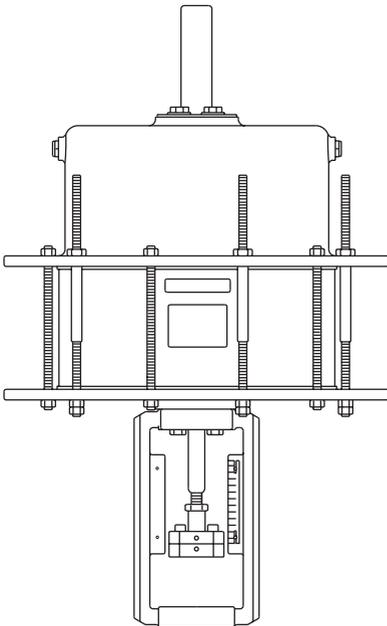
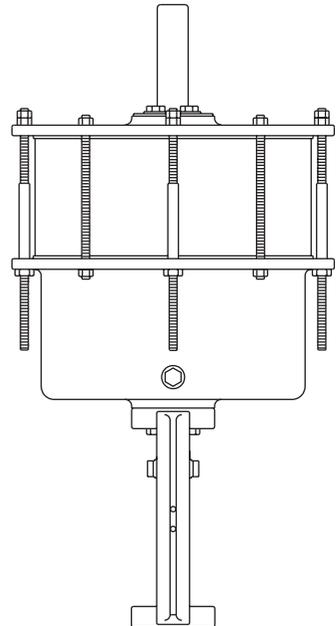


TN2000 Series
Pneumatic Piston Actuators
for DN125 to DN300 Spira-trol™ Series Control Valves
Installation and Maintenance Instructions

1. Safety information
2. General product information
3. Installation
4. Maintenance
5. Spare parts

**TN238_SE and TN249_SE****TN238_SR and TN249_SR**

1. Safety information

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel (see Section 1.11) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use / application. Please note that these products are out of the scope of the European Pressure Equipment Directive 97/23/EC.

- i) This product has been specifically designed for use on compressed air, which is in Group 2 of the above mentioned Pressure Equipment Directive. The products' use on other fluids may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
- ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- iii) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.

1.2 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.

1.3 Lighting

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

1.4 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.

1.5 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 and solvents.

1.6 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.

1.7 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 labelling of closed valves. Do not assume that the system has depressurised even when the pressure gauge indicates zero.

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns.

1.9 Tools and consumables

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

1.10 Protective clothing

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

1.11 Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions.

Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

1.12 Handling

Manual handling of large and/or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

1.13 Residual hazards

In some cases the product is provided with pre-compressed springs. Any operation to open the spring housing is to be carried out strictly following the correct procedure as detailed in this document.

1.14 Freezing

Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

1.15 Disposal

This product should not be dismantled without first releasing the compression on the spring (if fitted). This product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken, however the following list of exception will require individual disposal in line with local health and safety regulations:

- PTFE
- Polythene
- PVC
- Composite tube
- Nitrile NBR 70 shore 'O' rings and 'X' rings.

1.16 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

2. General product information

2.1 Description

The TN2000 series pneumatic piston actuators are designed for use with DN125 to DN300 Spira-trol™ control valves. There are three versions available: Single-acting, Double-acting (spring assist) and Double-acting (no springs) for matching the requirements of valves at various differential pressures and in a variety of applications.

Available types

SE = Single-acting, springs extend

SR = Single-acting, springs retract

DE = Double-acting, springs assisted (extend)

DR = Double-acting, springs assisted (retract)

DA = Double-acting

NDA = Double-acting, no springs

2.2 Technical data

Temperature range	5 °F to 230 °F -15 °C to +110 °C		
Maximum operating inlet pressure	SE and SR	116 psi g	8 bar g
	DA	116 psi g	8 bar g
	DE and DR	87 psi g	6 bar g
Air supply connection	½" screwed NPT		
Actuator travel	TN2300	100 mm	
	TN2400	150 mm	

2.3 Dimensions/weights (approximate) in mm and kg

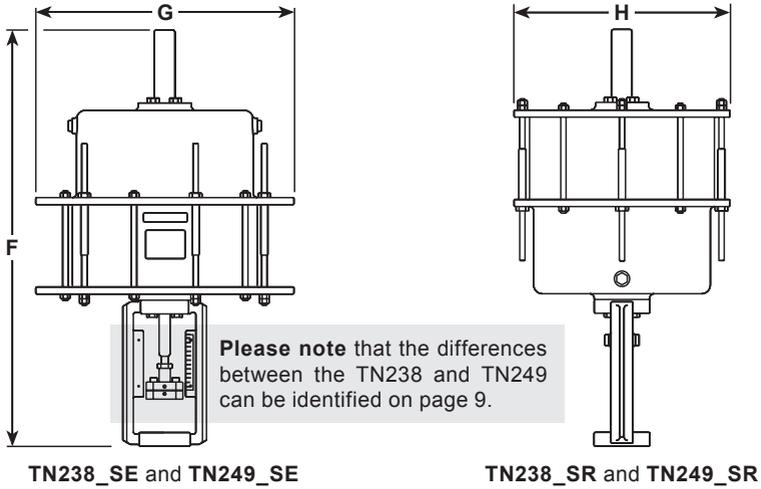


Fig. 1

Actuator range	F	G	H	Weight
TN238___E and variants	932	587	490	210 kg
TN238___R and variants	932	587	490	210 kg
TN238N DA	932	587	490	190 kg
TN249___E and variants	1282	750	660	390 kg
TN249___R and variants	1282	750	660	390 kg
TN249N DA	1282	750	660	273 kg

2.4 Materials (parts 1-18)

No.	Part	TN2300	TN2400	Material
1	Lower cylinder end cap			SG iron EN 1563 EN-GJS-400-15 : 5.3106
2	Piston			SG iron EN 1563 EN-GJS-400-15 : 5.3106
3	Spring			Chrome vanadium steel
4	Upper cylinder end cap			SG iron EN 1563 EN-GJS-400-15 : 5.3106
5	Cylinder			Composite tube
6	'O' ring			Nitrile NBR 70 SH
7	Threaded bar	M12	M16	Carbon steel (plated)
8	Nut	M12	M16	Carbon steel (plated)
9	Screw slotted pan head	M2.5 x 12	M2.5 x 12	Carbon steel (plated)
10	Yoke			SG iron
11	Screw	M12	M16	Carbon steel (plated)
12	Screw		M5	Carbon steel (plated)
13	Indicator plate			Carbon steel (plated)
14	Nut	M20	M24	Carbon steel (plated)
15	Bearing and seal insert			Carbon steel (plated)
16	Rod seal wiper	Ø25	Ø25	Polyurethane
17	DU plain bearing	Ø25	Ø25	PTFE / steel composite
18	Spindle			Stainless steel BS 970 431 S29

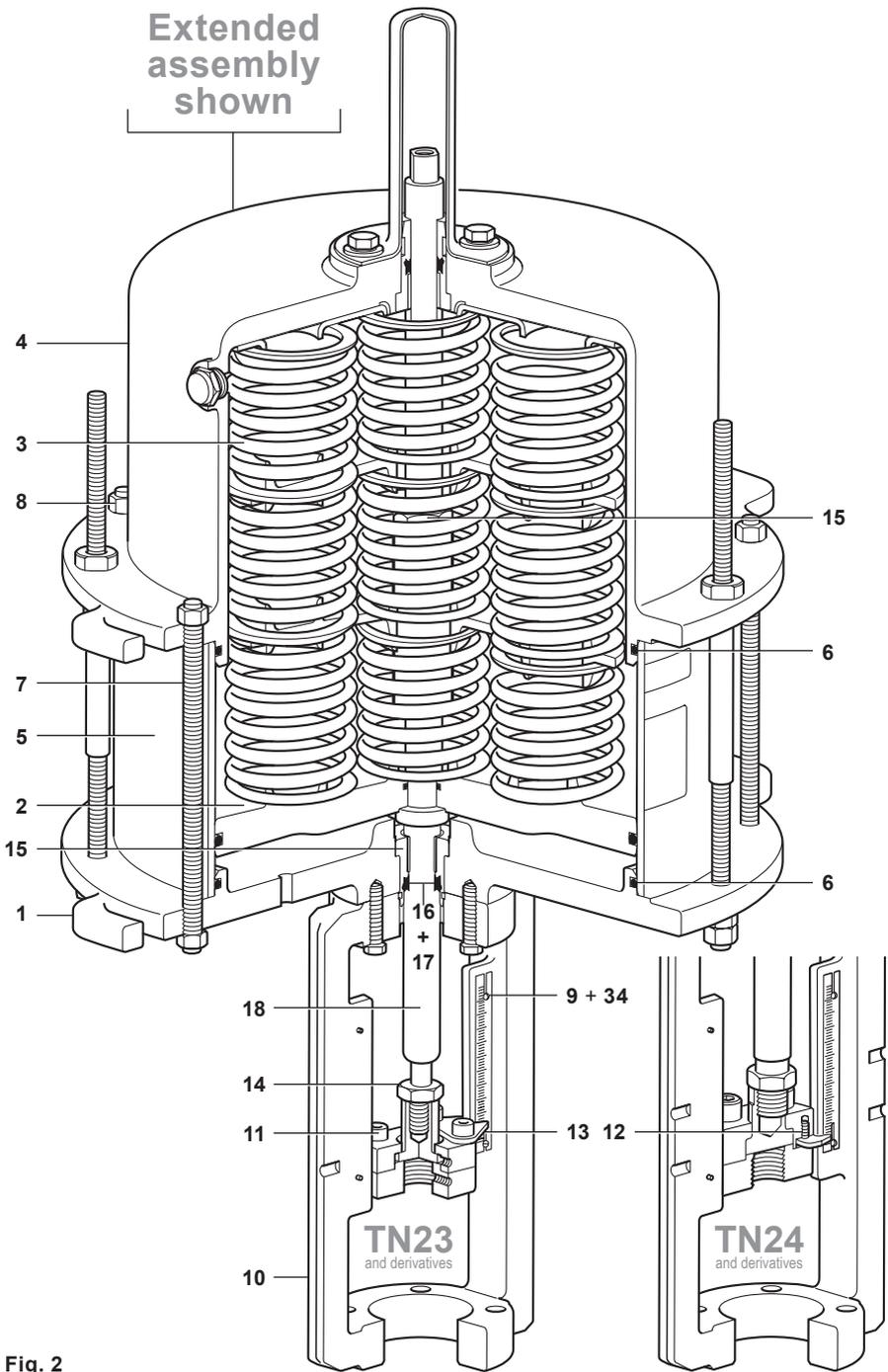


Fig. 2

2.4 Materials (parts 19-36)

No.	Part	TN2300	TN2400	Material
19	Connector			Stainless steel BS 970 431 S29
20	Scale			Stainless steel BS 1449 304 S16
21	Collar			Carbon steel (plated)
22	Threaded long bar	M12	M16	Carbon steel (plated)
23	'O' ring	27 x 3	27 x 3	Nitrile NBR 70 SH
24	Vent plug	½" NPT	½" NPT	Sintered bronze
25	Long nut	M12	M16	Carbon steel (plated)
26	'O' ring			Nitrile NBR 70 SH
27	Spring guide plate			Carbon steel (plated)
28	Label blank (Compressed spring warning)			Adhesive paper
29	Adaptor			Carbon steel (plated)
30	Label blank			Adhesive paper
31	Sleeve			Carbon steel (plated)
32	Cover spindle			Carbon steel (painted)
33	Formed hex. screw	M12 x 45	M16 x 50	Carbon steel (plated)
34	Nut	M2.5	M2.5	Carbon steel (plated)
35	Formed hex. screw	M12 x 16	M16 x 20	Carbon steel (plated)
36	Washer	M12	M16	Carbon steel (plated)

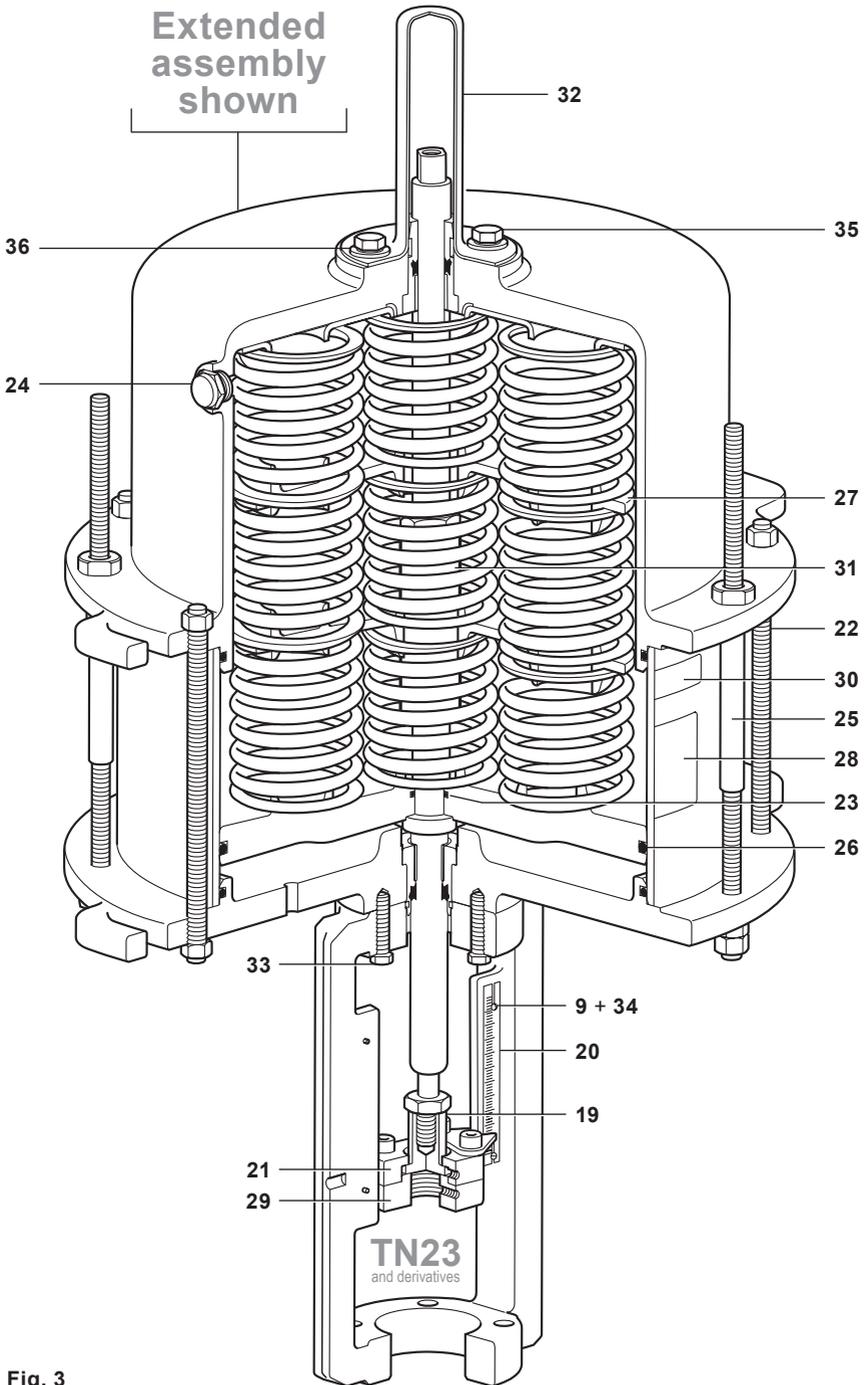
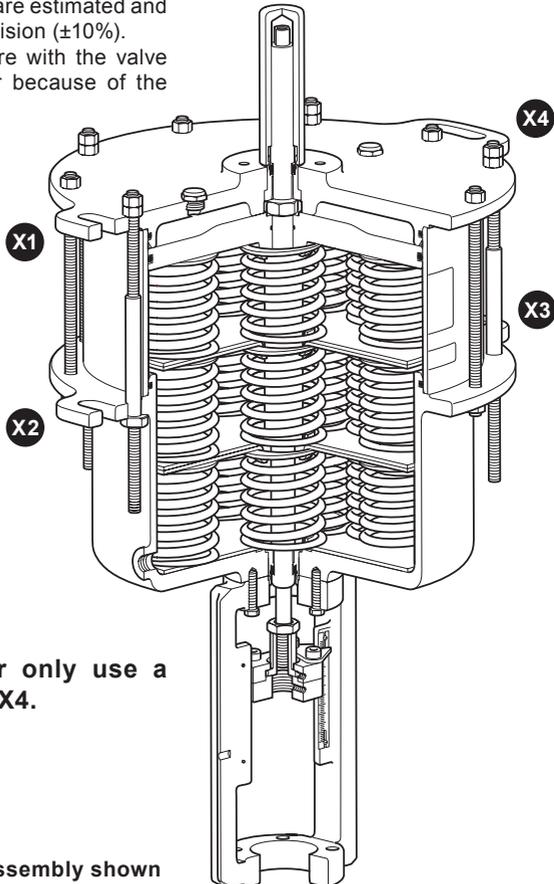


Fig. 3

2.5 Actuator data

Actuator range	Travel	Minimum thrust	Acting pressure						
			0 mm	30 mm	50 mm	70 mm	80 mm	100 mm	150 mm
TN2370 and variants	70 mm	14 KN	1.11 bar	1.36 bar	1.45 bar	1.54 bar			
TN2373 and variants		32 KN	2.49 bar	3.05 bar	3.25 bar	3.46 bar			
TN2380 and variants	100 mm	13 KN	1.00 bar	1.22 bar	1.32 bar	1.41 bar	1.45 bar	1.54 bar	
TN2383 and variants		30 KN	2.22 bar	2.74 bar	2.97 bar	3.17 bar	3.26 bar	3.46 bar	
TN2490 and variants	150 mm	27 KN	1.11 bar	1.37 bar	1.46 bar	1.58 bar	1.63 bar	1.73 bar	1.98 bar
TN2493 and variants		60 KN	2.45 bar	3.02 bar	3.30 bar	3.48 bar	3.58 bar	3.85 bar	4.35 bar

Caution: Those pressure ranges are estimated and directly related to the springs precision ($\pm 10\%$). Furthermore, the working pressure with the valve coupled can be a little bit upper because of the friction inside of it.



Note:
When lifting the actuator only use a lifting sling through X1 to X4.

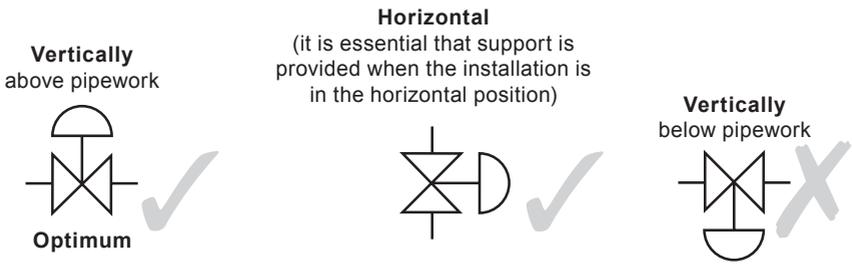
Fig. 4 Retract assembly shown

3. Installation

Caution: Sling eyes (X, see Figure 4) are **not to be used** for lifting an actuated valve assembly. Sling eyes can only be used to stabilise the assembly. Suitable support of the valve and actuator will be required.

See separate Installation and Maintenance Instructions for the control valve. For details of differential pressures associated with the Spira-trol™ KE and KEA control valves refer to the relevant actuator Technical Information (TI) sheet.

The actuators should be installed in such a position as to allow full access to both the actuator and the valve for maintenance purposes. The preferred mounting position is with the actuator and valve spindle in the vertical position or horizontal to the pipework (it is essential that support is provided when the installation is in the horizontal position), see Figure 5).



In an horizontal position, we recommend to use a support fixed to the threaded bar with an additional nut.

Above the actuator or below (for example, fixed to the floor).

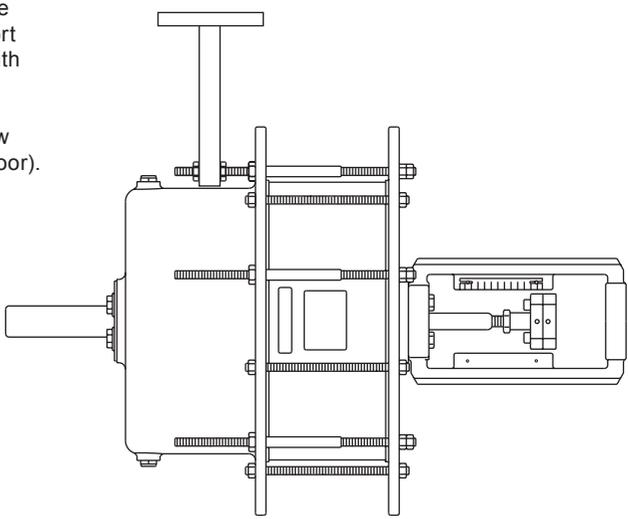


Fig. 5

3.1 Fitting the actuator (extend) to the valve

- Remove the screw (11).
- Ensure the indicator scale is facing the same way as the valve name-plate.
- Apply the control signal pressure to the bottom of the actuator to bring the spindle (18) to the mid-travel position.
- Manually push the valve spindle down to ensure that the plug is on the valve seat.
- Locate the actuator yoke onto the valve bonnet and fit the screws (A).
- Screw the lock-nut of the valve's spindle (B) down to the lowest part of the valve spindle.
- Screw the adaptor (29) onto the valve spindle.
- Loosen the lock-nut and screw the connector (19) upwards 3 turns, then remove the air supply.
- Apply the minimum signal pressure + 0.1 bar (1.45 psi) maximum to the bottom of the actuator, and then adjust the connector (19) so that it touches the bottom adaptor (29), then tighten the lock-nut (14).
- Release the control air signal.
- Fit the locking screws (11) loosely.
- Operate the actuator and valve over its full travel four times to ensure alignment.
- Tighten the mounting screws to 50 N m (36.9 lbf ft).

3.2 Fitting the actuator (retract) to the valve

- Remove the screw (11).
- Ensure the indicator scale is facing the same way as the valve name-plate
- Apply the control signal pressure to the top of the actuator to bring the spindle (18) to the mid-travel position.
- Manually push the valve spindle (B) down to ensure that the plug is on the valve seat.
- Locate the actuator yoke onto the valve bonnet and fit the screws (A).
- Screw the lock-nut of the valve's spindle down to the lowest part of the valve spindle.
- Screw the bottom adaptor (29) onto the valve spindle.
- Loosen the lock-nut and screw the connector (19) upwards 3 turns, then remove the air supply.
- Adjust the connector (19) so that it touches the bottom adaptor (29). Apply the minimum signal pressure + 0.1 bar (1.45 psi) maximum to the top of the actuator then unscrew the connector (19) downwards 3 turns, and finally tighten the lock-nut (14).
- Release the control air signal.
- Fit the locking screws (11) loosely.
- Operate the actuator and valve over its full travel four times to ensure alignment.
- Tighten the mounting screws to 50 N m (36.9 lbf ft).

Please note that the air supply to the actuator must be 'dry and free from oil'. Contact Spirax Sarco for more details with relation to composite tube/media compatibility. For high temperature conditions, insulate the control valve and pipework only to protect the actuator.

TN23
and derivatives

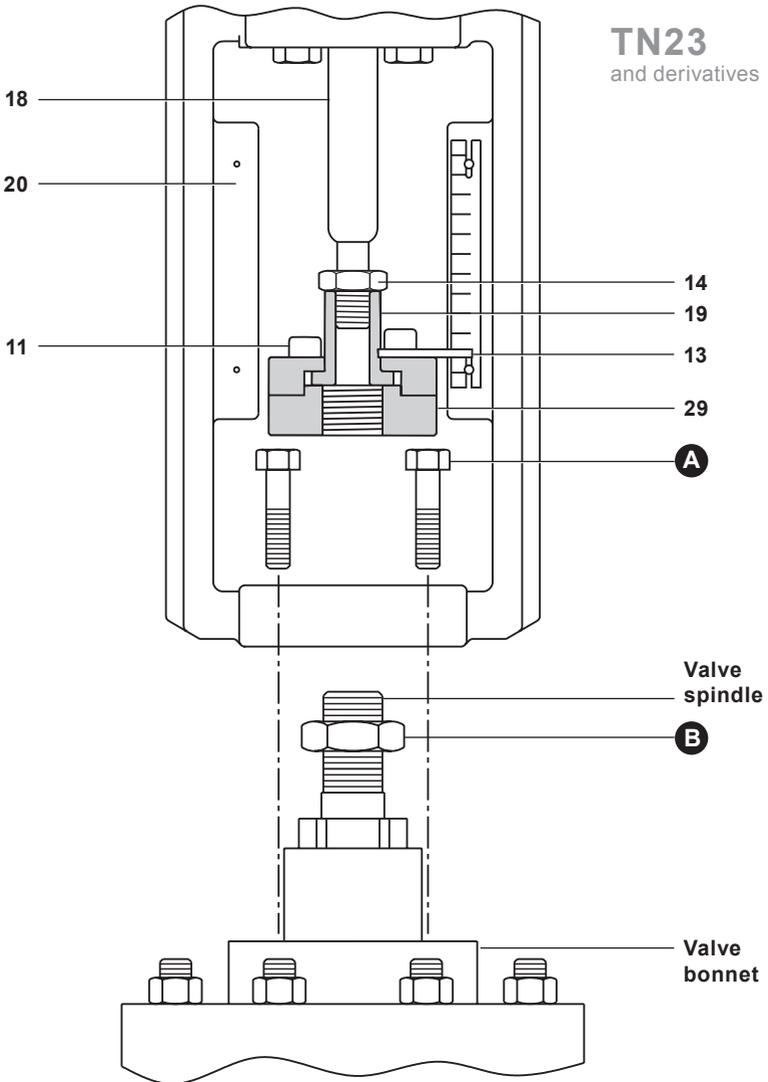


Fig. 6

Note: The actuator cannot be fitted onto an older style control valve.

Caution: If the complete assembly is installed horizontally then the air supply **must** be connected at the lowest point of the actuator.

Warning: The actuator cylinder must only be pressurized on the opposite side of the piston holding the spring. The housing vent cap must be left unrestricted. If the assembly is to be mounted horizontally then it is essential to provide suitable support for the actuator.

3.3 Fitting the actuator NDA (no springs) to the valve

- Remove the screw and nut (11).
- Ensure the indicator scale is facing the same way as the valve name-plate.
- Apply the control signal pressure to the bottom of the actuator to bring the spindle (18) to the mid-travel position.
- Manually push the valve spindle down to ensure that the plug is on the valve seat.
- Locate the actuator yoke onto the valve bonnet and fit the lock-nut (A).
- Screw the lock-nut of the valve's spindle (B) down to the lowest part of the valve spindle.
- Screw the bottom adaptor (29) onto the valve spindle.
- Then apply minimum signal pressure at the top of the actuator (on upper cover) to close the valve.
- Apply signal pressure at the yoke to retract the stem only 2 mm and adjust the connector (19) so that it touches the bottom adaptor (29), then tighten the lock-nut (14).
- Fit the locking screws (11) loosely.
- Operate the actuator and valve over its full travel four times to ensure alignment.
- Tighten the mounting nut to 50 N m (36.9 lbf ft).

TN24
and derivatives

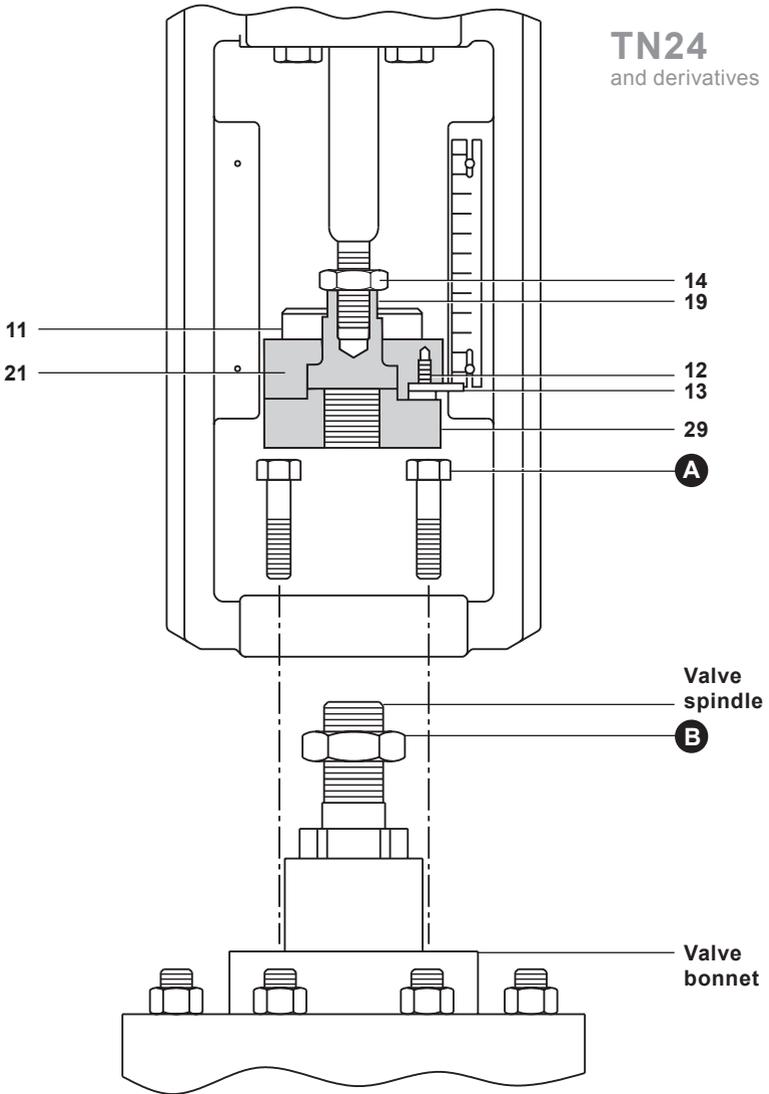


Fig. 7

4. Maintenance

Note: Before actioning any maintenance programme observe the 'Safety information' in Section 1.

Warnings:

- 1. Actuator support will be required due to weight.**
- 2. The actuator contains a pre-compressed spring.**
- 3. Special assembly tool required.**
- 4. Use POLYLUB GLY 801 (lubricating grease) only.**

The TN2000 series of pneumatic actuators are maintenance free. To ensure satisfactory operation it is strongly recommended that the control signal air is filtered and supplied dry and free of oil. Should it be necessary to replace spare parts the following procedure should be used.

4.1 Removing the actuator from the valve:

- Remove the screws (11).
- Remove the screws (A).
- Remove the air supply.
- Remove the actuator from the valve.

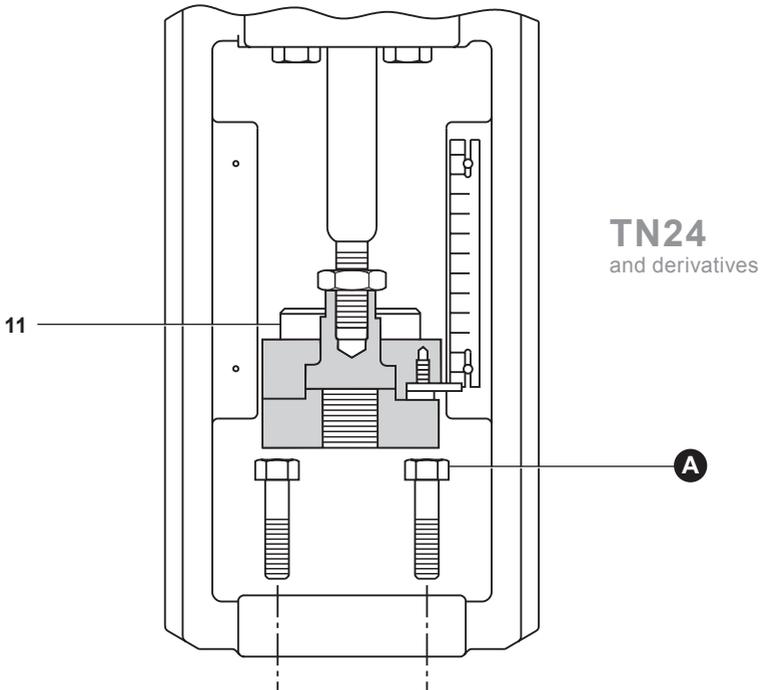
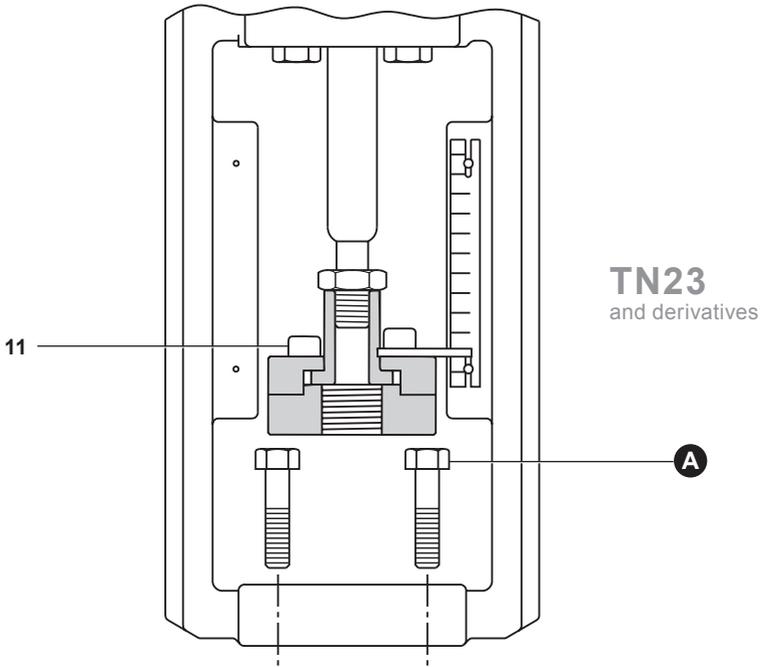


Fig. 8

4.2 Replacing the 'O' and 'X' rings (SE and DE actuators)

Note: Remove the actuator from the valve as described in Section 4.1.

Note: Short threaded bars which must be removed last to ensure that the spring tension is removed before taking the actuator apart.

- Loosen and remove the 5 threaded bars (7).
- Loosen then remove the remaining long securing nuts (25), see the 'Note' above.
- Remove the upper cylinder end cap (4).
- Remove the upper spring guide plate.
- Remove the springs (3) and the spring guide plate (27) (not applicable for DA).
- Remove the cylinder (5).
- If the bearing seals are to be replaced remove the spindle (18) with piston (2) to fit the lower seal (16).
- Replace the 'O' and 'X' rings (6, 23 and 26).

To rebuild the actuator follow the next procedure:

Caution: POLYLUB GLY 801 must be used to ensure smooth operation of the piston.

- Replace the spindle (18) if previously removed.
- Apply grease to the internal of the cylinder (5) and the bearings (17) (approximately 50 mm to be in contact with piston).
- Lower the cylinder (5) onto the lower cylinder end cap (1).
- Replace the springs (3) and the spring guide plates (27).
- Replace the upper cylinder end cap (4).
- Refit the long threaded bars (22) and tighten the securing nuts (25) evenly to pull the cylinder (5) onto the lower cylinder end cap (1). Then tighten to 60 Nm (44.2 lbf ft).
- Refit all remaining securing screws and nuts (7 and 8) and tighten to 30 Nm (44.2 lbf ft).
- Re-attach the actuator to the valve as described in Section 3.1.

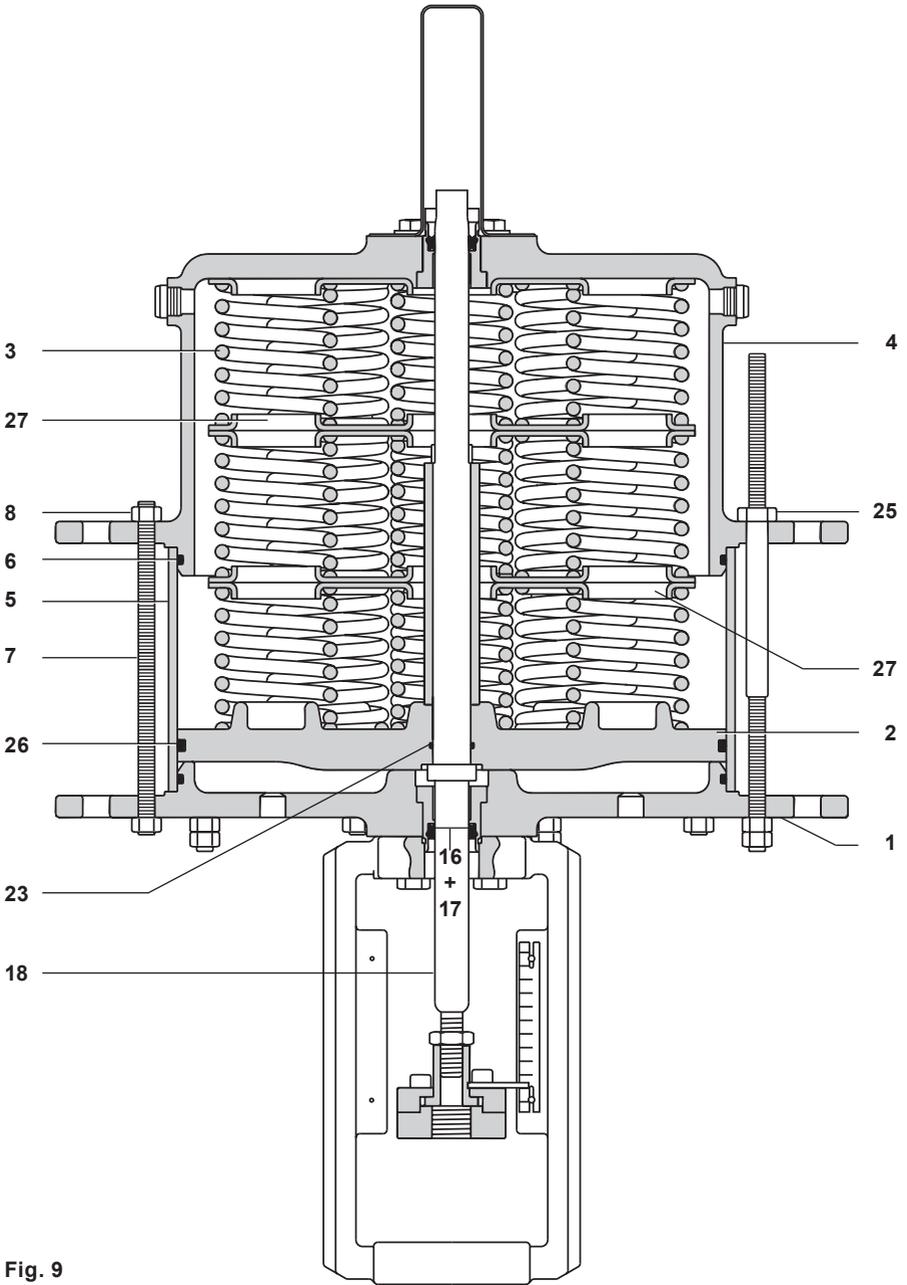


Fig. 9

4.3 Replacing the 'O' and 'X' rings (SR and DR actuators)

Note: Remove the actuator from the valve as described in Section 4.1

Note: There are 5 long securing nuts that must be removed last to ensure that the spring tension is removed.

- Loosen and remove the connector (19), see Figure 9.
- Loosen and remove the short threaded bars (7).
- Evenly loosen and remove the remaining long securing nuts (22), see the 'Note' above.
- Remove the lower cylinder cap (1).
- Remove the piston assembly (A part numbers: 2, 14, 18, 23, 26 and 31).
- Remove the cylinder (5).
- Replace the 'O' and 'X' rings (6, 16, 23 and 26).

To rebuild the actuator follow the next procedure:

Caution: POLYLUB GLY 801 must be used to ensure smooth operation of the piston.

- Apply grease to the internal of the cylinder (5) and the bearings (17) (approximately 50 mm to be in contact with the piston).
- Lower the cylinder (5) onto the lower cylinder (1).
- Lower the piston assembly into the actuator (A part numbers: 2, 14, 18, 23, 26 and 31), taking care not to damage the bearing (17) and seal (16).
- Replace the lower cylinder (1).
- Refit the long threaded bars (22) evenly to pull the piston assembly into the cylinders (4 and 5) by compressing the end cap (1). Then tighten to 60 Nm (44.2 lbf ft).
- Refit all remaining securing screws and nuts (7, 8 and 22) and tighten to 60 Nm (44.2 lbf ft).
- Re-attach the actuator to the valve as described in Section 3.2.

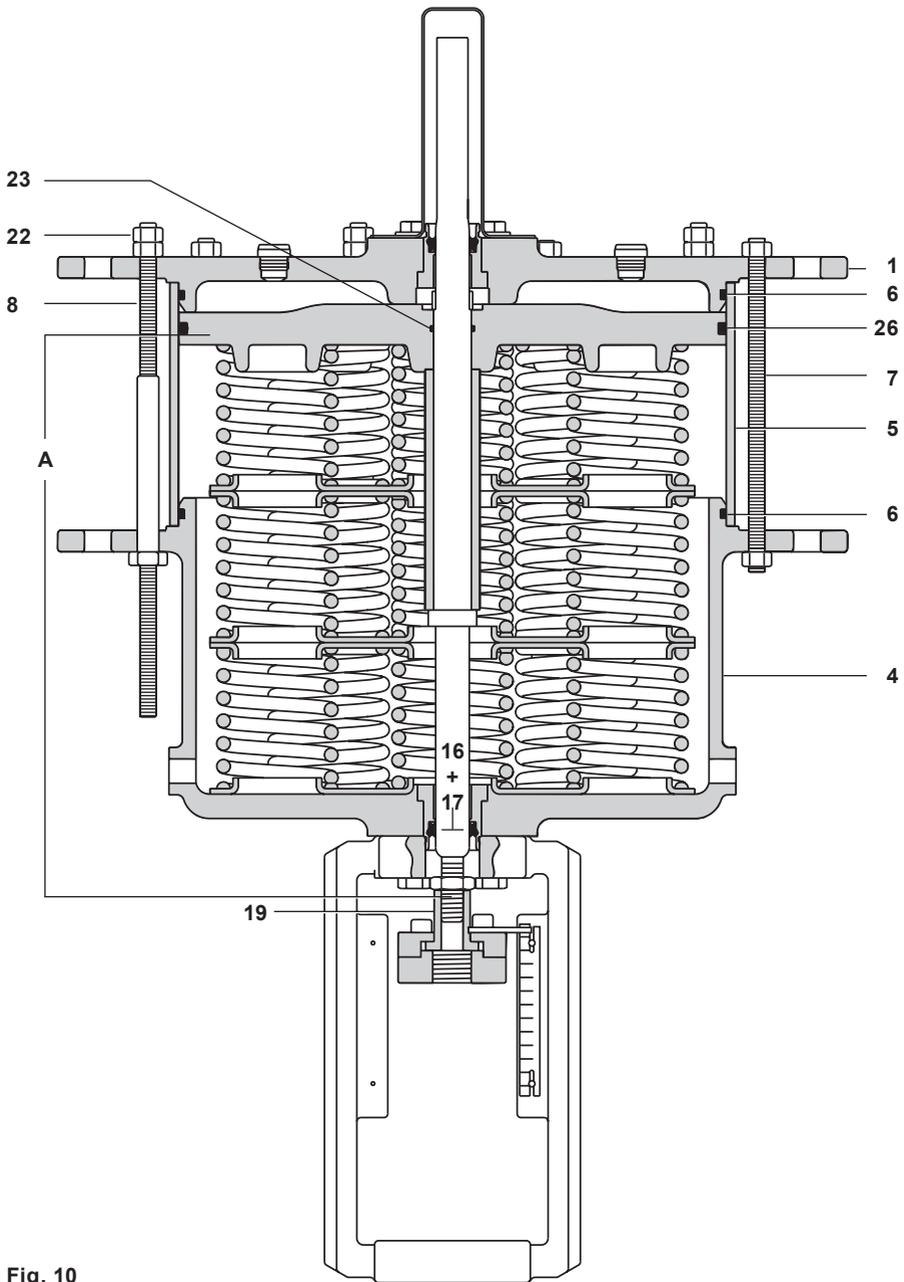


Fig. 10

5. Spare parts

The spare parts available are common across the range of actuators detailed in this document. No other parts are available as spares.

Available spares

'O' ring kit	6, 16, 23 and 26	Please note that the available spares are the same for the following units: - TN238_E, TN238_R and TN238NDA - TN249_E, TN249_R and TN249NDA
Travel indicator kit	9, 20 and 34	
Spring kit	3	

How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the actuator model.

Example: 1 - 'O' ring kit for a Spirax Sarco TN2383SE pneumatic piston actuator.

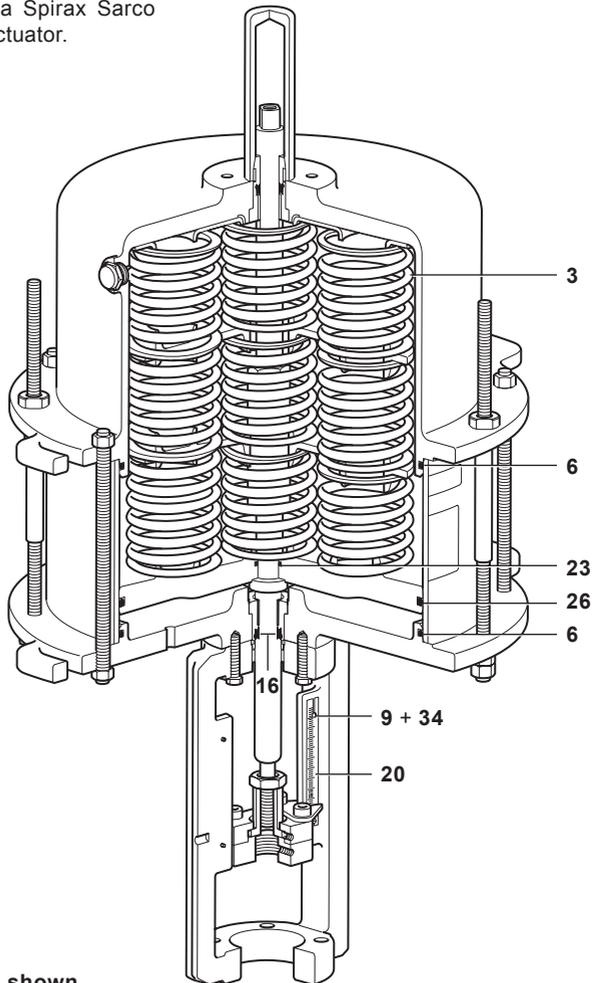


Fig. 11 TN238_E shown