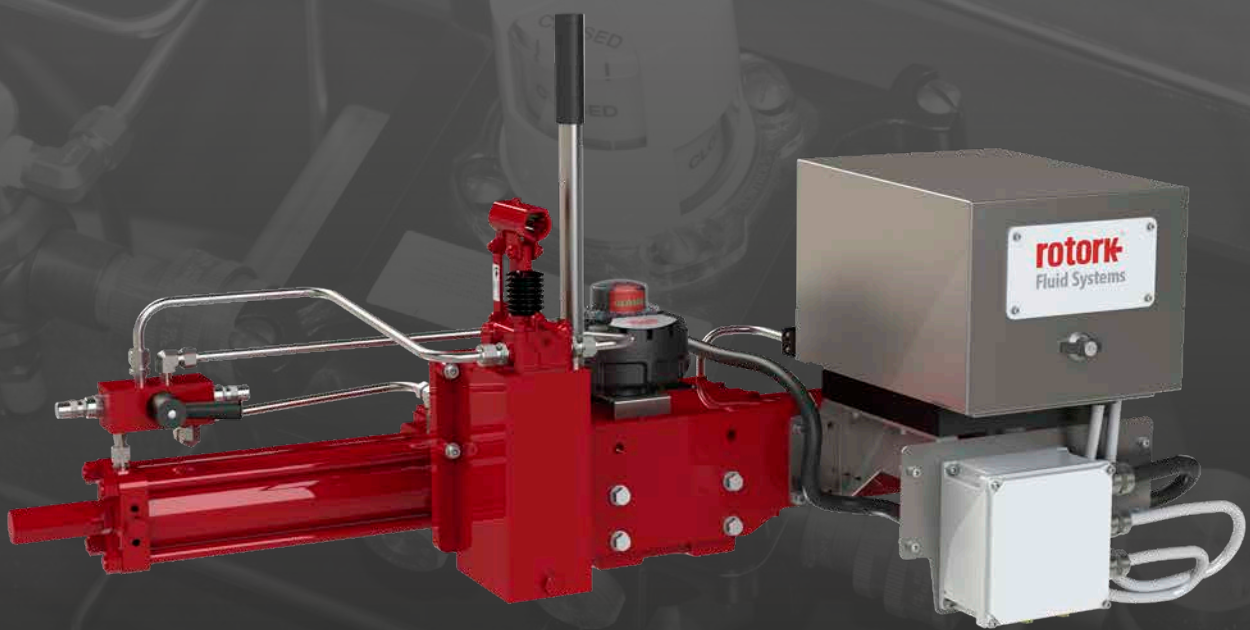


# rotork®

Keeping the World Flowing  
for Future Generations

## HPG range

Direct high pressure gas valve actuator



Installation, commissioning and maintenance manual

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**This manual contains important safety information. Please ensure it is thoroughly read and understood before installing, operating or maintaining the equipment.**

**Rotork reserves the right to modify, amend and improve this manual without notice.**

**Rotork is not responsible for damage or injury caused by the failure to observe the instructions contained herein.**

## 1. Introduction

This manual covers the High Pressure Gas (HPG) (Type 2) actuator range.

In this manual, warning indications are represented by icons, according to ISO 7010 Safety Signs:



Generic danger



Hand crush / pinch point



Electrocution



Explosive material



Substances toxic for the environment (terrestrial or aquatic) or which could have harmful, long-term effects

### 1.1 Customer service

For technical assistance, please contact Rotork customer service:

E-mail: [rfs.international@rotork.com](mailto:rfs.international@rotork.com)

Rotork, Via Padre Jacques Hamel, 138B, Porcari, Lucca, 55016, IT. Tel: +39 0583-222-1

Rotork plc, Brassmill Lane, Bath, UK. Tel +44 (0)1225 733200

## 2. Standards and regulations

Actuators destined for European member states and the United Kingdom have been designed, built and tested according to the quality control system, in compliance with the EN ISO 9001:2015 standard and with the following regulations/directives.

- 2006/42/EC: Machinery Directive (MD)
- S.I. 2008 No. 1597: The Supply of Machinery (Safety) Regulations 2008
- 2014/68/EU: Pressure Equipment Directive (PED)
- S.I. 2016 No.1105: Pressure Equipment (Safety) Regulations 2016 (PE(S)R)
- 2014/34/EU: Directive for safety equipment and systems to be used in potentially explosive atmospheres (ATEX)
- S.I. 2016 No. 1107: The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016
- 2014/30/EU: Electromagnetic Compatibility Directive (EMC)
- S.I. 2016 No. 1091: Electromagnetic Compatibility Regulations 2016
- BS EN ISO 12100: Machinery Safety Directive
- BS EN 60079-14: Explosive atmospheres - Part 14: Electrical installations design, selection and erection
- BS EN 1127-1: Explosive atmospheres - Explosion prevention and protection - Basic concepts and methodology
- BS EN ISO 80079-36: Non Electrical equipment for explosive atmospheres - Basic methods and requirements
- BS EN ISO 80079-37: Non-electrical equipment for explosive atmospheres - Non-electrical type of protection construction safety "c", control of ignition "b", liquid immersion "k"
- IEC 60079-46: Explosive atmospheres - Part 46: Equipment assemblies
- BS EN ISO 7010: Safety Signals
- BS EN 13445: Unfired Pressure Vessel

### 3. General information

This manual is produced to enable a competent user to install, operate and maintain the Rotork HPG range actuators.

The mechanical installation must be carried out as outlined in this manual and in accordance with any relevant national standard codes of practice.

Maintenance and operation must be carried out in accordance with the National Legislation and Statutory Provisions relating to the safe use of this equipment, applicable to the site of installation.

Any inspection or repair in a hazardous area must not be undertaken unless it conforms to National Legislation and Statutory Provisions relating to the specific hazardous area.

Only Rotork-approved replacement parts should be used. Under no circumstances should any modification or alteration be carried out on the equipment, as this could invalidate the conditions under which its certification was granted.

Only trained and experienced operators can install, maintain and repair Rotork actuators. Work undertaken must be carried out in accordance with instructions in this manual. The user and those persons working on this equipment must be familiar with their responsibilities under any statutory provisions relating to the health and safety of their workplace.

Operators must always wear appropriate Personal Protective Equipment (PPE) in line with the existing plant regulations.

#### Appropriate usage

Rotork HPG range actuators have been specifically developed to automate quarter-turn valves, such as ball valves, butterfly valves or plug valves installed on pipelines for gas transport and distribution.

**⚠ Improper use can damage the equipment or cause dangerous situations for health and safety. Rotork declines any responsibility for damage to people and/or objects resulting from the use of the equipment for applications different from those described in the present manual.**

**⚠ Hazardous area usage: Only use devices approved for hazardous area use. These devices will have an EX type label fixed to them. Before installation and operation in a potentially explosive atmosphere, read and follow the information and instructions on the EX label and any additional EX instructions in the documentation received with the device.**

### 4. Health and safety

**⚠ Before installing the equipment, verify whether it is suitable for the intended application. If unsure consult Rotork.**

#### 4.1 Residual risks

Residual risks resulting from equipment risk evaluation performed by Rotork.

#### 4.2 Thermal risks

Risk	Hot/cold surfaces during normal operation (RES_01).
Preventive measures	Operators should wear protective gloves.

#### 4.3 Health risks

Risk	Pressurised fluid ejection during normal operation (RES_02).
Preventive measures	All fittings must be properly sealed. All fixing clamps must be correctly tightened and sealed.
Risk	Risk of intoxication (according to the type of medium utilised) (RES_06).
Preventive measures	Operators must use PPE and any other equipment (breathing apparatus) based on the type of supply medium.

#### 4.4 Mechanical risks

Risk	Uncontrolled movement (remote operation) (RES_03).
Preventive measures	Assure that the actuator can not be operated remotely. Prior to starting, remove pneumatic supply, vent all pressure vessels, and remove electrical power.
Risk	Presence of moving parts (centre body, in the valve adapter) (RES_04).
Preventive measures	Check centre body cover is installed and hex bolts tightened before start-up.

#### 4.5 Noise

Risk	Noise >85 dB during operation (RES_05).
Preventive measures	Operators should wear ear protections. Operators should not stand near the equipment during operation.

## 5. Labels and nameplates

The following label is applied externally to the actuator:

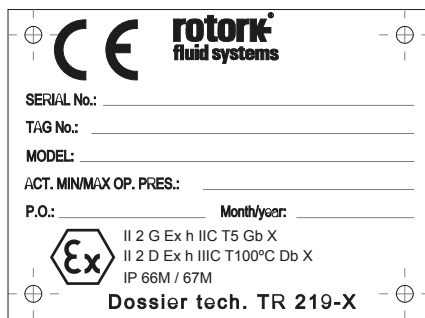


Fig 5.1 Actuator label

EX type of protection: constructional safety "c".

T5 temperature class is provided even if the actuator has no internal heat source. The maximum actuator temperature is near the environmental or exercise fluid temperature, whichever is the greater. The normal operating temperature range is -30 to +100 °C. The temperature range is specified within the project-specific technical documentation. Special applications out of the normal range are available upon request.

EX plate does not indicate the maximum environmental and/or exercise fluid temperature; this information is reported within the project specific technical documentation.

For CE (PED) marked actuators the following label is also used:

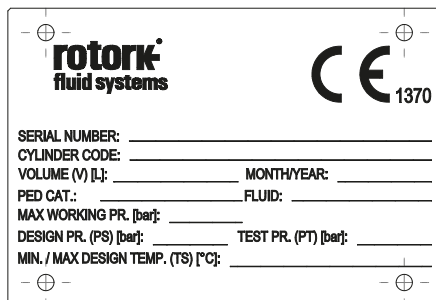


Fig 5.2 Actuator PED label

Label removal is not allowed.

## 6. Operating limits

**Do not use the actuator for applications outside its operating limits. Verify operating limits on the nameplate.**

### 6.1 Temperature

Standard: -29 to +60 °C (-20 to +140 °F)

Low: -46 to +40 °C (-51 to +104 °F)

Prevent external surface temperature from reaching the ignition point in potentially explosive environments.

The actuator surface temperature is strictly dependent on the temperature of the process fluid used and by the irradiation's conditions. The end user must check the surface temperature of the assembly, so that it cannot exceed the minimum gas ignition temperature, which classifies the area with the explosion's risk.

Dust and debris accumulated on the actuator will slow down its cooling and contribute to the increase of its external temperature.

### 6.2 Allowed fluid types

Inert gas, sweet dry natural gas. The operating medium shall be sweet gas, instrument air with particles filtering  $\leq 149 \mu\text{m}$  (Class 7 according to BS EN ISO 8573-1, Table 1), pressure dew point  $\leq -20 \text{ }^\circ\text{C}$  ( $-4 \text{ }^\circ\text{F}$ ) or, to be at least,  $10 \text{ }^\circ\text{C}$  below the ambient temperature (Class 3 according to ISO 8573-1, Table 2), total concentration of oil  $\leq 5 \text{ mg/m}^3$  (Class 4, according to BS EN ISO 8573-1, Table 3). If other medium is evaluated, contact Rotork to check the compatibility with the supply medium.

### 6.3 Expected lifetime

The expected lifetime is at least 25 years, in normal service conditions and with planned maintenance.

### 6.4 Tightening torque chart

RECOMMENDED TIGHTENING TORQUE (Class 8.8 bolts)		
Bolt size	Nm	Ft. Lbs
M6	8.5	6
M8	20	15
M10	40	30
M12	55	40
M14	110	81
M16	220	162
M20	430	317
M22	425	313
M24	585	431
M27	785	579
M30	1250	921
M33	1400	1030
M36	1750	1290

**⚠ This tightening torque table is not applicable to Section 10.2. When installing actuator on the valve, tighten bolts or nuts of the connecting stud bolts to the correct torque, in accordance with the size and material characteristics of the bolts installed by the customer.**

## 7. Handling and lifting

**⚠ Only trained and experienced personnel should handle/lift the actuator.**

**The actuator is supplied packed on pallets suitable for normal handling.**

**⚠ Handle the actuator with care. Never stack pallets.**

### 7.1 Lifting recommendations

- The lifting device and the sling must be suitably rated for the actuator weight and dimensions
- Do not use damaged sling(s)
- The sling must not be shortened with knots or bolts or any other makeshift device
- For lifting purposes, use only suitable lifting tools
- Do not drill holes, weld eye bolts or add any other type of lifting device on the actuator external surface
- Do not lift the actuator and valve combination with the actuator lifting lugs, only lift the actuator/valve assembly using the valve lifting lugs
- Every assembly must be evaluated separately for a safe and correct lifting
- Avoid pulls or abrupt movements during lifting and avoid pushing the load
- During lifting operations, do not handle the slings and/or the actuator

### 7.2 Lifting instructions

**NOTE: Indication of weight, centre of gravity, lifting points are reported within project-specific documentation.**

**Consult project-specific documentation before lifting.**

- Prior to lifting the actuator, remove electrical power and vent all pressure vessels
- Place the textile eye slings as shown in Fig 7.1
- Hook an additional chain sling on the gas/oil tanks support lifting plate

**⚠ The actuator must remain horizontal; balance the load.**

- If the actuator is equipped with a backup or reference tank, hook a chain on the additional lifting lug on the rear bracket
- Angle  $\beta$  must be between  $0^\circ$  and  $45^\circ$  as shown in Fig 7.2

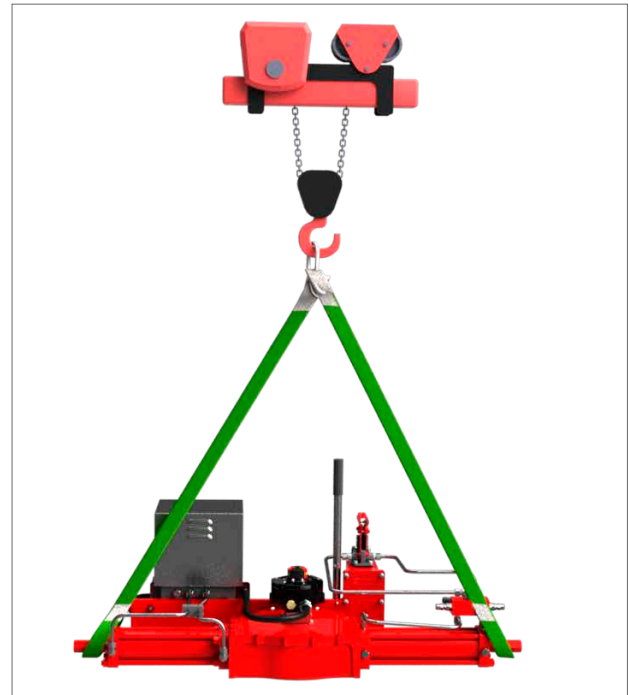


Fig 7.1 Lifting

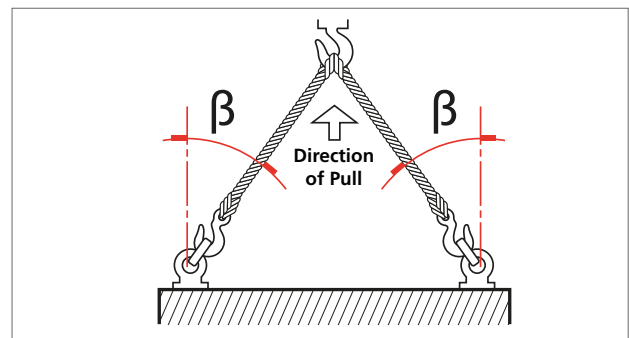


Fig 7.2 Lifting angle

## 8. Storage

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Rotork actuators are fully tested before leaving the factory.

In order to keep the actuator in good condition until installation, at least the following measures are recommended:

- Check the presence and assembling of dust plugs
- Store in a dry, well-aired place. Avoid long-term direct exposure to sunlight
- Keep the actuator on its shipping pallet until installation

**⚠ Never put the actuator directly on the ground.**

- Protect the valve coupling area (adapter flange and coupling joint, etc.) with rust preventive oil e.g. Mobilarma LT or equivalent
- Protect against weather action, covering the actuators with appropriate polyethylene sheets
- Check the actuator condition every 6 months and verify the above protection measures remain in place

**⚠ Remove packaging only at the installation time.**

**⚠ Actuator vent ports must be protected with polyethylene sheet to prevent water ingress during storage.**

## 9. Long term storage

---

If long-term storage is necessary, further operations must be carried out to maintain the actuator in a good working condition:

- Replace the plastic plugs with metal plugs
- Store in a dry, well-aired place. Avoid long-term direct exposure to sunlight
- Stroke the actuator every 12 months:
  - Cycle the actuator (using nitrogen gas with purity level >99.999%) to the working pressure indicated on the name plate
  - Cycle the actuator with all the existing controls (i.e. two complete strokes - one open, one closed) at least 5 times
  - Cycle the actuator fitted with the hydraulic manual override by means of the hand pumps for 4 complete strokes
  - Disconnect the pipeline gas and electric (if present) supply from the actuator, and carefully close all the threaded connections of the actuator
- Remove electrical component covers (if present) to ensure control terminals are clean and free from oxidation and humidity. Reassemble the covers
- In case of storage for over 12 months prior to installation, it is recommended to operate the actuator to verify correct operation



## 10. Installation on valve and earthing

Before proceeding, read and understand the health and safety information.

**NOTE: The valve should be properly secured prior to performing the following operations according to instructions provided by the valve's manufacturer.**

**⚠️ Prior to performing any operations check the operating drawings and TAG numbers. Consult Rotork for any additional information.**

### 10.1 Preliminary actions

**⚠️ Verify whether the EX classification of the actuator is compatible with the plant zoning. Refer to the actuator nameplate. The end user shall guarantee the valve earthing and the equal voltage potential between the valve and the actuator.**

- The centreline of the cylinder is usually aligned with the centreline of the associated pipework
- Ensure all fasteners are adequately tightened, to avoid loosening during operation, taking into account the vibrations induced by the dynamics of the pipeline
- Piping used to provide pipeline gas power to the actuator must be free from contaminants and debris. Ensure tubing runs are adequately fastened and supported to minimise repetitive stress induced the dynamics of the pipeline
- Ensure there are no leaks from any pipeline gas connections. Tighten as required

### 10.2 Instructions

The assembling can be performed by:

- Mounting directly using the actuator housing flange with threaded holes
- Using an adapter and a coupling joint between the actuator and the valve

The assembly position of the actuator must be in accordance with the actuator design, plant requirements and the valve model.

In order to assemble the actuator onto the valve, proceed as follows:

- Verify the coupling dimensions of the valve flange and stem; they must meet the actuator coupling dimensions
- Set the valve in the closed position. The actuator is supplied in the closed position. Check the position of the actuator by means of the position indicator on the centre body or on the limit switch (if present)
- Clean the valve and actuator coupling flanges, removing anything that might prevent electrical connection and adherence to the actuator flange interface: grease and paint residuals must be completely removed, if present
- Lubricate the valve stem with oil or grease, to facilitate assembling

- Lift the actuator according to handling and lifting instructions (Section 7)
- If possible, place the valve stem in a vertical position to facilitate assembling - in this case the actuator must be lifted while the coupling flange is kept in the horizontal position
- If the assembly is done using an adapter and a coupling joint, assemble the coupling joint onto the valve stem before proceeding with the assembly of the actuator
- Do not exert any force while lowering the actuator onto the valve

Installation must be performed by qualified personnel.

**⚠️ Hands must be kept away from the coupling area.**

- Clean and degrease the coupling bolts, stud bolts, nuts and the threads on actuator body flange. Apply a thin layer of thread sealing product (Loxal 55.03 or equivalent Loctite 243) on threaded connection and on power pins, if present, to preserve actuator ingress protection level
- Fix the actuator to the valve by means of threaded connections (bolts, stud bolts and nuts)
- Tighten the bolts or the nuts of the connecting stud bolts to the correct torque, in accordance with the size and material characteristics of the bolts installed by the customer

**⚠️ Support the actuator until full installed and fixing bolts are correctly tightened.**

**⚠️ Attention: Do not pressurise the actuator/valve adapter.**

- Check for possible damage to the paintwork and repair if necessary, according to the painting specification

**⚠️ Attention: End user should verify the electrical correctness of coupling, performing a standard continuity test between actuator and valve.**



Fig 10.1 Actuator/valve assembling example

## 11. Removal from valve

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The end user is in charge of removing the actuator from the valve.

**⚠ Removal shall be performed only by qualified staff, wearing/using appropriate personal protection devices.**

**⚠ Do not remove the actuator if the valve is blocked in the intermediate position. Contact Rotork customer service.**

In order to disassemble the actuator from the valve, proceed as follows:

- Cut off the gas and electrical power supply
- Vent any storage tanks (if present)
- Remove the gas supply pipe from the actuator
- Release any pressure from the control group
- Vent the gas circuit according to instructions in circuit gas venting (Section 12.11)
- Remove control and signal lines from electrical components
- Sling the actuator according to handling and lifting instructions (Section 7)
- Unscrew bolts or nuts from the stud bolts fixing the actuator to the valve
- Lift and remove the actuator from the valve

## 12. Operation

The following instructions must be followed and integrated into the end user safety programme when installing and using Rotork products. Read and save all instructions prior to installing, operating and servicing this product.

Follow all warnings, cautions and instructions marked on and supplied with the product.

**Install equipment as specified in the Rotork installation instructions and as per applicable local and national codes of practice. Connect all products to the proper pipeline gas sources.**

When replacement parts are required, ensure that the qualified service technician uses only replacement parts specified by Rotork.

Substitutions will invalidate any hazardous area certification and may result in fire, electrical shock, other hazards or improper operation.

### 12.1 Description

The HPG series actuator is a high pressure double-acting actuator specifically designed to use pipeline gas as the motive power source.

The main components of a HPG actuator are shown in Figure 12.1, 12.2 and 12.3.

IT	DESCRIPTION	QTY
1A1.1	Mechanical end stopper	2
1A1.2	Centre body	1
1A1.3	Hydraulic cylinder	1
1A1.4	High pressure pneumatic cylinder	1
1P1	Hydraulic override pump	1
C1	Gas block	1
1S1	Limit switch box	1
1V50A	Solenoid valves (OPEN)	1
1V50B	Solenoid valves (CLOSE)	1

Table 1: HPG parts list

Main components of a direct gas actuator are:

- High pressure pneumatic actuator
- Hydraulic cylinder equipped with manual pump
- Limit switch box
- Gas block

**⚠ Use only control devices supplied by Rotork.**

See further paragraphs for main functions description and main components for specific functions.

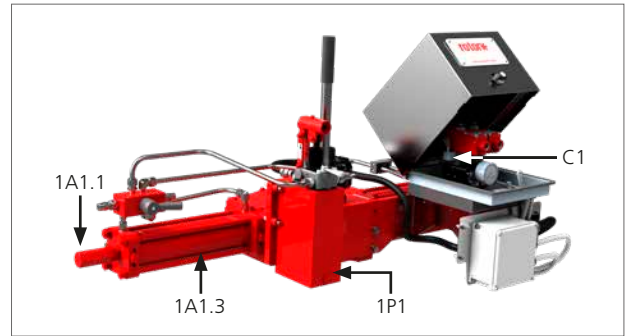


Fig 12.1 HPG main components (1 of 2)



Fig 12.2 Gas control

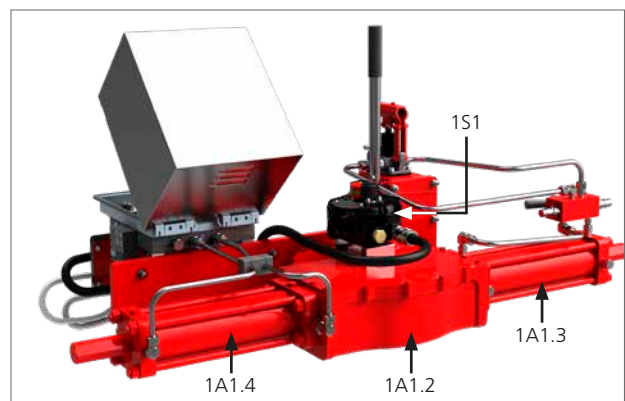


Fig 12.3 HPG main components (2 of 2)

## 12. Operation

### 12.2 Operating description

After being filtered, gas flows into the actuator high pressure pneumatic cylinder through the control valves (gas block), depending on the direction of the stroke (open or close).

These actuators are also fitted with a hydraulic emergency manual override operated using one hydraulic hand pump.

**⚠ HPG actuators exhaust power supply gas into the atmosphere during normal operation. This may present an unacceptable hazard in some applications.**

For further details refer to the operating diagram supplied for the specific application.

### 12.3 Angular stroke setting

**⚠ Certain valves incorporate their own stops. For such valves, it is recommended that the actuator stop bolt positions coincide with the valve stop positions.**

**⚠ Do not use the actuator outside  $90^\circ \pm 5^\circ$  operating range.**

The angular stroke is set by adjusting the stop bolts screwed into the end flange of the high pressure pneumatic cylinder and hydraulic cylinder respectively.

**⚠ An incorrect setting of angular stroke could cause damages to actuator, valve and/or to personnel.**

#### 12.3.1 Closed valve position setting

Adjust the stop bolt located in the end flange of the high pressure pneumatic cylinder, as follows:

- Use the hydraulic manual override to pressurise the cylinder until the actuator reaches the fully closed position
- Check where the actuator angular stroke stops. It should stop right at the fully closed position of the valve
- To change the stop position:

Remove the cap nut (5) and seal washer/O-ring (2).



Loosen stop nut (3).



- Use the hydraulic manual override to pressurise the cylinder (moving the valve towards the opening position); the piston will move away from stop bolt (1)
- If the actuator did not reach the fully closed position:

Adjust the stop bolt (1) anti-clockwise.

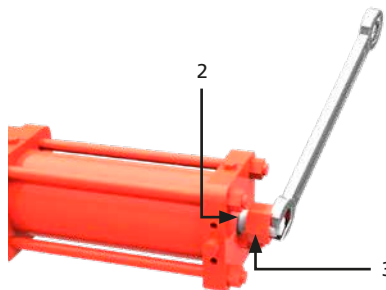


- If the actuator stopped beyond the fully closed position:

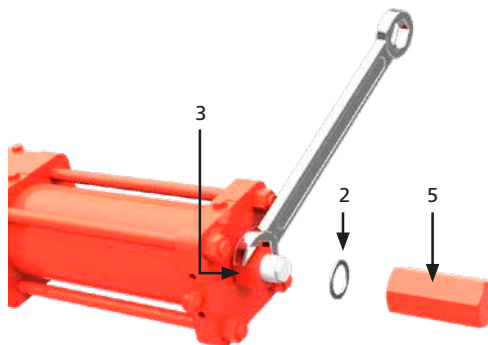
Adjust the stop bolt (1) clockwise.



- Verify the newly obtained angular position with one closing stroke
- Repeat this operation until the desired angle is obtained
- Hold stop bolt (1) with a wrench and tighten stop nut (3). Verify seal washer/O-ring (2) is properly placed



- Insert the seal washer/O-ring between the stop nut and the cap nut. The seal washer/O-ring (2) must be properly centred in the machined recess in the cap nut
- Hold the stop nut (3) with a wrench and tighten the cap nut (5)



## 12. Operation

### 12.3.2 Open valve position setting

Adjust the stop bolt located in the end flange of the hydraulic cylinder of the manual override, as follows:

- Use the hydraulic manual override to pressurise the cylinder until the actuator reaches the fully open position
- Check where the actuator angular stroke stops. It should stop right at the fully open position of the valve.
- To change the stop position:

Remove the cap nut (5) and seal washer/O-ring (2).

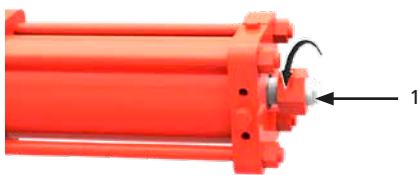


Loosen stop nut (3).



- Use the hydraulic manual override to pressurise the cylinder (moving the valve towards the close position); the piston will move away from stop bolt (1)
- If the actuator did not reach the fully open position:

Adjust the stop bolt (1) anti-clockwise.



- If the actuator stopped beyond the fully open position:

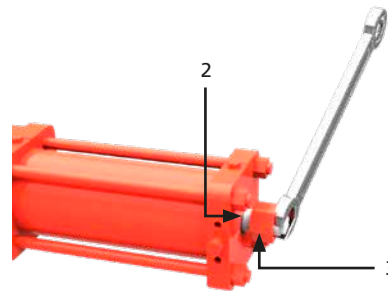
Adjust the stop bolt (1) clockwise.



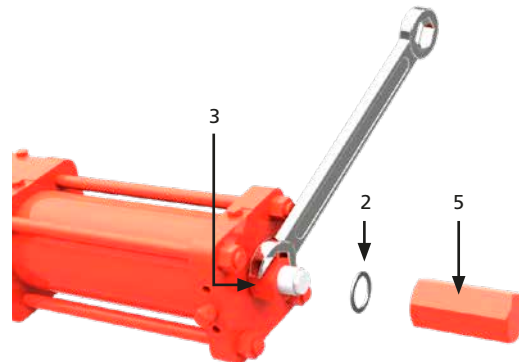
- Verify the newly obtained angular position with one opening stroke
- Repeat this operation until the desired angle is obtained

**NOTE: During this operation, it is normal to lose a small amount of gas through the thread of the stop bolt (1)**

- Hold stop bolt (1) with a wrench and tighten stop nut (3). Verify seal washer/O-ring (2) is properly placed



- Insert the seal washer between the stop nut and the cap nut. The seal washer/O-ring (2) must be properly centred in the machined recess in the cap nut
- Hold the stop nut (3) with a wrench and tighten the cap nut (5)



## 12. Operation

### 12.4 Hand pump override

Manual override is a standard feature of the HPG range. The design incorporates a separate cylinder for hydraulic override to ensure complete separation of high-pressure pipeline gas from the hydraulic fluid.

For manual override operation refer to PM-HPG2-004 (Section 16).

### 12.5 Limit switch setting

In case the actuator is provided with limit switches, their setting should be done by the user during the actuator testing operations on the valve.

The limit switches must be set so that they are actuated slightly earlier than the actuator angular stroke is stopped by the mechanical stops.

**⚠ Before performing any operation on electric components, read and follow the safety precautions reported in the manufacturer's maintenance manual. There is a risk of temporary modification of the component protection.**

- If a bracket or an accessory (limit switch box, positioner, etc.) has to be assembled to actuator, clean and degrease the coupling bolts, stud bolts, nuts and the threads on actuator body cover. Apply a thin layer of thread sealing product (Loxal 55.03 or equivalent Loctite 243) on threaded connection, to preserve actuator ingress protection level.

**⚠ Use only control devices supplied by Rotork. Installation of any accessory on the bare actuator must preserve the actuator ingress protection level.**

**⚠ Installation must be performed according to IEC 60079-14 and the end user must follow special conditions for safe use detailed in document PUB010-046.**

**⚠ Switch off the power supply prior to removing cover from the limit switch box.**

- Remove the box cover

#### 12.5.1 Closing limit switch

- Place the actuator/valve in the fully closed position
- Disengage the close limit cam
- Rotate the close limit cam until the closing switch is active
- Engage the cam into the splined retainer

#### 12.5.2 Opening limit switch

- Place the actuator/valve in the fully open position
- Disengage the open limit cam
- Rotate open limit cam until the opening switch is active
- Engage the cam into the splined retainer

**NOTE: Where 3 or more limit switches are fitted, move the actuator to the extra signaling position(s) and set the cams for each location.**

- Cycle the valve CLOSED and OPEN several times to ensure proper calibration
- Reassemble the box cover, verifying the cover seal is correctly positioned
- Turn the cover shaft manually, aligning it with the switch box shaft, and engage it
- Verify whether the position indicator correctly indicates the valve position
- Reconnect power supplies

For more information refer to the limit switch manufacturer's literature.



Fig 12.4 Typical limit switch box

## 12. Operation

### 12.6 Flow regulator setting

Flow regulators on manual override are adjusted in the factory according to job-specific stroking time(s).

In case it is necessary to achieve a fine regulation, the following actions should be performed:

- Remove the flow regulator caps by manually unscrewing them
- Rotate the flow regulators, by means of an Allen key, clockwise to lower the flow rate
- Rotate the flow regulators by means of an Allen key, counter-clockwise to increase the flow rate
- Stroke the actuator to verify stroking time(s)
- Perform the previous tuning until the required stroking time(s) is reached

**⚠ Do not tighten flow regulators completely closed: problem of loss of actuator functionality.**

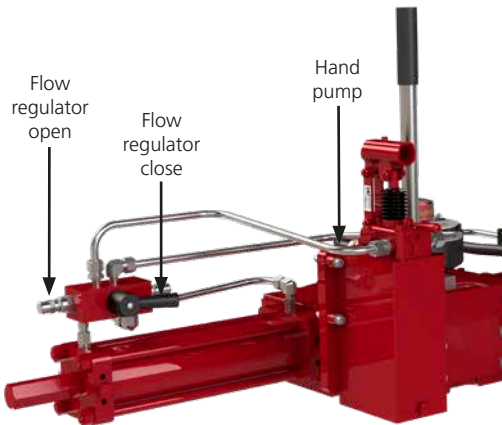


Fig 12.5 Manual override particular

### 12.7 Pipeline gas power supply

Verify the allowed supply pressure range on the actuator label.

**⚠ Verify the medium composition. Contact Rotork to check the compatibility with the supply medium.**

### 12.8 Connection to pipeline

Preliminary operations:

- Verify the sizes of pipes and fittings according to applicable plant specifications
- Clean the inside of the connection pipes by washing them with a suitable detergent and by blowing air into them
- The connecting pipes must be properly shaped and fixed to prevent stress or loosening of threaded connections

**NOTE: For tapered-thread fluid connections, apply a thin layer of thread sealing product (Loctite 577 or equivalent) to ensure a good seal.**

**⚠ Connect the pipeline gas power source in accordance with the applicable operating diagram, please refer to specific job for details.**

If isolation valve(s) are not present on the actuator, the end user should install valve(s) with a locking facility at the main actuator gas connection port(s).

The connection to the pipeline gas supply depends on the specific operating diagram, an example is shown in the following picture:

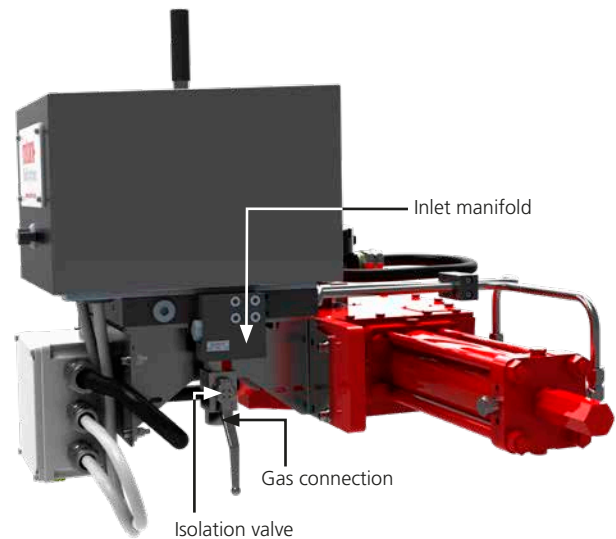


Fig 12.6 Single main supply

**NOTE: Between the main line and the actuator, the minimum suggested conductor outside diameter is 12 mm (at user's discretion).**

Refer to the specific operating diagram for specific application configuration.

## 12. Operation

### 12.9 Electrical connections

**⚠ Check the electrical components' supply voltage, before start-up.**

**⚠ Access to live electrical conductors is forbidden in hazardous areas, unless done under a special permit. Otherwise, all power should be isolated and the unit moved to a non-hazardous area for repair.**

**⚠ Prevent electrostatic charges in potentially explosive areas.**

Electrical connection can be performed as follows:

- Remove power supply
- Remove the plastic protection plugs from the cable entries
- Use only appropriately-certified reduction fittings, cable glands, fittings and explosionproof cables
- The cable glands must be tightened in the threaded inlets, to guarantee the waterproof and explosionproof protection
- Pay attention to the correct installation of the O-rings of the cable glands to prevent water and debris infiltration inside electric components
- The size of the electric supply cable must suit the electric power demand
- Insert the connection cables through cable glands and perform assembly according to the cable gland manufacturer's instructions
- Connect the cable wires to the terminal blocks in accordance with the applicable wiring diagram
- Electric connections must be made by using rigid conduits and trailing cables to prevent mechanical stresses in the cable entries
- On the unused entries of the junction box, replace the plastic plugs with approved metal plugs, in order to guarantee sealing and to comply with explosion safety protection codes
- Assemble the covers of the electric components, paying attention to seals
- Once connections have been completed, check electrical components functionality

**⚠ Actuator and electrical components must be protected from electrical sparks, lightning, magnetic or electro-magnetic fields, at user's discretion.**

**⚠ Installation must be performed according to IEC 60079-14 and the end user must follow special conditions for safe use detailed in document PUB010-046.**

### 12.10 Start up

During the start-up of the actuator, it is necessary to check whether:

- Gas supply pressure is as prescribed
- The feed voltage values of electrical components (solenoid valves coils, limit switches, pressure switches etc., if applicable) are as prescribed
- Actuator controls such as remote control, local control, emergency control etc. (if applicable) work properly
- Input remote signals are correct
- The setting of control unit components is according to the plant requirements
- Gas/hydraulic connections show no leakage. If necessary, tighten fittings
- The painted parts have not been damaged during transport, assembling or storage operations. On the contrary, after having removed rust, repair the damaged parts following the applicable painting specifications
- The actuator and all of its accessories work as expected
- The operating time is in accordance with the requirements

**⚠ The end user must guarantee equal voltage potential between the valve and the actuator and provide appropriate grounding. The final user shall indicate and maintain the grounding connections on the actuator.**



## 12. Operation

### 12.11 Circuit gas venting

In some occasions, for example, maintenance, it could be necessary to drain the hydraulic circuit and vent the gas present in the system.

Follow the subsequent instructions:

- Remove electric power supply
- Close the gas supply isolation valve

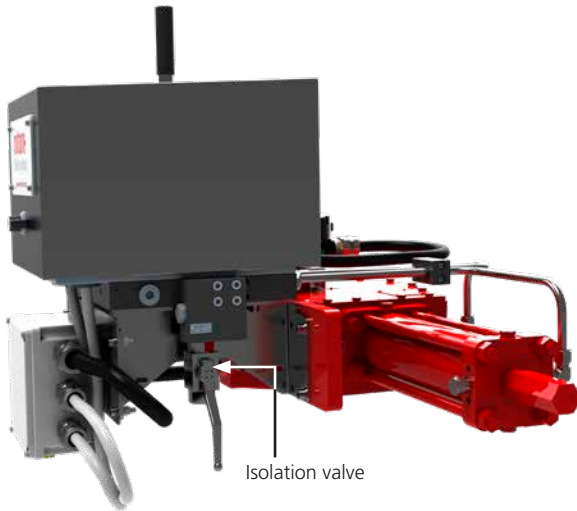


Fig 12.7

- Empty the backup tank (if present) and the line break tank (if present) opening the drain valve(s)
- Operate the solenoid valve manual override in both open and close stroke until 0 barg pressure is displayed on the gauge

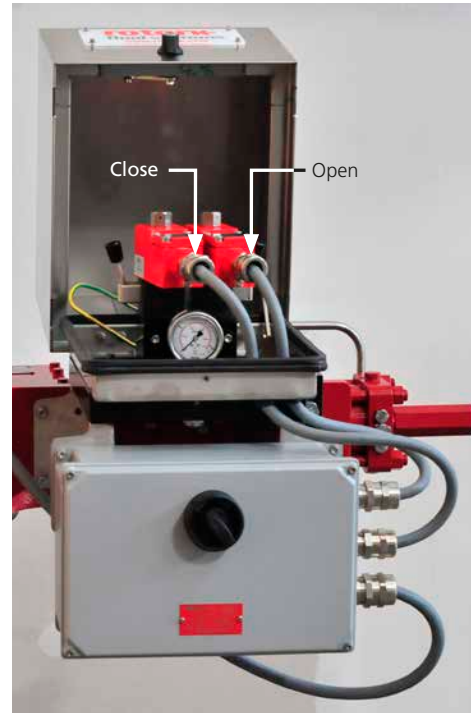


Fig 12.8

**⚠ Verify that all gas is vented before proceeding with any further operation.**

After gas venting and all other operations have been performed, restore the initial conditions:


- Close the vent valves of the backup tank and line break tank (if present)
- Open the isolation valves of the pipeline gas supply

### 13. Dismantling and disposal

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Prior to dismantling the actuator, check if any of its parts are still under pressure. The main pressure gauge on the gas block must indicate 0 barg.

- Verify that the backup tank (if applicable) is depressurised, otherwise slowly open the drain valve
- Verify that the reference tank (if applicable) is depressurised otherwise slowly open the drain valve
- Verify that the Local/Remote selectors are in the remote position

 **Used hydraulic fluid must be disposed of safely in accordance with the local environmental laws and regulations.**

- Dismount the actuator, separate and divide the various parts and components according to the type of material
- Dispose of the pieces of steel, cast iron and aluminum alloys as metal scraps
- Dispose of the rubber, PVC, resins etc. separately, in accordance with the existing national and regional regulations
- Electric components must be separately disposed of on specialised disposal sites

Actuators manufactured after 1993 do not contain asbestos or its by-products.

### 14. Rotork sales and service

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If your Rotork actuator has been correctly installed and sealed, it will give years of trouble-free service. Should you require technical assistance or spares, Rotork guarantees one of the highest levels of service in the flow control industry. Contact your local Rotork representative or the factory directly at the address on the nameplate, quoting the actuator type and serial number.

Some actuators have a special spare parts list. Refer to the project-specific documentation for further details

## 15. Troubleshooting

ID	FAILURE	POSSIBLE CAUSES	CORRECTIVE MEASURES
1	Missed valve actuation (by local controls)	• No gas supply	• Open the isolation valve on the supply gas line
		• Gas filter clogged (if present)	• Clean the gas filter according to <b>PM-HPG2-006</b> (Section 16)
		• Flow regulator closed	• Adjust the flow regulator according to flow regulator setting instructions (Section 12.6)
		• Failure of the local selector	• Contact Rotork customer service
		• Failure of the gas block	• Contact Rotork customer service
		• Low supply pressure	• Restore the supply pressure
		• Torque limit device undue intervention (if applicable)	• Contact Rotork customer service
		• Valve fault	• Consult the valve manufacturer's documentation
2	Missed valve actuation (by remote control)	• Pipework blocked, crushed or leaking	• Clean or repair as necessary
		• No electrical supply	• Restore the electrical supply
		• No gas supply	• Open the isolation valve on the supply gas line
		• Gas filter clogged (if present)	• Clean the gas filter according to <b>PM-HPG2-006</b> (Section 16)
		• Flow regulator closed	• Adjust the flow regulator according to flow regulator setting instructions (Section 12.6)
		• Failure of solenoid valve	• Contact Rotork customer service
		• Failure of the gas block	• Contact Rotork customer service
		• Low supply pressure	• Restore the supply pressure
• Torque limit device undue intervention (if applicable)	• Contact Rotork customer service		
3	Missed valve actuation (by manual override)	• Valve/actuator fault	• Consult the valve manufacturer's documentation • For actuator guidance refer to GH Installation and maintenance manual (PUB011-007)
		• Pipework blocked, crushed or leaking	• Clean or repair as necessary
		• Incorrect position of the hydraulic selector manual/remote	• Position the selector, related to the operation to be performed, in "manual" mode and action the related pump
		• Failure of the hydraulic selector manual/remote	• Contact Rotork customer service
		• No gas supply	• Open the isolation valve on the supply gas line
		• Oil below the allowed level	• Refill oil
		• Flow regulator closed	• Adjust flow regulator according to flow regulator setting instructions (Section 12.6)
		• Hand pump relief valve undue intervention	• Contact Rotork customer service
• Valve/actuator fault	• Consult the valve manufacturer's documentation • For actuator guidance refer to GH Installation and maintenance manual (PUB011-007)		
		• Pipework blocked, crushed or leaking	• Clean or repair as necessary

## 15. Troubleshooting

ID	FAILURE	POSSIBLE CAUSES	CORRECTIVE MEASURES
4	Low stroking time	• Low supply pressure	• Restore the correct value of the supply pressure
		• Incorrect flow regulator setting	• Adjust the flow regulator to increase the flow rate (Section 12.6)
		• High valve/actuator torque	• Consult the valve manufacturer's documentation • For actuator guidance refer to GH Installation and maintenance manual (PUB011-007)
		• Oil under the allowed level	• Refill oil
		• Pipe work blocked, crushed or leaking	• Clean or repair as necessary
5	Fast stroking time	• High supply pressure	• Restore the correct value of the supply pressure
		• Incorrect flow regulator setting	• Adjust the flow regulator to reduce the flow rate (Section 12.6)
6	Incorrect valve position	• Incorrect setting of mechanical stops	• Check the mechanical stop bolts position and adjust if necessary (Section 12.3)
		• Incorrect signal from limit switches	• Check the limit switches position (see Section 12.5)
7	Leakage	• Worn seals	• Replace seals according to <b>PM-HPG2-009</b> (Section 16)
		• Valve/actuator fault	• Consult the valve manufacturer's documentation • For actuator guidance refer to GH Installation and maintenance manual (PUB011-007)
8	Incorrect pressure indication by pressure gauge	• Pressure gauge fault	• Change pressure gauge according to the procedure <b>CM-HPG2-001</b> (Section 16)

For other problems, please contact Rotork customer service.

## 16. Periodic maintenance

Rotork recommends performing the following checks to help comply with the rules and regulations of the country of final installation:

**⚠ Remove pipeline gas supply before proceeding with maintenance operations, discharge accumulators or tanks, except where otherwise indicated.**

### Periodic maintenance schedule




MAINTENANCE ACTIVITY	PERIODICITY		REFERENCE
	Months	Years	
Visual check of external components and control groups	6		
Verify welding. In case of anomalies, contact Rotork	6		
Verify the control group cover is closed and locked	6		
Check pneumatic connections for leaks. Tighten pipe fittings as required	-	1	
Cleaning	-	1	PM-HPG2-001 Page 22
Visual check of painting. Verify absence of damages. Repair if necessary according to the painting specification	-	1	
Functional test	-	1	PM-HPG2 -002 Page 23
Check electrical components and grounding connections	-	1	PM-HPG2 -003 Page 24
Functional test by manual override	-	1	PM-HPG2 -004 Page 25
Discharge gas dehydrator condensate	6	-	PM-HPG2 -005 Page 26
Cleaning of gas filter	-	1	PM-HPG2 -006 Page 27
Gas dehydrator filter elements replacement (if applicable)	-	1	PM-HPG2 -007 Page 28
Clean the close limit valve gas vent (if applicable)		1	PM-HPG2 -008 Page 29
Cylinder seals replacement	-	5	PM-HPG2 -009 Page 30

### Corrective maintenance task


In case of fault, according to details in Section 15, the following operations could be executed by the end user.

MAINTENANCE ACTIVITY	REFERENCE
Replace the pressure gauge on gas control	CM-HPG2 -001 Page 31



## 16. Periodic maintenance

PM-HPG2-001		Page: 1/1
<b>Component:</b> HPG actuator	<b>Task:</b> Cleaning	
<b>Equipment, tools, materials:</b> Air compressor Project documentation (design and operating pressure values)	<b>Warnings:</b> 	
<b>Preliminary operations:</b>		
<b>Description:</b>  <b>Remove the pipeline gas supply before proceeding.</b> 1. Remove dust from the actuator external surface by blowing air  <b>Do not polish / rub non-metal surfaces with a dry cloth. The tools and cleaning procedures must not produce sparks or create adverse conditions in the environment during maintenance operations, to prevent potential explosion hazards.</b> <b>Prevent electrostatic charges in potentially explosive areas.</b>		

## 16. Periodic maintenance

PM-HPG2-002		Page: 1/1
<b>Component:</b> HPG actuator	<b>Task:</b> Functional test	
<b>Equipment, tools, materials:</b> Chronometer Project documentation (required stroke times)	<b>Warnings:</b> 	
<b>Preliminary operations:</b>		
<b>Description:</b> <b>NOTE: Actuator must be connected to the pipeline gas power supply to perform the following test.</b> <ol style="list-style-type: none"><li>1. Operate the actuator</li><li>2. Perform the stroke several times by local and remote (if applicable) control</li></ol> <p><b>⚠ Actuator exhausts medium supply in the atmosphere during normal operation. Wear PPE including breathing device in function of type of medium supply used.</b></p> <ol style="list-style-type: none"><li>3. Verify the actuator is correctly working</li><li>4. Note the stroke time(s)</li><li>5. Verify the stroke time(s) are as required</li></ol> <p>In case of stroke times out of required range refer to Troubleshooting ID 4, 5 (Section 15) to restore.</p>		

## 16. Periodic maintenance

PM-HPG2-003		Page: 1/1
<b>Component:</b> HPG actuator (electrical components)	<b>Task:</b> Check electrical components and grounding connections.	
<b>Equipment, tools, materials:</b> Project documentation	<b>Warnings:</b> 	
<b>Preliminary operations:</b>		
<b>Description:</b>  <b>Switch off the electric power supply before working on electrical devices.</b> <b>Read and follow the safety precautions reported in the manufacturer's maintenance manual.</b> <b>Risk of temporary modification of the component protection.</b> <b>Use only antistatic clothes.</b> <ol style="list-style-type: none"><li>1. Remove the cover from electric components</li><li>2. Check the electric device components</li><li>3. Verify the tightness of terminal blocks</li><li>4. Verify the absence of humidity and oxidation</li><li>5. Check the cable gland seals</li><li>6. Verify the grounding connection and restore if necessary</li></ol>		



## 16. Periodic maintenance

PM-HPG2-004

Page: 1/1

**Component:** Manual override

**Task:** Manual override functional test

**Equipment, tools, materials:**  
Project documentation

**Warnings:**

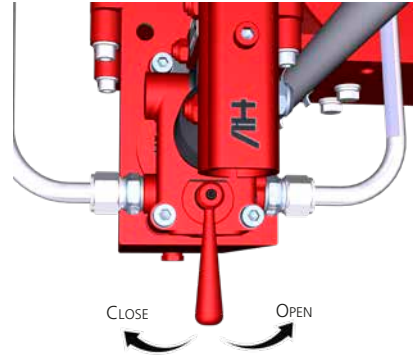


**Preliminary operations:**

**Description:**

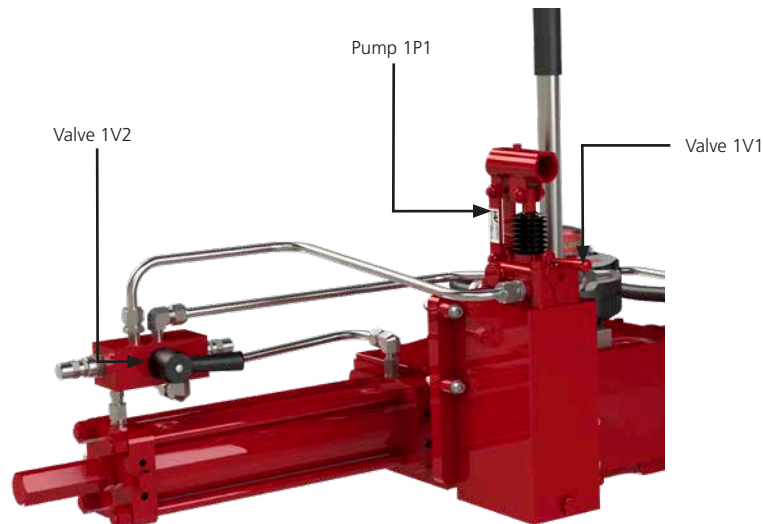
**Opening operation**

1. Verify the actuator is not in the completely open position
2. Move the remote/local selector (1Z50B) into the "local" position (L) (if present)
3. Rotate the valve 1V2 clockwise completely until the stop position to enable manual operation
4. Shift the hand-operated valve 1V1 to the open position
5. Operate the hydraulic pump 1P1
6. Return valve 1V1 to the middle position
7. Rotate valve 1V2 counter-clockwise completely until the stop position to enable remote operation
8. Move remote/local selector (1Z50B) to the "remote" position (if present)


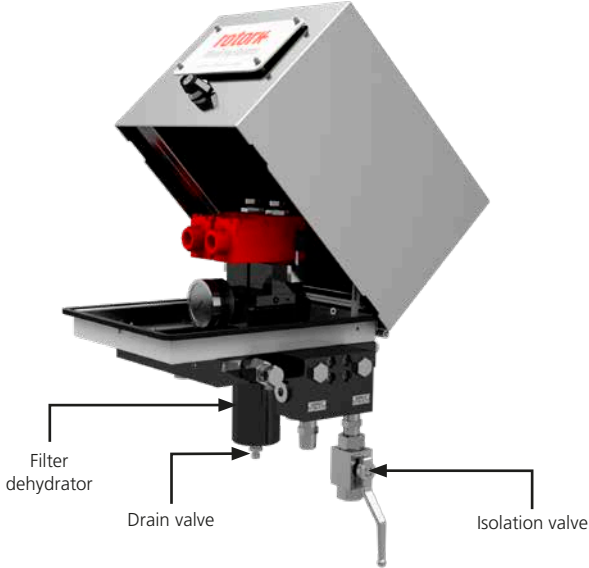


**Closing operation**

9. Verify the actuator is not in the completely closed position
10. Move the remote/local selector (1Z50B) in "local" position (L) (if present)
11. Rotate valve 1V2 clockwise completely until the stop position to enable manual operation
12. Shift the hand operated valve 1V1 to the close position
13. Operate the hydraulic pump 1P1
14. Return valve 1V1 to the middle position
15. Rotate valve 1V2 counter-clockwise completely until the stop position to enable remote operation
16. Move remote/local selector (1Z50B) to the "remote" position (if present)



## 16. Periodic maintenance

PM-HPG2-005		Page: 1/1
<b>Component:</b> Dehydrator gas filter (if present)	<b>Task:</b> Discharge gas dehydrator condensate	
<b>Equipment, tools, materials:</b> Project documentation Wrench (10 mm)	<b>Warnings:</b> 	
<b>Preliminary operations:</b> Circuit gas venting (Section 12.11)		
<b>Description:</b> <p><b>⚠ Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by Rotork or by end user) to the closed position. Lock the valve to prevent unintentional opening.</b></p> <p><b>Consult project specific documentation.</b></p> <ol style="list-style-type: none"><li>1. Vent the gas circuit according to instructions in circuit gas venting (Section 12.11)</li><li>2. Carefully loosen the screw of the drain valve and drain the condensate</li><li>3. When all condensate has been ejected, tighten the screw</li><li>4. Open the isolation valve on the supply gas line</li></ol>		
		
<p><i>Fig 16.1 Filter dehydrator</i></p>		

## 16. Periodic maintenance

PM-HPG2-006

Page: 1/1

**Component:** Mechanical gas filter

**Task:** Cleaning of gas filter

**Equipment, tools, materials:**

Wrench (22 mm)  
Project documentation

**Warnings:**

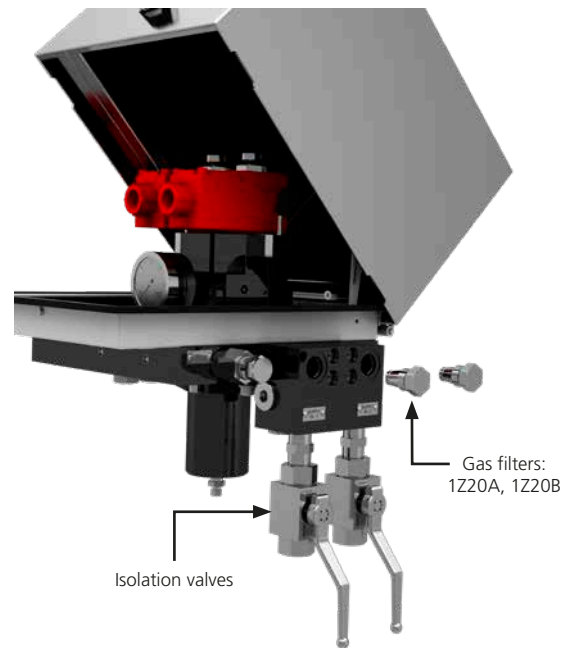
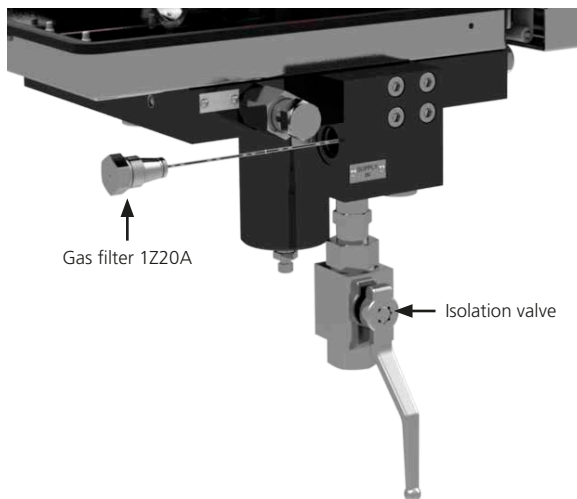


**Preliminary operations:** Circuit gas venting (Section 12.11)



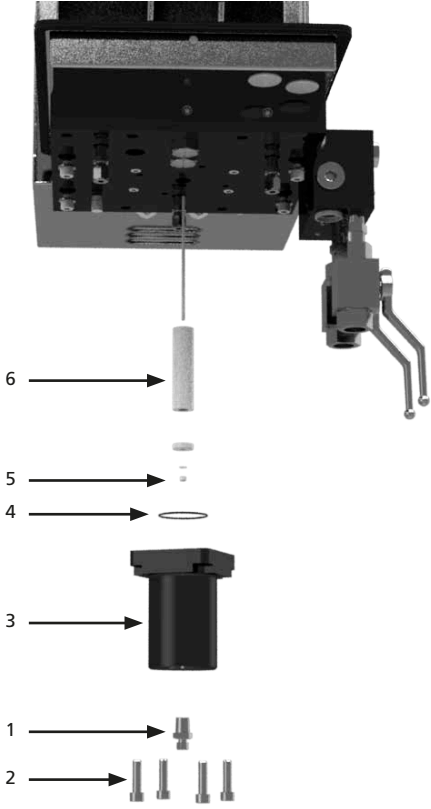
**Description:**

**⚠ Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by Rotork or by the end-user) to the closed position. Lock the valve to prevent unintentional opening.**


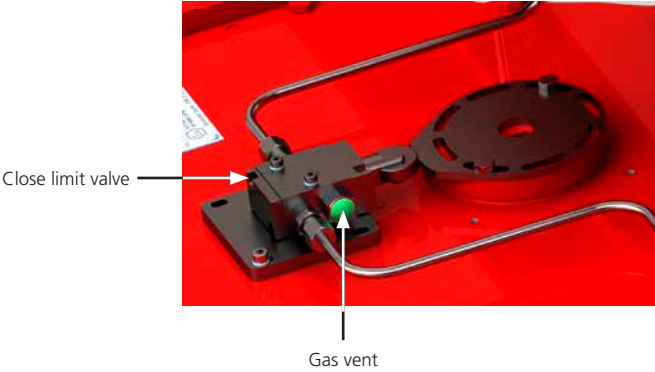
1. Vent the gas present in the system according to instructions in circuit gas venting (Section 12.11)
2. Ensure that there is no gas pressure in the circuit. The pressure gauge must show 0 barg
3. Unscrew gas filter (1Z20A) (Position and number of filters vary in case of manifold with 1 inlet or 2 inlets), using the wrench
4. Clean the filter with compressed air
5. Check if the filter O-rings are in a good condition; otherwise replace them
6. Lubricate the O-ring with grease (Section 18.1)
7. Reassemble the gas filter
8. Open the manual valve on the supply gas line





## 16. Periodic maintenance

PM-HPG2-007		Page: 1/1
<b>Component:</b> Dehydrator gas filter	<b>Task:</b> Gas dehydrator filter elements replacement (if applicable)	
<b>Equipment, tools, materials:</b> Air compressor Project documentation Wrench (16 mm) Allen wrench (6 mm)	<b>Warnings:</b> 	
<b>Preliminary operations:</b> Circuit gas venting (Section 12.11)		
<b>Description:</b>  <b>Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by Rotork or by end user) to the closed position. Lock the valve to prevent unintentional opening.</b>		
Consult project-specific documentation.		
<ol style="list-style-type: none"><li>1. Vent the gas circuit according to instructions in circuit gas venting (Section 12.11)</li><li>2. Ensure that there is no gas pressure in the circuit. The pressure gauge must show 0 barg</li><li>3. Unscrew four hex socket bolts (2)</li><li>4. Remove bowl (3)</li><li>5. Unscrew bolt (5)</li><li>6. Remove filter element (6)</li><li>7. Clean bowl and drain valve (1)</li><li>8. Replace filter elements (6) and screw bolt (5) into the body</li><li>9. Check O-ring (4) is in good conditions, otherwise replace it</li><li>10. Lubricate the O-ring with grease (Section 18.1)</li><li>11. Reassemble the bowl with flange (3) and fix them by screwing bolts (2)</li><li>12. Tighten drain valve (1)</li><li>13. Open the manual valve on the supply gas line</li></ol>		
		




## 16. Periodic maintenance

PM-HPG2-008		Page: 1/1
<b>Component:</b> Close limit valve	<b>Task:</b> Clean the close limit valve gas vent	
<b>Equipment, tools, materials:</b> Wrench (16 mm) Compressed air Project documentation	<b>Warnings:</b> 	
<b>Preliminary operations:</b>		
<b>Preliminary actions</b> 1. Consult the project-specific documentation		
<b>Description:</b> 1. Remove the 1/4" BSP gas vent with a 16 mm wrench 2. Clean the gas vent with compressed air 3. Reinstall the gas vent		
		

## 16. Periodic maintenance

PM-HPG2-009		Page: 1/1
<b>Component:</b> HPG actuator – high pressure pneumatic cylinder	<b>Task:</b> Cylinder seals replacement	
<b>Equipment, tools, materials:</b> Spare seals Wrench Lifting tools Project documentation	<b>Warnings:</b> 	
<b>Preliminary operations:</b> Circuit gas venting (Section 12.11)	Removal from valve	
<p><b>Description:</b></p> <p> <b>Remove the pipeline gas supply before proceeding.</b></p> <p><b>Preliminary actions</b></p> <ol style="list-style-type: none"> <li>1. Move the actuator to the closed position</li> <li>2. Vent the gas present in the system according to instructions in circuit gas venting (Section 12.11)</li> <li>3. The pressure gauge must show 0 bar</li> <li>4. Remove the components (e.g. limit switch box, gas storage tank, back-up tank) located on the centre body cover, if any</li> <li>5. Remove the hydraulic and pipeline gas pipes</li> <li>6. Remove the actuator from the valve (Section 11)</li> <li>7. Position the actuator on a workbench (if possible) or in a stable position</li> </ol> <p><b>For high pressure pneumatic cylinder seals replacement, refer to GH Installation and maintenance manual (PUB011-007). In addition grease piston, cylinder seals and cylinder sliding parts with Shell Gadus V25.</b></p> <ol style="list-style-type: none"> <li>8. Re-install the pipeline gas and hydraulic pipes</li> <li>9. Install the components (e.g., limit switch box, gas storage tank) located on the centre body cover, if any</li> <li>10. The actuator must be tested before it is assembled on the valve</li> <li>11. Cycle the actuator several times, using exclusively dry nitrogen gas, to check functionality and absence of leakages</li> <li>12. Check that the painted parts have not been damaged during disassembly and /or reassembly</li> <li>13. If necessary, repaint them in accordance with the applicable painting specifications</li> <li>14. The actuator is now ready to be assembled onto the valve</li> </ol>		

## 16. Periodic maintenance

CM-HPG2-001		Page: 1/1
<b>Component:</b> Gas control	<b>Task:</b> Replace the pressure gauge on gas control	
<b>Equipment, tools, materials:</b> Pressure gauge Wrench (14 mm)	<b>Warnings:</b> 	
<b>Preliminary operations:</b> Circuit gas venting (Section 12.11)		
<b>Description:</b>  <b>Remove pipeline gas supply before proceeding.</b> <ol style="list-style-type: none"><li>1. Vent the gas present in the system according to instructions in circuit gas venting (Section 12.11)</li><li>2. Carefully unscrew the pressure gauge</li><li>3. Replace it with another one</li><li>4. Tighten the pressure gauge</li><li>5. Connect the pipeline gas supply</li><li>6. Verify that the pressure gauge correctly indicates the pressure in the circuit</li></ol>		
		

## 17. Part list

For spare part list, refer to GH Installation and maintenance manual (PUB011-007).

## 18. Grease and hydraulic oil specification

In general, there is no need to lubricate the actuator because its mechanism is lubricated for life. The standard grease for Rotork scotch yoke actuators is shown below. If an alternative was specified and/or supplied, please refer to the job-specific documentation.

### 18.1 Grease

The following grease is recommended for lubrication of mechanical components of the scotch yoke for temperature range -29 to +60 °C (-20 to +140 °F):

MANUFACTURER	DOW CORNING CORPORATION
Trade name	MOLIKOTE® P40
Color	CLEAR BROWN
Unworked penetration (ISO 2137)	310-350 mm/10
Viscosity of oil at 40 °C (104 °F) (DIN 51 562)	360 mm <sup>2</sup> /s
Service temperature	-40 to 230 °C (-40 to 446 °F)
Drop point (ISO 2176)	NONE
Four Ball Tester	
Weld load (Din 51 350 pt.5)	3000 N
Wear scar under 800 N load ( Din 51 350 pt.5)	0.94 mm
Coefficient of friction <sup>†</sup>	
Screw test - $\mu$ thread	0.16
Screw test - $\mu$ head	0.08

QUANTITY OF GREASE IN HOUSING	
Centre body size	Qty (kg/lb)
065	0.3 / 066
085	0.3 / 066
100	0.3 / 066
130	0.4 / 088
160/161	0.5 / 1.10
200/201	0.5 / 1.10
270/271	0.8 / 1.76
350	1.2 / 2.64

<sup>†</sup> Coefficient of friction in bolted connection, M12x1.75, 8.8, on blackened surface

The following grease is recommended for lubrication of mechanical components of the scotch yoke for temperature range -46 to +40 °C (-51 to +104 °F):

Manufacturer	MOBIL
Trade name	MOBILTEMP®SHC 100TM
NLGI grade	2
Colour	CLEAR BROWN
Penetration, density, viscosity	
Worked penetration at 25 °C (77 °F) (ASTM D 217)	280
Viscosity of oil at 40 °C ( 104 °F) ASTM D445)	100 cSt
Temperature	
Drop point (ASTM D 2265)	>260 °C (>500 °F)
Load - carrying capacity, wear protection, service life	
Four ball tester (ASTM D 2266)	0.4 mm
Weld load (ASTM D 2596)	>200
Corrosion protection (ASTM D6138)	0



## 18. Grease and hydraulic oil specification

### 18.2 Hydraulic oil

This is the standard oil specification for Rotork high pressure gas actuators working at temperature between -20 to +60 °C (-4 to +140 °F) for Ex and non-Ex application. The same is applied for lubrications of seals and grooves for maintenance purposes.

Manufacturer	MOBIL
Trade name	DTE 10 EXCEL 32
ISO viscosity grade	32
Viscosity, ASTM D 445	
cSt @ 40 °C (104 °F)	32.7
cSt @ 100 °C (212 °F)	6.63
Viscosity index, ASTM D 2270	164
Brookfield viscosity ASTM D 2983, cP @ -20 °C (-4 °F)	1090
Brookfield viscosity ASTM D 2983 cP @ -30 °C (-22 °F)	3360
Brookfield viscosity ASTM D 2983 cP @ -40 °C (-40 °F)	14240
Tapered roller bearing (CEC L-45-A-99), %viscosity loss	5
Density 15 °C, ASTM D 4052, kg/L	0.8468
Copper strip corrosion, ASTM D 130, 3 hrs @ 100 °C (212 °F)	1B
Rust characteristics, ASTM D 665B	Pass
FZG gear test, DIN 51534, fail stage	12
Pour point, ASTM D 97	-54 °C (-65 °F)
Flash point, ASTM D 92	250 °C (482 °F)
Foam sequence I, II, III, ASTM D 892, ml	20/0
Dielectric strength, ASTM D877, kV	49
Acute aquatic toxicity (LC-50, OECD 203)	Pass

This is the standard oil specification for Rotork high pressure gas actuators working at temperature between -46 to +40 °C (-51 to +104 °F) for Ex application. The same is applied for lubrications of seals and grooves for maintenance purposes.

Manufacturer:	TECCEM
Trade name:	SynTop 1003 FG
ISO viscosity grade:	3
Viscosity, ASTM D 445	
cSt @ -40 °C	73
cSt @ -55 °C	2.6
cSt @ 40 °C	3.2
Pour point, °C, ASTM D 97	-88 °C
Flash point, °C, ASTM D 92	140 °C
Density 20° C, kg/L	0.86

This is the standard oil specification for Rotork high pressure gas actuators working at temperature between -46 to +40 °C (-51 to +104 °F) for non-Ex application. The same is applied for lubrications of seals and grooves for maintenance purposes.

Manufacturer	MOBIL
Trade name	UNIVIS HVI
ISO viscosity grade	32
Viscosity, ASTM D 445	
cSt @ 40 °C (104 °F)	13.5
cSt @ 100 °C (212 °F)	5.3
Viscosity index, ASTM D 2270	404
Kinematic viscosity @ -40 °C (-40 °F), ASTM D 445	371 cSt
Copper strip corrosion, ASTM D 130	1A
Pour point, ASTM D 97	-60 °C (-76 °F)
Flash point, ASTM D 92	101 °C (214 °F)

An alternative oil may have been specified for your application. Please refer to the job specific documentation.

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