and connections
Design and operation
Installation
Device design
Ordering information

Manual and maintenance/Spare parts

Contents: Specific operational hints and tips
Maintenance instructions
Spare part drawing
Spare parts list

RMG Group Catalogue

Contents: Products from the entire RMG by Honeywell
Important technical data for RMG gas pressure regulators
incl. flow parameters, setting ranges, accuracy classes and lock-up pressure classes
Important technical data for RMG safety devices
incl. setting ranges and accuracy groups

For More Information
To learn more about RMG´s advanced gas solutions, contact your RMG account manager or visit www.rmg.com

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