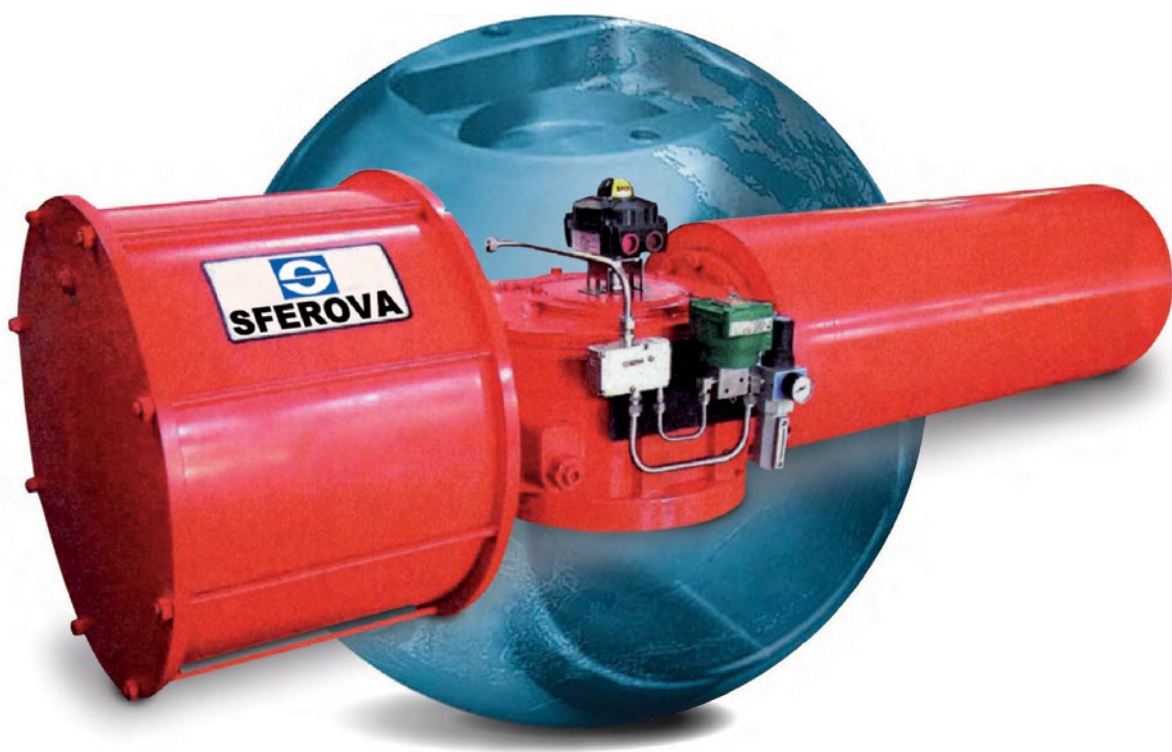




# G Type Range of Actuators

Installation & Operation Instruction Manual



## Heavy Duty Scotch Yoke Pneumatic & Hydraulic Actuators



Head Office and Factory:

**Sferova s.r.l**

Via delle Industrie, 30/32 I-20050 Sulbiate (MI)-Italy

Tel. +39 039 6079599 | Fax. +39 039 6079582

[www.sferova.com](http://www.sferova.com) | [info@sferova.com](mailto:info@sferova.com)



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## 1. Introduction

This IOM applies to G series scotch yoke and tie rod driven quarter turn pneumatic actuators including both double acting and spring return actuators of models G14XXX, G16XXX, G25XXX, G30XXX, G35XXX, G40XXX, G48XXX and G60XXX. The IOM also applies to scotch yoke actuated double acting and spring return hydraulic actuators of models G14XXX, G16XXX, G25XXX, G30XXX, G35XXX, G40XXX, G48XXX and G60XXX.

## 2. Working Environmental Conditions and Applications

### 2.1 Suitable Environment Temperature

- For standard pneumatic actuator: -20°C~80°C
- For low temperature pneumatic actuator: -40°C~80°C
- For high temperature pneumatic actuator: -20°C~120°C

### 2.2 Operating Pressure

- Pneumatic: 3~7 Bar
- Hydraulic: 60~150 Bar

### 2.3 Operating Media

- Pneumatic: dry and clean compressed air
- Hydraulic: hydraulic oil within 40CST viscosity. Low temperature hydraulic oil should be used for low temperature applications.

G Series actuators are used to automate quarter turn valves such as ball, butterfly, plug valves etc., widely applicable to most industries like oil and gas transmission offshore platforms, chemical and petrochemical, water, power and other industries.

## 3. Technical Data

Output Torques:

- Double acting actuators: 830~250000 N.m
- Spring return actuators: 307~71753 N.m
- Larger actuators can be produced upon request

## 4. Installation, Tube & Fittings

- 4.1 Avoid high temperature, low temperature, high moisture and corrosive applications unless the actuator has been specially designed for the application.
- 4.2 Use brass or 316 stainless steel tubing, try to avoid vibration, secure piping to avoid leakage. In the case of any vibration or impact during transportation, check tubing and fittings for leakage.
- 4.3 Different pneumatic actuators have different air inlet sizes, from 3/8" to 2". Using a smaller size piping will reduce opening speeds. Refer to Table 1:

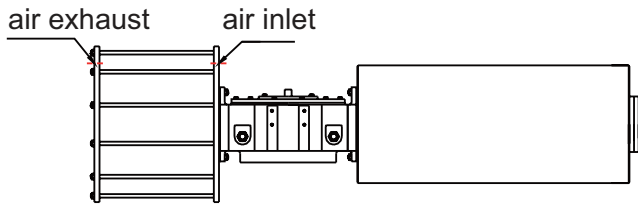
**Table 1 Air Inlet Size**

Actuator size	200	250	300	350	400	450	500
Air inlet size	3/8"	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"
Actuator size	550	600	700	800	900	1000	1100
Air inlet size	3/4"	1"	1"	1 1/2"	2"	2"	2"

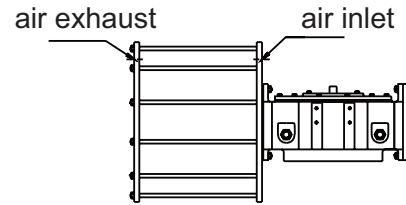
- 4.4 To ensure quick operation of the actuator, do not use a smaller tube or fitting size than the inlet size provided. Also valves with reduced orifices will reduce air flow.

- 4.5 Operating media is filtered dry air, if dew point is over -15°C use a dryer.

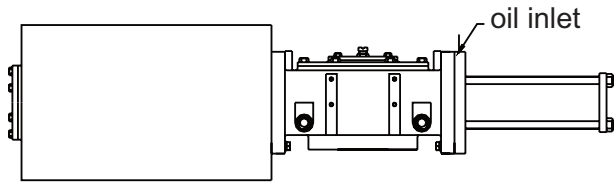
4.6 Pneumatic (air) & Hydraulic Actuator (Oil) Supply Inlet and Exhaust Positions are as per Figures 1, 2, 3, 4 below: -



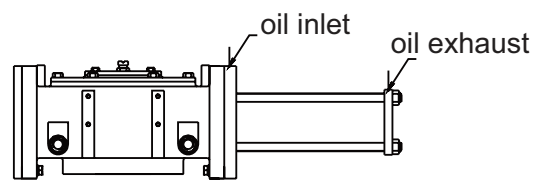
**Figure 1: Single Acting Pneumatic Actuator**



**Figure 2: Double Acting Hydraulic Actuator**

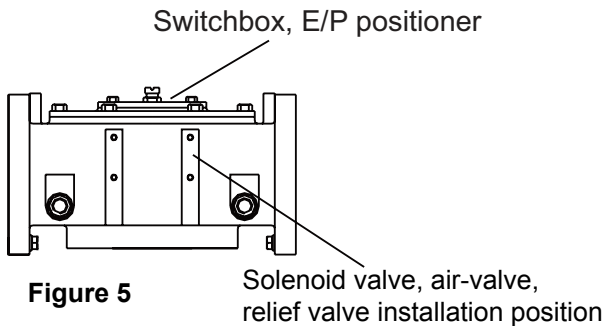


**Figure 3: Single Acting Hydraulic Actuator**

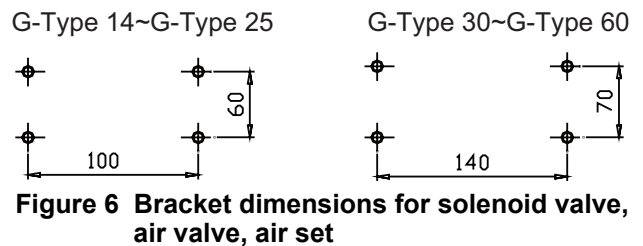


**Figure 4: Double Acting Hydraulic Actuator**

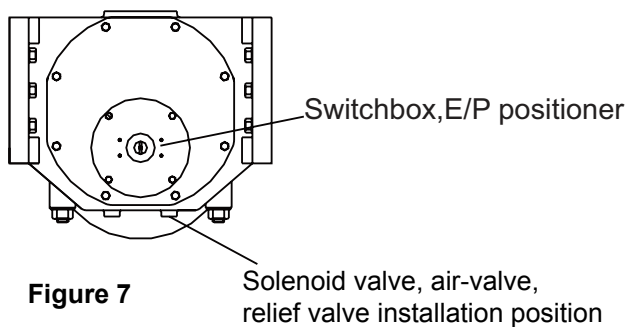
4.7 Dimensions and Mounting Positions of Accessories, refer Figures 5 to 8 below: -



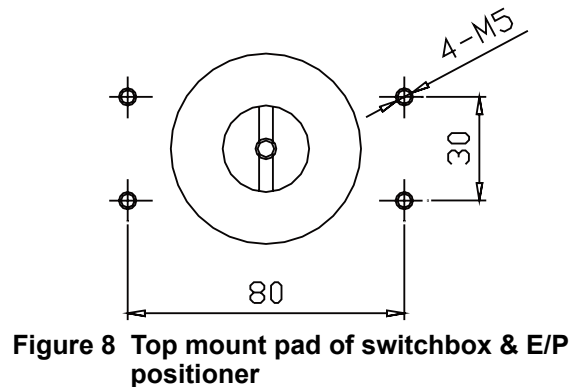
**Figure 5**



**Figure 6 Bracket dimensions for solenoid valve, air valve, air set**



**Figure 7**



**Figure 8 Top mount pad of switchbox & E/P positioner**

## 5. Operation

### 5.1 Auto-Operation

On/Off Control for Pneumatic & Hydraulic Actuated Valves:

- A) The valve is open when solenoid valve is energised (Fail Close Type)
- B) The valve is close when solenoid valve is de-energised (Fail Close Type)
- C) The valve is close when solenoid valve is energised (Fail Open Type)
- D) The valve is open when solenoid valve is de-energised (Fail Open Type)

Modulating Control for Pneumatic & Hydraulic Actuated Valve:

- Input 4~20mA electric signals to the Electro-Pneumatic positioner, valve's open degree is proportionally regulated in 0°~ 90°stroke through different current size the positioner achieves.
- Input 0.02~0.1MPa air signals to the Pneumatic-Pneumatic positioner, valve's open degree is proportionally regulated in 0°~90° stroke through different air pressure the positioner supplies.

## 5.2 Manual Over-ride Operation

### 5.2.1 Manual over-ride for **double acting** pneumatic & hydraulic actuators

#### 5.2.1.1 Declutchable Gearbox - DA Actuators

For models G14XXX, G16XX and G25XXX double acting pneumatic actuators, a **declutchable worm gear** operator mounted between valve and the pneumatic or hydraulic actuator is available as a manual over-ride (refer Figure 9 & 10).

Manual operating steps: firstly open the equalising valve on the pneumatic actuator, draw out the pull pin of the gear operator with one hand, simultaneously use another hand to turn the clutch lever counter clockwise until the worm and worm gear engages, then release the pull pin. After the pin has returned into the eccentric sleeve, you can then operate the valve manually. Turn the handwheel clockwise to close the valve, turn the handwheel counterclockwise to open the valve.

To return to automatic mode first draw out the pull pin in the gear operator with one hand, simultaneously, use another hand to turn the clutch lever clockwise, until the worm and worm gear engages, then release the pull pin. After the pin has returned into the eccentric sleeve, close the equalising valve.

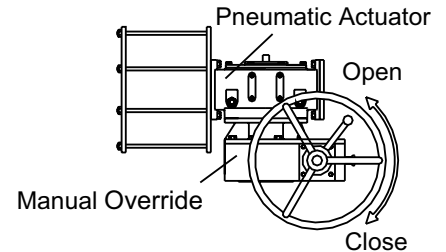


Figure 9

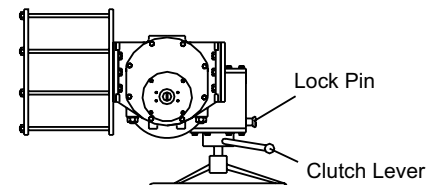


Figure 10

#### 5.2.1.2 Hydraulic Manual Over-ride - DA Actuators

For models G30XXX, G35XXX, G40XXX, G48XXX and G60XXX double acting pneumatic or hydraulic actuators (refer Figures 11 & 11A), a hydraulic cylinder over-ride with a hand pump is available. When manual operating is required, firstly open the equalising valve (2) mounted on the pneumatic actuator, close ball valve (2) by operating the hand pilot valve to control the hydraulic cylinder's oil supply/exhaust, and operate the hand pump to energise opening or closing the valve manually.

To return to automatic operation, set the handle of the 4 port 3 position manual directional valve (1) to the middle position and open ball valve (2). Manual over-ride is then disengaged.

Refer to 5.2.2.3 for operation of manual over-ride system

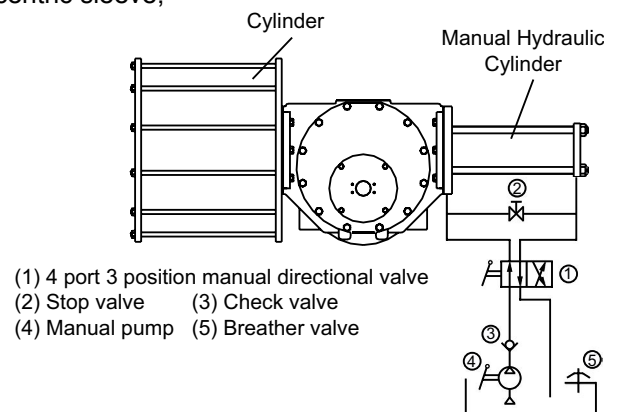


Figure 11

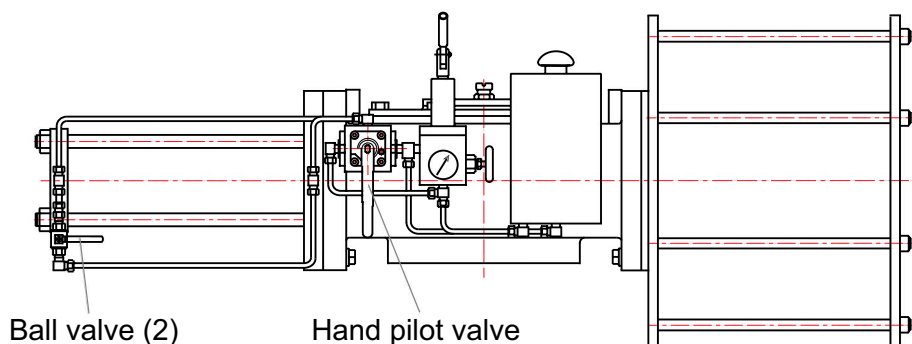


Figure 11A

## 5.2.2 Manual Over-ride for **Single Acting** Pneumatic or Hydraulic Actuator

### 5.2.2.1 Jackscrew Operator - SR Actuators

The jackscrew operator (Figure 12) is only available in G-Type14XXX & G-Type16XXX for single acting (spring return) actuators. The jackscrew operator is a side mounted operator. Turning the handwheel, controls the valve position by screwing in & out the trapezoid screw into and out of in spring case (compressing & decompressing the spring). To turn the valve, turn the jackscrew handwheel clockwise to compress the spring, counter-clockwise to decompress the spring. If the actuator is set 'fail closed' compressing the spring will open the valve.

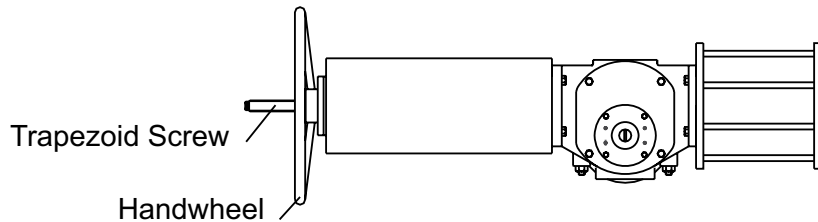


Figure 12

After manual operation, screw out the trapezoid screw until the spring is disengaged toward the actuator to return to auto-operation, check to ensure the spring can open fully and the spring is totally disengaged from the jackscrew. Avoid fully screwing out the integral trapezoid screw, as the screw also acts as a position stop to ensure the valve is correctly returned to the full open & close position.

### 5.2.2.2 Hydraulic Manual Over-ride - SR Actuators

The hydraulic cylinder manual over-ride system is available for G-Type 25XXX ~ G-Type 60XXX. The hydraulic manual over-ride is a system which consists of a hydraulic cylinder, manual pump, tank, globe valve, check valve and other parts, and is easy to operate and maintain (see Figures 13, 14 & 15).

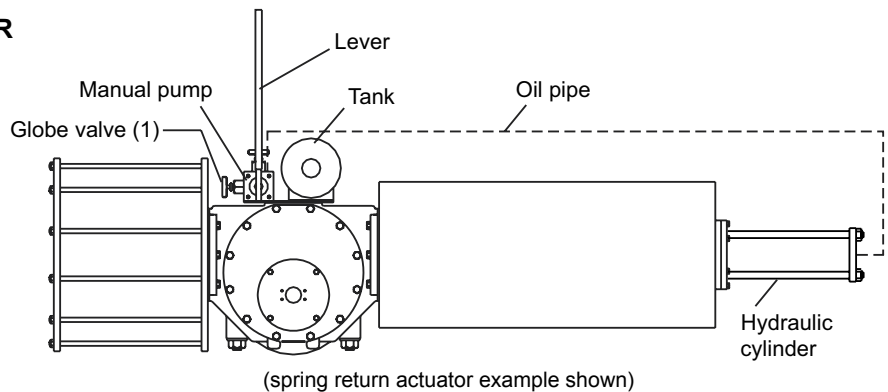


Figure 13

### 5.2.2.3 Operation of Hydraulic Manual Over-ride System:

1. Close globe valve (1), open globe valve (2);
2. Inject oil to the oil cylinder by operating manual pump with lever handle, this will activate the hydraulic cylinder which in turn will compress the spring (in the case of 'spring return' actuators) to open the valve (assuming the actuator is set 'fail closed' in the case of spring return actuators).
3. To deactivate, close globe valve (2).
4. Once the valve is closed, open the globe valve (1) to revert to normal operation with no over-ride.

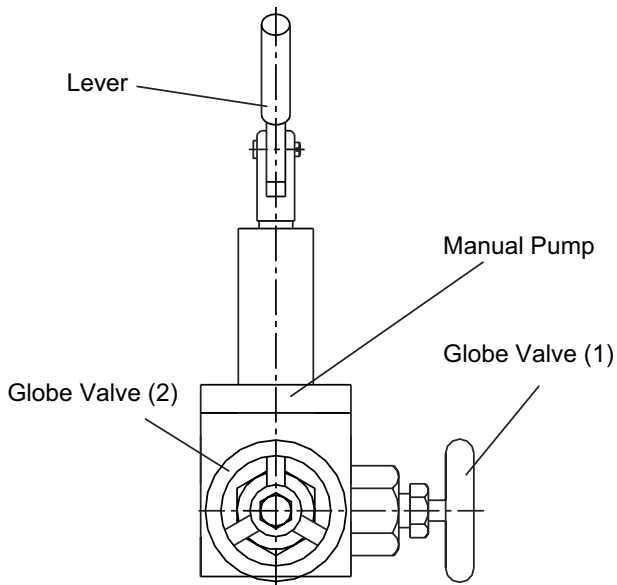
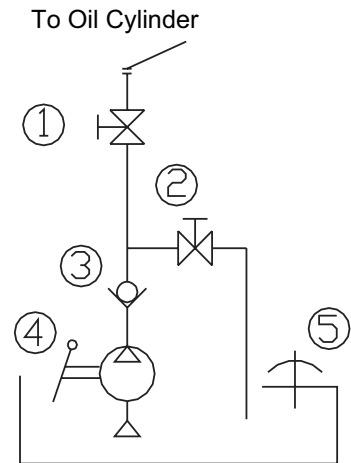


Figure 14



Hydraulic System Schematic  
(Also refer Figure 11)

Figure 15

## 6. Stroke Adjustment (Travel Stop Adjustment)

The stroke adjustment can be made for Pneumatic and Hydraulic actuators from 80° to 100° as follows.

Loosen the stroke nut then:

1. Screw out the open position stroke bolt, to increase the open position. Screw in the open direction to decrease the open position.
2. Screw out the close position stroke bolt to increase the closed position, screw in the close position to decrease the closed position.

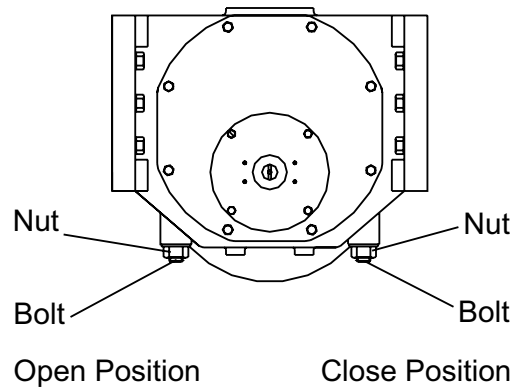


Figure 16

Note: Tighten the lock nut after adjusting the appropriate on/off position.



## 7. Modular Structure Description

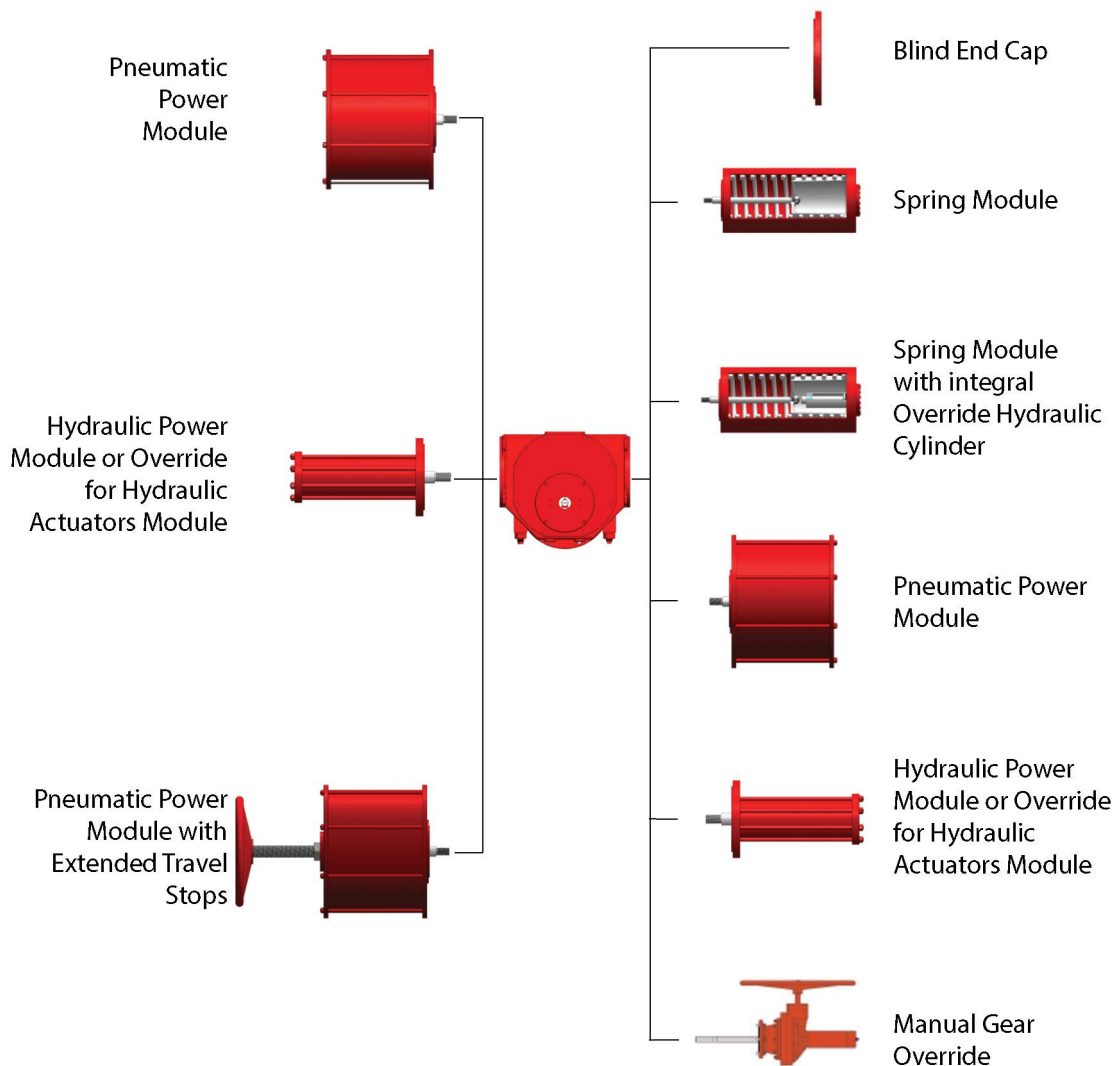
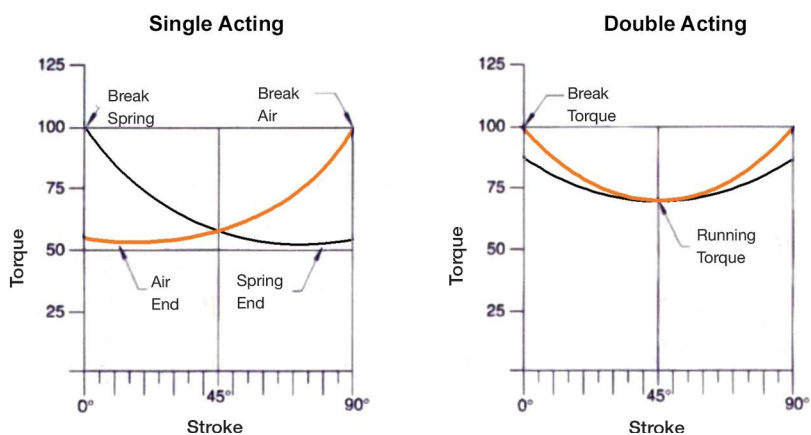


Figure 17

## Torque Characteristics



Non-declutchable mechanical over-ride for G30 and G48 spring-return models.

G-Type series actuators is the module-in design which consist of different modules. Different functions are available with different combinations.



## 8. Assembly Drawing & Part List

### Assembly Drawing

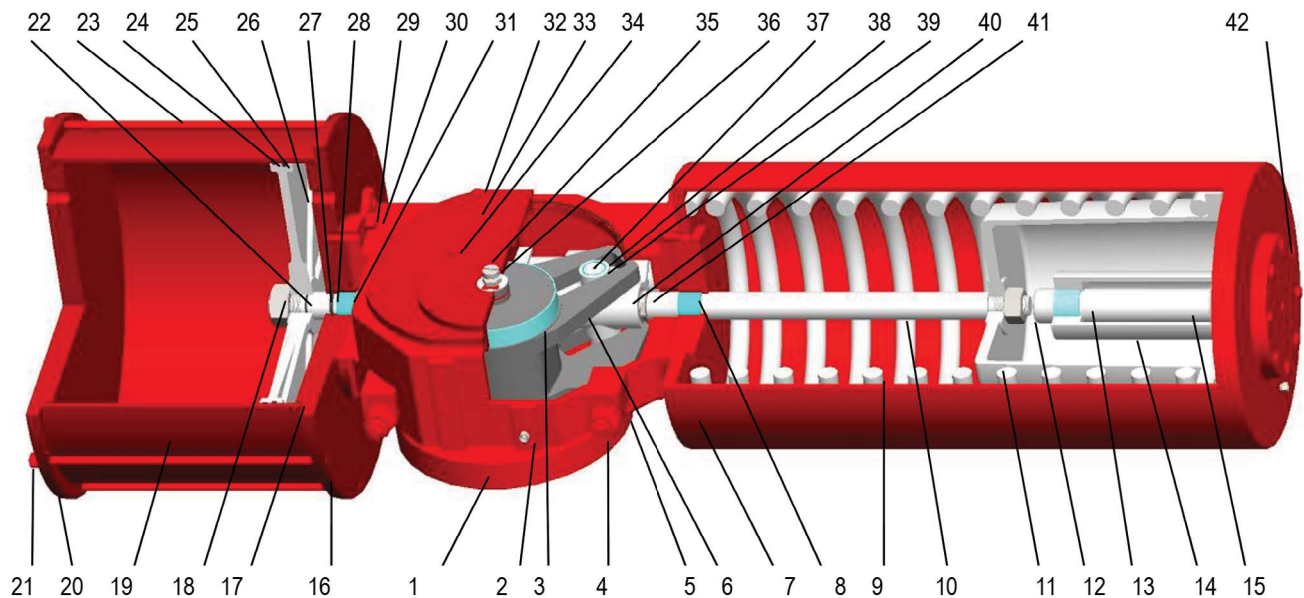


Figure 18

### Part List

No.	Name	Material	No.	Name	Material
1	Body	Ductile Iron	22	O-Ring	NBR/Viton
2	Vent Valve	Carbon Steel	23	Screw	Alloy Steel
3	Sliding Bearing	Metal + TFE	24	Guide Ring	PTFE
4	Adjust Stud	Alloy Steel	25	O-Ring	NBR/Viton
5	Nut	2H	26	Piston	Ductile Iron
6	Yoke	Carbon Steel	27	Center Bar	Alloy Steel
7	Spring Case	Carbon Steel	28	O-Ring	NBR/Viton
8	Sliding Bearing	Metal + TFE	29	Stud	Alloy Steel
9	Spring	Alloy Steel	30	Nut	2H
10	Tension rod	Alloy Steel	31	Sliding Bearing	Metal + TFE
11	Spring Seat	Carbon Steel	32	Bolt	Carbon Steel
12	Nut	2H	33	Body Cap	Ductile Iron
13	Sliding Bearing	Metal + TFE	34	Bolt	Carbon Steel
14	Hydraulic Cylinder	Carbon Steel	35	Cover	Ductile Iron
15	Hydraulic Piston	Carbon Steel	36	Drive Shaft	Alloy Steel
16	Adapter	Ductile Iron	37	Roller	Alloy Steel
17	O-Ring	NBR/Viton	38	Sliding Bearing	Metal + TFE
18	Nut	2H	39	Pin	Alloy Steel
19	Cylinder	Carbon Steel	40	Guide Block	Ductile Iron
20	End Cap	Ductile Iron	41	Nut	Carbon Steel
21	Nut	2H	42	Cover Plate	Carbon Steel

## 9. Module Replacement

G Series actuators consist of versatile modules with different combinations as shown in Section 7. When necessary, actuator acting types can be converted through changing the modules. The same conversion methods can be used for Pneumatic & Hydraulic.

Only a trained actuator specialist should attempt disassembly and conversion. Actuators can be under high spring loads and dangerous devices. Valves can be rapidly slammed shut posing a safety threat. Entrapped, dangerous fluid can be rapidly expelled.

### 9.1 To change Spring Return actuator from fail closed (FC) to fail open (FO): -

(An easier way than the below procedure, if space allows, is to spin the actuator 180° and remount on the valve in the opposite direction, but then you will have to replace the open-closed indicator).

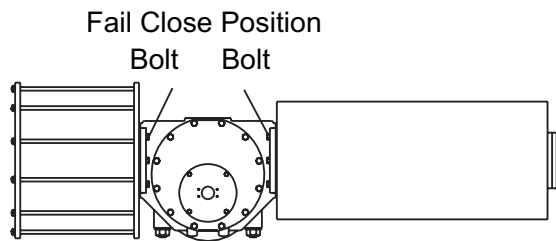


Figure 19

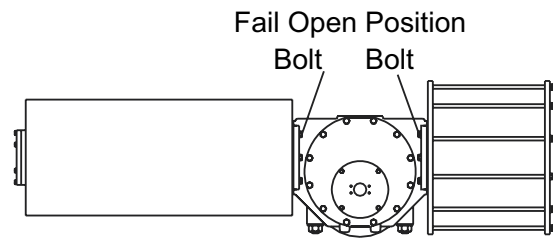


Figure 20

Replacement steps (refer to assembly drawings and parts list section 8).

1. Only attempt once actuator is removed from valve.  
First ensure the spring is not energised or engaged, then loosen the spring end cap bolts and remove the spring cover 42.
2. Withdraw Spring rod with special tooling (see Figure 21).
3. Loosen the bolts on the top cover 34, remove the top cover 35.
4. Loosen the bolts on the body cap 32, remove the body cap 33.
5. Rotating nut 41 anti-clockwise, spin it out from the guide block 40, while unscrewing it from the spring center bar.
6. Loosen the bolts connecting the spring module and body, remove the spring module.
7. Unscrew the nut (anti-clockwise) connecting the cylinder center bar to the guide block, then screw it out from the guide block.
8. Loosen the bolts connecting the pneumatic power module and body, remove the pneumatic power module.
9. Replace the pneumatic power module at the other end of the body and the spring module to the other end, then reconnect nut 41 to connect the cylinder to the center bar with the guide block 40, rotating nut 41 in place.
10. Bolt pneumatic power module to the body and tighten the bolts.
11. Replace the spring module to the other end of the body in the reverse order shown above.
12. Mount the body cap onto the body, install the bolt connecting the body cap and body, tighten the bolts.
13. Mount the cover on body cap, install the bolt connecting the cover and body cap, tighten the bolts.
14. Screw out the trapezoidal screw in the tooling of spring end cap, to separate it from the spring seat in the spring case, loosen the bolts which installed the tooling on spring end, remove the tooling.
15. Install the spring end cap, screw and tighten bolts connect body cap and cover.
16. Supply or cut off air to the actuator to check whether the drive can move smoothly.

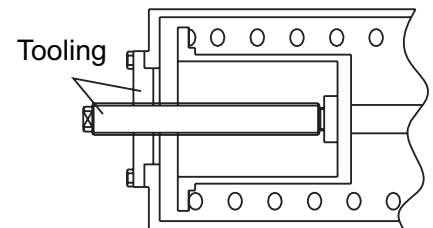


Figure 21

### 9.2 To change Spring Return actuator from fail open (FO) to fail closed (FC): -

Use the same method as fail close position to fail open position conversion above.

### 9.3 Change double acting type to Single Acting Spring Return type.

Replacement Steps (refer to assembly drawings and parts list section 8 as a guide but use the as-built drawing for the specific model supplied):

1. Withdraw Spring rod with special tooling.
2. Loosen the bolt which connect blind plate and body, remove the blind plate.

3. Loosen the bolt 34 on the cover, remove the cover 35.
4. Loosen the bolt 32 on body cap, remove the body cap 33.
5. Replace the spring module to the end of the body connecting spring case to the center bar with the guide block 40, rotating nut 41 in place.
6. Screw out the trapezoidal screw in the tooling of spring end cap, to separate it from the spring seat in the spring case, loosen the bolts which installed the tooling on spring end, remove the tooling.
7. Assemble the spring end cap, then screw and tighten the bolt connecting the spring cylinder cover and spring cylinder.
8. Assemble the body on the cylinder, then screw and tighten the bolt connecting the body cap and the body.
9. Assemble the top cover on the body cap, then screw and tighten the bolt connecting the body cap and the top cover.
10. Supply air to the actuator, and actuated it for 4~5 times to check if it works smoothly.

#### 9.4 Convert Spring Return Type to Double Acting Type Actuator

Follow the below steps (Please refer to the assembly chart and parts list section 8 as a guide but use the as-built drawing for the specific model supplied):

1. Loose the bolt on the spring end cap, and take the spring end cap 42.
2. Withstand the spring piston rod with the special tool.
3. Loosen the bolt 34 on the top cover, and take the top cover 35.
4. Loosen the bolt 32 on the body cap, and take the body cap 33.
5. Rotate the bolt 41 in counter- clockwise direction and back out it from the guide block 40, then take it from the piston rod.
6. Loosen the bolt connecting spring module and the body and remove the spring module.
7. Assemble the blind plate on the body where spring module is assembled, then screw and tighten the bolt connecting blind plate and body.
8. Assemble the body cap on the body, then screw and tighten the bolt connecting the body cap and body.
9. Assemble the top cover on the body cap, then screw and tighten the bolt connecting the body cap and top cover .
10. Supply air to the 2 air ports on the spring module of actuator, and actuate it for 4~5 times to check if it works smoothly.

#### 9.5 To assemble the Jackscrew on the Spring Module

Follow these steps:

1. Loosen the bolt on the spring end cap and take the spring end cap 42.
2. Assemble the Jackscrew on the side of spring cylinder.
3. Screw and tighten the bolt connecting the Jackscrew and spring cylinder.
4. Rotate the hand wheel on the Jackscrew and open/ close the valve for 2~3 times to check if the manual over-ride works smoothly.

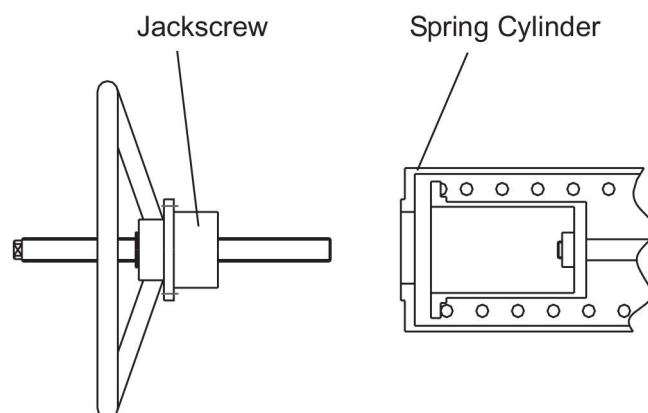


Figure 22

### 9.6 To assemble the Hydraulic Manual Over-ride Mechanism onto the Spring Module

Follow these steps:

1. Loosen the bolt on the spring end cap and remove the spring end cap 42.
2. Fit the O-ring and Stop collar to the O-ring of hydraulic cylinder.
3. Assemble the hydraulic cylinder into the spring cylinder.
4. Fit the O-ring into the spigot of spring cylinder side.
5. Assemble the spring cylinder cover on the spring cylinder.
6. Screw and tighten the bolt connecting the spring cylinder cover and the spring cylinder.
7. Please refer to Figure 11 and Section 5.2.1.2, to assemble the manual pump onto the body cap, then screw and tighten the bolt.
8. Connect the stainless tube, high pressure fittings and the hydraulic cylinder.
9. Add some hydraulic oil into the tank of the manual pump, then power oil to the hydraulic cylinder by operating the lever on the manual pump. Activate the actuator allowing it to run to the full open position, and check if there is leakage and if the manual over-ride works well.

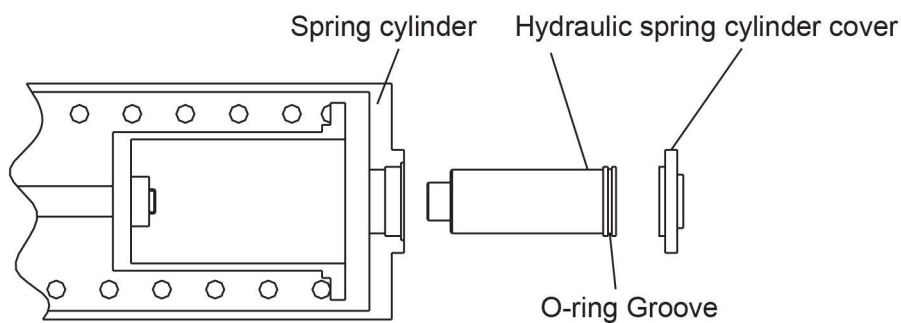


Figure 23

### 9.7 To assemble the Optional 'Opening Limit Mechanism' on the Spring Module

Follow these steps:

1. Loosen the bolt on the spring end cap and remove the spring end cap 42 (refer section 8).
2. Assemble the open limit mechanism (the Jackscrew handwheel mechanism can perform the same task) on the spring cylinder side.
3. Screw and tighten the bolt connecting the opening limit mechanism and spring cylinder.

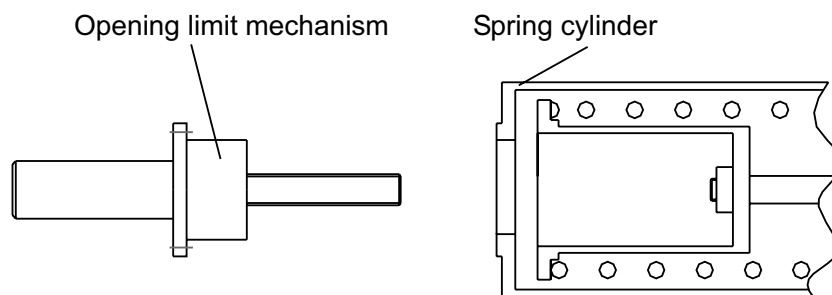


Figure 24

## 10. Cautions

- 10.1 When the spring return type actuator with the opening limit mechanism or Jackscrew enters into auto-operation mode after manual operation, the trapezoid screw must be backed out to the normal disengaged position.
- 10.2 When the spring return type actuator with the opening limit mechanism or Jackscrew enters into the auto-operation mode after manual operation, the 2 globe valves on the manual pump must be opened.
- 10.3 When the double acting type actuator with the gear mechanism enters into the auto-operation mode after manual operation, the hand lever must be set to the auto position.

10.4 Don't rotate the hand wheel and or lever if the manual over-ride is not needed.

10.5 To confirm if the air pressure is normal before operation.

10.6 The operation medium should be filtered dry, clean air and hydraulic oil.

## **11. Maintenance**

11.1 First, to confirm if the air pressure is normal.

11.2 If the solenoid valve is energised and the supplied air can be shifted. If yea, please check the electric circuit.

11.3 If the solenoid valve is energised and the supplied air can be shifted, please take the actuator from the valve and check the actuator and valve separately.

11.4 When checking the actuator, please supply air to the actuator firstly and check if the actuator works normally and if there is leakage.

11.5 If there is leakage, please change the seal.







