Installation, Operation, Maintenance Instructions

Pneumatic und Electropneumatic Actuators

Series 4, Types 37, 38, 39, 3D and 47, 48, 49, 4D

GENERAL INFORMATION ON SAFETY

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Kämmer actuators. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance on the actuator. Separate installation, operation, maintenance instructions cover additional features (such as special trim, handwheels, extension bonnets, etc.).

To avoid possible injury to personnel or damage to actuator parts, WARNING and CAUTION notes must be strictly adhered to. Modifying this product, substituting nonfactory parts, or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.

WARNING: Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.

Work on these actuators may only be carried out by trained personnel using the correct tools.

Unpacking

While unpacking the actuator, check the packing list against the materials received. Lists describing the actuator and accessories are included in each shipping container.

When lifting the actuator from the shipping container, attach the lifting straps to avoid damage to the tubing and mounted accessories. On larger actuators, lift the actuator using straps through the yoke legs or if provided, lifting brackets bolted to bonnet studs.

WARNING: When lifting an actuator with lifting straps through the yoke legs, be aware that the center of gravity may be above the lifting point. Therefore, support must be given to prevent the actuator from rotating. Failure to do so can cause serious injury to personnel or damage to the actuator and nearby equipment.

In the event of shipping damage, contact your shipper immediately. Should any problem arise, call your representative.

Installation

Be sure to provide proper overhead clearance for the actuator to allow for disassembly of the plug from the valve body.

Connect air supply and instrument signal (air or mA) lines. Throttling control valves are equipped with a valve positioner. Two connections are marked: One for the air supply and the other for the instrument signal. Both the actuator and positioner are suitable for 4,2 bar (60 psi) air supply. An air regulator is not compulsory unless the supply pressure exceeds 4,2 bar (60 psi). An air filter should be installed before the positioner unless supply air is unusually clean and dry. All connections must be free of leaks.

CAUTION: On actuators equipped with air filters, the air filter must point down: otherwise, the air filter will not perform properly.

NOTE: *In some rare cases, the air supply must be limited to less than 4,2 bar. In these cases refer to the nameplate.*

ACTUATOR MAINTENANCE

At least once every six months, check for proper operation by following the preventative maintenance steps outlined below. These steps can be performed while the valve is in-line and, in some cases, without interrupting service.

Examine the actuator for damage caused by corrosive fumes or process drippings.

Clean actuator and repaint areas of severe oxidation.

If possible, stroke the actuator and check for smooth, full-stroke operation. Unsteady stem movement could indicate an internal problem.

WARNING: Keep hands, hair, clothing, etc. away from all moving parts when operating the actuator. Failure to do so can cause serious injury.

Ensure all accessories, brackets and bolting are securely fastened.

If possible, remove air supply and observe actuator for correct fail-safe action.

Check the actuator for air leaks.

If an air filter is supplied, check and replace cartridge if necessary.

Detailed spare parts lists are available upon request.

1 GENERAL ACTUATOR INFORMATION

Kämmer actuators can be supplied without a positioner or with integral P/P or I/P positioners. Positioners of other manufactures can be side-mounted.

1.1 Method of operation (actuators with integral Kämmer positioner)

1.1.1 P/P Actuator

The actuator with integrated pneumatic positioner works on the force balance principal, which ensures that the position of the actuator stem is proportional to the value of the input signal (see figs. 1 and 2).

An increased signal to the double diaphragm assembly creates an unbalanced condition. The pilot valve then moves to cover the vent, increasing the positioner output pressure to the actuator diaphragm until the forces of the positioner spring and the double diaphragm are equal. The positioner output is then stabilized at an amount necessary to maintain the desired valve position.

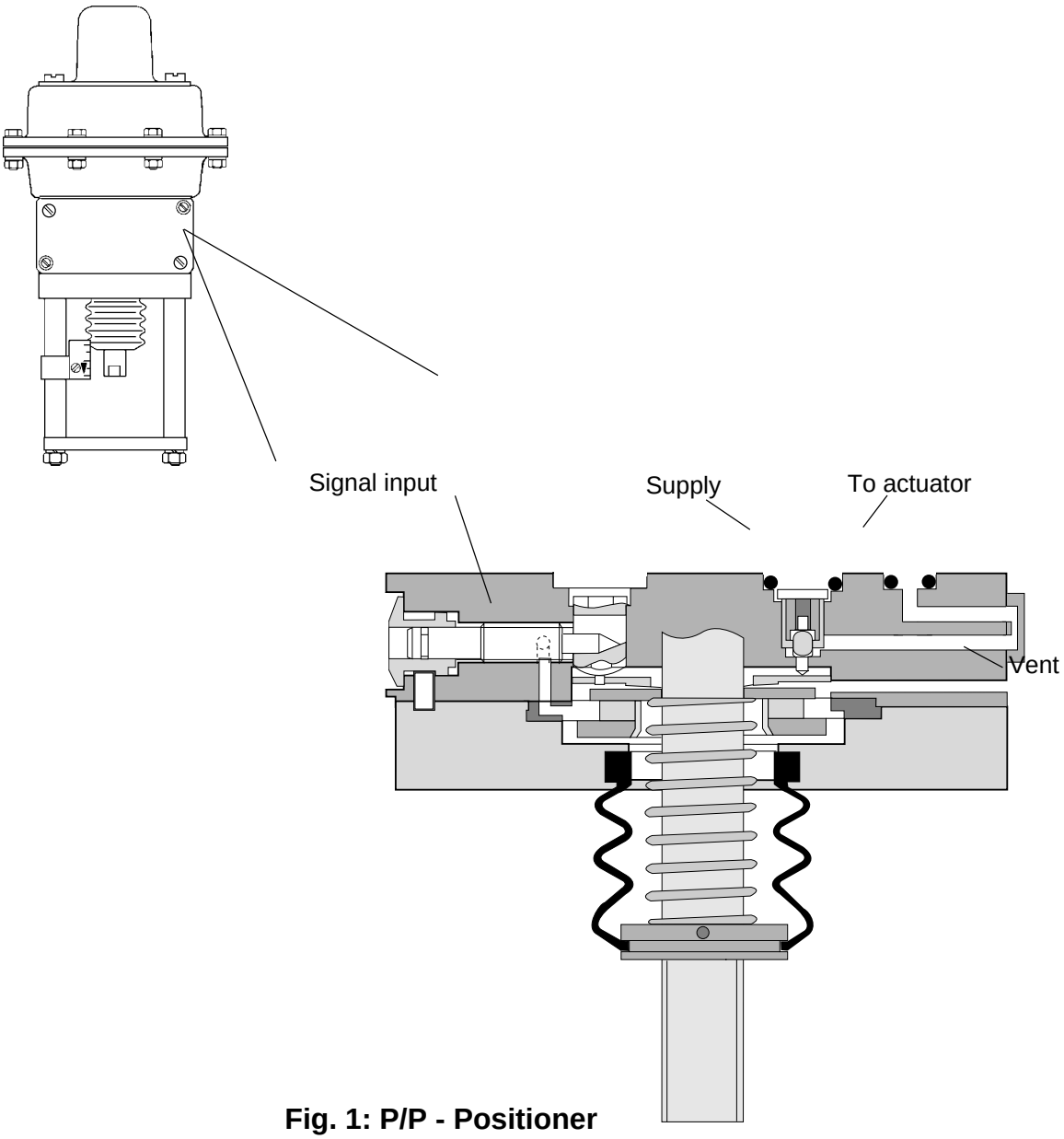


Fig. 1: P/P - Positioner

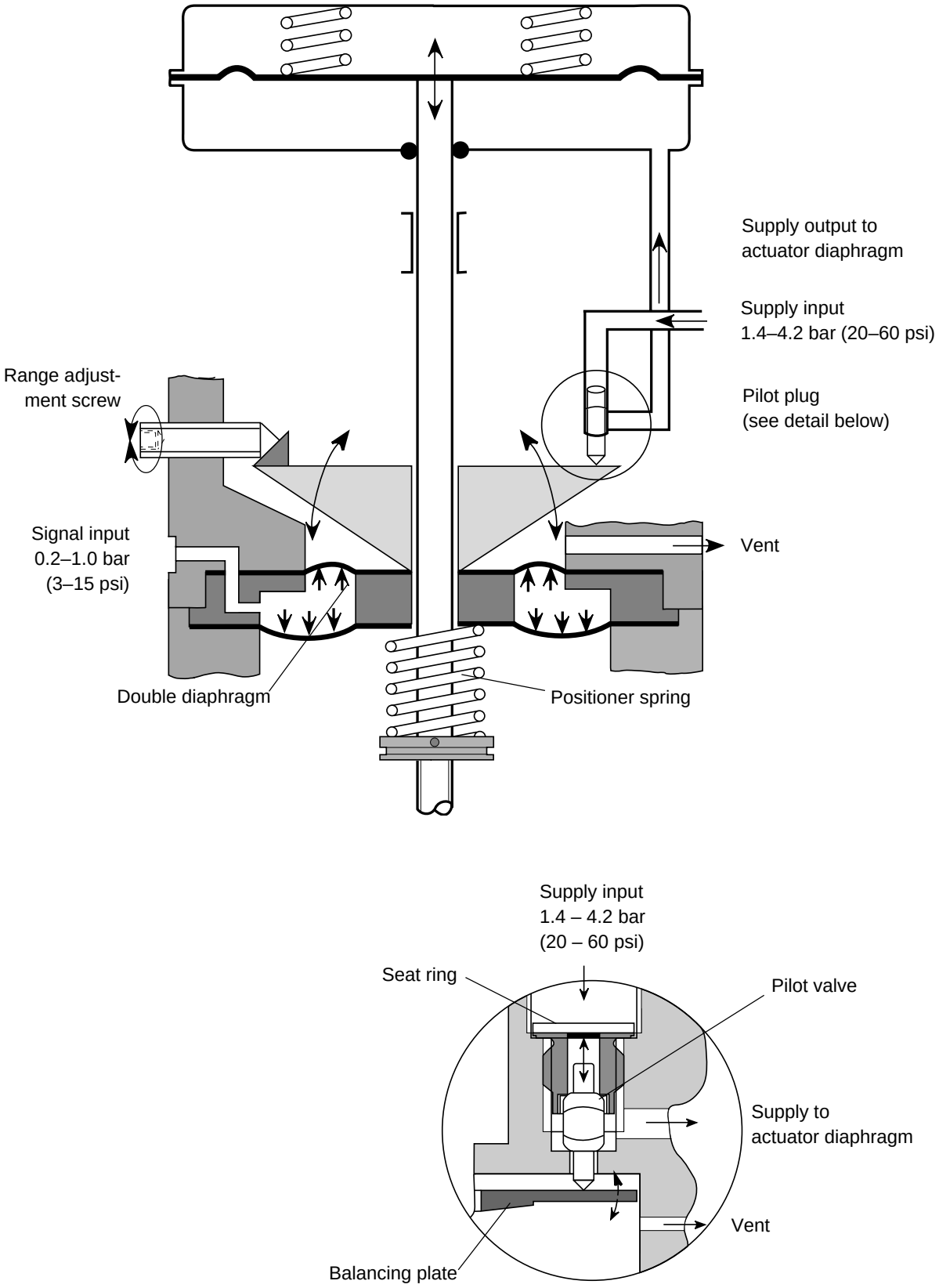


Fig. 2: P/P - Positioner

1.1.2 I/P Actuator

The I/P transducer, which is an integral part of the actuator, converts the standard electric signal (0/4 – 20 mA) into a standard pneumatic signal (0.2 – 1.0 bar) by means of a system of light weight moving parts. This form of signal conversion is extremely insensitive to shocks. The pneumatic signal is supplied to the integrated pneumatic positioner.

The pneumatic positioner works on the force balance principal, which ensures that the position of the actuator diaphragm is always directly proportional to the value of the instrument input signal pressure (see figs. 3 and 4).
An increased signal to the double diaphragm assembly creates an unbalanced condition. The pilot valve then moves to cover the vent, increasing the positioner output pressure to the actuator diaphragm until the forces of the positioner spring and the double diaphragm are equal. The positioner output is then stabilized at an amount necessary to maintain the desired valve position.

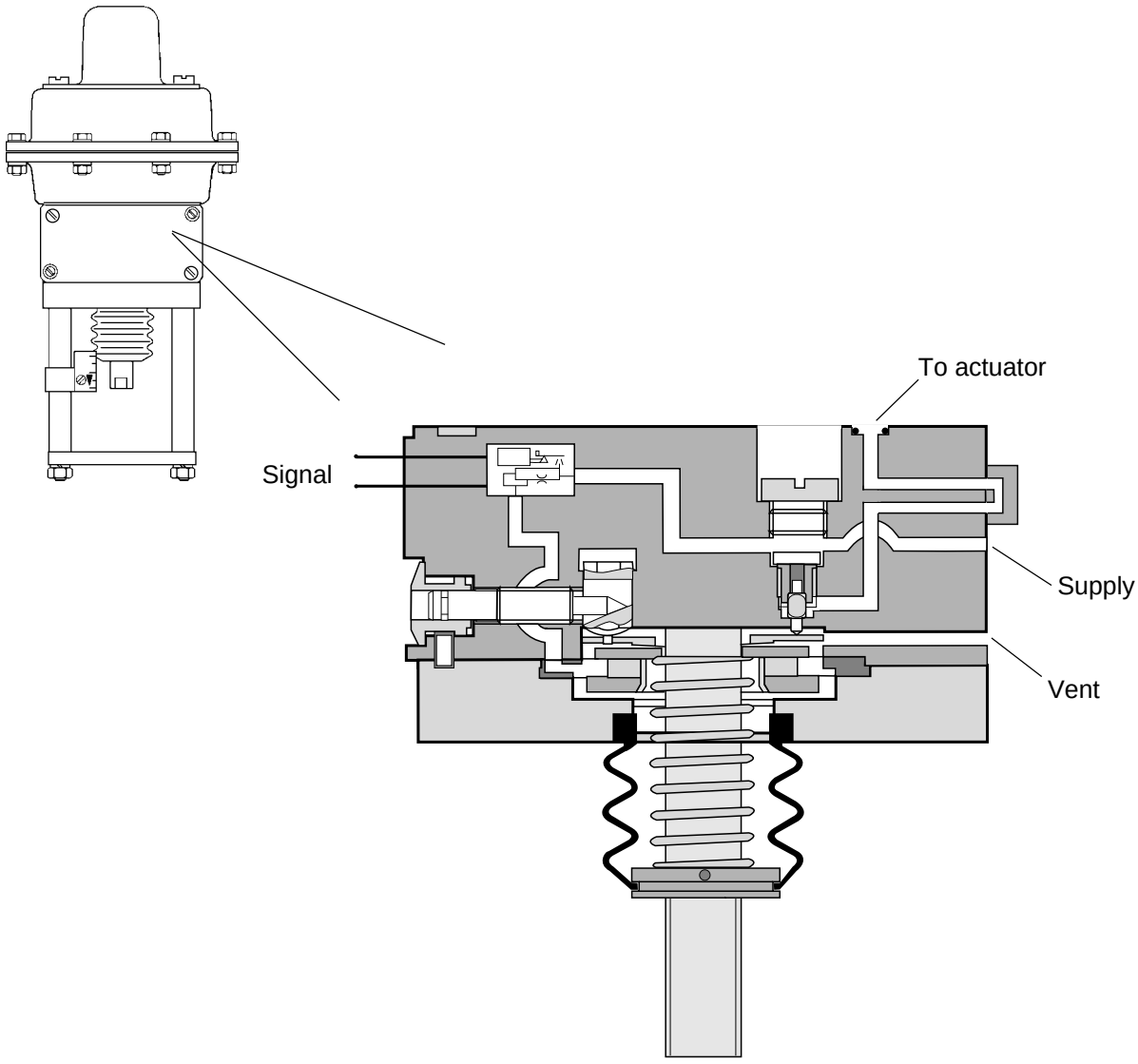


Fig 3: I/P Positioner

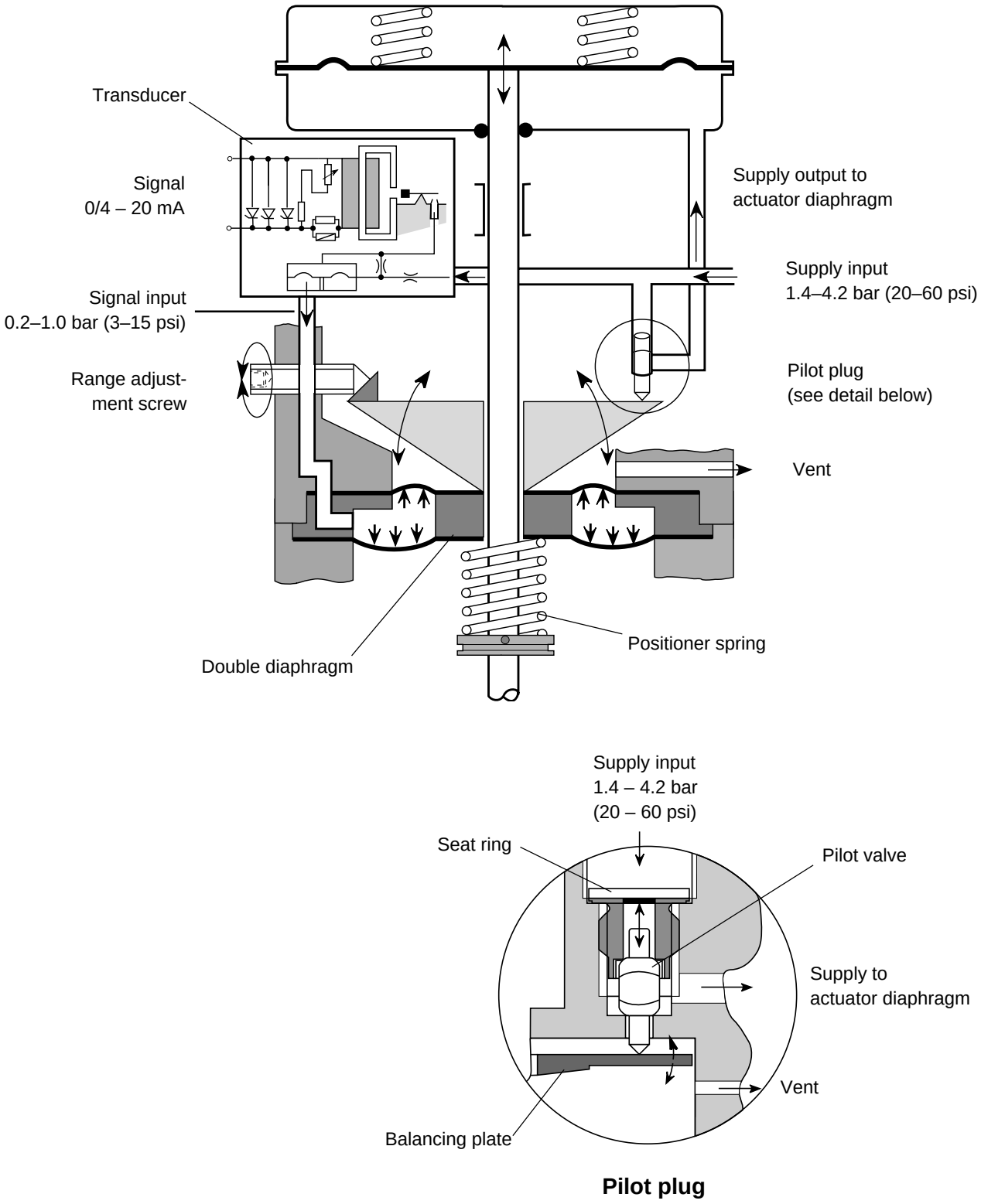
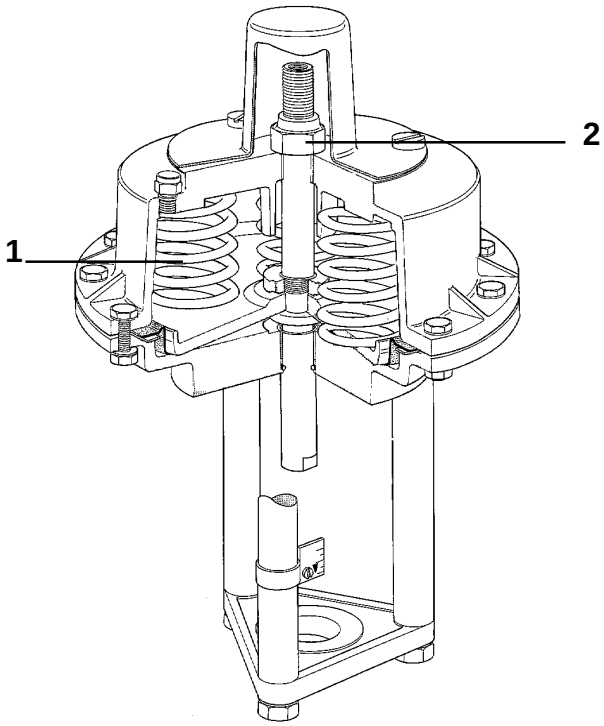
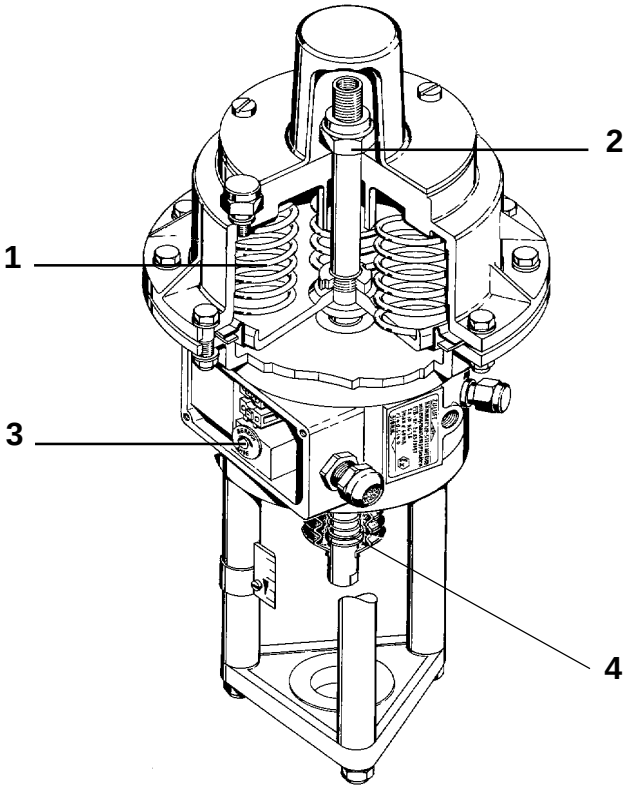


Fig. 4: I/P Positioner



Series 47 / 48 / 49
(without positioner)



Series 37 / 38 / 39
(with positioner)

Fig. 5

1.2 Actuator Springs - (fig. 5 pos. 1)

Different actuator spring sets are available depending on the actuator thrust requirements and the fail position of the actuator. The appropriate spring set can be chosen from the spare parts list.

1.3 Zero Adjustment Locknut - (fig. 5 pos. 2)

The zero adjustment locknut is used as a mechanical stop so that the actuator just begins to travel when the desired signal is applied to the positioner.

1.4 Range Adjustment - (fig. 5 pos.3)

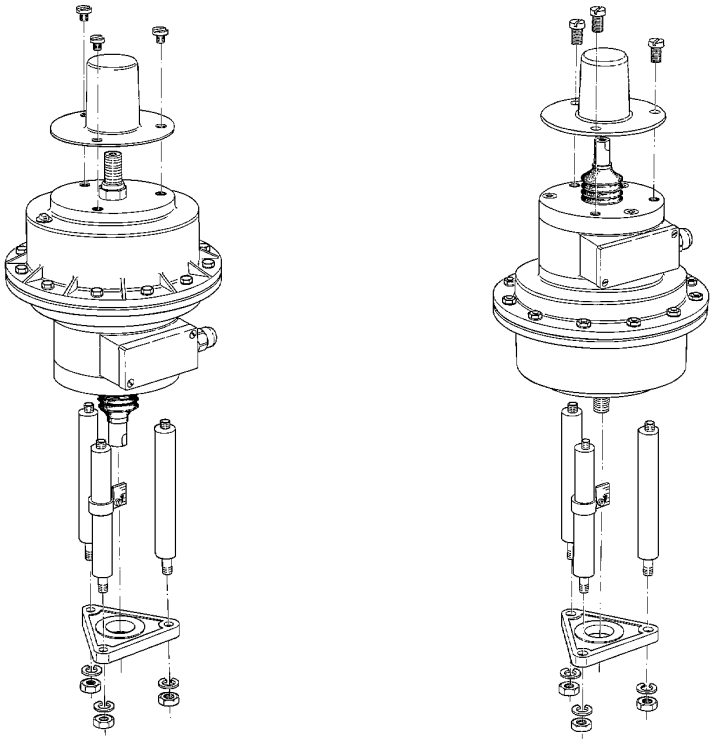
(Actuator with positioner only)
The actuator travel is adjusted by means of the range adjustment screw. Turn the range adjustment screw so that the actuator stem travels the required distance in response to the positioner input signal.

1.5 Positioner Spring - (fig. 5 pos. 4)

(Actuator with positioner only)
To change the signal range from full to split range the positioner spring must be changed.

Examples:
from 3-15 psi to 3-9 psi or 9-15 psi
from 4-20 mA to 4-12 mA or 12-20 mA

Notice that split ranging on electro-pneumatic actuator is also done by means of the positioner spring.
After removal of the spring boot and retaining ring on older actuators or by removing the boot, positioner spring adjustment nut on newer actuators, the spring can be replaced.

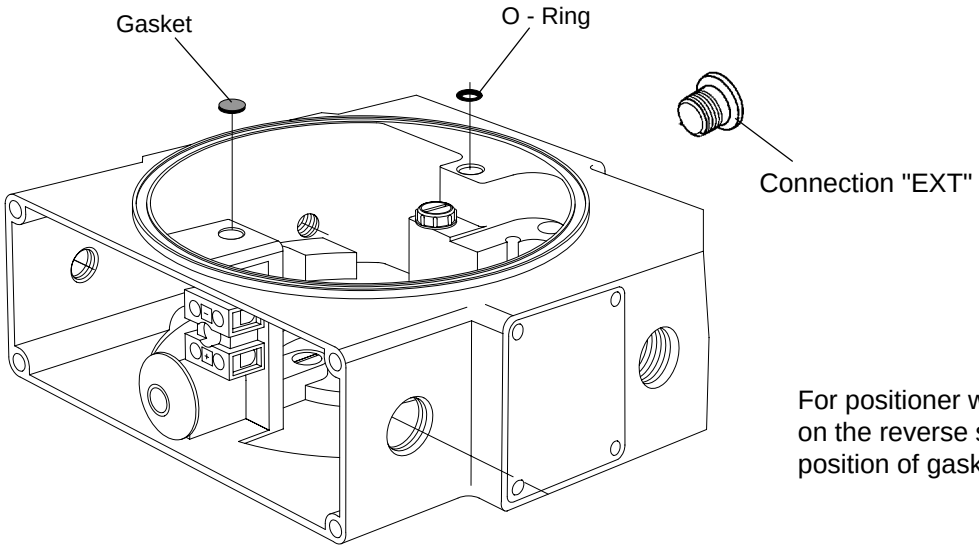


Air-to-open **Air-to-close**

Fig. 6

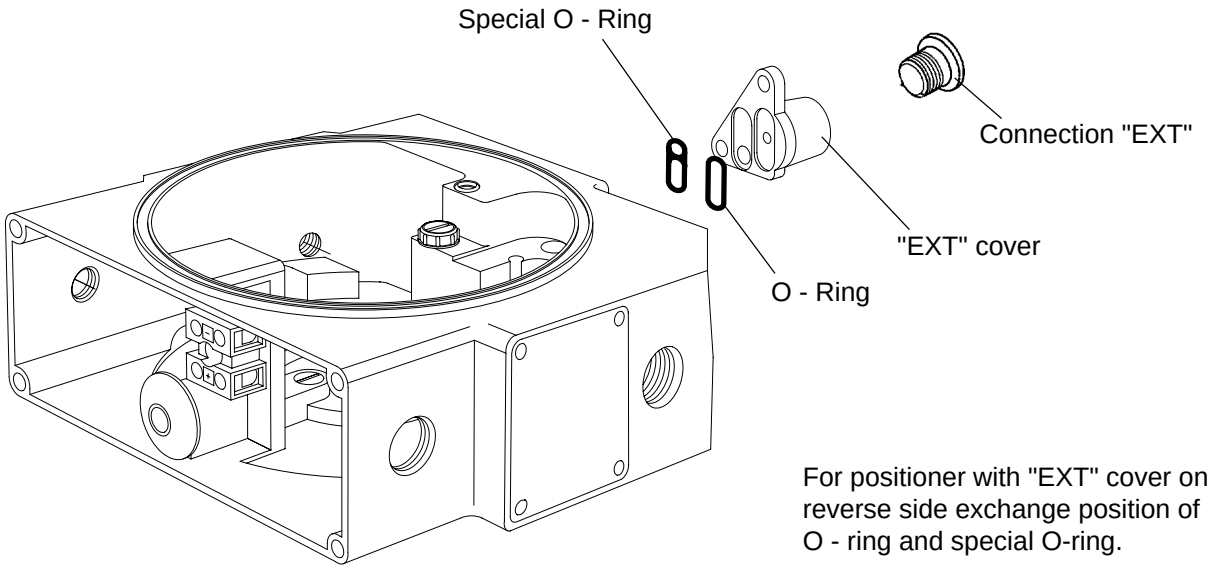
1.6 Changing the Actuator Action

To change the actuator action from fail-open to fail-closed, or vice versa, the complete actuator must be reversed. Remove the yoke assembly and actuator cap, invert the actuator and replace all parts. If necessary, use other spring sets (see spare parts list) according to the actuator thrust requirements.



For positioner without "EXT" cover on the reverse side exchange position of gasket and O-ring.

Fig. 7a



For positioner with "EXT" cover on the reverse side exchange position of O - ring and special O-ring.

Fig. 7b

1.7 External Piping

When using solenoid valves (not NAMUR), lock-up valves, volume boosters, etc.; external piping is possible without the need of additional parts. Solenoid valves to NAMUR-standard (modified) can be bolted directly onto the positioner body.

Positioner **without** "EXT" cover on the reverse side:

Exchange position of gasket and O - ring (Fig. 7a).
Remove the plugs marked "EXT" from the positioner body and diaphragm case.
Accessories can now be piped between the positioner and diaphragm case.

Positioner **with** "EXT" cover on the reverse side:

Exchange the position of the O - ring and special O - ring in the "EXT" cover. (Fig. 7b)
Remove the plugs marked "EXT" from the positioner body and diaphragm case.
Accessories can now be piped between the positioner and diaphragm case.

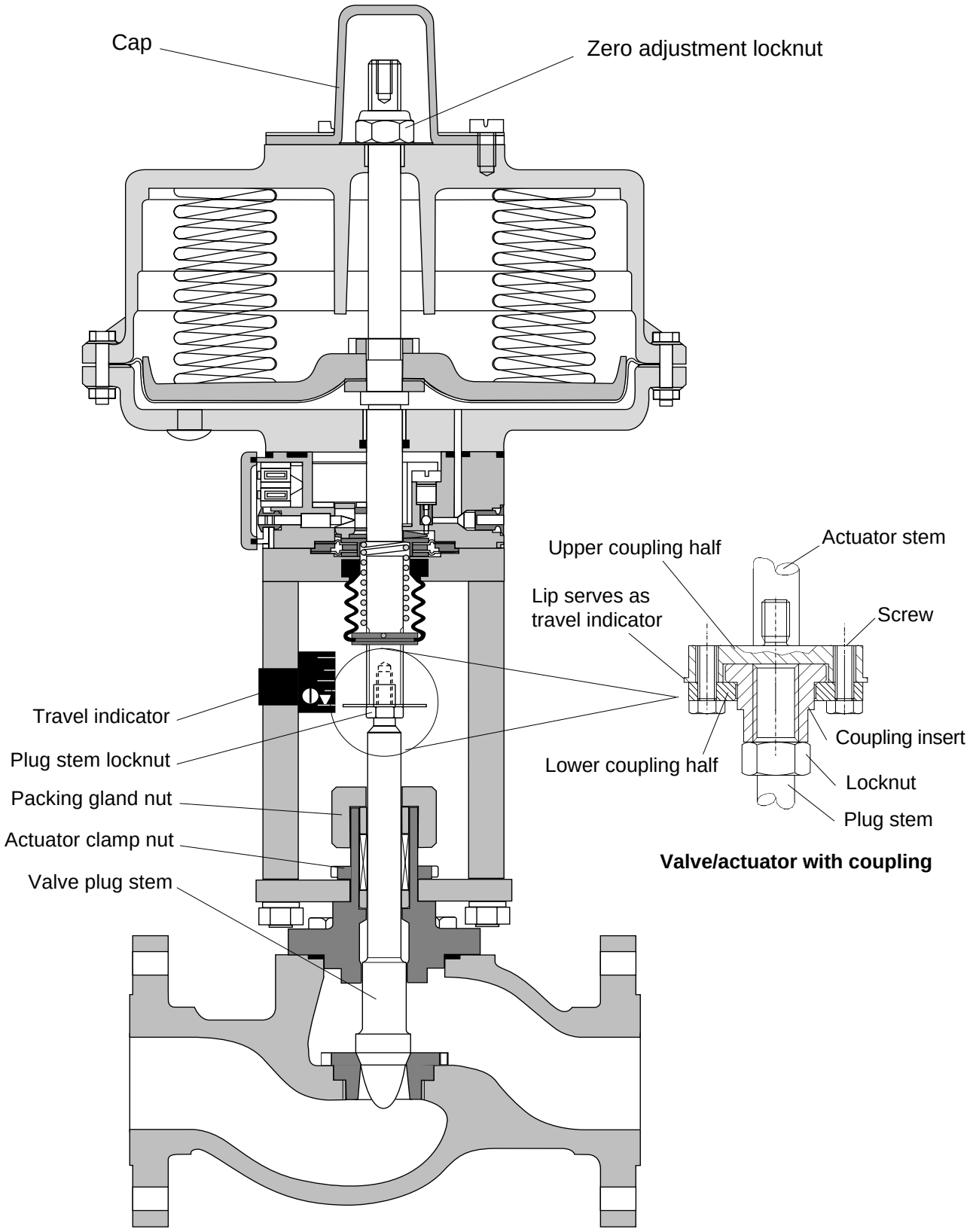


Fig. 8: Typical actuator and valve configuration

2 GENERAL SERVICE INFORMATION

Service to the actuator is best performed when the actuator is removed from the valve body. For the purpose of these instructions, consider the actuator as a separate subassembly with the procedures described in these instructions being performed on a bench. However, many service repairs and adjustments can be accomplished in the field while the actuator and valve body are still connected to each other.

2.1 REMOVING ACTUATOR FROM VALVE BODY

For air-to-open actuators start with 2.1.1

For air-to-close actuators start with 2.1.2

2.1.1 Remove the valve cap and nameplate. Turn the zero adjustment locknut until it just makes contact with the actuator spring case (this removes the spring force from the valve plug).

2.1.2 Valve/actuator without coupling

2.1.2.1 With a wrench, hold the actuator stem to prevent it from rotating while using a second wrench to loosen the plug stem locknuts.

Warning: If the actuator stem is rotated the diaphragm will be twisted and this may cause irreparable damage.

2.1.2.2 Loosen the packing gland nut and the actuator clamp nut.

2.1.2.3 Being sure not to turn the plug stem, rotate the actuator assembly counterclockwise to disengage the actuator stem from the valve plug stem.

IMPORTANT: Ensure that the plug assembly is not rotated with the plug seated. This may cause irreparable damage to the seating faces.

2.1.2.4 Lift the actuator assembly from the valve body subassembly. At the same time, remove the plug stem locknuts, the travel indicator disc, packing gland nut, and clamping nut.

2.1.3 Valve/actuator with coupling

2.1.3.1 With a wrench, hold the actuator stem to prevent it from rotating while using a second wrench to loosen and remove coupling screws.

2.1.3.2 Remove the yoke rod nuts and lift actuator assembly from the valve.

2.2 CONNECTING ACTUATOR TO VALVE BODY

General Notes:

• The actuator must be calibrated before connecting it to the valve body. See section 3 "Calibration" of these instructions.

• All worn or damaged parts must be replaced. All parts to be reused should be cleaned for ease of reassembly.

2.2.1 Valve/actuator without coupling

2.2.1.1 Place the actuator assembly onto the valve body subassembly. At the same time, install the clamping nut, packing gland nut, plug stem locknuts, and the travel indicator disc.

2.2.1.2 "Air-to-open/fail-to-close" actuators only:

Rotate the actuator assembly clockwise, threading the actuator stem onto the plug stem until the yoke plate just makes contact with the bonnet flange, and the actuator is properly aligned for installation.

IMPORTANT: Ensure that the plug assembly is not rotated with the plug seated. This may cause irreparable damage to the seating faces.

"Air-to-close/fail-to-open" actuators only:

Lift the plug stem to the actuator stem. Thread the plug stem into the actuator stem so that the distance "plug in seat", to "plug raised", is approximately the distance of the specified stroke.

2.2.1.3 Tighten the clamping nut and the packing gland nut (see valve service instructions for torque values).

2.2.1.4 Adjust the valve plug for seat off by threading the plug stem further into or out of the actuator stem. **DO NOT** rotate the plug stem while the valve is in the closed position. Open the valve first, make the adjustment while the valve is open, and then close the valve to check for seat-off.

2.2.1.5 After final adjustments are made, lock the two stem nuts against the actuator stem and set the position of the travel indicator on the yoke rod.

2.2.2 Valve/actuator with coupling

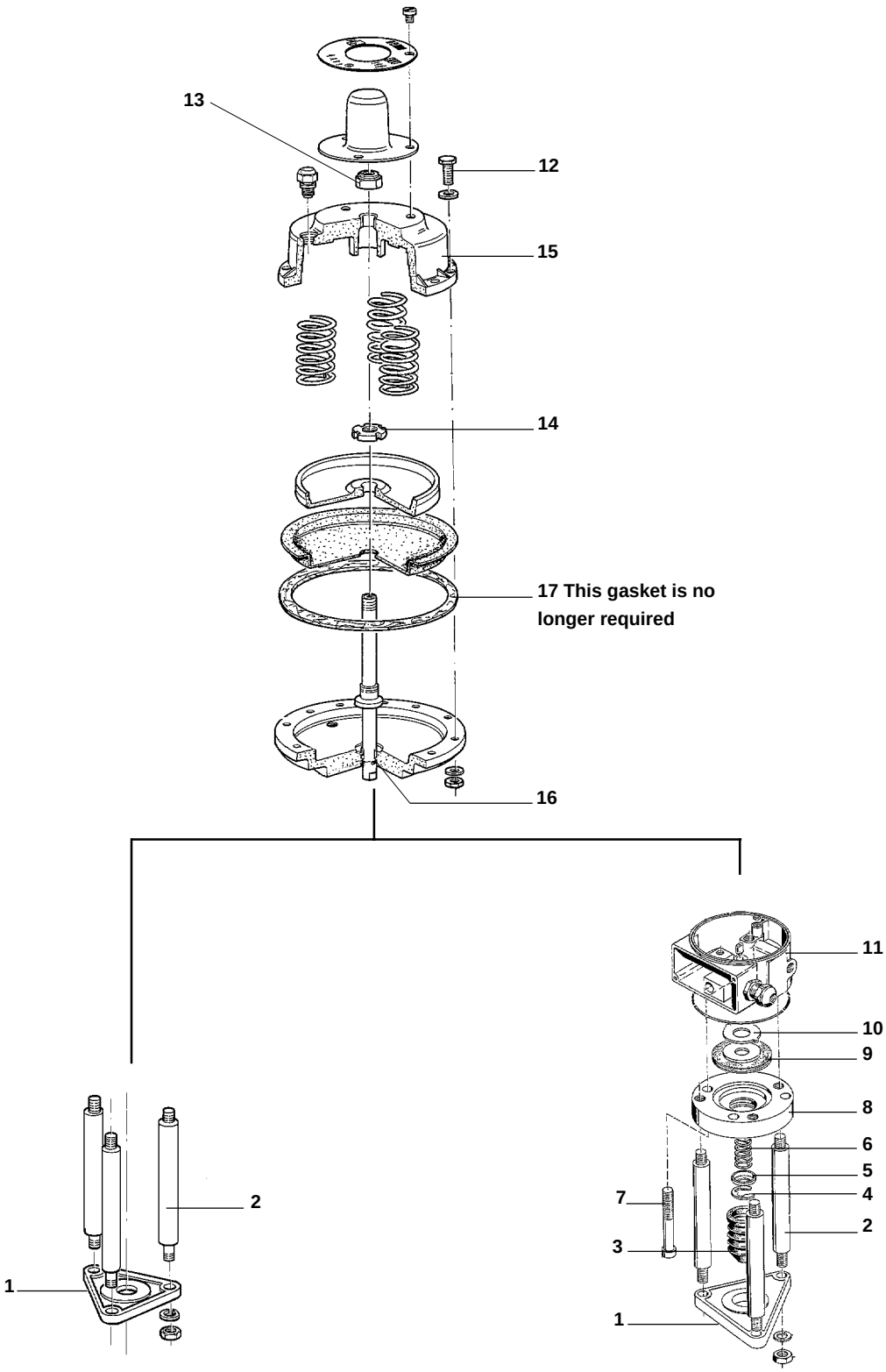
2.2.2.1 Place actuator onto valve.

2.2.2.2 Screw on and tighten yoke rod nuts.

2.2.2.3 Fit the coupling screws finger tight.

2.2.2.4 Adjust the valve plug for seat off by threading the plug stem further into or out of the coupling insert. **DO NOT** rotate the plug stem while the valve is in the closed position. Open the valve first, make the adjustment while the valve is open, and then close the valve to check for seat-off

2.2.2.5 After final adjustment tighten the coupling screws and set the position of the travel indicator on the yoke rod.



Series 47 / 48 / 49 (without positioner)

Series 37 / 38 / 39 (with positioner)

Fig. 9

2.3 ACTUATOR DISASSEMBLY

(refer to fig. 9)

To help reassembly note or mark the relationship between the parts to be disassembled.

2.3.1 Remove yoke plate (1) and yoke rods (2).

For actuators without positioner continue with 2.3.5.

2.3.2 Actuators without adjustable positioner spring (see Fig. 9)

Remove the positioner spring boot (3), retaining ring (4), seating washer (5), and positioner spring (6).

Actuators with adjustable positioner spring (see Fig. 15)

Loosen the set screw in the positioner spring adjusting nut and remove the nut. Remove boot and positioner spring.

2.3.3 Loosen and remove the positioner cover screws (7), positioner cover (8), double diaphgram (9) and balancing plate (10).

2.3.4 Remove the positioner (11). All inner positioner parts are now accessible for replacement or maintenance (*for positioner details see figs. 10 and 11*).

2.3.5 Loosen and remove all case screws (12).

⚠ **WARNING:** Actuators with high thrust spring sets and/or actuators with 40 mm (1.5") stroke must be held in a press to prevent possible injury when removing the case screws.

2.3.6 Unscrew the zero adjustment lock nut (13).

2.3.7 The spring case and diaphragm case can now be separated, and the springs removed.

2.3.8 Holding the actuator stem, unscrew and remove the clamping nut (14) to service the actuator diaphragm and diaphragm plate.

2.4 ACTUATOR ASSEMBLY

(refer to figs. 9 to 13)

2.4.1 Install the diaphragm and diaphragm plate on the actuator stem. Use Loctite® #242 on the threaded portion of the actuator stem where the clamping nut (14) is to be installed. Install and tighten the clamping nut, being sure not to kink the diaphragm.

2.4.2 Place the spring set into the spring case so that they sit in the recessed area of the case (15). Smaller diameter springs are placed inside of larger diameter springs.

2.4.3 Insert the actuator stem through the hole in the spring case (15).

2.4.4 Install the zero adjustment locknut (13) on the actuator stem and tighten it down fully to compressing the springs.

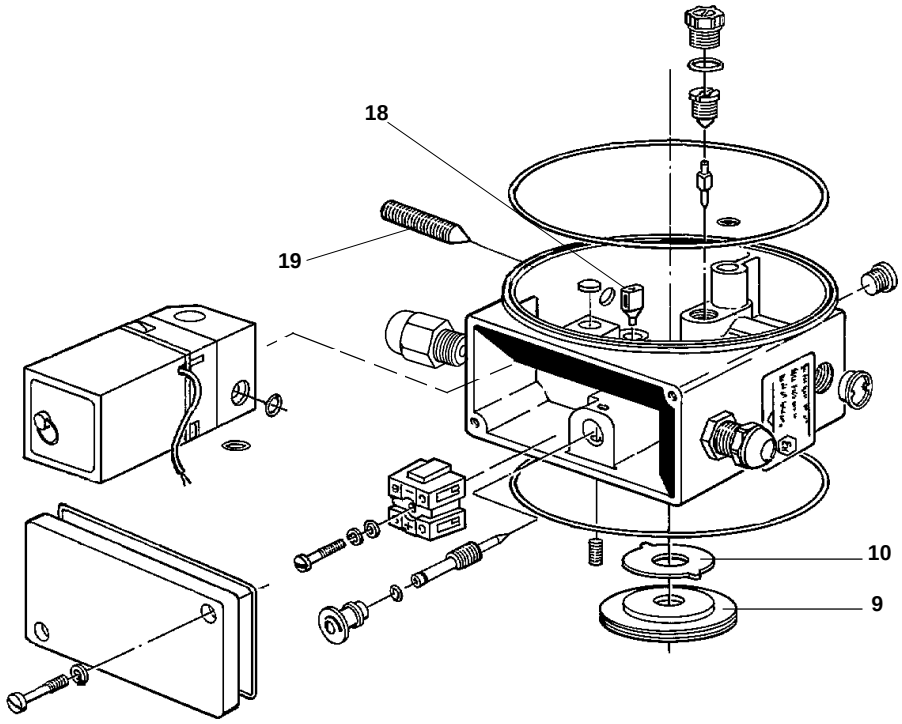
⚠ **WARNING**: A press must be used to compress the springs when high thrust spring sets are installed or when actuator stroke is 40 mm.

2.4.5 Before inserting a new O-ring (16) in the diaphragm case, pack the O-ring groove with a multi-temperature assembly paste

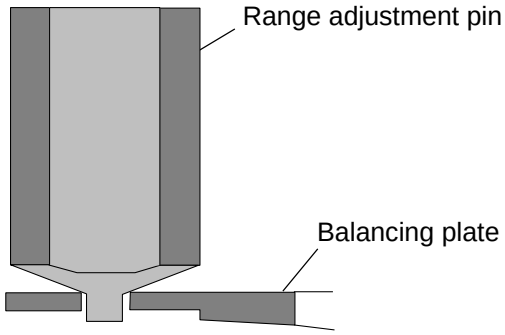
2.4.6 Replace the diaphragm gasket (17) and install the diaphragm case onto the spring case assembly.

2.4.7 Install and tighten all case screws (12), washers and nuts using a crisscross pattern.

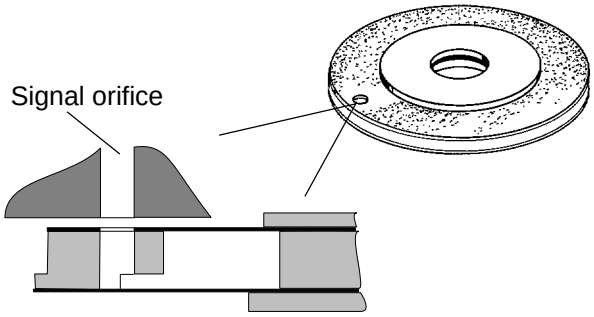
Continued....



Positioner
Fig. 11



Balancing plate assembly
Fig. 12



Double diaphragm
Fig. 13

(2.4 Actuator assembly continued)

2.4.8 to 2.4.11 for actuator with positioner only.

2.4.8 Assemble the positioner using new O-rings, gaskets and filters and install the positioner body (see figs. 11).

2.4.9 Install the balancing plate (10) so that the small hole fits over the plastic range adjustment pin (see fig.12), and the bevelled side faces the double diaphragm (flat side to positioner).

2.4.10 Install the double diaphragm assembly (9) aligning the small hole in the diaphragm with the hole in the diaphragm ring and the signal orifice in the positioner body (see fig. 13).

2.4.11 Actuator without adjustable positioner spring (see Fig 9)

Install the positioner cover (8), positioner cover screws (7), positioner spring (6), seating ring (5), retaining ring (4), and positioner spring boot (3) (see Fig. 9).

Actuator with adjustable positioner spring (see Fig 15)

Install the positioner cover, positioner cover screws, positioner spring and positioner spring boot. Thread adjusting nut onto actuator stem and adjust roughly using the gauge (lower edge of adjusting nut the underside of positioner cover).

2.4.12 Refit yoke rods (2) and yoke plate (1).

The actuator is now ready to be calibrated.

2.5 POSITIONER SERVICE

The KÄMMER integral positioner is designed to be a maintenance free unit. However; moisture, oil and dirt entering the positioner can dampen its performance, which will cause the need for maintenance and repair. When this happens, remove all internal parts and clean them thoroughly. Replace all O-rings, filters and damaged parts, and reassemble the positioner body according to fig. 11.

Positioners with integral I/P transducers are more sensitive to contaminants than those without. Therefore, it is very important that all parts to be reused are extremely clean and dry.

I/P transducer

To remove the I/P transducer, disconnect the wires from the terminal block and loosen the set screw (19) on the side of the positioner housing. The I/P transducer can then be pulled from the front of the positioner housing. The main cause of transducer malfunction is a polluted air supply. Filters are situated in the input and output orifices of the transducer and are readily accessible after removing the O-rings. Apart from the O-rings and filters the transducer contains no user serviceable parts. The transducer is factory adjusted to exactly 4 – 20 mA or 0 – 20 mA (documented by a sticker on the transducer cover) and an attempt to field calibrate is not recommended. For repair and/or calibration the transducer assembly should be returned to Kämmer.

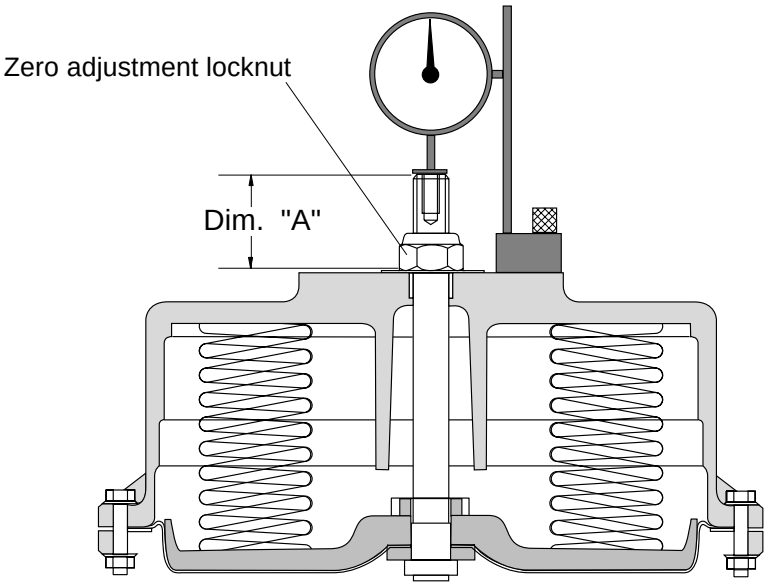
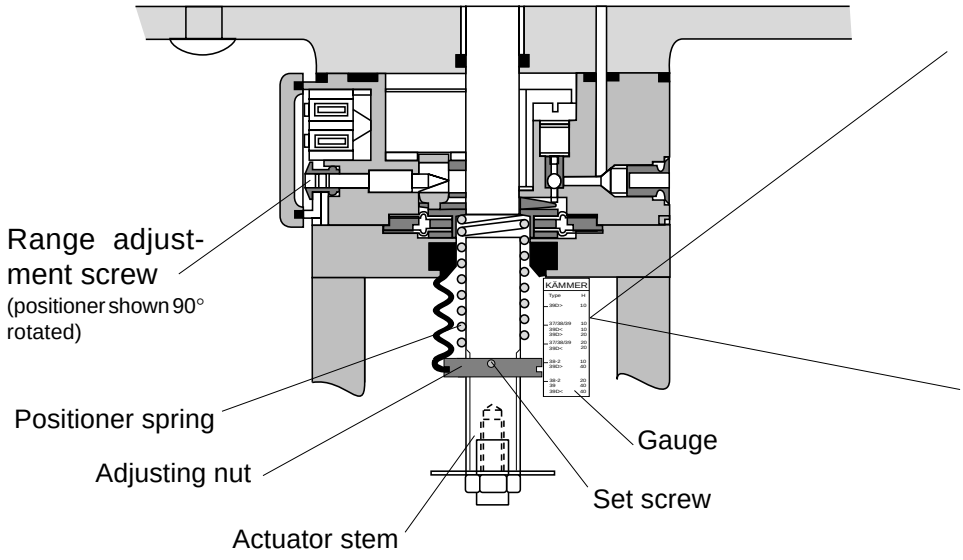
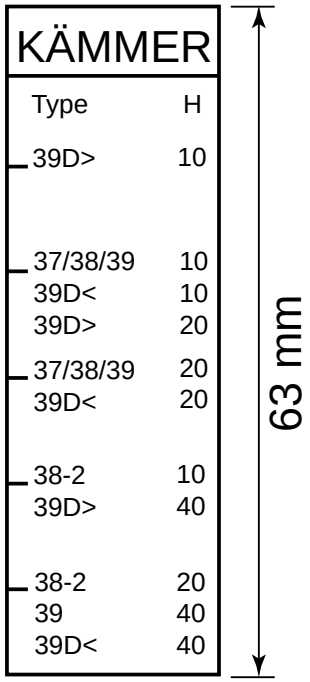


Fig. 14: Dial gauge





Gauge (scale 1:1)

Adjust positioner spring with gauge
Fig. 15

3 Calibration

Calibrate actuator

(actuator without adjustable positioner spring)

3.1 Range adjustment

See nameplate for signal range, supply pressure and stroke.

3.1.1 Connect air supply to the "SUPPLY" port of the actuator and an adjustable signal source to the "SIGNAL" connection. Attach a dial gauge to the actuator (see Fig 14).

3.1.2 Undo the zero adjustment locknut until it is a few threads free of the actuator housing. Set the signal to the low end value (e.g. 0,2 bar or 4 mA). Adjust the dial gauge to zero.

3.1.3 Set the signal to the high end value (e.g. 1,0 bar or 20 mA).

3.1.4 Using the range adjusting screw set the actuator to full stroke + 1.5 mm (e.g. stroke 20 + 1.5 mm = 21.5 mm).

3.1.5 Make adjustment with the range adjusting screw as required until desired stroke is obtained

3.2 Zero adjustment

3.2.1 The zero adjustment can only be set after the final range adjustment has been made.

3.2.2 Maintain the low end signal (e.g. 0.2 bar or 4 mA) and turn the zero adjustment locknut until it just makes contact with the actuator housing.

3.3 Calibrate actuator

(actuator with adjustable positioner spring)

See nameplate for signal range, supply pressure and stroke.

3.3.1 Connect air supply to the "SUPPLY" port of the actuator and an adjustable signal source to the "SIGNAL" connection. Attach a dial gauge to the actuator (see Fig 14).

3.3.2 Undo the zero adjustment locknut until it is a few threads free of the actuator housing.

Loosen the set screw and thread the adjusting nut on the actuator stem until it's lower face is in alignment with the appropriate type designation on the gauge.

3.3.3 Set the signal to the low end value (e.g. 0.2 bar or 4 mA). Adjust the dial gauge to zero.

3.3.4 Set the signal to the high end value (e.g. 1.0 bar or 20 mA).

3.3.5 Using the range adjusting screw set the actuator to full stroke + 1.5 mm (e.g. stroke 20 + 1.5 mm = 21.5 mm).

3.3.6 Set signal and dial gauge to zero.

3.3.7 Set the signal to the low end value. Adjust the positioner spring adjusting nut to compress/ decompress the positioner spring until the actuator stem rises 1.5 mm.

3.3.8 Set the signal to the high end value (e.g. 1.0 bar or 20 mA). Using the range adjusting screw set the actuator to full stroke + 1.5 mm (e.g. stroke 20 + 1.5 mm = 21.5 mm).

3.3.9 Repeat adjustments **3.3.3** to **3.3.8** until both adjustments are correct.

3.3.10 Set signal to zero and tighten the set screw in the adjusting nut. Set the signal to the low end value. Set the dial gauge to zero and tighten zero adjustment locknut, until the dial gauge pointer just moves (nut contacts the actuator housing) and then a further 1/4 turn (around $^{3}/_{10}$ mm pretension).

3.3.11 Check all adjustments for correctness.

3.4 Calibrate actuator/valve

3.4.1 Connect air supply to the "SUPPLY" port of the actuator and an adjustable signal source to the "SIGNAL" connection. Undo the zero adjustment locknut until it is a few threads free of the actuator housing. Attach a dial gauge to the actuator and set it to zero.

3.4.2 Determine the instrument signal at which the plug should begin moving off the seat and apply that signal to the valve. If the plug stem does not begin to move at the predetermined signal, adjust the signal to midrange until the plug is off the seat, loosen the plug stem locknut and turn the plug stem in or out of the actuator stem.

For example, if the plug begins to move at a lower signal than the predetermined one, turn the plug stem out of the actuator stem. If the plug begins to move at a higher signal than the predetermined one, turn the plug into the actuator stem. Repeat this process until the actuator is calibrated as required and re-tighten the plug stem locknut. Adjust the zero adjustment locknut until it is 2 mm off the actuator and replace the actuator cap.

CAUTION: Do not turn the plug stem when the plug is seated; otherwise, the plug and seat ring may be damaged.

3.5 Calibrate actuators without a positioner

3.5.1 With no air supply to the actuator, adjust the zero adjustment locknut until dimension "A" as shown in the table below is achieved.

Actuator size	Stroke		Dimension "A" (mm)
	Inch	mm	
47	$^{3}/_{8}$	10	35
47	$^{3}/_{4}$	20	25
48 / 49	$^{3}/_{8}$	10	55
48 / 49	$^{3}/_{4}$	20	45
48 / 49	$1^{1}/_{2}$	40	25
49D	$1^{1}/_{2}$	40	55

4 TECHNICAL DATA

	Actuator without positioner				Actuator with P/P positioner				Actuator with I/P positioner			
	47	**48**	**49**	**49D**	**37**	**38**	**39**	**39D**	**IP-37**	**IP-38**	**IP-39**	**IP-39D**
Diaphragm area cm²	80	200	500	2 x 500	80	200	500	2 x 500	80	200	500	2 x 500
Thrust max. kg	160	400	1000	2000	160	400	1000	2000	160	400	1000	2000
Stroke mm	10/20	10/20	10/20/40	10/20/40	10/20	10/20	10/20/40	10/20/40	10/20	10/20	10/20/40	10/20/40
Time at stroke 10 mm s*	0.1	0.25	0.5	1	0.5	1	2.5	5	0.5	1	2.5	5
20 mm s*	0.2	0.5	1	2	1	2	5	10	1	2	5	10
40 mm s*	–	–	2	4	–	–	10	20	–	–	10	20
Signal range	3 – 15 psi 0.2 – 1.0 bar 20 – 60 kPa				3 – 15 / 3 – 9 / 9 – 15 psi 0.2 – 1.0 / 0.2 – 0.6 / 0.6 – 1.0 bar 20 – 100 / 20 – 60 / 60 – 100 kPa				0/4 – 20, 4 – 12, 12 – 20 mA or rev. – –			
Input resistance	–				–				260 Ohm			
Inductivity / Capacitance	–				–				negligible (≈0)			
Spring range	see appropriate spare parts list				see appropriate spare parts list				see appropriate spare parts list			
Supply pressure	20 – 60 psi 1.4 – 4.2 bar 140 – 420 kPa				20 – 60 psi 1.4 – 4.2 bar 140 – 420 kPa				20 – 60 psi 1.4 – 4.2 bar 140 – 420 kPa			
Accuracy	–				±1%				≦ 1%			
Hysteresis	–				< 1%				≦ 1%			
Operating sensitivity	–				–				≦ 0.1%			
Amplification factor	–				50				50			
Supply pressure influence	–				0.4% / 0.1 bar				0.4% / 0.1 bar			
Air consumption at 1,4 bar	–				0.6 Nm³ / h				0.6 Nm³ / h			
Electrical protection	–				–				EEx ia C T6, PTB No. Ex-93.C. 2104X Suitable for connection to intrinsical safe circuits with I max. ≦ 60 mA (T6) thru 150 mA (T4)			
Housing protection	–				–				IP 54			
Allowable ambient temp.	– 30 to + 80 °C (-22 to +176° F)											
Actuator action	air-to-open / air-to-close, reversible											
Installation position	optional											
Air supply	dry and oil-free (instrument air)											

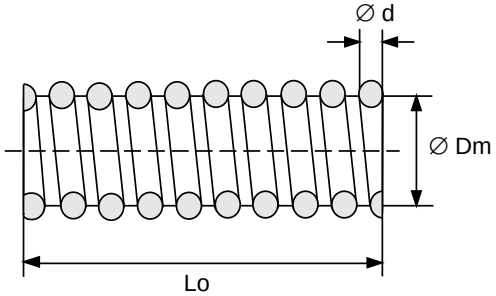
* Stroking time with 1.4 bar supply pressure.

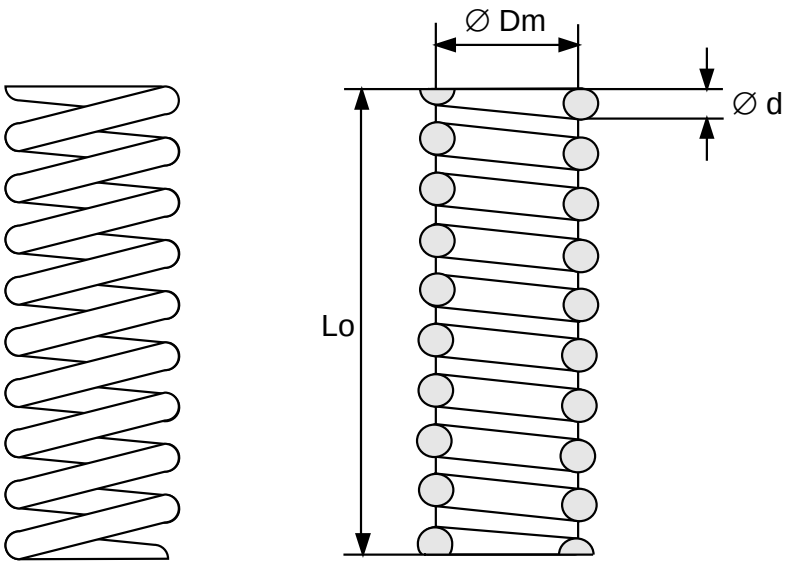
Spring set No.	Spring range (bar)	Spring set consists of:							
		Qty.	Part No.	Colour code	Dimensions * Ø Dm / Ø d / L o	Qty.	Part No.	Colour code	Dimensions * Ø Dm / Ø d / L o
710	0,2 - 1,0	3	37 10 10	W	20,5 / 3,20 x 42,5	-	-	-	-
711	0,3 - 0,9	3	37 10 40	S	23,0 / 3,20 x 45,0	-	-	-	-
712	0,5 - 1,1	3	37 10 20	B	22,0 / 3,20 x 48,3	-	-	-	-
713	1,0 - 1,9	3	37 10 20	B	22,0 / 3,20 x 48,3	3	37 10 30	R	14,0 / 2,2 x 56,7
714	1,0 - 2,2	6	37 10 20	B	22,0 / 3,20 x 48,3	-	-	-	-
715	1,5 - 2,7	3	37 10 20	B	22,0 / 3,20 x 48,3	6	37 10 30	R	14,0 / 2,2 x 56,7
716	1,5 - 3,0	6	37 10 20	B	22,0 / 3,20 x 48,3	3	37 10 30	R	14,0 / 2,2 x 56,7
717	2,0 - 3,8	6	37 10 20	B	22,0 / 3,20 x 48,3	6	37 10 30	R	14,0 / 2,2 x 56,7
722	0,5 - 1,1	3	37 20 20	B	26,0 / 2,75 x 56,7	-	-	-	-
723	0,9 - 1,9	3	37 20 20	B	26,0 / 2,75 x 56,7	3	37 20 30	R	19,7 / 2,2 x 60,0
724	1,0 - 2,2	6	37 20 20	B	26,0 / 2,75 x 56,7	-	-	-	-
725	1,3 - 2,7	3	37 20 20	B	26,0 / 2,75 x 56,7	6	37 20 30	R	19,7 / 2,2 x 60,0
726	1,4 - 3,0	6	37 20 20	B	26,0 / 2,75 x 56,7	3	37 20 30	R	19,7 / 2,2 x 60,0
727	1,8 - 3,8	6	37 20 20	B	26,0 / 2,75 x 56,7	6	37 20 30	R	19,7 / 2,2 x 60,0
810	0,2 - 1,0	3	38 10 10	W	35,5 / 5,60 x 62,5	-	-	-	-
811	0,3 - 0,9	3	38 10 40	S	32,0 / 5,00 x 65,0	-	-	-	-
812	0,5 - 1,1	3	38 10 20	B	39,0 / 5,60 x 68,3	-	-	-	-
813	1,0 - 1,9	3	38 10 20	B	39,0 / 5,60 x 68,3	3	38 10 30	R	26,5 / 4,0 x 76,7
814	1,0 - 2,2	6	38 10 20	B	39,0 / 5,60 x 68,3	-	-	-	-
815	1,5 - 2,7	3	38 10 20	B	39,0 / 5,60 x 68,3	6	38 10 30	R	26,5 / 4,0 x 76,7
816	1,5 - 3,0	6	38 10 20	B	39,0 / 5,60 x 68,3	3	38 10 30	R	26,5 / 4,0 x 76,7
817	2,0 - 3,8	6	38 10 20	B	39,0 / 5,60 x 68,3	6	38 10 30	R	26,5 / 4,0 x 76,7
820	0,2 - 1,0	3	38 20 10	W	40,0 / 5,00 x 65,0	-	-	-	-
821	0,3 - 0,9	3	38 20 40	S	36,5 / 4,50 x 70,0	-	-	-	-
822	0,5 - 1,1	3	38 20 20	B	42,5 / 5,30 x 76,7	-	-	-	-
823	0,9 - 1,9	3	38 20 20	B	42,5 / 5,30 x 76,7	3	38 20 30	R	26,5 / 3,6 x 80
824	1,0 - 2,2	6	38 20 20	B	42,5 / 5,30 x 76,7	-	-	-	-
825	1,3 - 2,7	3	38 20 20	B	42,5 / 5,30 x 76,7	6	38 20 30	R	26,5 / 3,6 x 80
826	1,4 - 3,0	6	38 20 20	B	42,5 / 5,30 x 76,7	3	38 20 30	R	26,5 / 3,6 x 80
827	1,8 - 3,8	6	38 20 20	B	42,5 / 5,30 x 76,7	6	38 20 30	R	26,5 / 3,6 x 80
921	0,3 - 0,9	3	39 20 40	S	55,0 / 8,00 x 110	-	-	-	-
922	0,5 - 1,1	3	39 20 20	B	66,0 / 9,00 x 116,7	-	-	-	-
923	1,0 - 1,9	3	39 20 20	B	66,0 / 9,00 x 116,7	3	39 20 30	R	43 / 6,3 x 133,3
924	1,0 - 2,2	6	39 20 20	B	66,0 / 9,00 x 116,7	-	-	-	-
925	1,5 - 2,7	3	39 20 20	B	66,0 / 9,00 x 116,7	6	39 20 30	R	43 / 6,3 x 133,3
926	1,5 - 3,0	6	39 20 20	B	66,0 / 9,00 x 116,7	3	39 20 30	R	43 / 6,3 x 133,3
927	2,0 - 3,8	6	39 20 20	B	66,0 / 9,00 x 116,7	6	39 20 30	R	43 / 6,3 x 133,3
941	0,3 - 0,9	3	39 40 40	S	57,0 / 7,00 x 120	-	-	-	-
942	0,5 - 1,0	3	39 40 20	B	67,0 / 7,20 x 138	-	-	-	-
943	0,8 - 1,6	3	39 40 20	B	67,0 / 7,20 x 138	3	39 40 30	R	45,7 / 5,25 x 148
944	0,9 - 1,9	6	39 40 20	B	67,0 / 7,20 x 138	-	-	-	-
945	1,2 - 2,3	3	39 40 20	B	67,0 / 7,20 x 138	6	39 40 30	R	45,7 / 5,25 x 148
946	1,3 - 2,6	6	39 40 20	B	67,0 / 7,2 0x 138	3	39 40 30	R	45,7 / 5,25 x 148
947	1,7 - 3,3	6	39 40 20	B	67,0 / 7,20 x 138	6	39 40 30	R	45,7 / 5,25 x 148

* All dimensions in mm

Colour code:
(Each spring is marked with a spot of paint)

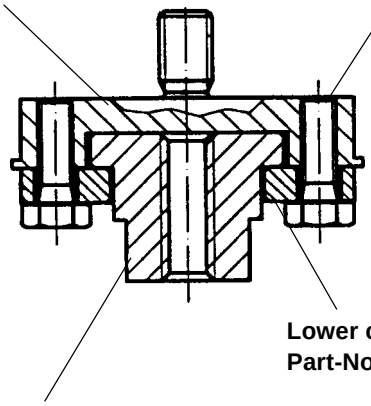
W = White
B = Blue
R = Red
S = Black





Part - No.	Spring range [bar]	Spring range [mA]	Stroke [mm]	Lo [mm]	ø Dm [mm]	ød [mm]
0 36 00 10 00	0.2 - 1.0	0/4 - 20	10	39.75	20.0	2.0
0 36 00 20 00	0.2 - 0.6	0/4 - 10/12	10	42.5	20.0	1.6
0 36 00 30 00	0.2- 1.0 | 0.6 - 1.0	0/4 - 20 | 10/12 - 20	20 | 10	55.5	19.5	1.7
0 36 00 40 00	0.2 - 0.6	0/4 - 10/12	20	60.0	22.5	1.5
0 36 00 50 00	0.2- 1.0 | 0.6 - 1.0	0/4 - 20 | 10/12 - 20	40 | 20	85.0	20.5	1.6
0 36 00 60 00	0.2 - 0.6	0/4 - 10/12	40	100	21.0	1.4
0 36 00 70 00	0.6 - 1.0	10/12 - 20	40	140.0	18.7	1.4

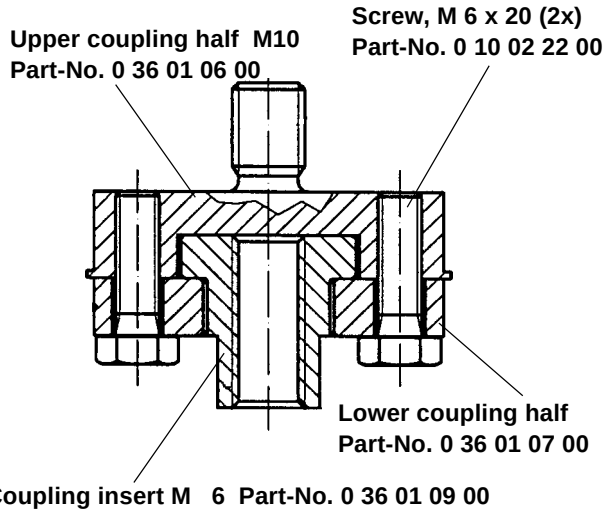
Coupling for actuators with 2 yoke rods



Coupling insert M 4 Part-No. 0 37 01 08 00
Coupling insert M 6 Part-No. 0 37 01 09 00
Coupling insert M 10 Part-No. 0 37 01 10 00

Coupling assy. M 6 / M 4 Part-No. 0 37 01 03 00
Coupling assy. M 6 / M 6 Part-No. 0 37 01 01 00
Coupling assy. M 6 / M 10 Part-No. 0 37 01 02 00

Coupling for actuators with 3 yoke rods



Coupling insert M 6 Part-No. 0 36 01 09 00
Coupling insert M 10 Part-No. 0 36 01 08 00

Coupling assy. M 10 / M 6 Part-No. 0 36 01 01 00
Coupling assy. M 10 / M 10 Part-No. 0 36 01 02 00

Germany

Flowserve Essen GmbH
Kammer Ventile
Manderscheidtstrasse 19
D-45141 Essen
Tel.: (02 01) 89 19 5 • Fax: (02 01) 89 19 600

Flowserve Essen GmbH
Sales Office Hamburg

Tel.: (02 01) 89 19 665
Fax: (02 01) 89 19 662

Flowserve Essen GmbH
Sales Office Niederrhein
Hoher Weezer Weg 27a

D - 47574 Goch
Tel.: (0 28 23) 9 80 02
Fax: (0 28 23) 9 80 03

Flowserve Essen GmbH
Sales Office West
Büdericher Straße 8

D - 47877 Willich
Tel.: (0 21 54) 20 20 71
Fax: (0 21 54) 20 20 73

Flowserve Essen GmbH
Sales Office Maintal
Robert-Bosch-Strasse 11

D - 63477 Maintal
Tel.: (0 61 81) 42 404 11
Fax: (0 61 81) 42 404 29

Flowserve Essen GmbH
Sales Office Frankfurt
Steinweg 22

D - 65824 Schwalbach a. Ts.
Tel.: (06196) 85 203
Fax: (06196) 84 462

Flowserve Essen GmbH
Sales Office Südwest
Am Mühlhübel 13

D - 67686 Mackenbach
Tel.: (06 374) 99 27 84
Fax: (06 374) 99 27 85

Flowserve Essen GmbH
Sales Office Augsburg
Staatsstraße 10

D - 86450 Altenmünster
Tel.: (0 82 95) 9 00 03
Fax: (0 82 95) 9 00 04

Flowserve Essen GmbH
Sales Office Ost
Oberhasel 18

D - 07407 Kirchhasel
Tel.: (0 36 72) 43 19 82
Fax: (0 36 72) 43 19 89

FRANCE
Flowserve S.A.S.
SEREG
12, av. du Québec, BP645
F- 91965 Courtaboeuf Cedex

Tel.: +33 1 60 92 32 87
Fax : +33 1 60 92 32 99

USA / CANADA
Flowserve (FCD)
KAMMER VALVES, INC.
1300 Parkway View Drive
Pittsburgh, Pa 15205 U.S.A.

Tel.: +1 412 787 - 8803
Fax: +1 412 787 -1944

SWITZERLAND
Flowserve S.A.
Kammer Vannes.
Allée du Quartz 1
CH-2300 La Chaux-de-Fonds

Tel.: +41 (0) 32 925 9700
Fax: +41 (0) 32 926 5422

AUSTRALIA
Flowserve Australia PTY LTD
14 Dalmore Drive
Scoresby VICTORIA 3179

AUSTRALIA

Tel.: +61 3 9764 0060
Fax: +61 3 9764 0013

AUSTRIA
Flowtec Industrietechnik GmbH
Weinitzstrasse 1
8045 Graz

AUSTRIA

Tel.: +43 (0) 316 69 70 69-0
Fax: +43 (0) 316 69 70 69-9

DENMARK
Scana Godtkjær & Armatur as
Kong Svends Vej 65
2765 Smorum

DENMARK

Tel.: +45 44 20 00 00
Fax: +45 44 20 00 01

FINLAND
KONTRAM OY
PO. Box 88
02201 Espoo

FINLAND

Tel. +358 9 8866 4500
Fax: +358 9 8866 4599

GREAT BRITAIN
Flowserve
Station Road, Pershore
Worcestershire, WR10 2BZ

ENGLAND

Tel.: +441386 554 551
Fax: +441386 554 968

IRELAND
Flexachem Manufacturing Ltd
Donnybrook Commercial Centre
Douglas, Cork

IRELAND

Tel.: +353 21 363742
Fax: +353 21 891297

ISRAEL
TECHNOMAD LTD
19 Hashikma Str.
Azor 58009

ISRAEL

Tel.: +972 3 5585550
Fax: +972 3 5585090

ITALY
EUROVALVE S.R.L.
Via Camicie Rosse 11
20090 Opera (MI)

ITALY

Tel.: +390 2 57 6018 45
Fax: +390 2 57 6017 00

JAPAN
TOKO VALEX Co., Ltd
2-17, 4-chome, Matsushima
Edogawa-Ku, Tokyo

JAPAN 132

Tel.: +81 3 3655 6769
Fax: +81 3 3655 5181

NETHERLANDS
Conovalve B.V.
Postbus 270
3100 AG Schiedam

NETHERLANDS

Tel.: +31 10 4 71 53 33
Fax: +31 10 4 70 44 82

NORWAY
NOR Instruments A.S.
Jerikoveien 26
1067 Oslo

NORWAY

Tel.: +47 2210 05 00
Fax: +47 2210 0510

R. O. C.
Eagle Process Service Ud.
Suite 4, 5th Floor No. 312
Chung Hsiao E. Road, Sec. 4
Taipei, Taiwan, R. O. C.
TAIWAN

Tel.: +8862 2751 6197
Fax: +8862 2781 4640

SINGAPORE
Valtek Asia Pacific Operations
c/o Durco-Valtek Asia
12, Tuas Avenue 20
Singapore 2263
SINGAPORE

Tel.: +65 862 3332
Fax: +65 862 4940

SOUTH AFRICA
Valtek South Africa (Pty.) Ltd
P. O. Box 9279
Edenglen 1613

SOUTH AFRICA

Tel.: +2711 609 2094-96
Fax: +2711 609 3735

SWEDEN
alnab
Ögärdesvägen
433 86 Partille

SWEDEN

Tel.: +46 31 44 94 50
Fax: +46 31 44 94 55