PP Series
Installation and Maintenance Guide

Designed and manufactured in accordance to the requirements of the European Pressure Equipment Directive 2014/68/EU and carries the CE mark when so required and applicable.

1. Warranty

Spirax Sarco warrants, subject to the conditions described below, to repair and replace without charge, including labor costs, any components which fail within 1 year of product delivery to the customer. Such failure must have occurred because of defect in material or manufacturing and not as a result of product not being used in accordance with the instructions of this manual.
This warranty does not apply to products which require repair or replacement due to normal wear out or products that are subject to accident, misuse or improper maintenance.
Spirax Sarco Hiter only obligation with Warranty is to repair or replace any product that we consider defective. Spirax Sarco Hiter reserves the right to inspect the product in customer installations or request the return of the product with freight prepaid by the buyer.
Spirax Sarco Hiter may replace or repair any parts that are deemed defective without further responsibilities. All repairs or services executed by Spirax Sarco Hiter, which are not covered by this warranty, will be charged according to the current price list.

THIS IS THE ONLY SPIRAX SARCO HITER WARRANTY TERM AND ONLY HEREBY SPIRAX SARCO HITER EXPRESS.BUYER DISCLAIMS ALL OTHER WARRANTIES IMPLIED BY LAW, INCLUDING ANY MARKET WARRANTY FOR A PARTICULAR PURPOSE.

Access
Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product. Arrange suitable lifting gear if required.

Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required.

Hazardous liquids or gases in the pipeline
Consider what is in the pipeline or what may have been in the pipeline at some previous time. Consider; flammable materials, substances hazardous to health, extremes of temperature.

Hazardous environment around the product
Consider; explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

The system
Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

Pressure systems
Ensure that any pressure is isolated and safely vented to atmospheric pressure.
Consider double isolation (double block and bleed) and the locking or labeling of closed valves. Do not assume that the system has depressurized even when the pressure gauge indicates zero.

Temperature
Allow time for temperature to normalize after isolation to avoid danger of burns.
Tools and consumables
Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco Hiter replacement parts.

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Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco Hiter replacement parts.

Protective clothing
Consider whether any protective clothing required by yourself and / or others in the vicinity to protect against the hazards of, for example, chemicals, high / low temperature, noise, falling objects, and dangers to eyes and face.

Permits to work
All work must be carried out or be supervised by a suitably competent person. Post 'warning notices' if necessary.

Electrical works
Before starting work study the wiring diagram and wiring instructions, and check any special requirements. Consider special emphasis on primary and phase source, local isolation of the major systems, fuse requirements, grounding, special cables, cable entries and electrical voltage selection.

Commissioning
After installation or maintenance, ensure that the system is working properly.
Perform tests on all alarms and protective devices.

Storage
Equipment and materials shall be stored in a proper place and securely.

Disposal
Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

3. Introduction

The **PP Series** is a linear pneumatic piston type actuator used on linear valves in module control system.

It is a versatile actuator which can be changed from direct acting to reverse acting, with no need of additional parts.

For continued reliability and valve performance, only original spare parts from **Spirax Sarco Hiter** should be used for the maintenance of this product.

Generally actuators are supplied assembled to valves, although they can also be supplied separate.

4. Installation

4.1 The equipment is inspected in factory and shipped in proper packages.

4.2 A carefully inspection should be performed in the receiving and before installation in order to ensure no damage has been caused during transport and eventual storage.

4.3 Consult the Actuator Installation and Maintenance Manual to install and adjust the equipment. The valve installation instructions must be accomplished according to respective manual and internal parts disassembly.

4.4 Control valves should be installed in an easy-maintenance place, with enough space for actuator removal and internal parts disassembly.

4.5 Supply air connections are manufactured in NPT, for all cylinder sizes, according to Table 1.

4.6 Depending on specifications, rigid tubes may be used for connections between the actuator (regulator filter and positioner) and the controller instrument outlet. However, these connections length must be decreased as much as possible, to avoid delay in control signs.

4.7 When the actuators are supplied with positioner and regulator filter, the pressure lines among them are already performed in factory..

4.8 In order they can correctly operate within design specifications, the actuators of piston/spring must be installed in vertical position or forming the least angle possible to the vertical position. Horizontal position and positions next the horizontal should be avoided.

WARNING

If the actuator to be installed is equipped with top manual handwheel and if the following given instructions are applied, the manual handwheel shall be locked in neutral position (superior extreme position of handwheel), once when in this position, the handwheel does not interfere normal pneumatic operation neither limits the actuator travel.

4.9 Before starting actuator assembly on valve, check the following items:
- Identify valve action (normal opened or normal closed).
- Identify valve travel
- Check if the shaft on actuator is correspondent to the valve.

Table 1 - SUPPLY CONNECTIONS

Actuator	Thread
PP02	1/8" NPT
PP03	1/4" NPT
PP04	
PP05	
PP06	3/8" NPT
PP07	

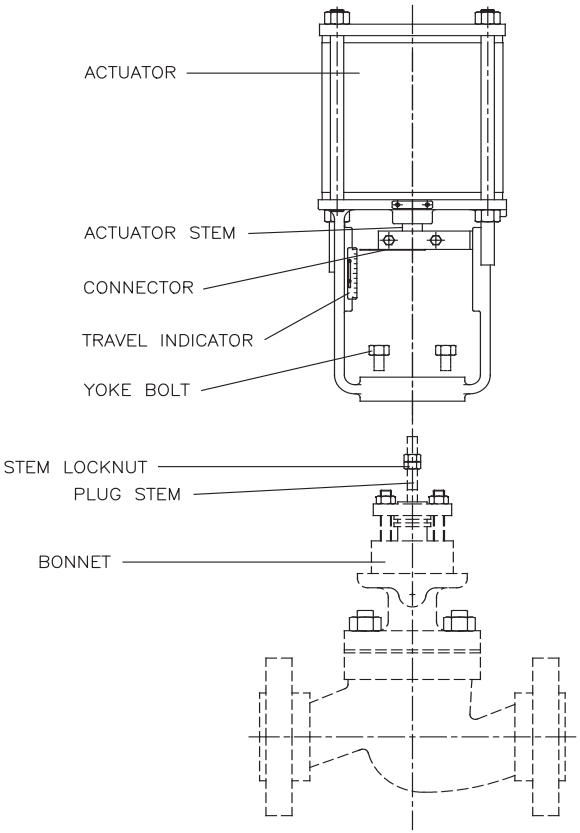

Figure 1 – Actuator installation

4.10 INSTALLATION AND ADJUSTMENT

In disassembly procedure description, our reference shall be figure 1, except when otherwise indicated.

WARNING

For bellows seal valves, the plug stem should not be submitted to rotary movement, or the bellow shall be damaged. Perform the assembly and adjustment of the actuator on valve in the following sequence:

4.10.1 DIRECT ACTING FOR VALVES WITHOUT BELLOW SEALS

4.10.1.1 Displace the plug stem to the most bottom position.

4.10.1.2 Position correctly the actuator on valve bonnet.

4.10.1.3 Fasten the actuator on valve bonnet through the locking bolt.

4.10.1.4 Connect the plug stem on actuator stem, using a key on the stem backing nut and rotate the plug steam up to complete the maximum travel of valve opening. When completing the travel, ensure that the connector indicates the travel begin (upper limit) on travel plate. If need, adjust the course plate to reach the travel plate begin (upper limit), with no pressure to the actuator.

4.10.1.5 Pressurize the actuator up to the travel end is indicated (lower limit) on travel plate. This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.1.6 Apply a wrench to the stem nut and stem backing nut, rotating the obturator stem up to the plug makes contact to the valve seat. Do not allow the plug is rotated when making contact to the valve seat.

4.10.2 DIRECT ACTING FOR VALVES WITH BELLOW SEAL

4.10.2.1 Keep the plug stem in the position in which the valve has been supplied.

4.10.2.2 Position correctly the actuator on valve bonnet

4.10.2.3 Connect the plug stem on actuator stem rotating the actuator, do not allow the actuator stem rotation. Rotate the actuator up to reach the maximum travel of valve opening. When completing the travel, be sure the connector indicates the travel start (upper limt) on travel plate. If necessary, adjust the travel plate to get indication of travel start (lower limit), with no pressure applied to the actuator

4.10.2.4 Pressurize the actuator up to the travel end is indicated (lower limit) on travel plate. This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.2.5 Rotate the actuator until the plug makes contact to the valve seat. Do not allow the plug be rotated when making contact to the valve seat.9).

4.10.2.6 Fasten the actuator on valve bonnet through the locking bolts.

4.10.3 REVERSE ACTING FOR VALVES WITHOUT BELLOW SEALS

4.10.3.1 Displace the plug stem for position lower limit.

4.10.3.2 Position correctly the actuator on valve bonnet.

4.10.3.3 Pressurize the actuator up to its maximum travel. Be sure the connector indicates the travel start (upper limit) on travel plate. If necessary, adjust the travel plate to get the indication on travel start (upper limit) with no change on pressure applied to the actuator.

4.10.3.4 Fasten the actuator on valve bonnet by locking bolt.

4.10.3.5 Connect the plug stem on actuator stem, applying a wrench to the plug stem nut up to complete the maximum travel of valve opening.

4.10.3.6 Relief the pressure inside the actuator up to the travel end is indicated (lower limit) on travel plate. This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.3.7 Apply a wrench to the stem nut and stem backing nut, rotating the plug stem up to the plug makes contact to the valve seat. Do not allow the plug is rotated when making contact to the valve seat.

4.10.4 REVERSE ACTING FOR VALVES WITH BELLOW SEAL

4.10.4.1 Keep the plug stem in position in which the valve has been supplied.

4.10.4.2 Position correctly the actuator on valve bonnet.

4.10.4.3 Pressurize the actuator up to its maximum travel. Be sure the connector indicates the travel start (upper limit), with no change on pressure applied to the actuator.

4.10.4.4 Connect the plug stem on actuator stem, rotating the actuator. Do not allow the plug stem rotation. Rotate the actuator to reach the maximum travel of valve opening.

4.10.4.5 Relief the pressure inside the actuator up to the travel end is indicated (lower limit) on travel plate. This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.4.6 Rotate the actuator until the plug makes contact to the valve seat. Do not allow the plug be rotated when making contact to the valve seat.

4.10.5 DOUBLE ACTING FOR VALVE WITHOUT BELLOW SEAL

4.10.5.1 Displace the plug stem to the position lower limit.

4.10.5.2 Position correctly the actuator on valve bonnet.

4.10.5.3 Pressurize the actuator by bottom connection, thus lifting the actuator stem up to its upper limit.

4.10.5.4 Be sure the connector indicates the travel begin (upper limit) on travel plate. If need, adjust the travel indicator to reach the travel plate begin (upper limit), with no change to the applied pressure.

4.10.5.5 Fasten the actuator on valve bonnet through the locking bolts.

4.10.5.6 Connect the plug stem on actuator stem, using a key on the stem backing nut and rotate the plug steam up to complete the maximum travel of valve opening.

4.10.5.7 Relief the pressure inside the actuator up to the travel end is indicated (lower limit) on travel plate.

4.10.5.8 This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.5.9 Apply a wrench to the stem nut and stem backing nut, rotating the plug stem up to the plug makes contact to the valve seat. Do not allow the plug is rotated when making contact to the valve seat.

4.10.6 DOUBLE ACTING FOR VALVES WITH BELLOW SEAL

4.10.6.1 Keep the plug stem in position in which the valve has been supplied.

4.10.6.2 Position correctly the actuator on valve bonnet.

4.10.6.3 Pressurize the actuator through bottom connection, thus lifting the actuator stem up to its upper limit. Be sure the connector indicates the start (upper limit) on travel plate.
If necessary, adjust the travel plate to reach the travel start indication (upper limit) with no applied pressure change.

4.10.6.4 Connect the plug stem on actuator stem, using a key on the stem backing nut and rotate the plug stem up to complete the maximum travel of valve opening.

4.10.6.5 Relief the pressure in the actuator by bottom connection, and pressurize it by top connection up to the travel end is indicated (lower limit) on travel plate. This is not a definitive situation, once the total valve closing is not reached yet, because there is a gap between the plug and its seat.

4.10.6.6 Rotate the actuator until the plug makes contact to the valve seat. Do not allow the plug be rotated when making contact to the valve seat.

IMPORTANT

After the actuator assembly and adjustment, for direct or inverse acting as double-acting, for valve with or without bellow seal, apply to the actuator a variable pressure in the whole pneumatic signal range (25-50 psig) and check the valve travel. Be sure the valve is totally opened and totally closed in respective.

4.11 ACTUATOR ADJUSTMENT

The actuator should provide displacement correspondent the whole plug travel within spring range is applied to the piston. Pressures inside valve body originate powers in actuator which have direct influence on pressure range applied to the piston.
In some situations, valve travel can not be completed; this happens when pressure conditions in valve body are different from those which the valve has been factory-adjusted. In these cases, we recommend increasing pressure on actuator piston. It is important to stress that actuator spring has pressure range of defined amplitude.

5.1 Disassembly

ATTENTION
Before starting the actuator disassembly, relief all the pressure inside of the actuator, remove the air compressed lines connected to it.

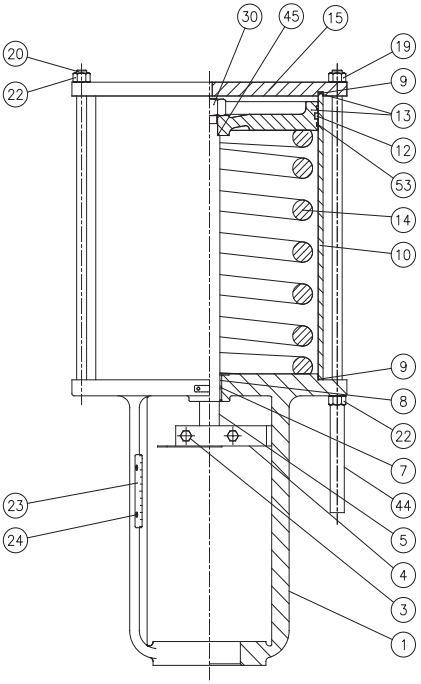

Fig. 2 – Direct acting actuator

In disassembly procedure description, our reference shall be Figure 2, except when otherwise is indicated.

5.1.1 DIRECT ACTING

5.1.1.1 Loose the connector bolt (3).

5.1.1.2 Unscrew the plug stem from the actuator stem (5), loosing the stem backing nut for valve without bellow seal or rotating the actuator if the valve has bellow seal (in this case, unscrew the bolt (2) of the actuator yoke basis so that the actuator can be rotated.

5.1.1.3 Remove both yoke bolts (20).

5.1.1.4 Remove the tension stud bolts covers (44) and carefully the tension stud-bolts (19).

5.1.1.5 Remove the cover (36) and lift the cylinder (10), removing it as well as the cylinder o-rings (9).

5.1.1.6 Remove the stem bolt (17) and washer (16).

5.1.1.7 Remove the piston (13) together with the piston o-ring (12).

5.1.1.8 Remove the spring (14).

5.1.1.9 Remove the connector (4) of the actuator (5) stem.

5.1.1.10 Remove the valve yoke (1), and locking bolt(2), if they have not been removed yet.

5.1.1.11 For a complete disassembly, remove the stem o-ring (7).

5.1.2 REVERSE ACTING

ATTENTION
Before starting these actuators disassembly, keep them pressurized in their maximum travel.

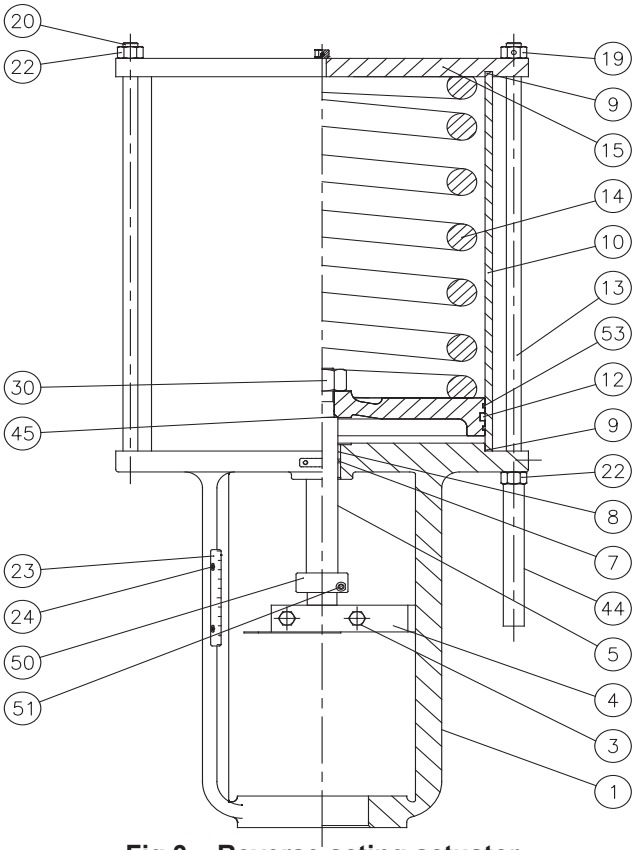

Fig.3 – Reverse acting actuator

5.1.2.1 Loosen the connector bolt (3).

5.1.2.2 Unscrew the plug stem from the actuator stem (5) with a wrench the stem nut and stem backing nut for valves without bellow seal or rotating the actuator in case of bellow seal valve (in such case, unscrew the locking screws (2) of the actuator yoke basis (1), so that it can be rotated.

5.1.2.3 Relief the pressure in the actuator and remove all compressed air lines connected to it.

5.1.2.4 Remove the valve actuator, removing the locking bolt (2) if they have not been removed yet.

5.1.2.5 Remove yoke studs (20).

5.1.2.6 Remove the pressure stud bolts covers (42) and carefully remove the pressure stud bolts (19)

5.1.2.7 Remove the cover (36) and lift the cylinder (10), removing the cylinder O rings (9).

5.1.2.8 Remove the spring (14).

5.1.2.9 Remove the stem bolt (17) and washer (16).

5.1.2.10 Remove the travel limiter (18).

5.1.2.11 Remove the piston (13), together with the piston o-ring (12).

5.1.2.12 Remove the connector (4) and actuator stem (5).

5.1.2.13 For a complete disassembly, remove the stem O ring (7).

5.1.3 DIRECT ACTING

ATTENTION
Before starting these actuators disassembly, keep them pressurized in their maximum travel.

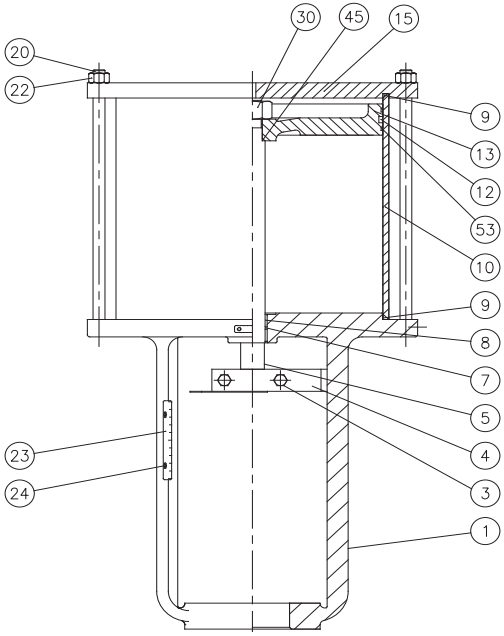

Fig. 4 – Double acting actuator

5.1.3.1 Loosen the connector bolt (3).

5.1.3.2 Unscrew the valve plug stem from the actuator stem (3). For valve without bellows seal, turn the stem by using a wrench on the locknuts. For valve with bellows seal, remove the actuator bolts (2) and turn the actuator.

5.1.3.3 Relief the pressure in the actuator and remove all compressed air lines connected to it.

5.1.3.4 Remove the valve actuator, removing the locking bolt (2) if they have not been removed yet.

5.1.3.5 Remove the cylinder stud bolt (19) and the yoke stud bolt (20).

5.1.3.6 Remove the cover (36) and lift the cylinder (10), removing the cylinder o-rings (9).

5.1.3.7 Remove the stem bolt (17) and washer (16).

5.1.3.8 Remove the piston (13) together with the piston O ring (12).

5.1.3.9 Remove the travel limiter (18).

5.1.3.10 Remove the connector (4) and actuator stem (5).

5.1.3.11 For a complete disassembly, remove the stem O ring (7)**.**

5.1.4 DIRECT ACTING WITH HANDWHEEL

To the actuator proceed as indicated with direct actuator without handwheel.

For remove the handwheel (32) drive out the lockpin (31). Take out the handwheel bolt (30) by the inside of upper cylinder (10). These actuator do not have the cylinder O ring (9) and the stem O ring (7).

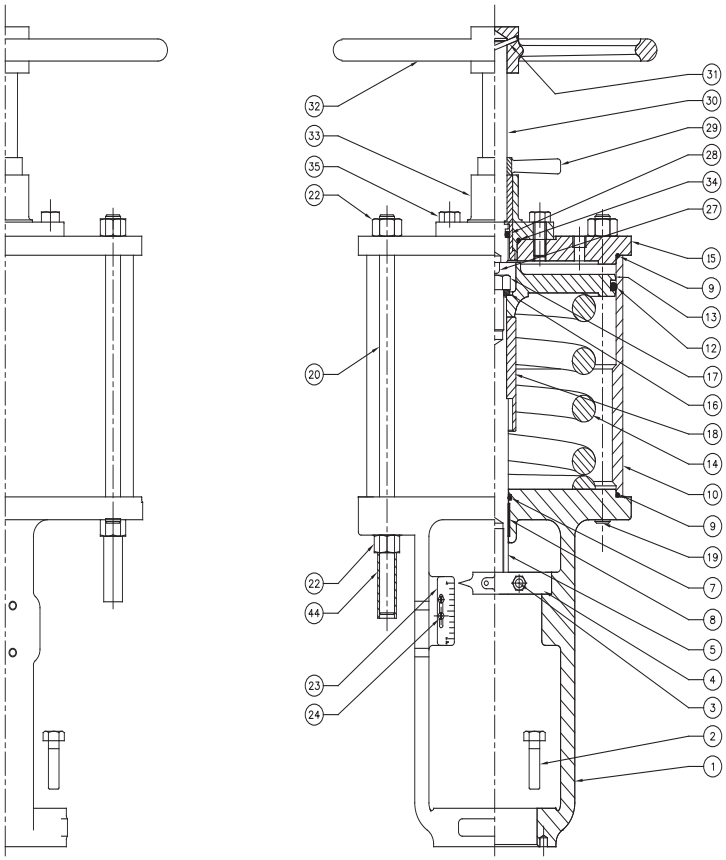

Fig.5 – Direct acting actuator with handwheel

5.1.5 REVERSE ACTING WITH HANDWHEEL

ATTENTION
Before starting these actuators disassembly, keep them pressurized in their maximum travel.

5.1.5.1 Loosen the connector bolt (3).

5.1.5.2 Unscrew the valve plug stem from the actuator stem (3). For valve without bellows seal, turn the stem by using a wrench on the locknuts. For valve with bellows seal, remove the actuator bolts (2) and turn the actuator.

5.1.5.3 Relief the pressure in the actuator and remove all compressed air lines connected to it.

5.1.5.4 Remove the valve actuator, removing the locking bolt (2) if they have not been removed yet.

5.1.5.5 Remove the cotter pin (37), nuts (35), bearing (33) and bearing washers (34).

5.1.5.6 Remove the yoke stud bolt (20).

5.1.5.7 Take out the compression bolts covers (44) and carefully unscrew the tension bolts (2).

5.1.5.8 Remove the cover (15) from the cylinder (10) and take off the cylinder O ring (9).

5.1.5.9 Remove the spring (14).

5.1.5.10 Remove the connector (4).)

5.1.5.11 Remove the stem sub assembly with piston (5) (10) (13) (16) (18) (26) e (40).

5.1.5.12 Remove the locking pin (40) and unscrew the handwheel stem (26).

5.1.5.13 Take off the washer (16), the stop travel (18) and the piston (13) all together with piston o-ring.

5.1.5.14 For complete disassembly, remove the stem O ring (7).

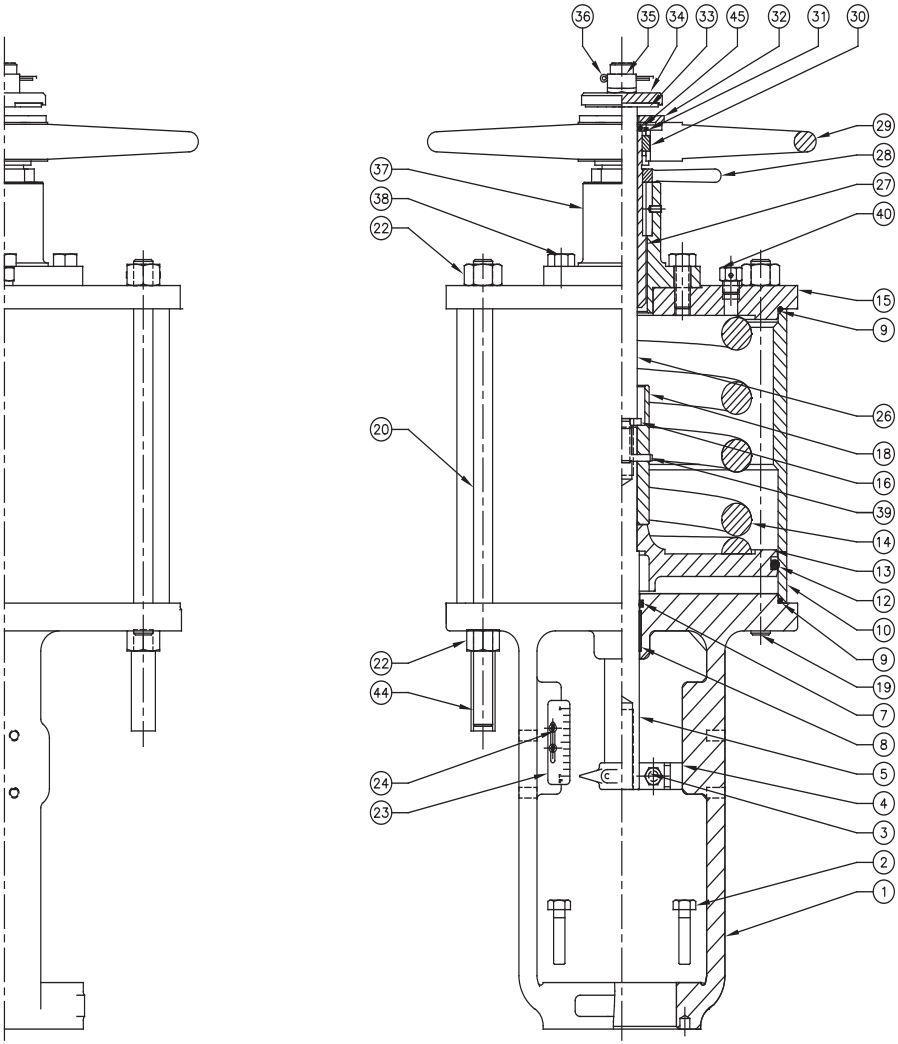

Fig. 6 – Reverse acting actuator with handwheel

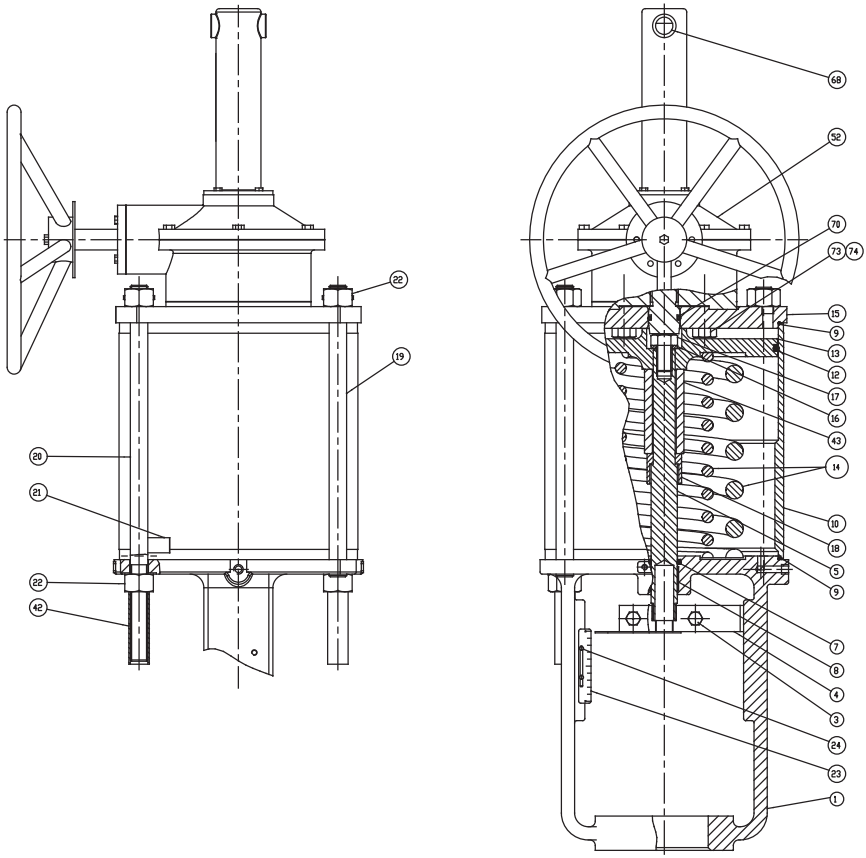

Fig. 7 – Direct Acting Actuator with Handwheel

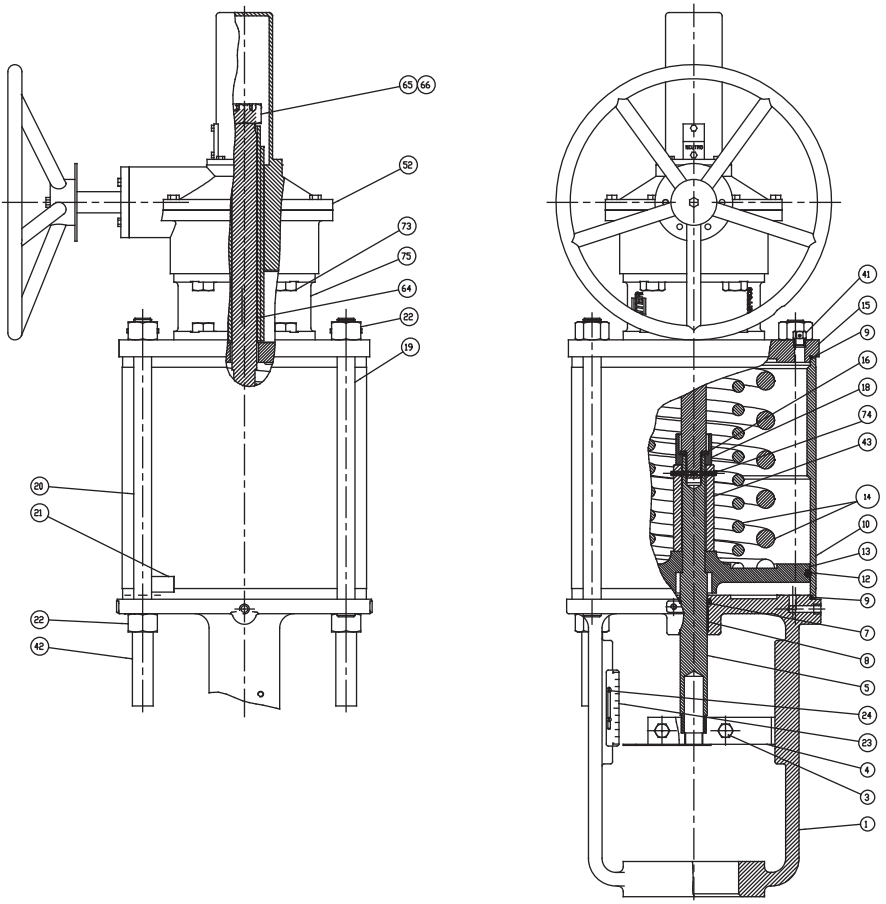

Fig. 8 – Reverse Acting Actuator with Handwheel
06 and 07 PP Sizes

5.2 Cleaning, Inspection and Repair

All valve metallic parts must be cleaned using solvent and dried with compressed air after inspection. The approved parts should be kept clean and very well protected up to the assembly. Oil protector application on steel carbon non-painted parts is recommended. If there is a damage that can not be resolved by parts replacement and/or corrective actions, the valve should be returned properly assembled to **Spirax Sarco HITER** for general revision.

5.2.1 Inspect all actuator components, mainly the sealing area.

5.2.2 Replace all actuator components which are damaged after a detailed inspection.

In disassembly procedure description, our reference shall be figure 2, except when otherwise indicated.

5.3 Assembly

Assemble the actuator in reverse order described in previous 2.1 (DISASSEMBLY).
The following instructions shall help in proper assembly and smooth operation of the actuator.

5.3.1 Apply grease in the o-ring (7), guide bushing (8), piston o-ring (12) and if with handwheel in spindle.

5.3.2 The springs shall be perfectly positioned in piston (13).

5.3.3 Tighten the stud bolts (19) and nuts (22) alternately to able smooth compression of the springs.

5.3.4 For assembly and adjusting see section 4 - INSTALLATION .

TABLE 2 – PART LIST – DIRECT ACTING ACTUATOR (Figs. 2, 5 and 7)

Item	Description	Item	Description	Item	Description
1	YOKE	16	WASHER	31	LOCKING PIN
2	LOCKING BOLT	17	STEM BOLT	32	HANDWHEEL
3	CONNECTOR BOLT	18	TRAVEL LIMITER	33	SUBASSEMBLY OF CUBE
4	CONNECTOR	19	TENSION BOLT	●34	HANDWHEEL BODY O-RING
5	STEM	20	CYLINDER STUD-BOLT	35	HANDWHEEL BOLT
●7	STEM O-RING	21	INSTRUCTION PLATE	36	CYLINDER COVER
8	GUIDE BUSHING	22	NUT	42	TENSION BOLT CAP
●9	CYLINDER O-RING	23	TRAVEL PLATE	43	SPACER
10	CYLINDER	24	PLATE BOLT	52	MANUAL ACTUATOR REDUCER SET
●12	PISTON O-RING	27	BALL	68	VISOR
13	PISTON	●28	SPINDLE O-RING	70	O-RING
●14	SPRING	29	SPINDLE LOCKING	73	BOLT(ACTR REDUCER SET)
15	COVER	30	SPINDLE	74	O-RING

● Recommended spare parts.

TABLE 3 – PART LIST – DOUBLE ACTING ACTUATOR – (Fig. 4)

Item	Description	Item	Description	Item	Description
1	YOKE	• 9	CYLINDER O RING	18	TRAVEL STOP
2	LOCKING BOLT	10	CYLINDER	19	CYLINDER STUD BOLT
3	CONNECTOR BOLT	●12	PISTON O RING	22	NUT
4	CONNECTOR	13	PISTON	23	TRAVEL PLATE
5	STEM	15	COVER	24	PLATE BOLT
●7	STEM O RING	16	WASHER	36	CYLINDER COVER
8	GUIDE BUSHING	17	STEM SCREW	42	

● Recommended spare parts.

TABLE 4 – PART LIST – REVERSE ACTING ACTUATOR – (Figs. 3, 6 and 8)

Item	Description	Item	Description	Item	Description
1	YOKE	20	CYLINDER STUD BOLT	37	COTTER PIN
2	LOCKING BOLT	21	INSTRUCTION PLATE	38	HANDWHEEL BOLT
3	CONECTOR BOLT	22	NUT	39	HANDWHEEL BODY BOLT
4	CONECTOR	23	TRAVEL PLATE	40	LOCKING PIN
5	STEM	24	PLATE BOLT	41	VENT
●7	STEM O RING	26	HANDWHEEL STEM	42	TENSION BOLT CAP
8	GUIDE BUSHING	27	SPINDLE	43	SPACER
●9	CYLINDER O RING	28	SPINDLE LOCK	52	MANUAL ACTUATOR REDUCER SET
10	CYLINDER	29	HANDWHEEL	64	MANUAL ACTUATOR STEM
●12	PISTON O RING	30	KEY	65	NUT
13	PISTON	●31	RETAINING RING	66	COTTER PIN
●14	SPRING	32	SUPPORT RING	73	HEX BOLT
15	COVER	●33	BEARING	74	ELASTIC PIN
16	WASHER	34	BEARING WASHER	75	SPACER
18	TRAVEL LIMITER	35	STUD NUT		
19	TENSION BOLT	●36	CYLINDER COVER		

● Recommended spare parts.

Notes

Spirax Sarco by Hiter
Headquarters and Factory

Av. Jerome Case, 2600 - Éden
Sorocaba - SP, 18087-220
Fone +55 (15) 3225-0330
vendas@br.hiter.com
www.hiter.com/en