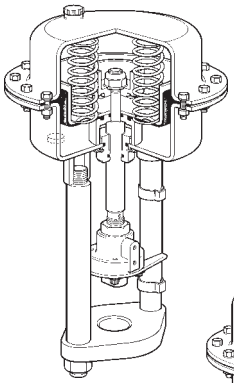
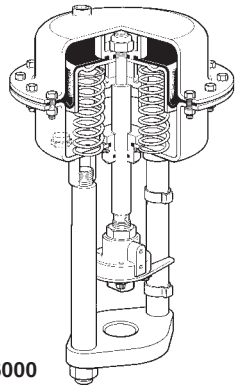
spirax sarco

Types PN5000 and PN6000 Series Pneumatic Actuators

Installation and Maintenance Instructions



PN5000



PN6000

1. General

2. Installation

3. Commissioning

4. Reversal of Actuator Action

5. Spare parts

6. Maintenance

7. Associated 2 Port valves

8. Associated 3 Port valves

PN5000 Series,Spring Extend Pneumatic Actuators

Available types

Spring extend spindle actuators.
5100 Series, single spring, yoke mounted.
5200, 5300 & 5400 Series, multi-spring, pillar mounted.

Description

A range of compact linear actuators having 4 diaphragm sizes for matching the requirements of different valves at various differential pressures. Each actuator is fitted with mechanical stroke indicators and incorporate a rolling diaphragm to give linearity over the full operating stroke.
The actuators are designed for easy conversion to spring retract spindle operation (and vice versa) in the field using the same components and without the need of special tools.
These actuators are designed to operate with 2 Port KE and 3 Port QL Valves as detailed below.

Actuator Type	Valve Type
20 mm travel	KE 43, KE 71, KE 73 and KE 63 (DN15-50) KE 61 (DN15-25) QL 43 & QL 73 (DN15-50)
30 mm travel	KE 43, KE 63 and KE 73 (DN65-100) QL 43 & QL 73 (DN65 - DN100)

Technical data

Temperature Range	—20 to 110°C
Maximum operating range	6 bar
Linearity	2%
Hysteresis	3% max

Air supply connection

Actuator Type	Connection
5100 & 5200 Series	1/8" BSP
5300 & 5400 Series	1/4" BSP

Compressed air consumption

Actuator Type	Travel	Volume - Litres (normal)
5100 Series	20 mm	0.33
5200 Series	20 mm	0.99
5300 Series	20 mm	1.39
	30 mm	1.65
5400 Series	20 mm	2.36
	30 mm	2.78

Spring ranges

Actuator Types	Spring Range	Travel
5120	0.2 (0.4) to 1.0 (1.2) bar	20 mm
5121	0.2 to 0.6 bar	20 mm
5122	0.6 to 1 bar	20 mm
5123	2.0 to 4.0 bar	20 mm
5220	0.2 (0.4) to 1.0 (1.2) bar	20 mm
5221	0.2 to 0.6 bar	20 mm
5223	2.0 to 4.0 bar	20 mm
5320	0.2 (0.4) to 1.0 (1.2) bar	20 mm
5321	0.2 to 0.6 bar	20 mm
5322	0.6 to 1.0 bar	20 mm
5323	2.0 to 4.0 bar	20 mm
5330	0.4 to 1.2 bar	30 mm
5333	2.0 to 4.0 bar	30 mm
5420	0.2 (0.4) to 1.0 (1.2) bar	20 mm
5421	0.2 to 0.6 bar	20 mm
5422	0.6 to 1.0 bar	20 mm
5423	2.0 to 4.0 bar	20 mm
5430	0.4 to 1.2 bar	30 mm
5433	2.0 to 4.0 bar	30 mm

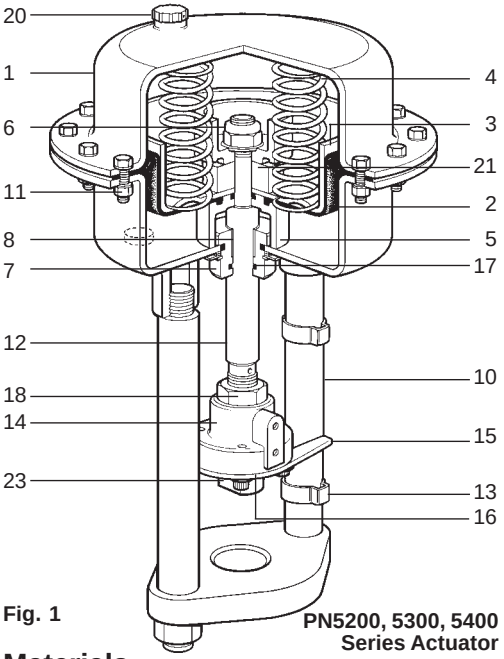
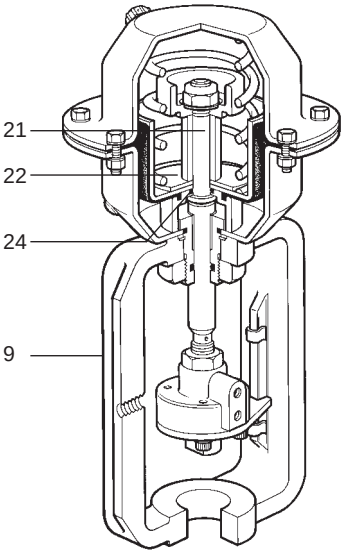


Fig. 1

PN5200, 5300, 5400 Series Actuator



PN5100 Series Actuator

Materials

No.	Part	Material
1	Diaphragm housing	Pressed steel
2	Rolling diaphragm	Fabric reinforced nitrile rubber
3	Piston	Pressed steel
4	Spring	Spring steel
5	Diaphragm clamp casting	Stainless steel
6	Nyloc nut	Steel
7	Piston guide	Stainless steel
8	DU bearing	PTFE/Steel composite
9	Yoke (5100 series)	Aluminium
10	Pillars (5200, 5300 & 5400 series)	Steel
11	Housing securing nuts & bolts	Steel
12	Spindle	Stainless steel
13	Travel indicators	Spring steel
14	Connector	Steel
15	Indicator plate	Steel
16	Lock plate	Steel
17	'O' ring	Rubber
18	Lock nut	Steel
19	Mounting flange	Steel
20	Cap (with vent hole)	Plastic
21	Spacer	Steel
22	Spring location washer (5100 series)	Steel
23	Adaptor	Steel
24	'O' ring	Rubber

PN6000 Series, Spring Retract Pneumatic Actuators

Available types

Spring retract spindle actuators.
6100 Series - single spring - yoke mounted.
6200, 6300 & 6400 Series - multi spring - pillar mounted.

Description

A range of compact linear actuators having 4 diaphragm sizes for matching the requirements of different valves at various differential pressures. Each actuator is fitted with mechanical stroke indicators and incorporate a rolling diaphragm to give linearity over the full operating stroke.
The actuators are designed for easy conversion to spring extend spindle operation (and vice versa) in the field using the same components and without the need of special tools.
These actuators are designed to operate with 2 Port KE Valves and 3 Port QL Valves as detailed below.

Actuator Type	Valve Type
20 mm travel	KE 43, KE 71, KE 73 and KE 63 (DN15-50) QL 43 & QL 73 (DN15-50)
30 mm travel	KE 43, KE 63 and KE 73 (DN65-100) QL 43 & QL 73 (DN65 - DN100)

Technical data

Temperature Range	—20 to 110°C
Maximum operating range	6 bar
Linearity	2%
Hysteresis	3% max

Air supply connection

Actuator Type	Connection
6100 & 6200 Series	1/8" BSP
6300 & 6400 Series	1/4" BSP

Compressed air consumption

Actuator Type	Travel	Volume - Litres (normal)
6100 Series	20 mm	0.33
6200 Series	20 mm	0.99
6300 Series	20 mm	1.39
	30 mm	1.65
6400 Series	20 mm	2.36
	30 mm	2.78

Spring ranges

Actuator Types	Spring Range	Travel
6120	0.2 to 1.0 bar	20 mm
6121	0.2 to 0.6 bar	20 mm
6122	0.6 to 1 bar	20 mm
6220	0.2 to 1.0 bar	20 mm
6221	0.2 to 0.6 bar	20 mm
6320	0.2 to 1.0 bar	20 mm
6321	0.2 to 0.6 bar	20 mm
6322	0.6 to 1.0 bar	20 mm
6330	0.2 to 1.0 bar	30 mm
6420	0.2 to 1.0 bar	20 mm
6421	0.2 to 0.6 bar	20 mm
6422	0.6 to 1.0 bar	20 mm
6430	0.2 to 1.0 bar	30 mm

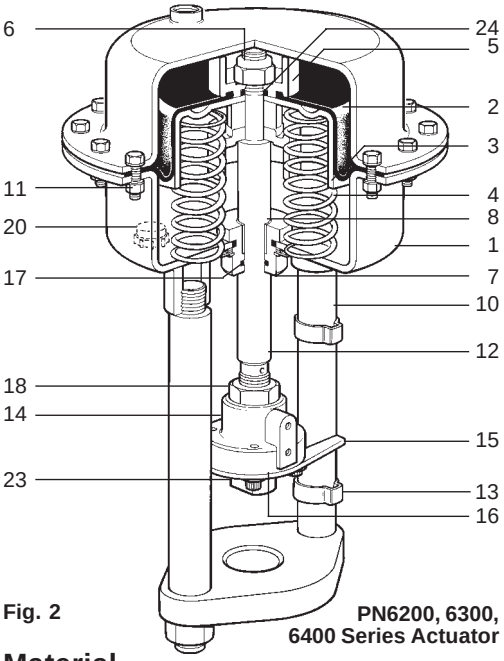
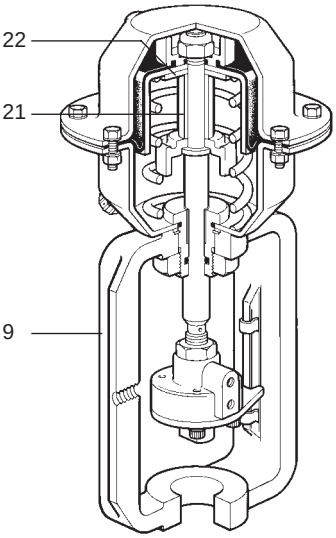


Fig. 2 **PN6200, 6300, 6400 Series Actuator**



PN6100 Series Actuator

Material

No	Part	Material
1	Diaphragm housing	Pressed steel
2	Rolling diaphragm	Fabric reinforced nitrile rubber
3	Piston	Pressed steel
4	Spring	Spring steel
5	Diaphragm clamp casting	Stainless steel
6	Nyloc nut	Steel
7	Piston guide	Stainless steel
8	DU bearing	PTFE/Steel composite
9	Yoke (6100 series)	Aluminium
10	Pillars (6200, 6300, 6400 series)	Steel
11	Housing securing nuts & bolts	Steel
12	Spindle	Stainless steel
13	Travel indicators	Spring steel
14	Connector	Steel
15	Indicator plate	Steel
16	Lock plate	Steel
17	'O' ring	Rubber
18	Lock nut	Steel
19	Mounting flange	Steel
20	Cap (with vent hole)	Plastic
21	Spacer	Steel
22	Spring location washer (6100 series)	Steel
23	Adaptor	Steel
24	'O' ring	Rubber

2. Installation

See also separate Installation and Maintenance Instructions for the control valve — Section 7. For details of differential pressures associated with KE and QL valves refer to Technical Information Sheets. For KE valves refer to TI-P357-03 and TI-P357-02 for PN5000 and PN6000 series actuators. For QL valves refer to TI-P357-10 and TI-P357-09 for PN5000 and PN6000 series actuators.

The actuator should be installed in such a position as to allow full access to both actuator and valve for maintenance purposes. The preferred mounting position is with the actuator and valve spindle in the vertical position above or below the horizontal pipework.

The actuator ambient temperature limits are -20°C to +110°C. For low temperature conditions the air supply must be dry. For high temperature conditions to protect the actuator, insulate the control valve and pipework.

Warning

The actuator housing must only be pressurised on the opposite side of the diaphragm to the springs. The housing plastic vent cap must be left unrestricted.

Number of springs

PN5100 and 6100 series are fitted with a single spring, all other models have multi springs. The number of springs fitted is dependent on the spring range. Refer to Table 1.

Table 1 : PN5000/PN6000 Spring

Actuator Type	Number of springs	Inside dia. (mm)	Length (mm)	Identification (vertical stripe)	Spring range	Travel
5120/6120	1	51	89	Black	0.2—1.0 bar	20 mm
5121/6121	1	52.5	94	Blue	0.2—0.6 bar	20 mm
5122/6122	1	52.5	114	Green	0.6—1.0 bar	20 mm
5123/6123	1	51.7	104	Red	2.0—4.0 bar	20 mm
5220/6220	4	23	80	Black	0.2—1.0 bar	20 mm
5221/6221	4	23.5	82	Blue	0.2—0.6 bar	20 mm
5223/6223	8	23.5	84	Red	2.0—4.0 bar	20 mm
5320/6320	6	28	85	Black	0.2—1.0 bar	20 mm
5321/6321	4	28.9	83	Blue	0.2—0.6 bar	20 mm
5322/6322	4	28.9	110	Green	0.6—1.0 bar	20 mm
5323/6323	8	28	100	Red	2.0—4.0 bar	20 mm
5330/6330	4	28.5	87.5	White	0.2—1.0 bar	30 mm
5333/6333	8	30	105	Brown	2.0—4.0 bar	30 mm
5420/6420	4	39	116	Black	0.2—1.0 bar	20 mm
5421/6421	4	39.5	118	Blue	0.2—0.6 bar	20 mm
5422/6422	4	40	140	Green	0.6—1.0 bar	20 mm
5423/6423	8	39	130	Red	2.0—4.0 bar	20 mm
5430/6430	4	39	119	White	0.2—1.0 bar	30 mm
5433/6433	8	39.5	141	Brown	2.0—4.0 bar	30 mm

3. Commissioning

If the actuator/valve has been supplied with a positioner refernce should be made to the separate Installation and Maintenance Instructions for this product.

3.1 Adjusting Spring

The actuator spring range and lift off pressure will be indicated on the nameplate. Should it be necessary to check or adjust the lift off pressure the procedure is described in paragraphs 3.2 and 3.3

Important

To prevent damage to the valve seat, please ensure the plug does not turn while pressing on the seat during assembly or adjustment. To prevent damage to the diaphragm ensure actuator spindle is not allowed to rotate when the diaphragm is assembled within its housing.

3.2 PN5000 Spring Extend Actuators

Note: Adjustment of the spring will only alter the pressure of the control signal air at which the valve commences to move off its seat (set point) and will not alter the spring pressure range required to move the valve through its full travel. i.e. 0.2 to 1.0 bar spring (range 0.8 bar) set to commence to lift at 0.4 bar will require a 1.2 bar air pressure (range 0.8 bar) to obtain valve full travel.

To adjust set point proceed as follows:—
Ensure the control valve has been isolated the actuator housing is pressure free. Loosen valve adaptor locknut.
Loosen and remove socket screws, locking plate and drop anti-rotation/indicator plate over valve stem. Using two spanners whilst holding actuator connector loosen actuator locking nut.
Apply the control signal pressure required to commence lifting the valve plug off its seat. With the valve plug remaining on its seat adjust with equal turns both the actuator connector and valve adaptor until the adaptor enters and presses tightly against the actuator connector. See Fig. 3 for correct installation. Attach the anti-rotation/indicator plate (4), locking plate (3) with socket screws to the actuator connector. Tighten screws. (See Fig. 4).
Release the control air pressure signal and re-check that the valve just commences to move off its seat at the new spring range minimum pressure and is fully open at the spring range maximum pressure.
After the test set the travel indicators to the end of travel positions. With the valve at mid travel using two spanners tighten actuator connector locknut. Tighten valve adaptor locknut.

Important
Do not turn the valve plug on its seat when under pressure from the actuator. Do not allow the actuator spindle to rotate when the diaphragm is assembled within its housing.

Ensure actuators or valve spindles do not protrude outside their respective connector or adaptor as this will prevent correct location.

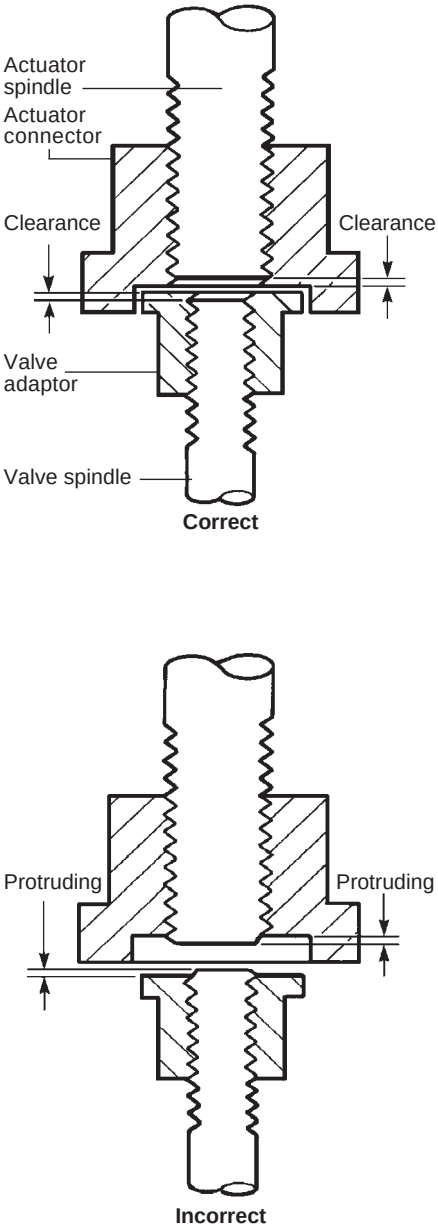


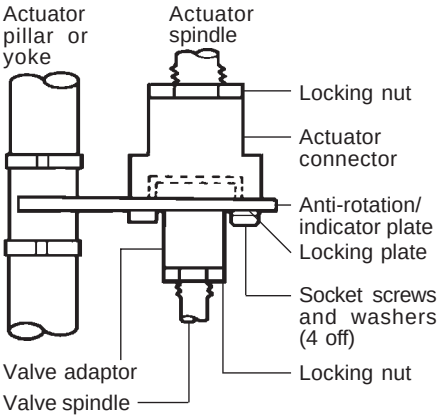
Fig. 3 Assembly of Actuator Adaptor and Valve Connector

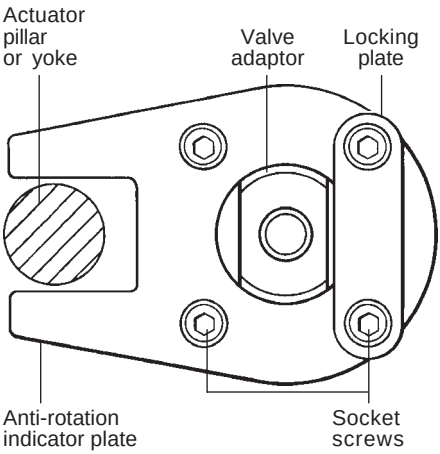
3.3 PN6000 Series, Spring Retract Actuators

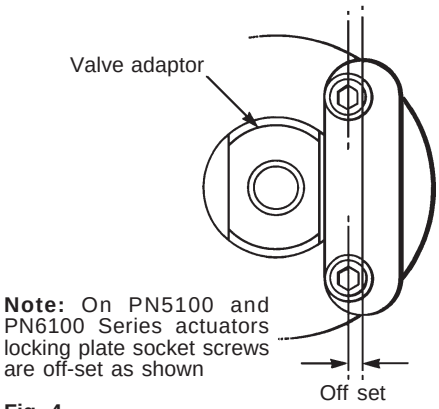
Note: Adjustment of the spring will only alter the pressure of the control signal air at which the valve commences to close (set point) and will not alter the spring pressure range required to move the valve through its full travel. i.e. 0.2 to 1.0 bar spring (range 0.8 bar) set to commence to lift at 0.4 bar will require a 1.2 bar air pressure (range 0.8 bar) to obtain valve full travel.

To reset or adjust set point proceed as follows:—
Ensure the control valve has been isolated and the actuator housing is pressure free.
Loosen valve adaptor locknut. Loosen and remove socket screws, locking plate and drop anti-rotation/ indicator plate over valve stem. Using two spanners whilst holding actuator connector loosen actuator connector locking nut. Apply the control signal pressure required to commence valve plug closing. Ensuring the valve plug is in its fully open position adjust with equal turns both the actuator connector and valve adaptor until the adaptor enters and presses tightly against the actuator connector. See Fig. 3 for correct installation. Attach the anti-rotation/indicator plate, locking plate with socket screws to the actuator connector. Tighten screws. (See Fig. 4).
Release the control air pressure signal and recheck that the valve just commences to close at the new spring range minimum pressure and is fully closed at the spring range maximum pressure.
After the test set the travel indicators to the end positions. With the valve at mid travel using two spanners tighten actuator connector locknut. Tighten valve adaptor locknut.

Important
Do not turn the plug on its seat when under pressure from the actuator. Do not allow the actuator spindle to rotate.







Note: On PN5100 and PN6100 Series actuators locking plate socket screws are off-set as shown

Fig. 4

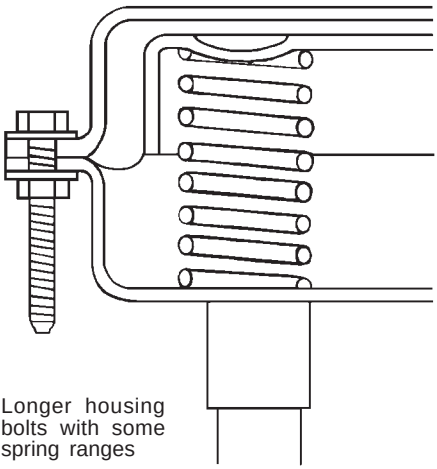
4. Reversal of Actuator Action

The operation of each actuator can be reversed i.e. PN5000 series spring extend can be converted to PN6000 series spring retract and vice versa. No special equipment is required.

To reverse actuator operation proceed as follows:

4.1 Removing Actuator from Valve

Drive actuator into approximately mid-travel position with the air supply. Loosen valve adaptor locknut. Loosen and remove socket screws, locking plates and rest anti rotation/ indicator plate over valve stem. Using two spanners, whilst holding actuator connector loosen actuator locking nut.
Loosen and remove yoke mounted actuators mounting nut or pillar mounted actuators hexagon nuts and lift actuator off the valve.
Reduce air supply pressure until housing is pressure free. Disconnect air supply from the actuator.



Longer housing bolts with some spring ranges

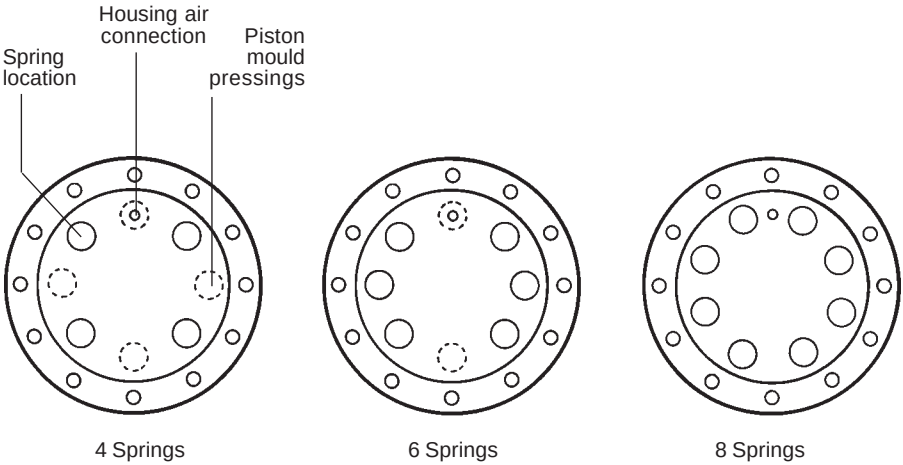
Fig. 5

4.2 Reversing PN5000 Series Spring Extend to PN6000 Spring Retract.

Loosen and remove housing screws (11) and remove housing lid (1).
Note 1 — On certain spring ranges 3 off longer housing bolts are fitted (11). These should be removed after all other bolts are removed and should be loosened evenly to prevent distortion. Ensure that the locknut (18) is tightened onto the actuator connector (14). Using two spanners whilst holding actuator connector, loosen Nyloc nut (6).
Remove spring (s) (4), Nyloc nut, fibre washer, diaphragm clamp (5), spacer (21), spring location washer (single spring actuators only) (22), piston guide (3), diaphragm (2), 'O' Ring (24) and bottom diaphragm clamp (5).
Reassemble in the following order:
Refit bottom diaphragm clamp, spacer and spring location washer (single spring actuators only). Turn piston upside down and refit spring (s) and piston ensuring on multi spring actuators that the springs are correctly located over piston mould locations. (See Fig. 6)
Refit diaphragm and top diaphragm clamp ensuring the diaphragm lip is correctly located within the clamp groove. Fit fibre washer and Nyloc nut. Using two spanners, whilst holding actuator connector tighten Nyloc nut.
Refer to Table 2 for torque rating. Ensuring that the top housing bolt holes line up with the bottom housing holes. Refit top housing and securing nuts and bolts.
2 — Housing securing bolts should be tightened evenly to avoid distortion. On some spring ranges 3 off longer housing bolts are provided to span the longer spring. If supplied, these should be positioned 120° apart and tightened evenly prior to fitting the remaining bolts. (See Fig. 5)
3 — To avoid distortion of the diaphragm do not fully tighten housing bolts until all bolts have been fitted. Final tightening should then be carried out evenly. Refer to Table 2 for torque rating. Remove plastic cap (20) from top housing and refit into bottom housing.
Refer to Section 4.4, reference refitting of actuator to valve.

Table 2 Recommended tightening torques

Actuator	Housing bolts (12)		Nyloc nut (14)	
series	Size	Torque N m	Size	Torque N m
PN5100/PN6100	M5	2 ± 0.25	M10	27 ± 3
PN5200/PN6200	M5	2 ± 0.25	M12	40 ± 3
PN5300/PN6300	M6	2.5 ± 0.25	M12	40 ± 3
PN5400/PN6400	M8	5 ± 0.25	M12	40 ± 3



Note: Arrange springs as shown to avoid interference with housing air connection.

Fig. 6 Position of Multi-springs

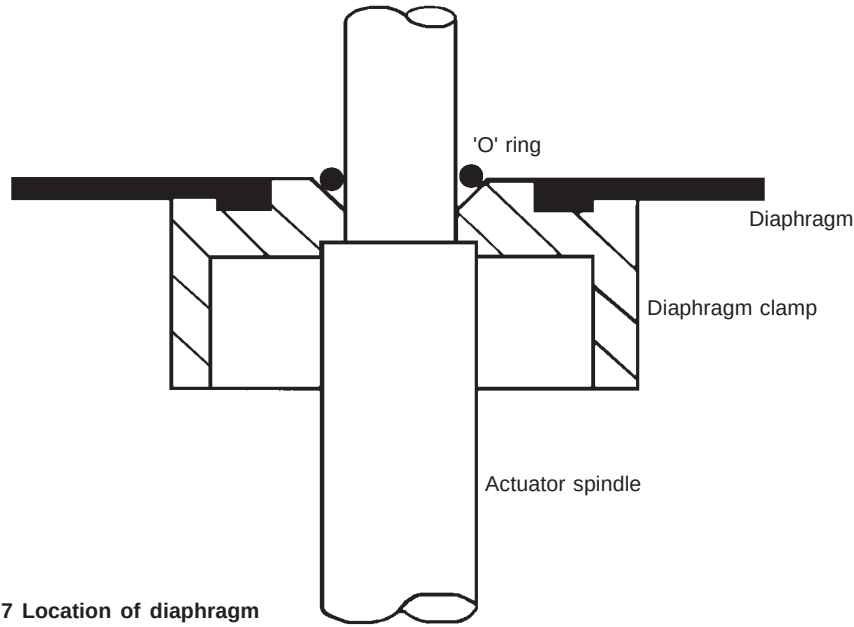


Fig. 7 Location of diaphragm

4.3 Reversing PN6000 Series Spring Retract to PN5000 Series Spring Extend

(See Fig. 1 and 2)

Loosen and remove housing screws (11) and remove housing lid (1).

Note 1 — On certain spring ranges 3 off longer housing bolts are fitted, positioned evenly apart. These should be loosened after all other bolts are removed and should be loosened evenly to prevent distortion. This is necessary to relieve all spring force before removing housing lid. Ensuring that the locknut (18) is tightened onto the actuator connector (14), using two spanners whilst holding actuator connector, loosen and remove Nyloc nut (6), fibre washer, diaphragm clamp (5), 'O' Ring (24), diaphragm (2), piston (3), spring location washer (single spring actuators only) (22), spring (s) (4) and spacer (2). Reassemble in the following order:-

Turn diaphragm upside down and refit ensuring that diaphragm lip is correctly located in lower Actuator clamp groove (See Fig. 7). Turn piston upside down and refit ensuring it is pressing tightly against diaphragm.

Refit spring location washer (single spring Actuators only), spacer, top diaphragm clamp, fibre washer and Nyloc nut.

Using 2 spanners, whilst holding Actuator connector, tighten Nyloc nut to the torque rating given in Table 2. Refit spring (s) ensuring that on multi spring Actuators the springs are correctly located over the piston pressing locations (See Fig. 6).

Ensuring that top housing bolt holes line up with the bottom housing holes, refit top housing and securing nuts and bolts.

2 — Housing fixing bolts should be tightened evenly to avoid distortion. On some spring ranges 3 off longer housing bolts are provided to span the longer spring. If fitted, these should be positioned 120° apart and tightened evenly before fitting and tightening the remaining bolts (See Fig. 5)

3 — To avoid distortion of the diaphragm do not fully tighten housing bolts until all bolts have been fitted. Final tightening should then be carried out evenly. Refer to Table 2 for torque rating.

Remove plastic cap (20) from bottom housing and refit into top housing.

Refer to Section 4.4. reference refitting of Actuator to valve.

4.4. Refitting Actuator to Valve.

4.4.1. Yoke mounted - single spring Actuators. Place Actuator yoke over valve spindle and locate on bonnet shoulder. Locate and tighten valve mounting nut to 50Nm.

Note — it may be necessary to adjust the position of the valve adaptor and actuator connector.

4.4.2. Pillar mounted - multi spring Actuators Position Actuator pillars over valve bonnet flange fixing holes and locate.

Note 1 — On some spring ranges due to the high spring tension being exerted it may be necessary to counter-balance the spring pressure with an air signal onto the Actuator housing to realign Actuator pillars. If this is necessary, apply an air pressure signal equal to the lower value of the spring range rating. (Refer to Actuator name plate for spring pressure range). Fit pillar nuts and tighten to 35 ± 2 Nm.

2 — It may be necessary to adjust the position of the valve adaptor and actuator connector to correctly locate the actuator on the valve.

4.5. Recommissioning

On completion of reversal of operation it will be necessary to recommission the valve/ actuator. Refer to Section 3 regarding commissioning following Section 3.2 - Spring Extend Actuators or, Section 3.3 - Spring Retract Actuators, as appropriate.

5.1 Single Spring Actuators

The spare parts available are in heavy outline. Parts drawn in broken line are not supplied as spares.
These spares are for PN5100 and PN6100 series single spring actuators.
For PN5200, 5300, 5400, 6200, 6300 and 6400 series multi-spring actuators see page 13.

Available spares

Stem seal kit (Piston guide bearing and 'O' ring's)	A,C,H
Diaphragm kit (Diaphragm, Nyloc nut and Washer and 'O' ring)	D,E,F,H
Travel Indicator kit (2 off indicators)	G
Spring kit (Spring - includes 3 off longer Hex. Head bolts, washers and nuts on some spring ranges).	B,J

How to order
Always order spares by using the description given in the column headed Available Spare and stating the actuator type.

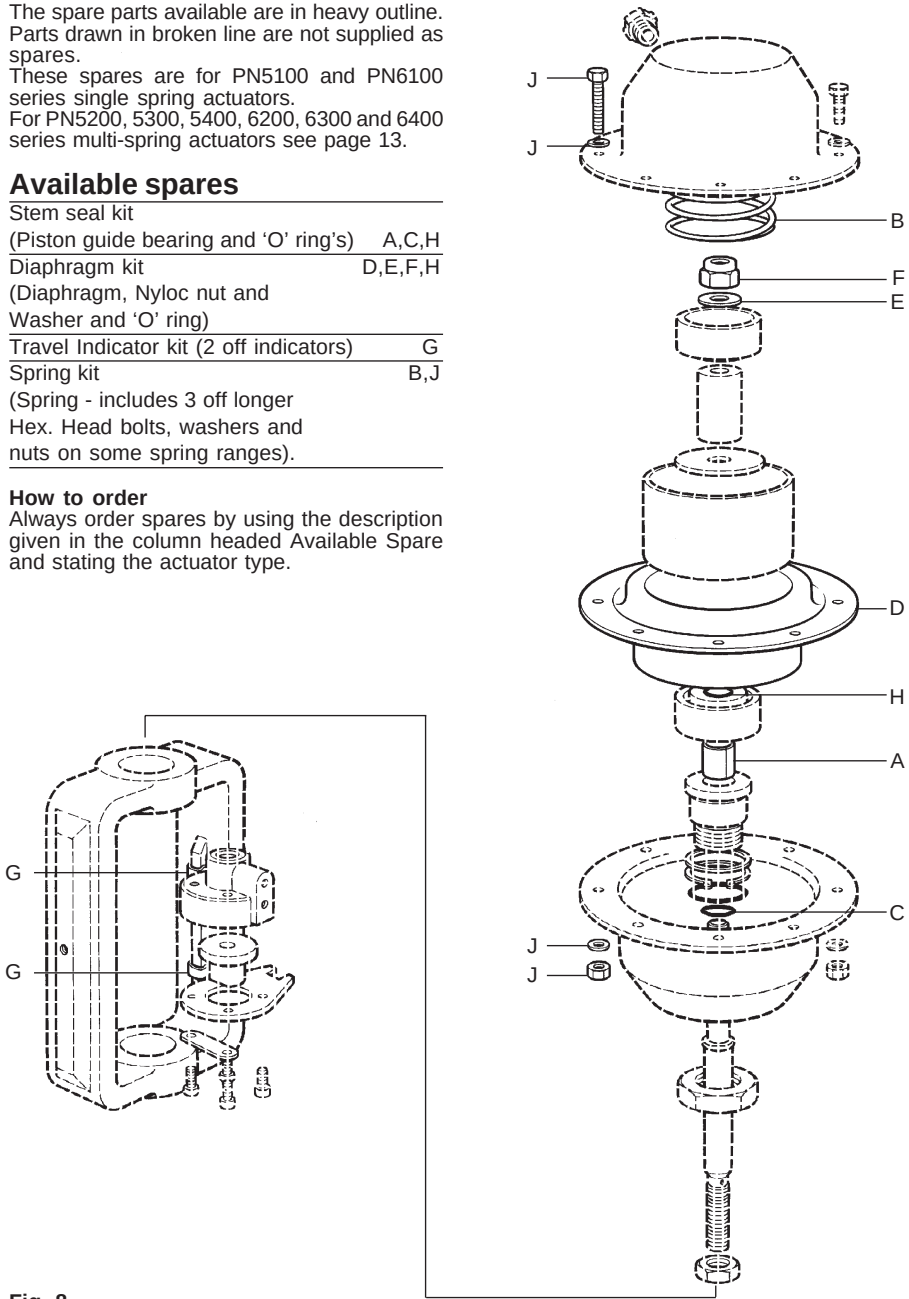


Fig. 8

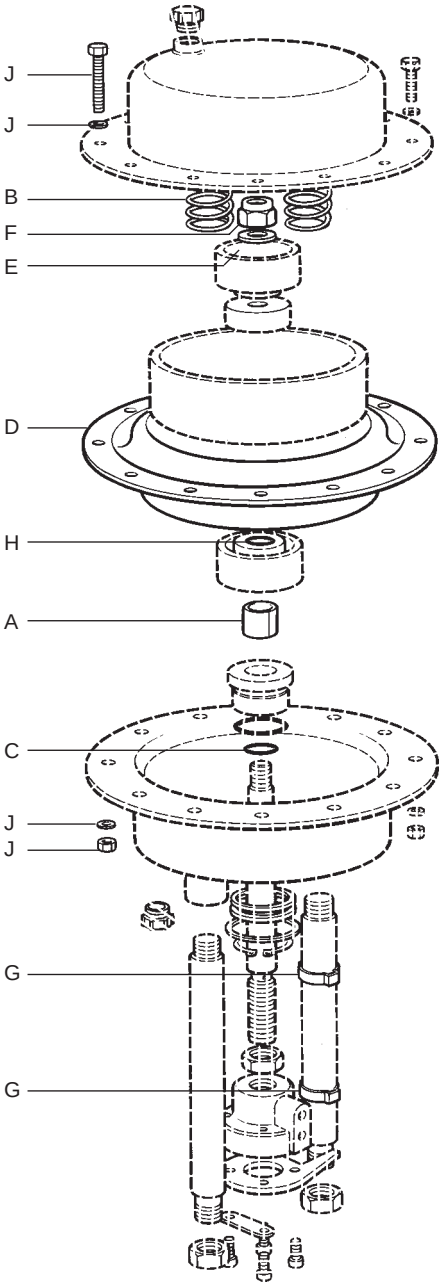


Fig. 9

5.2 Multi-Spring Actuators

The spare parts available are shown in heavy outline. Parts drawn in broken line are not supplied as spares.

These spares are for PN5200, 5300, 5400, 6200, 6300 and 6400 Series multi-spring actuators.
For PN5100 and 6100 Series single spring actuators see page 12.

Available spares

Stem seal kit (Piston guide bearing and 'O' ring's)	A,C,H
Diaphragm kit (Diaphragm, Nyloc nut and Washer and 'O' ring's)	D,E,F,H
Travel Indicator kit (2 off indicators)	G
Spring kit (Set of Springs - includes 3 off longer Hex. Head bolts, washers and nuts on some spring ranges).	B,J

How to order
Always order spares by using the description given in the column headed Available Spare and stating the actuator type.

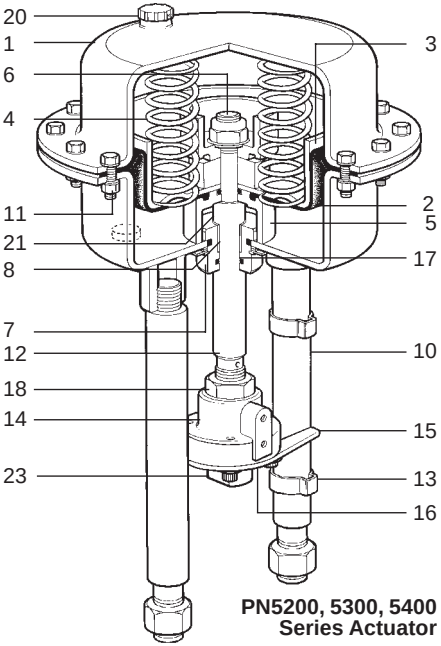
Example: 1 — Stem seal kit for PN5220 pneumatic actuator.

How to fit
Full fitting instructions are given in the operating and maintenance instructions supplied with the actuator.

The PN5000 and PN6000 series pneumatic actuators are maintenance free. To ensure satisfactory operation it is strongly recommended that the control signal air is filtered and supplied free of oil and water. Should it be necessary to replace spare parts the following procedure should be followed.

6.1 PN5000 Series

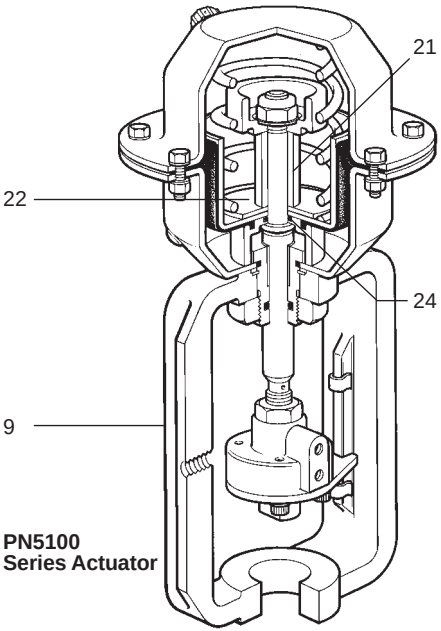
6.1.1 Diaphragm Kit - How to Fit (See Fig. 10) Remove actuator from valve as described in Section 4.1.
Remove top housing (1). As described in Section 4.2. Remove spring/springs. Tighten nut (18) onto connector (14). Using two spanners whilst holding actuator connector, to prevent actuator spindle rotating, loosen and remove Nyloc nut (6) and fibre washer.
Remove diaphragm clamp (5) spacer (21) and on PN5100/PN6100 series single spring actuators spring location washer (22). Remove piston (3) and diaphragm (2) and 'O' Ring (24). Refit new 'O' Ring and diaphragm ensuring diaphragm lip fits tightly into the groove of the lower diaphragm clamp (5) (See Fig. 7) and re-assemble all items in reverse order fitting new fibre washer and Nyloc nut.
Refit top housing and tighten screws evenly. Refer to Table 2 for torque ratings.
Note: Certain spring pressure ranges require three longer housing bolts to span the longer spring ranges fitted - (See Fig. 5). If supplied these should be fitted 120° apart and tightened evenly. The remaining housing bolts should then be fitted and tightened evenly.



PN5200, 5300, 5400 Series Actuator

6.1.2 Spring Kit - How to Fit (See Fig. 10) Remove actuator from valve as described in section 4.1.

Remove top housing as described in section 4.2. Remove spring(s).
Replace new spring(s), refit top housing and tighten bolts evenly. (Refer to Table 2 for torque ratings). Note: Some spring ranges require 3 off longer housing bolts. These will be supplied with the spare spring kits as appropriate.
Longer housing bolts should be fitted as described in section 6.11.
Refit actuator to valve as described in section 4.4 and recommission spring adjustment as described in section 3.



PN5100 Series Actuator

6.2 PN6000 Series

6.2.1 Diaphragm Kit - How to Fit (See Fig. 11) Remove actuator from valve as described in Section 4.1. All other details as 6.11 above reversed.
6.2.2 Spring Kit - How to Fit (See Fig. 11) Remove actuator from valve as described in Section 4.1. All further details as 6.1.2 above reversed.

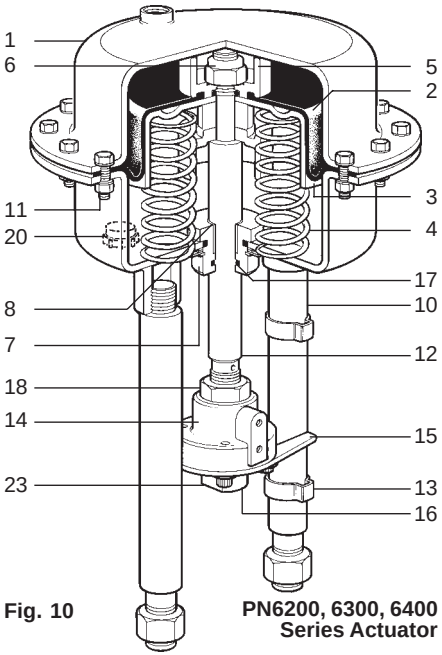
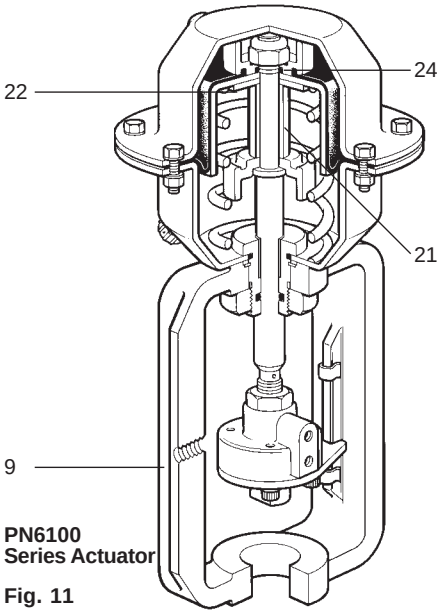


Fig. 10 **PN6200, 6300, 6400 Series Actuator**

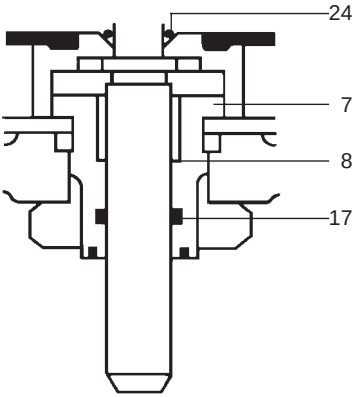


PN6100 Series Actuator

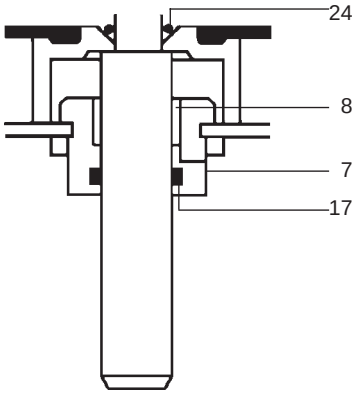
Fig. 11

6.3 PN5000 & PN6000 Series

6.3.1 Stem Seal Kit - How to Fit (See Fig. 12)
Remove actuator from valve as described in section 4.1.
Remove top housing and dismantle as described in section 4.2 removing all components including spacer (21) and bottom diaphragm clamp (5).
Withdraw actuator spindle. Remove 'O' ring (17) and tap out DU guide bearing (8) taking care not to damage piston guide (7).
Smear new 'O' ring with silicon grease and replace. Replace new DU guide bearing which may require gentle tapping to locate.
Refit actuator spindle taking care not to damage 'O' ring or bearing surface with spindle threaded end.
Re-assemble components in reverse order.
Refer to section 6.1.1 reference longer spindle screws if fitted. Refit actuator to valve as described in section 4.4 and recommission as described in section 3.



PN5100/PN6100 Series



PN5200, 5300, 5400, 6200, 6300 and 6400 Series

Fig. 12

3010052/3

IM-S24-15
CH Issue 3

DN15 to 100
KE43, 61, 63, 71 and 73 Control Valves
Installation and Maintenance Instructions

1. Operation

2. Installation and commissioning

3. Valve options

4. Maintenance

5. Spare parts

Printed in the UK

1. Operation

1. General description
With the development of modern industrial processes, experience has shown that the advantage of precise control instruments will be lost unless the associated control valves have good operating and flow characteristics. The KE range of valves have been designed to meet these requirements and embody a precise equal percentage flow, linear and fast opening characteristic having a high turndown ratio. Many common components are utilised throughout the range, thus ensuring the minimum stocking of spare parts by users.

2. Technical details and ratings
Maximum body pressure at 120°C.

SG iron (KE71 and 73)	25 bar
Cast steel (KE43)	40 bar
Stainless steel (KE61 and 63)	40 bar at 50°C

Maximum temperatures:

SG iron	250°C
Cast steel / stainless steel	250°C

Refer to appropriate TI for relevant pressure/temperature relationships

KE43	valves	TI-P353-01
KE61	valves	TI-P300-02
KE63	valves	TI-P300-01
KE71 and 73	valves	TI-P356-01

Maximum differential pressure against which the valve will shut off is dependent upon the actuator used. Refer to appropriate actuator TI.

3. Flow characteristic Equal percentage

4. Nomenclature
KE71 SG iron screwed valves
KE73 SG iron flanged valves
KE43 Cast steel flanged valves
KE61 Stainless steel screwed valves
KE63 Stainless steel flanged valves

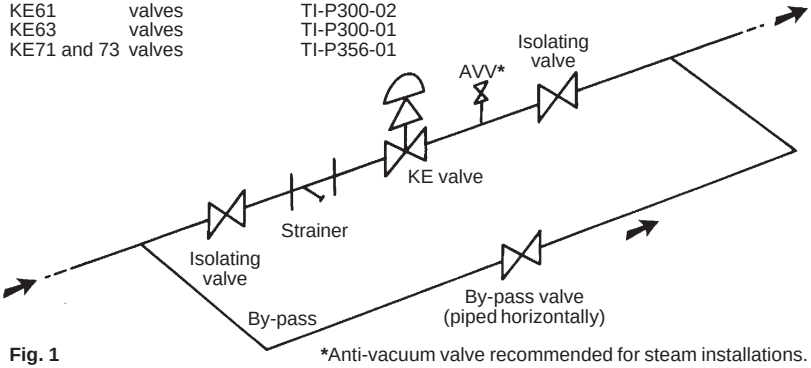


Fig. 1 ***Anti-vacuum valve recommended for steam installations.**

2. Installation and commissioning

5. Valves should be installed in a horizontal pipeline so that flow is in the direction indicated by the arrow cast on the body. Unless adequately supported, valves with pneumatic actuators should be positioned vertically upwards or downwards and valves with electric actuators through 90° upwards from horizontal. A suitable strainer should always be fitted before the control valve.

6. Bypass arrangements (Fig. 1)
It is recommended that isolating valves be fitted upstream and downstream of the control valve together with a manual regulating valve to bypass the group. The process may then be controlled by the bypass valve while the control valve is isolated for maintenance purposes.

7. Commissioning
For commissioning instructions refer to the Operation, Installation and Maintenance Instructions, covering Spirax Sarco Actuators.

KE Valve Options

Description

The Spirax Sarco KE valve range has a number of options which are available over and above the standard valve details contained on TI-P356-01, TI-P353-01 and TI-P300-01.

• Spindle sealing

High temperature packing (H)

Design temperature	-10°C to 400°C*
Material	Graphite rings

* (S) High temperature packing and high temperature bolting is required above 300°C.

Note: Differential pressures contained in TI-P357-10 and TI-P357-02 do not apply when high temperature packing is used. Contact Spirax Sarco for details.

Bellows sealed (B)
See TI-P301-01, TI-P301-02, and TI-P301-03.

• Plug and seat treatment

Soft seal (G)

Design temperature	-10°C to 200°C
Material	PTFE
Leakage	IEC 534-4 Class VI

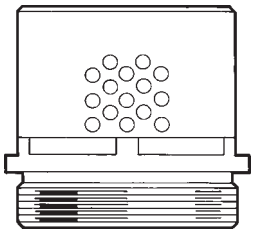
Hard faced trims (W)

Design temperature	-10°C to 400°C
Material	Stellite (cobalt / chromium / tungsten alloy)

Low noise trim (N) Reduces noise level by 10 dBA

Design temperature	-10°C to 400°C
Material	316L stainless steel

Low noise trim

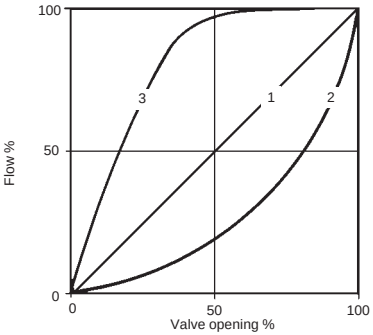


• Valve characteristic

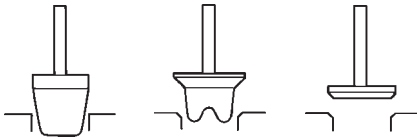
The following options are available for the entire KE valve range:-

1. Linear (L)
2. Equal percentage (E)
3. Fast opening (F)

Flow characteristic curves



Typical valve plug designs



1. Linear (L) 2. Equal percentage (E) 3. Fast opening (F)

• Capacity values K_{VS}

Size DN	15	20	25	32	40	50	65	80	100
Equal % / Linear	4	6.3	10	16	25	36	63	100	160
	1.6	6.3	10	16	16	25	36	63	100
*Reduced Kvs	1.0	4	6.3	10	10	16	25	36	63
	0.4	1.6	4	6.3	6.3	10	16	25	36
Fast opening	4	6.3	10	18	28	50	85	117	330
Low noise	-	-	8	12	18	26	50	63	90

*The reduced trim option is only available with the standard equal percentage and linear trim.

Local regulations may restrict the use of this product to below the conditions quoted.
In the interests of development and improvement of the product, we reserve the right to change the specification.

Control valve selection guide

Valve size	DN 15, 20, 25, 32, 40, 50, 65, 80, 100	DN25
Valve series	K series - 2 port	K
Valve characteristic	L = Linear E = Equal percentage F = Fast opening	E
Body material	4 = Cast steel 6 = Stainless steel 7 = SG iron	7
Connections	1 = Screwed 3 = Flanged	3
Stem sealing option	B = Bellows sealed D = Bellows sealed with high temperature bolting H = High temperature packing S = High temperature packing with high temperature bolting	
Seating option	G = Soft seal (PTFE) W = Hard facing	
Trim	N = Low noise	N
K_{VS}	To be specified	K_{VS}10
Connection type	To be specified	PN25

DN25	K	E	7	3			N	K_{VS}10	PN25

How to order

Example: 1 - DN25 KE 73 N K_{VS} 10 with PN25 flanges

Control valve spares
See TI-P301-02 for bellows sealed control valves spares
See TI-S24-10 for KE 43, 63, 71 and 73 valve spares.

4. Maintenance

8. Procedure for renewing chevron gland seals (Fig. 2).

Safety note: care should be taken when handling gaskets since the stainless steel reinforcing strip can easily inflict cuts.

a) Isolate valve on both sides.

b) Remove actuator from valve. Refer to Installation and Maintenance Instructions covering Spirax Sarco Actuators.

c) Caution: Care should be taken in removing the bonnet since fluid under pressure may be trapped between the isolating valves.
Unscrew the nuts (8) securing the bonnet to the body and remove the bonnet (6) complete with stem and plug (5).

d) Remove locknut (1).

e) Unscrew gland nut (3), withdraw valve stem and plug, remove and discard the gland ring set (4) and 'O' Ring (4a),or gasket (4b).

f) Examine parts for signs of damage or deterioration and renew as necessary. Note that score marks or scaly deposits on valve stem (5) will lead to early failure of the seals.

g) Clean parts taking care to avoid scratching stem or bore of gland nut. Refit valve stem and plug.

h) Using new bonnet gasket (7) refit the bonnet (6) on the valve body, leaving the stem protruding.
Replace the nuts (8) and tighten to the correct torque (see chart), ensuring valve plug is on its seat.

i) To replace new stem seal assembly (4), firstly fit spring over valve stem (5).
If damaged, 'O' ring /gasket (4a and 4b) should be replaced under the gland nut head..
New chevron gland seals to be firmly inserted into the gland nut (3) followed by the guide bush, which should be retained in place for assembly purposes by applying a small amount of grease, with care being taken to avoid damage to the sealing edges.
Refit gland nut (3) over the valve stem (5), screwing down to ensure 'O' ring (4a), or gasket (4b) is bedded down onto the bonnet (6).
Chevron seals should be fitted into gland nut (3) as shown in Fig. 2.

j) Ensure that the stem (5) moves freely.

k) Refit valve locknut (1).

l) Refit actuator, clamping nut (2) and connect actuator to valve stem.

m) Bring valve back into service.

n) Check for leakage at gland.

9. Procedure for renewing graphite gland seals (Fig. 2).

a) Isolate valve on both sides.

b) Remove actuator from valve. Refer to Installation and Maintenance Instructions covering Spirax Sarco Actuators.

Caution: Care should be taken in removing the bonnet since fluid under pressure may be trapped between the isolating valves.

c) Unscrew the four nuts (8) securing the bonnet to the body and remove the bonnet (6) complete with stem and plug (5).

d) Remove locknut (1).

e) Unscrew gland nut (3a). Withdraw stem and plug (5), remove and discard gland set (4c), and gasket (4b) from the bonnet.

f) Examine parts for signs of damage or deterioration and renew as necessary. Note that score marks or scaly deposits on valve stem (5) will lead to early failure of the seals.

g) Clean parts taking care to avoid scratching stem or bore of gland nut.

h) The replacement graphite stem seal should now be fitted. Note that the stem seal contains a top and bottom support ring and a graphite pack. The order of the graphite pack should be maintained as supplied during fitting.
Place the bottom support ring into the bonnet. One by one add the graphite rings and each time use the gland nut (3a) to drive down into the bonnet. Ensuring the junction of the ring ends are rotated by 90°C. (as shown below) Leave the gland nut loosely assembled so that the seals are not compressed.

Ring 1 Ring 2 Ring 3 Ring 4 Ring 5

i) Refit the valve stem and plug assembly by carefully sliding the valve stem in order to pass through the seals.

j) Using new bonnet gasket (7) refit the bonnet (6) on the valve body, ensuring the plug is on the valve seat, and replace the nuts and tighten to the correct torque (see chart of recommended torques).

k) Screw down the gland nut until it just starts to compress the packing.
Compress the stem seal by tightening the gland nut (3a) by 1½ turns. Raise the lower valve stem after each tightening of the gland nut to encourage the seals to bed down correctly.

l) Refit the actuator using clamping nut (2) and connect the actuator to the valve stem.

m) Stroke the valve 5 times to allow the seals to bed in finally.

n) Adjust the gland nut (3a) by 1/3 of a turn for 15-50 mm size valves and ½ turn for 65 to 100 mm valves.

m) Stroke the valve 5 times to allow the seals to bed in finally.

n) Adjust the gland nut (3a) by 1/3 of a turn for 15-50 mm size valves and ½ turn for 65 to 100 mm valves.

o) Commission the actuator according to the appropriate Installation and maintenance instructions.

p) Bring the valve back into service.

q) Check for leakage at the gland. Should there be a small amount of seepage from the valve stem, this may be stopped by carefully tightening the gland nut. Care should be taken not to overtighten as this may cause the spindle to lock up. Note also heat the actuator spring setting may need to be adjusted following the adjustment of the stem seal

10. Procedure for renewing valve plug and seat

a) Isolate valve on both sides.

b) Remove actuator from valve. Refer to Installation and Maintenance Instructions covering Spirax Sarco Actuators.

c) Caution: Care should be taken in removing the bonnet since fluid under pressure may be trapped between the isolating valves.
Unscrew the nuts (8) securing the bonnet to the body and remove the bonnet (6) complete with stem and plug (5).

d) Remove locknut (1).

e) Unscrew gland nut (3), withdraw stem and plug (5) and remove and discard the gland set (4) and 'O' ring (4a), or gasket (4b) from the bonnet. Clean bonnet then replace new stem and plug.

KE63 Warning: The 316 type stainless steel used in the construction of this product, particularly for screwed or close fitting parts, is very susceptible to galling or cold welding. This is an inherent characteristic of this type of material and great care should therefore be taken when dismantling or reassembling.
If the application permits it is recommended that a light smear of a PTFE based grease is applied to any mating parts before reassembly.

f) Unscrew and remove valve seat (9). Remove seat gasket (10) and replace with new seat gasket (10).

g) Lightly smear the threads of the new seat (9) with silicon grease and screw it into the body. Tighten to the correct torque (see chart) ensuring valve plug is on its seat.

h) Using a new gasket (7) refit the bonnet (6) on the valve body. Replace the nuts (8) and tighten to the correct torque (see chart).

i) Fit new stem seal assembly (4) and 'O' ring (4a),or gasket (4b) as described in Paragraph 8(i), ensuring valve stem (5) moves freely after assembly.

j) Refit actuator, clamping nut (2) and connect actuator to valve stem.

k) Bring valve back into service.

L) Check for leakage at gland.

Chart of recommended torques (Nm)

Size	Seat (9)	Bonnet nuts (8)	Gland nut (3) chevron seals only
DN15	40 ± 5	15 - 20	25 - 30
DN20	53 ± 3	20 - 25	25 - 30
DN25	80 ± 5	25 - 30	25 - 30
DN32	130 ± 5	40 - 45	25 - 30
DN40	220 ± 5	40 - 45	25 - 30
DN50	150 ± 5	60 - 65	25 - 30
DN65	300 ± 12	47 - 53	32 - 38
DN80	400 ± 16	55 - 61	32 - 38
DN100	600 ± 24	45 - 51	32 - 38

Attention should be given to leaking glands immediately. If left, the valve spindle may be damaged by scoring.

Note: To avoid damage to gland seals the valve stem (5) should be correctly fitted within the bonnet before replacing gland nut (3) chevron seal assembly.

Handling precautions for PTFE

Within its working temperature range PTFE is a completely inert material, but when heated to its sintering temperature it gives rise to gaseous decomposition products or fumes which can produce unpleasant effects if inhaled. Fumes can be produced during processing: for example, when the material is heated to sinter it, or when brazed connections are being made to cable insulated PTFE. The inhalation of these fumes is easily prevented by applying local exhaust ventilation to atmosphere as near to their source as possible.

Smoking should be prohibited in workshops where PTFE is handled because tobacco contaminated with PTFE will during burning give rise to plymer fumes. It is therefore important to avoid contamination of clothing, especially the pockets, with PTFE and to maintain a reasonable standard of personal cleanliness by washing hands and removing any particles lodged under the fingernails.

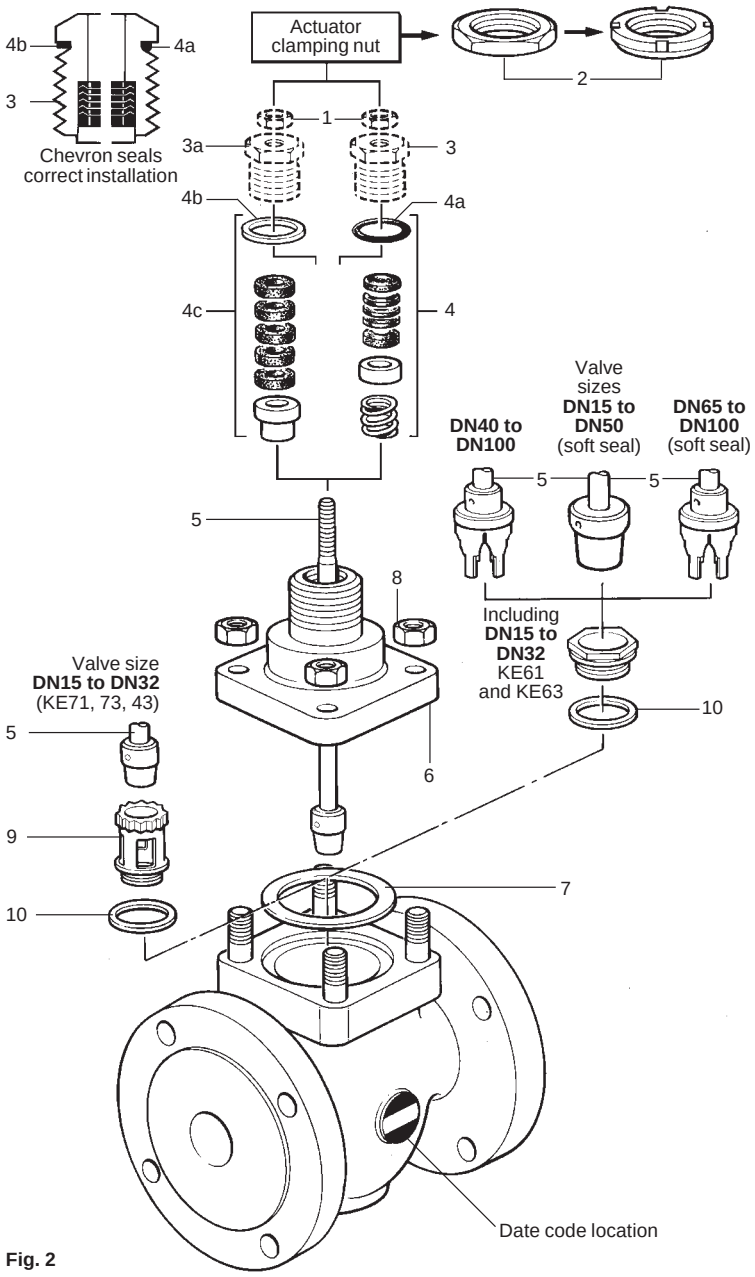

4b
4a
3
Chevron seals
correct installation
Actuator
clamping nut
2
1
3a
3
4b
4a
4c
4
Valve
sizes
DN40 to
DN100
DN15 to
DN50
(soft seal)
DN65 to
DN100
(soft seal)
5
5
5
8
Including
DN15 to
DN32
KE61
and KE63
10
Valve size
DN15 to DN32
(KE71, 73, 43)
5
6
9
10
7
Date code location

Fig. 2

5. Spare parts

Note: When placing an order for spares please indicate clearly the product date code (found on the label of the valve body i.e. 612) to ensure that the order is processed quickly, efficiently and correctly.

DN15 to DN100
The spare parts available are in heavy outline. Parts drawn in broken line are not supplied as spares.

AVAILABLE SPARE	
Actuator clamping nut	A
Valve gland seal kit (gasket, chevrons, guide bush, spring)	B
Standard plug* and stem assembly with bonnet gasket	D, E
Soft seated plug and stem assembly with bonnet gasket	D1, E
Valve seat and seat gasket	F, G
Bonnet gasket (packet of 3)	E
High temperature valve gland seal kit (top support ring, graphite stem seal, bottom support ring)	C

* Denotes equal percentage, linear or fast opening plug.

Note: see TI-P301-02 for bellows sealed valve spares.

How to order spares
Always order spares by using the description given in the column headed available spare, stating, the following information and the date code of the product.

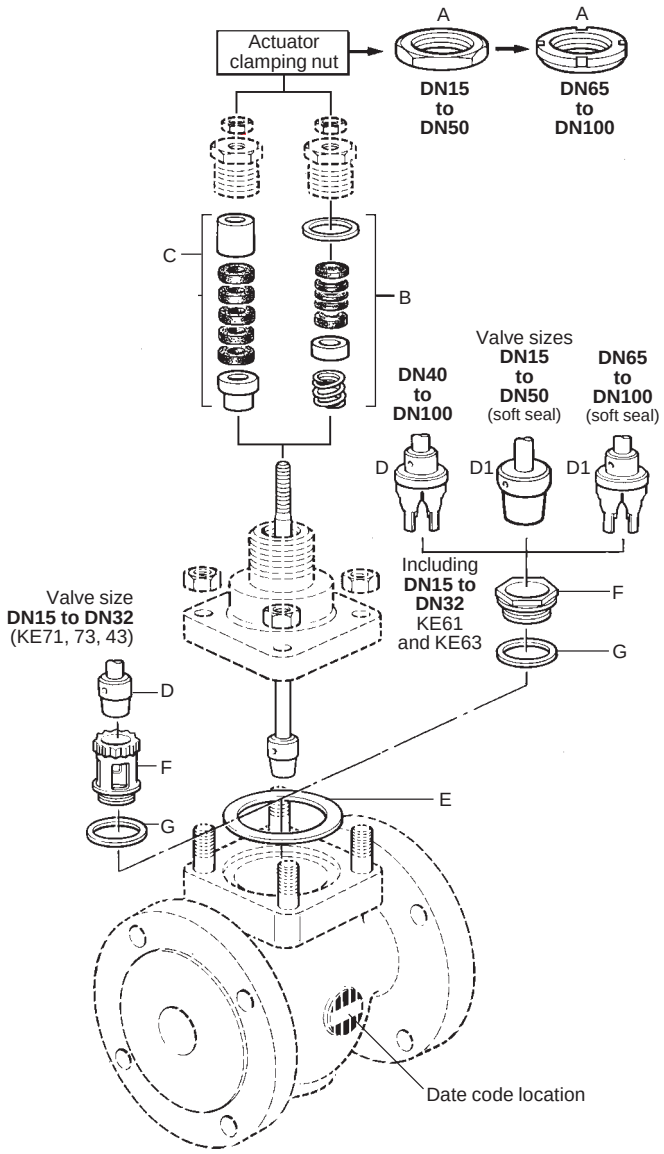
Example: 1 - Valve seat and seat gasket kit for DN25 KE73 K_{VS} 10 flanged to PN25. Date coded 612.

How to fit
Full fitting instructions are given in the operating and maintenance instructions supplied with the spare.

Control valve selection guide

Valve size	DN 15, 20, 25, 32, 40, 50, 65, 80, 100	DN25
Valve series	K series - 2 port	K
Valve characteristic	L = Linear E = Equal percentage F = Fast opening	E
Body material	4 = Cast steel 6 = Stainless steel 7 = SG iron	7
Connections	1 = Screwed 3 = Flanged	3
Stem sealing option	H = High temperature packing	
Seating option	G = Soft seal (PTFE) W = Hard facing	
Trim	N = Low noise	
Kvs	To be specified	K_{VS}10
Connection type	To be specified	PN25

DN25	K	E	7	3				K_{VS}10	PN25


Actuator clamping nut
A
A
DN15 to DN50
DN65 to DN100
C
B
Valve sizes
DN40 to DN100
DN15 to DN50 (soft seal)
DN65 to DN100 (soft seal)
D
D1
D1
Including DN15 to DN32 KE61 and KE63
F
G
Valve size DN15 to DN32 (KE71, 73, 43)
D
F
G
E
Date code location

spirax sarco

IM-P359-01
CH Issue 1

QL 43, QL 43D, QL 73 and QL 73D Control Valves

Installation and Maintenance Instructions

1. General
2. Installation
3. Commissioning
4. Maintenance
5. Spare parts

1. General

QL 43, QL 43D, QL 73 and QL73D

QL 43, QL 43D, QL 73 and Ql 73D three port mixing and diverting control valves are suitable for use with either pneumatic or electric actuators.
Below is a breif description of each valve type.

Valve reference	Body material	Spindle sealing
QL 43 3 Port (mixing) and QL 43 D (diverting)	Cast steel	PTFE chevron seals
QL 73 3 port (mixing) and QL 73D (diverting)	S.G.iron	PTFE chevron seals

2. Installation

The valve should be installed in such a position as to allow full access to the valve and actuator for maintnenance purposes.
The preferred mounting arrangement is with the valve spindle in a vertical position with the actuator on top.
Remove the flange protectors and fit the valve into the pipeline taking notice of the direction of flow arrow on the body. Pay particular attention with three port valves to the correct flow direction as shown below in Fig. 1.
The valve should be insulated to protect the actuator where high ambient temperatures exist. If the valve and actuator are to be painted after installation, care must be taken to keep the valve and actuator spindle free from paint.
To achieve optimum control, the inlet and outlet pipework should be of a straight length equal to ten times the nominal bore of the valve. Do not impose any strain on the valve body due to pipe misalignment.
Flush clear all pipework prior to fitting valve. A strainer upstream of each valve is strongly recommended. On saturated steam systems a separator fitted upstream of the valve is also recommended.
Tighten flange bolts evenly. Check bolts for tightness after twenty-four hours of operation. In fitting an actuator to a control valve, ensure the valve plug is not on its seat when the actuator is fitted. This will avoid damage to the valve plug, stem and seat.

3. Commissioning

Commissioning

QL series valves are available with PTFE chevron seals. The PTFE chevron seals are spring loaded. The spring tension maintains the necessary force to achieve a proper stem seal.
Bonnet and flange bolts should be retightened after twenty-four hours in operation. When doing this, the valve should never be in the closed position.
Tighten the bolts gradually in steps, diametrically in pairs. Do not overtighten. To couple the valve to the actuator and for actuator operation, refer to separate installation and maintenance instructions provided with each actuator.

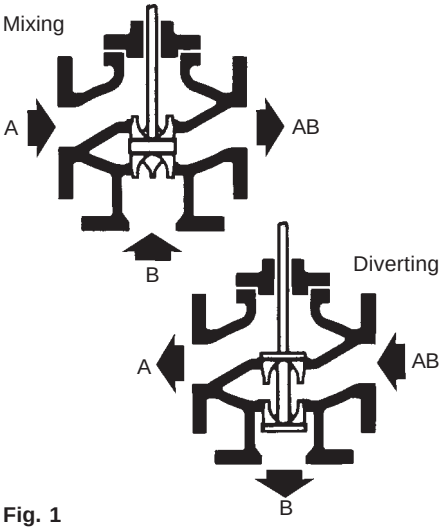


Fig. 1

Maintenance

1.1 To renew spindle seals

Isolate control valve and remove all pressure. Drive the actuator to the mid position. Referring to actuator Installation and Maintenance Instructions, remove the actuator from the valve. Loosen and remove gland nut (1) lifting it over the spindle (2).

Remove all packing (3) with spring (4) and clean the packing compartment. Clean the valve spindle and inspect for damage. If damaged, replace it. Rough surfaces will wear the sealing lips of the chevron seals enormously and will cause premature failure of the packing unit. Insert new packing, referring to Fig. 2 or 3. The PTFE chevron seals should be lubricated before inserting with a small amount of silicone grease. The sealing lips must face against the pressure direction. Slide gland nut over the spindle and tighten carefully.

1.2 To renew plug and spindle

Isolate control valve and remove all pressure. Drive the actuator to the midposition. Referring to the actuator Installation and Maintenance Instructions, remove the actuator from the valve. Referring to Fig. 2 or 3, loosen gland nut (1). Loosen hexagonal nuts (5) and remove bonnet (6).

1.2.1 Mixing valves (Fig. 2)

Unscrew the upper seat ring (8) using the special tool availble on loan from Spirax Sarco Ltd. Pull spindle upwards and out through the top of the valve.

Replacement is reverse of the above.

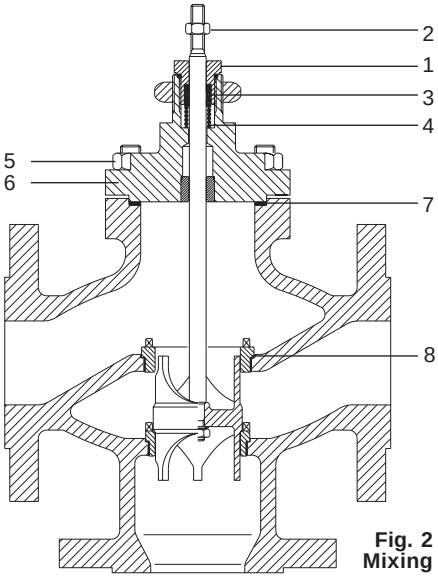


Fig. 2 Mixing

1.2.2 Diverting valves (Fig. 3)

Unscrew the locking nut of the lower plug (9) and pull the plug (10) downwards and out through the port 'B'.

Pull spindle upward and out through the top valve.

Replacement is reverse of above.

It is recommended that the gland packing is renewed at the same time as the plug and spindle assembly. Change the bonnet gasket (7) and refit bonnet.

Tighten nuts diametrically. Tighten gland nut carefully.

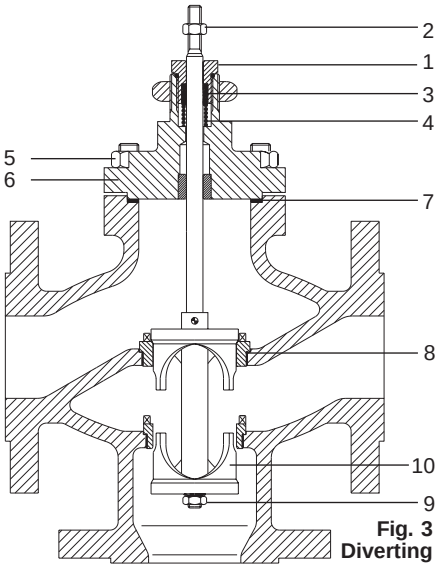


Fig. 3 Diverting

5. Spare Parts

QL 43, QL 43D
QL 73, QL 73D

The spare parts available are in heavy outline. Parts drawn in broken lines are not supplied as spares. These spares are for sizes DN15 to DN100.

AVAILABLE SPARE		
Seal kit	Sizes DN15 to DN50	A, B, C, D
	Sizes DN65 to DN100	A, B, C, D, G
Plug and spindle kit and bonnet gasket		E, F
Bonnet gasket (packet of 3)		F
Actuator clamping nut (DN15 to DN50)		J

How to order
Always order spares by using the description given in the column headed Available Spares and stating the size and type of valve.

Example: 1 - Seal kit for DN65 Spirax Sarco QL 43 control valve.