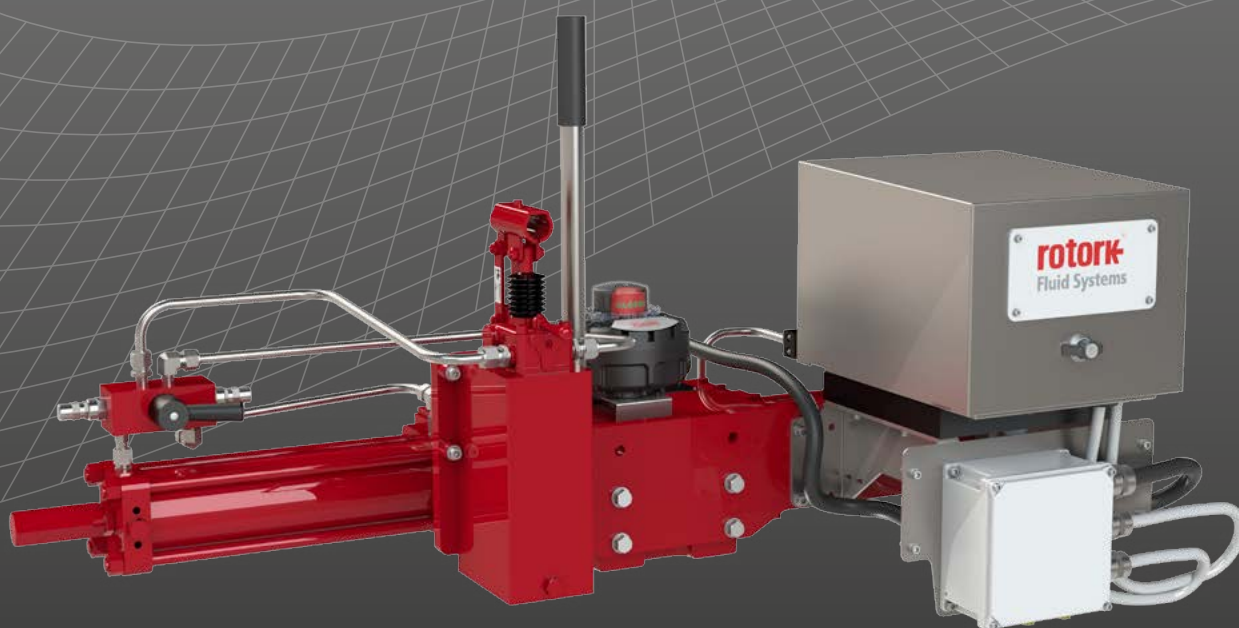


rotork[®]

Fluid Systems

HPG Range

Direct High Pressure Gas Valve Actuator



Installation, Commissioning and
Maintenance Manual

Keeping the World Flowing

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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 FLUID SYSTEMS RESERVES THE RIGHT TO MODIFY, AMEND AND IMPROVE THIS MANUAL WITHOUT NOTICE.

ROTORK FLUID SYSTEMS IS NOT RESPONSIBLE FOR DAMAGE OR INJURY CAUSED BY THE FAILURE TO OBSERVE THE INSTRUCTIONS CONTAINED HEREIN.

1.0 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 the Rotork Fluid Systems customer service:

E-mail: rfs.international@rotork.com

Rotork Fluid Systems, Porcari, Lucca, IT

Tel: +39 39 0583 222447

Rotork plc, Brassmill Lane, Bath, UK

Tel +44 (0)1225 733200

2.0 Standards & Regulations

Actuators destined for European member states have been designed, built and tested according to the Quality Control System, in compliance with the EN ISO 9001:2008 standard and with the following regulations/directive.

- 2006/42/EC: Machinery Directive
- 2014/68/EU: Pressure Equipment Directive (PED)
- 2014/34/EU: Directive For Safety Equipment And Systems to be used in potentially explosive atmospheres (ATEX)
- 2014/30/EU: Electromagnetic Compatibility Directive
- EN ISO 12100: Machinery Safety Directive
- EN 60079-14: Explosive Atmospheres - Part 14: Electrical Installations Design, Selection And Erection
- ISO 80079-36: Non-Electrical Equipment For Explosive Atmospheres - Basic method and requirements
- EN 1127-1: Explosive Atmospheres – Explosion prevention and protection
- ISO 80079-37: Non-Electrical Equipment For Explosive Atmospheres - Non-electrical type of protection construction safety "c", control of ignition sources "b", liquid immersion "k"
- EN 60079-14:2014: Explosive Atmospheres. Electric installations design, selection and erection
- EN ISO 7010: Safety Signal

3.0 General Information

This manual is produced to enable a competent user to install, operate, adjust, inspect, maintain, dismantle and dispose Rotork Fluid Systems HPG Range actuators.

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

Maintenance and operation should 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 should 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 should be allowed to 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 should be familiar with their responsibilities under any statutory provisions relating to the Health and Safety of their workplace.

Operators should always wear appropriate personal protection devices (PPDs) in line with the existing plant regulations.

3.1 Appropriate Usage

Rotork Fluid Systems HPG series have been specifically developed to motorize 1/4" 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 Fluid Systems 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.

4.0 Health and Safety

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

4.1 Residual Risks

Residual risks resulting from equipment risk evaluation performed by Rotork Fluid Systems.

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	Pressurized 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 utilized) (RES_06).
Preventive measures	Operators must use P.P.D.s 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 (center body, in the valve adapter) (RES_04).
Preventive measures	Check center 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.

5.0 Labels and Nameplates

5.1 Labels and Nameplates

For actuators destined for site within the European Union, the CE mark certifies the conformity of the machine with the essential health and safety requirements of the European Directives for the product.

The plate is applied externally on the center body cover and displays, the following data:

- Serial number
- Tag number
- Model
- Min/max operating pressure
- Order number
- Month / year of manufacture
- ATEX protection
- CE conformity marking
- Name of technical file deposited with a Notified Body

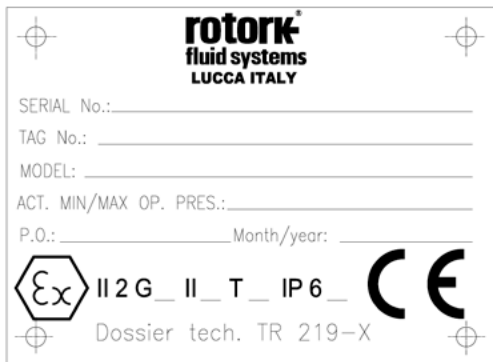


Fig 5.1 CE nameplate

If CE (PED) marking is required, the following plate applies:

- Serial number
- Cylinder code
- 2014/68/EU category
- Fluid
- Volume (Lt.)
- Production month and year
- Maximum working pressure
- Design pressure
- Testing pressure
- Minimum / Maximum design temperature
- CE conformity marking
- Notified body number 1370

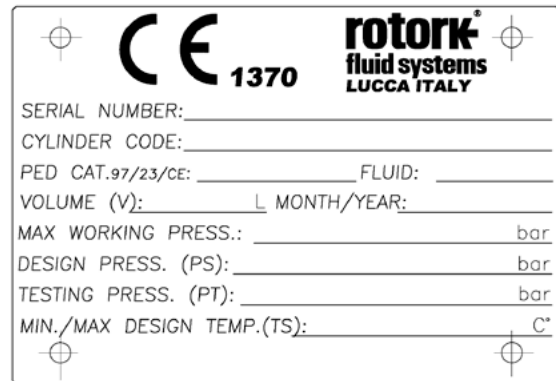


Fig 5.2 PED nameplate

Do not remove or modify the nameplate/s. Nameplate must be kept legible at all times.

In case the plate is damaged or illegible, a duplicate must be requested.

6.0 Operating Limits

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

6.1 Temperature

Temperature: -29/+60 °C (Standard), -46/+40 °C (Low).

Prevent external surface temperature to reach 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 has to check the surface temperature of the assembly, so that this cannot go over the minimum gas ignition's 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.

6.3 Expected Lifetime

Expected Lifetime greater than 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

7.0 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 estimated 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, center of gravity, lifting points are reported within specific project 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 β must be between 0° and 45° as shown in Fig 7.2

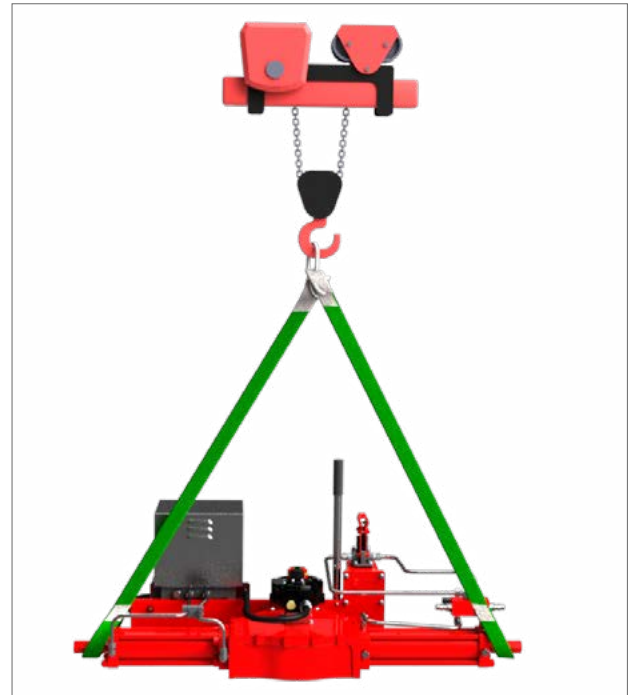


Fig 7.1 Lifting

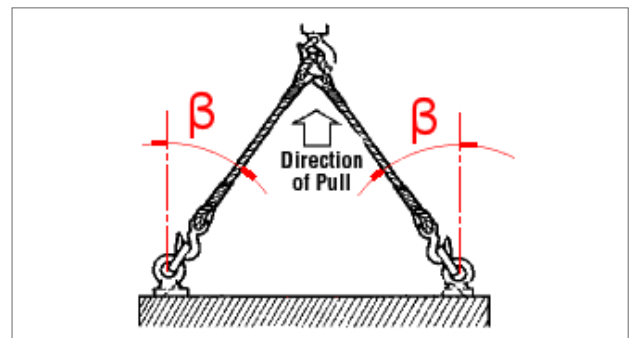


Fig 7.2 Lifting angle

8.0 Storage

Rotork Fluid Systems actuators have been fully tested before leaving the factory.

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

- Check presence and assembling of dust plugs
- Keep the actuator on 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 package only at the installation time.

9.0 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
- 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 components 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

10.0 Installation on Valve

Before proceeding, read and understand the Health and Safety information.

NOTE: The valve should be properly secured prior to perform 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 Fluid Systems for any additional information.

10.1 Preliminary Actions

⚠️ Verify the ATEX classification of the actuator is compatible with the plant zoning. Refer to actuator nameplate.

- The centerline of the cylinder is usually aligned to the centerline of the associated pipe work
- 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 minimize 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 center body or on the limit switch (if present)
- Clean the coupling flange of the valve and remove anything that might prevent adherence to the actuator flange. Grease shall be completely removed
- Lubricate the valve stem with oil or grease, to facilitate assembling

Lift the actuator according instructions in "Handing and Lifting" on page 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.

- 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 pressurize the actuator/valve adapter.**

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



Fig 10.1 Actuator/valve assembling example

11.0 Removal from Valve

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 Fluid Systems 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 page 17
- Remove control and signal lines from electrical components
- Sling the actuator in line with the instructions given on page 7
- Unscrew bolts or nuts from the stud bolts fixing the actuator to the valve
- Lift and remove the actuator from the valve

12.0 Operation

The following instructions must be followed and integrated into end user safety program 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 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	Center 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 Fluid Systems.

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

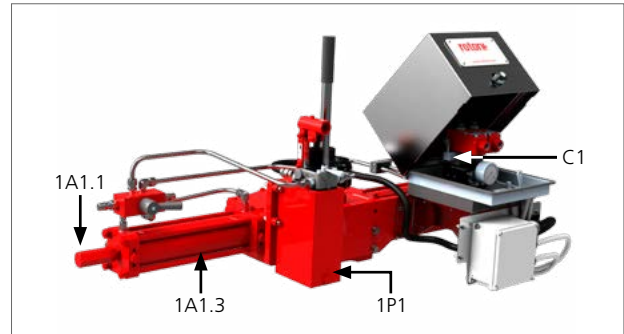


Fig 12.1 HPG main components (1 of 2)



Fig 12.2 Gas Control

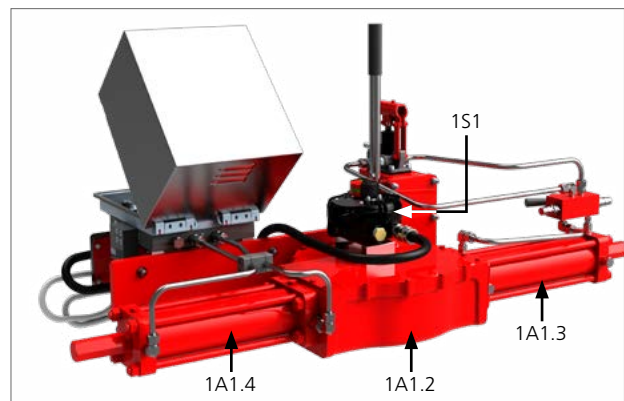


Fig 12.3 HPG main components (2 of 2)

12.0 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 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 position.

⚠️ 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:

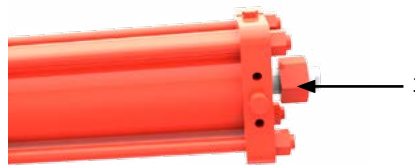
- Use the hydraulic manual override to pressurize the cylinder until the actuator reaches the fully closed position
- Check where the actuator angular stroke stops. It should stop right at the fully closed position of the valve

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 pressurize 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.



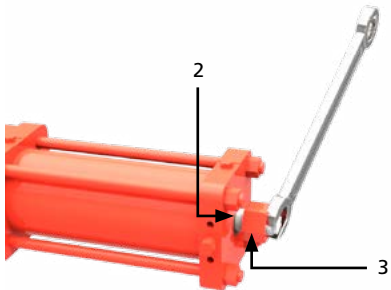
12.0 Operation

- If the actuator stopped beyond the fully closed position:

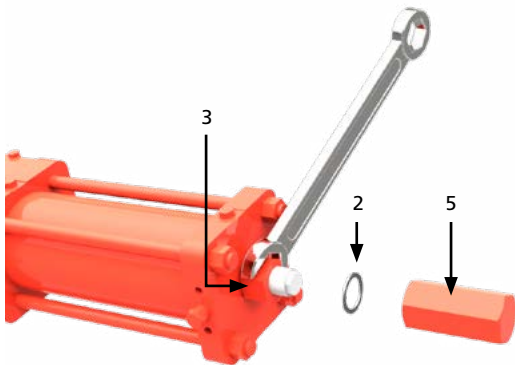
Adjust the stop bolt (1) clockwise.



- 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 centered in the machined recess in the cap nut
- Hold the stop nut (3) with a wrench and tighten the cap nut (5)

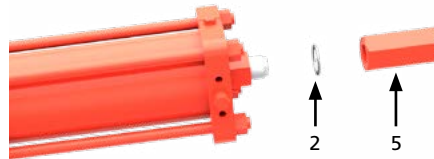


12.3.2 Open Valve Position Setting

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 pressurize 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 pressurize 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.



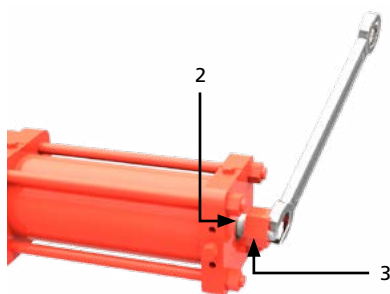
- If the actuator stopped beyond the fully open position:

Adjust the stop bolt (1) clockwise.

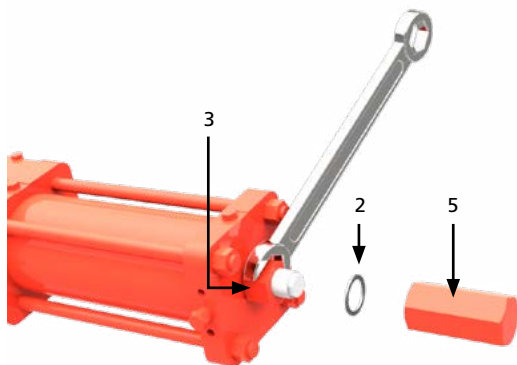


12.0 Operation

- 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 oil 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 centered in the machined recess in the cap nut
- Hold the stop nut (3) with a wrench and tighten the cap nut (5)



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**, page 25.

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. Risk of temporary modification of the component protection.

⚠ 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 to the switch box shaft, and engage it
- Verify if the position indicator correctly indicates the valve position
- Reconnect power supplies

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

12.0 Operation



Fig 12.4 Typical limit switch box

12.6 Flow Regulator Setting

Flow regulators on manual override are regulated in factory according job specific stroking time(s).

In case it is necessary 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 reaching the required stroking time(s)

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

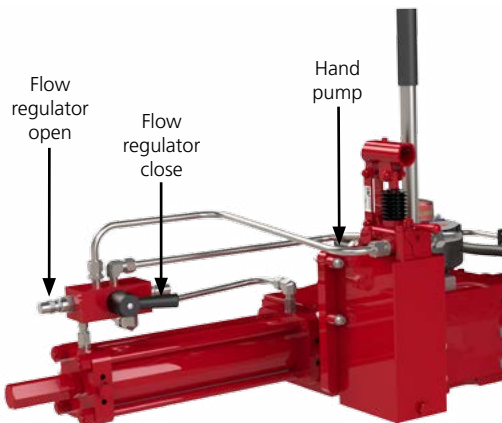


Fig 12.5 Manual override particular

12.7 Pipeline Gas Power Supply

Verify allowed supply pressure range on actuator label.

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

12.8 Connection to Pipeline

Preliminary operations

- Verify 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 to 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 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:

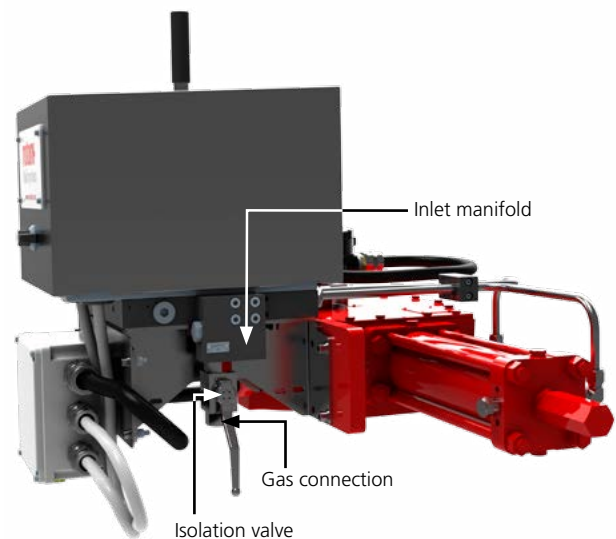


Fig 12.6 Single main supply


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


Refer to specific operating diagram for specific application configuration.

12.0 Operation

12.9 Electrical Connections


 **Check 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 explosion-proof cables
- The cable glands must be tightened in the threaded inlets, to guarantee the waterproof and explosion proof 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 care.**

12.10 Start Up

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

- 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
- Actuator and all of its parties work as expected
- Operating time is in accordance with 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.**

12.0 Operation

12.11 Circuit Gas Venting

In some occasions, example for 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

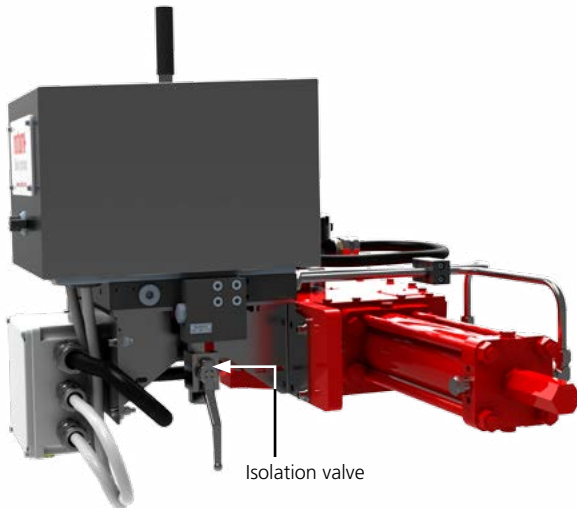


Fig 12.7

- 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

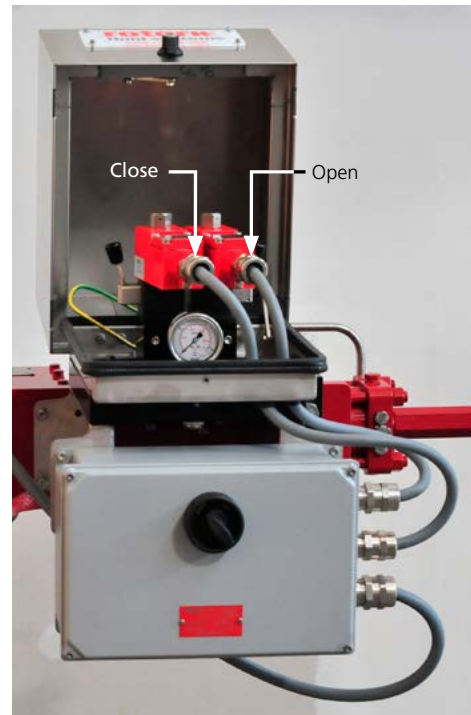


Fig 12.8

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


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

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

13.0 Dismantling & Disposal

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 depressurized otherwise slowly open the drain valve
- Verify that the reference tank (if applicable) is depressurized 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 are to be separately disposed of on specialized disposal sites

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

14.0 Rotork Sales and Service

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 the best service in the world. Contact your local Rotork representative or the factory direct 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

15.0 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 (see PM-HPG2-006 page 27)
		• Flow regulator closed	• Regulate flow regulator according instructions reported in par. "FLOW REGULATOR SETTING" page 15
		• Failure of local selector	• Contact Rotork Fluid Systems customer service
		• Failure of the gas block	• Contact Rotork Fluid Systems Customer Service
		• Low supply pressure	• Restore the supply pressure
		• Torque limit device undue intervention (If applicable)	• Contact Rotork Fluid Systems Customer Service
		• Valve fault.	• Consult the valve manufacturer's documentation
2	Missed valve actuation (by remote control)	• Pipe work 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 (see PM-HPG2--006 page 27)
		• Flow regulator closed	• Regulate flow regulator according instructions reported in par. FLOW REGULATOR SETTING page 15
		• Failure of solenoid valve	• Contact Rotork Fluid Systems customer service
		• Failure of the gas block	• Contact Rotork Fluid Systems customer service
		• Low supply pressure	• Restore the supply pressure
		• Torque limit device undue intervention (If applicable)	• Contact Rotork Fluid Systems customer service
• Valve/actuator fault	• Consult the valve manufacturer's documentation • For GH Bare Actuator refer to GH/D Installation and Maintenance Manual (MM-006-1-E)		
3	Missed valve actuation (by manual override)	• Pipe work 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 Fluid Systems customer service
		• No gas supply	• Open the isolation valve on the supply gas line
		• Oil under the allowed level	• Refill oil
		• Flow regulator closed	• Regulate flow regulator according instructions reported in par. "FLOW REGULATOR SETTING" page 15
		• Hand pump relief valve undue intervention	• Contact Rotork Fluid Systems customer service
		• Valve/actuator fault	• Consult the valve manufacture's documentation • For bare actuator refer to GH installation and maintenance manual (MM-006-1-E)

15.0 Troubleshooting

ID	FAILURE	POSSIBLE CAUSES	CORRECTIVE MEASURES
4	Low stroking time	<ul style="list-style-type: none"> Low supply pressure 	<ul style="list-style-type: none"> Restore the correct value of the supply pressure
		<ul style="list-style-type: none"> Incorrect flow regulator setting 	<ul style="list-style-type: none"> Adjust the flow regulator to increase the flow rate (see par. FLOW REGULATOR SETTING page 15)
		<ul style="list-style-type: none"> High valve/actuator torque 	<ul style="list-style-type: none"> Consult the valve manufacturer's documentation For GH Bare Actuator refer to GH/S Installation and Maintenance Manual (MM-005-1-E) or GH/D Installation and Maintenance Manual (MM-006-1-E)
		<ul style="list-style-type: none"> Oil under the allowed level. 	<ul style="list-style-type: none"> Refill oil
		<ul style="list-style-type: none"> Pipe work blocked, crushed or leaking 	<ul style="list-style-type: none"> Clean or repair as necessary.
5	Fast stroking time	<ul style="list-style-type: none"> High supply pressure 	<ul style="list-style-type: none"> Restore the correct value of the supply pressure
		<ul style="list-style-type: none"> Incorrect flow regulator setting 	<ul style="list-style-type: none"> Adjust the flow regulator to reduce the flow rate (see par. FLOW REGULATOR SETTING page 15)
6	Incorrect valve position	<ul style="list-style-type: none"> Incorrect setting of mechanical stops 	<ul style="list-style-type: none"> Check mechanical stop bolts position and regulate if necessary (see page 12)
		<ul style="list-style-type: none"> Incorrect signal from limit switches 	<ul style="list-style-type: none"> Check limit switches position (see page 14)
7	Leakage	<ul style="list-style-type: none"> Worn seals 	<ul style="list-style-type: none"> Replace seals (see PM-HPG2-009 at page 30).
		<ul style="list-style-type: none"> Valve/actuator fault 	<ul style="list-style-type: none"> Consult the valve manufacture's documentation For GH Bare Actuator refer to GH/D Installation and Maintenance Manual (MM-006-1-E)
8	Incorrect pressure indication by pressure gauge	<ul style="list-style-type: none"> Pressure gauge fault 	<ul style="list-style-type: none"> Change Pressure gauge according to procedure CM-HPG2-001 page 31

For other problems, please contact Rotork Fluid Systems Customer Service.

16.0 Periodic Maintenance and Corrective Maintenance

Rotork Fluid Systems 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 RFS	6		
Verify 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 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 indication reported in par. Troubleshooting page, 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



16.0 Periodic Maintenance and Corrective Maintenance

PM-HPG2-001		Page:1/1
Component: HPG actuator	Task: Cleaning	
Equipment, Tools, Materials: Air compressor Project documentation (design and operating pressure values)	Warnings: 	
Preliminary Operations:		
Description:		
<p> Remove pipeline gas supply before proceeding.</p> <p>1. Remove dust from actuator external surface by blowing air.</p> <p> 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, so as to prevent potential explosion hazards.</p> <p>Prevent electrostatic charges in potentially explosive areas.</p>		


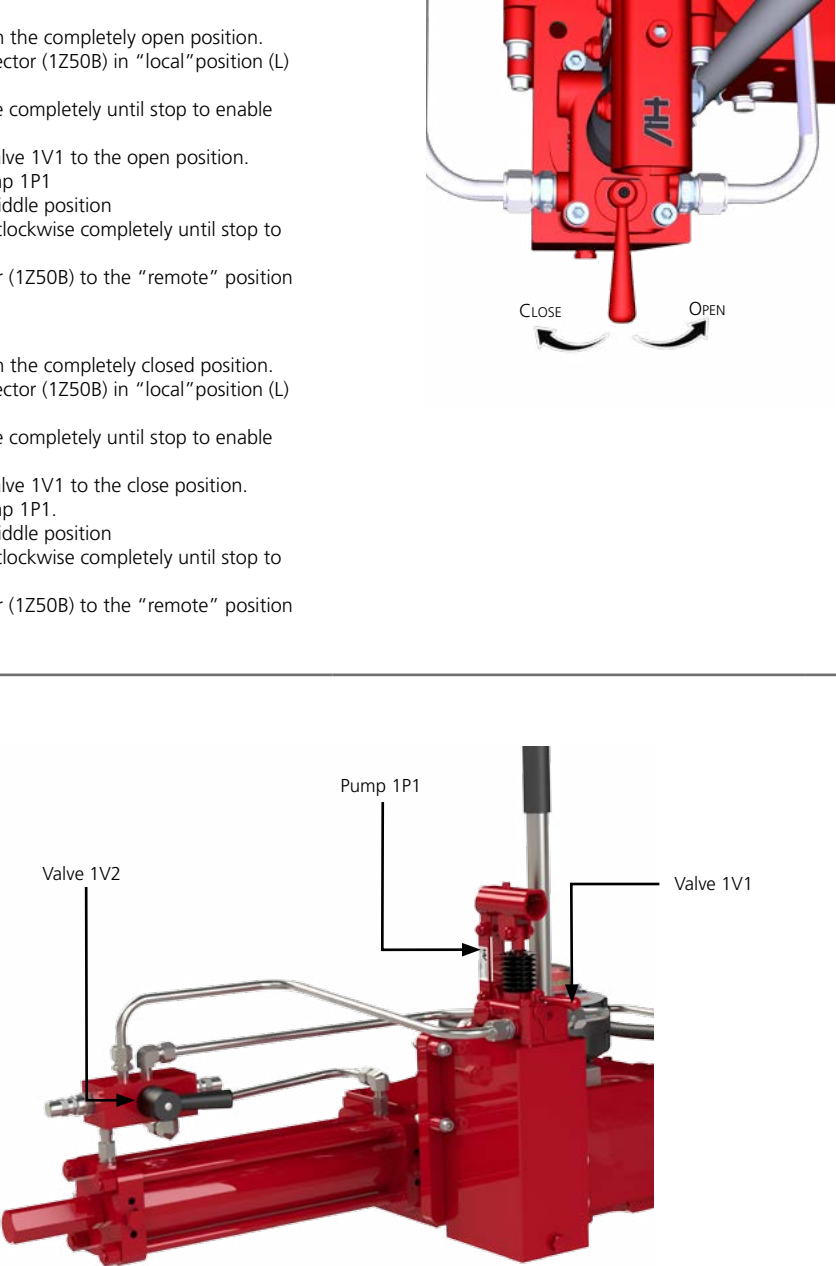
16.0 Periodic Maintenance and Corrective Maintenance

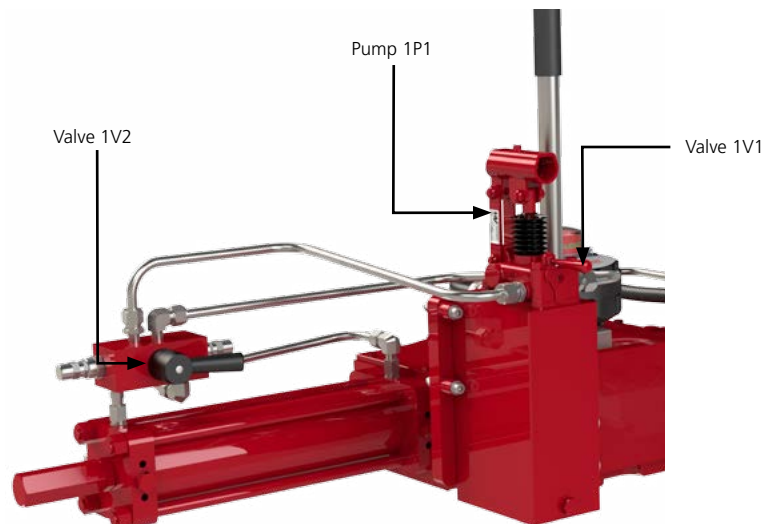
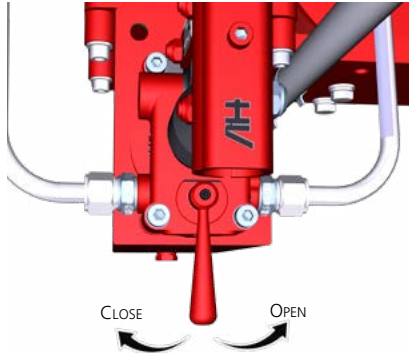
PM-HPG2 -002		Page:1/1
Component: HPG actuator	Task: Functional test	
Equipment, Tools, Materials: Chronometer Project documentation (required stroke times)	Warnings: 	
Preliminary Operations:		
<p>Description: NOTE: Actuator must be connected to the pipeline gas power supply to perform the following test.</p> <ol style="list-style-type: none"> 1. Operate the actuator. 2. Perform the stroke several times by local and remote (if applicable) control. <p>⚠ Actuator exhausts medium supply in the atmosphere during normal operation. Wear PPD including breathing device in function of type of medium supply used.</p> <ol style="list-style-type: none"> 3. Verify actuator is correctly working. 4. Note the stroke time(s). 5. Verify stroke time(s) are as required. <p>In case of stroke times out of required range refer to Troubleshooting ID 4, 5 (see page 20) to restore.</p>		

16.0 Periodic Maintenance and Corrective Maintenance


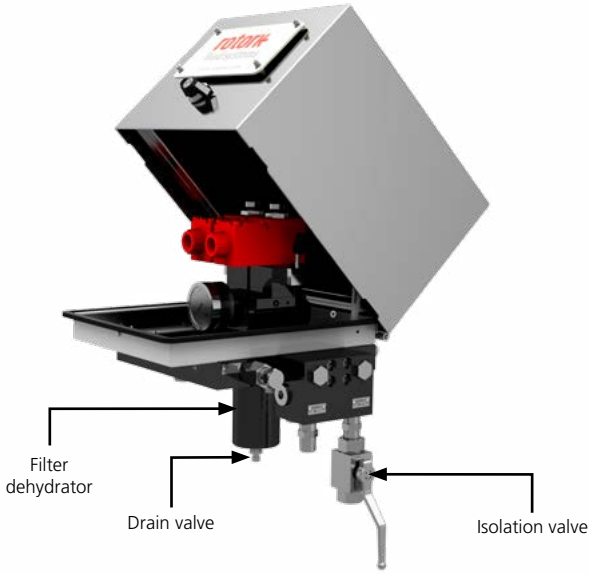
PM-HPG2 -003		Page:1/1
Component: HPG actuator (Electrical components)	Task: Check electrical components and grounding connections.	
Equipment, Tools, Materials: Project documentation	Warnings: 	
Preliminary Operations:		
Description:  Switch off electric power supply before working on electrical devices.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

16.0 Periodic Maintenance and Corrective Maintenance





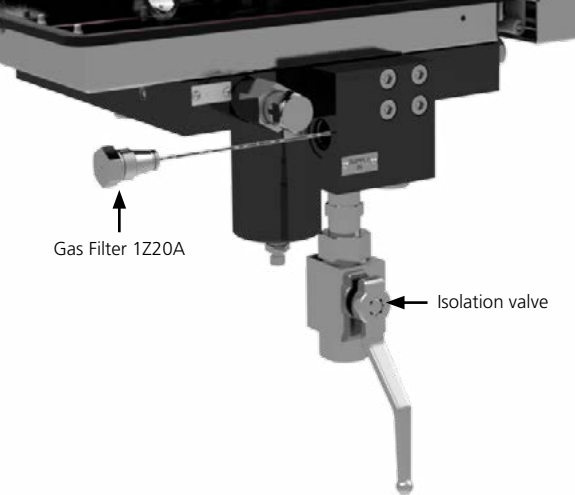
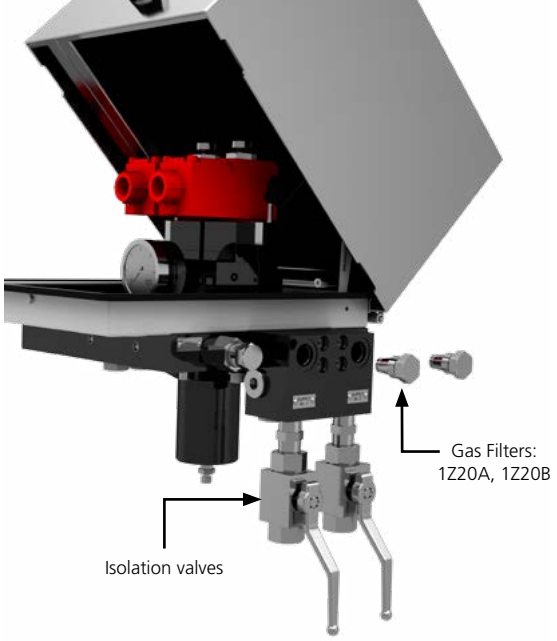
PM-HPG2 -004		Page:1/1
Component: Manual override	Task: Manual override functional test	
Equipment, Tools, Materials: Project documentation	Warnings: 	
Preliminary Operations:		
Description:		
<p>Opening operation</p> <ol style="list-style-type: none"> 1. Verify the actuator is not in the completely open position. 2. Move the remote/local selector (1Z50B) in "local" position (L) (if present). 3. Rotate valve 1V2 clockwise completely until stop 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 stop to enable Remote operation. 8. Move remote/local selector (1Z50B) to the "remote" position (if present). <p>Closing operation</p> <ol style="list-style-type: none"> 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 stop 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 stop to enable Remote operation. 16. Move remote/local selector (1Z50B) to the "remote" position (if present). 		
		




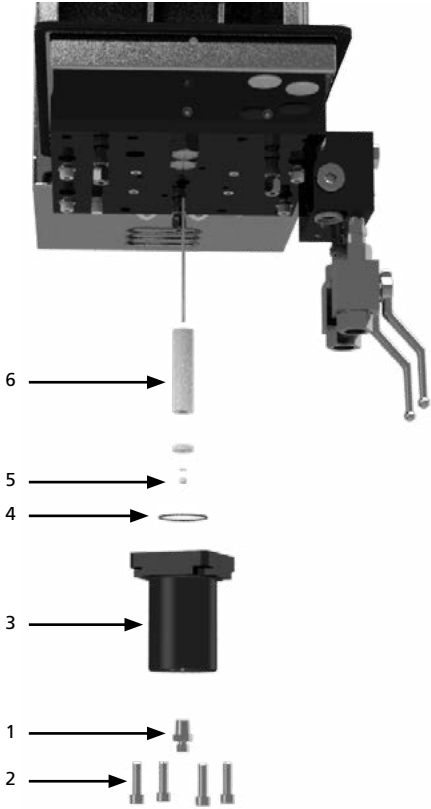
16.0 Periodic Maintenance and Corrective Maintenance

PM-HPG2-005		Page:1/1
Component: Dehydrator gas filter (if present)	Task: Discharge gas dehydrator condensate	
Equipment, Tools, Materials: Project documentation Wrench (10 mm)	Warnings: 	
Preliminary Operations: CIRCUIT GAS VENTING page 17		
Description: <p>⚠ Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by RFS or by end user) to the closed position. Lock the valve to prevent unintentional opening.</p> <p>Consult project specific documentation.</p> <ol style="list-style-type: none">1. Vent the gas circuit according to instructions in CIRCUIT GAS VENTING page 17.2. Carefully loosen the screw of the drain valve and drain the condensate.3. When all condensate has been ejected, tighten the screw.4. Open the isolation valve on the supply gas line.		
		
<p><i>Fig 16.1 Filter dehydrator</i></p>		


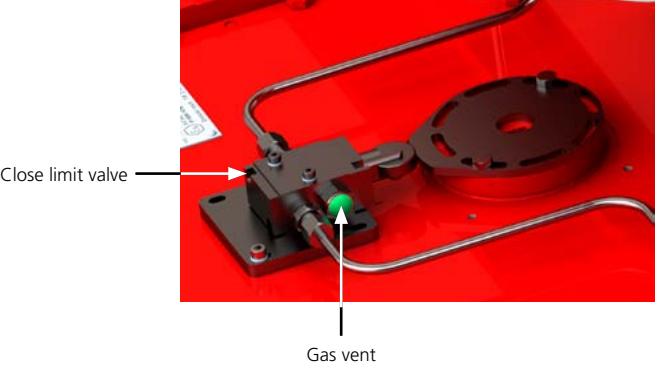
16.0 Periodic Maintenance and Corrective Maintenance

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 page 17		
Description:  Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by RFS or by end user) to the closed position. Lock the valve to prevent unintentional opening. <ol style="list-style-type: none">1. Vent the gas present in the system according to instructions in CIRCUIT GAS VENTING page 17.2. 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 a grease film, see page 32.7. Reassemble the gas filter.8. Open the manual valve on the supply gas line.		
		



16.0 Periodic Maintenance and Corrective Maintenance

PM-HPG2-007		Page:1/1
Component: Dehydrator Gas filter	Task: Gas dehydrator filter elements replacement (if applicable)	
Equipment, Tools, Materials: Air compressor Project documentation Wrench (16 mm) Allen wrench (6 mm)	Warnings: 	
Preliminary Operations: CIRCUIT GAS VENTING page 17		
Description:		
<p>⚠ Remove the gas supply to prevent unintentional operation. Move the isolation valve(s) on the supply gas line (supplied by RFS or by end user) to the closed position. Lock the valve to prevent unintentional opening.</p> <p>Consult project specific documentation.</p> <ol style="list-style-type: none"> 1. Vent the gas circuit according to instructions in CIRCUIT GAS VENTING page 17. 2. Ensure that there is no gas pressure in the circuit. The pressure gauge must show 0 barg. 3. Unscrew four hex socket bolts (2). 4. Remove bowl (3). 5. Unscrew bolt (5). 6. Remove filter element (6). 7. Clean bowl and drain valve (1). 8. Replace filter elements (6) and screw bolt (5) into the body. 9. Check O-ring (4) is in good conditions, otherwise replace it. 10. Lubricate O-ring with a thin grease layer, see page 32. 11. Reassemble the bowl with flange (3) and fix them screwing bolts (2). 12. Tighten drain valve (1). 13. Open the manual valve on the supply gas line. 		
		

16.0 Periodic Maintenance and Corrective Maintenance

PM-HPG2-008		Page:1/1
Component: Close limit valve	Task: Clean the close limit valve gas vent	
Equipment, Tools, Materials: Wrench (16 mm) Compressed air Project documentation	Warnings: 	
Preliminary Operations:		
Preliminary actions 1. Consult project specific documentation.		
Description: 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.		
		

16.0 Periodic Maintenance and Corrective Maintenance

PM-HPG2-009		Page:1/4
Component: HPG actuator-High pressure pneumatic cylinder	Task: Cylinder seals replacement	
Equipment, Tools, Materials: Spare seals Wrench Lifting tools Project documentation	Warnings: 	
Preliminary Operations: CIRCUIT GAS VENTING page 17	Removal from valve	
<p>Description:</p> <p> Remove pipeline gas supply before proceeding.</p> <p>Preliminary actions</p> <ol style="list-style-type: none"> 1. Move the actuator to the closed position. 2. Vent the gas present in the system according to instructions in CIRCUIT GAS VENTING page 17. 3. Pressure guage must show 0 bar. 4. Remove the components (e.g. limit switch box, gas storage tank, back-up tank) located on the center body cover, if any 5. Remove hydraulic and pipeline gas pipes. 6. Remove actuator from valve (par. Removal from valve, page 9). 7. Position the actuator on a workbench (if possible) or in a stable position. <p>For High pressure pneumatic cylinder seals replacement, refer to GH/D Installation and Maintenance Manual (MM-006-1-E).</p> <ol style="list-style-type: none"> 8. Re-install pipeline gas and hydraulic pipes. 9. Install the components (e.g., limit switch box, gas storage tank) located on the center body cover if any. 10. The actuator must be tested before it is assembled on the valve. 11. Cycle the actuator several times, using exclusively dry nitrogen gas, to check functionality and absence of leakages. 12. Check that the painted parts have not been damaged during disassembly and /or reassembly. 13. If necessary repaint them in accordance with the applicable painting specifications. 14. The actuator is now ready to be assembled on the valve. 		

16.0 Periodic Maintenance and Corrective Maintenance

CM-HPG2-001		Page:1/1
Component: Gas Control	Task: Replace the Pressure Gauge on Gas Control	
Equipment, Tools, Materials: Pressure gauge Wrench (14 mm)	Warnings: 	
Preliminary Operations: CIRCUIT GAS VENTING page 17		
Description:  Remove pipeline gas supply before proceeding. <ol style="list-style-type: none">1. Vent the gas present in the system according to instructions in CIRCUIT GAS VENTING page 17.2. Carefully unscrew the pressure gauge.3. Replace with another one.4. Tighten the pressure gauge.5. Connect pipeline gas supply.6. Verify that pressure gauge correctly indicate the pressure in the circuit. 		

17.0 Part List

For Spare Part list, refer to GH/S Installation and Maintenance Manual (MM-005-1-E) or GH/D Installation and Maintenance Manual (MM-006-1-E).

18.0 Grease & Hydraulic Oil Specification

In general, there is no need to lubricate the actuator because its mechanism is lubricated -for life. The standard grease and oil for Rotork Fluid Systems scotch yoke actuators are 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 $-29^{\circ} < T < +60^{\circ} \text{C}$:

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 °C) (DIN 51 562)	360 mm ² /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 ⁽¹⁾	
Screw Test - μ Thread	0.16
Screw Test - μ Head	0.08

QUANTITY OF GREASE IN HOUSING	
Center 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

¹ 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 $-46^{\circ} \text{C} / +40^{\circ} \text{C}$:

Manufacturer	MOBIL
Trade name	MOBILTEMP [®] SHC 100TM
NLGI Grade	2
Colour	CLEAR BROWN
Penetration, Density, Viscosity	
Worked Penetration at 25 °C (ASTM D 217)	280
Viscosity of Oil at 40 °C (104 °F) ASTM D445)	100 cSt
Temperature	
Drop Point (ASTM D 2265)	> 260 °C
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

18.0 Grease & Hydraulic Oil Specification

18.2 Hydraulic Oil

This is the standard oil specification for Rotork Fluid systems high pressure gas actuators working at temperature between -20 °C/+60 °C. 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	32.7
cSt @ 100 °C	6.63
Viscosity Index, ASTM D 2270	164
Brookfield Viscosity ASTM D 2983, cP @ -20 °C	1090
Brookfield Viscosity ASTM D 2983 cP @ -30 °C	3360
Brookfield Viscosity ASTM D 2983 cP @ -40 °C	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	1B
Rust Characteristics, ASTM D 665B	Pass
FZG Gear Test, DIN 51534, Fail Stage	12
Pour Point, °C, ASTM D 97	-54
Flash Point, °C, ASTM D 92	250
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 Fluid systems high pressure gas actuators working at temperature between -46 °C/+40 °C. 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	13.5
cSt @ 100 °C	5.3
Viscosity Index, ASTM D 2270	404
Kinematic Viscosity @ -40 °C, ASTM D 445	371 cSt
Copper Strip Corrosion, ASTM D 130	1A
Pour Point, °C, ASTM D 97	-60 °C
Flash Point, °C, ASTM D 92	101 °C

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

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A full listing of our worldwide sales and service network is available on our website.

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Rotork is a corporate member of the Institute of Asset Management



PUB016-003-00
Issue 08/17

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