3-port valves

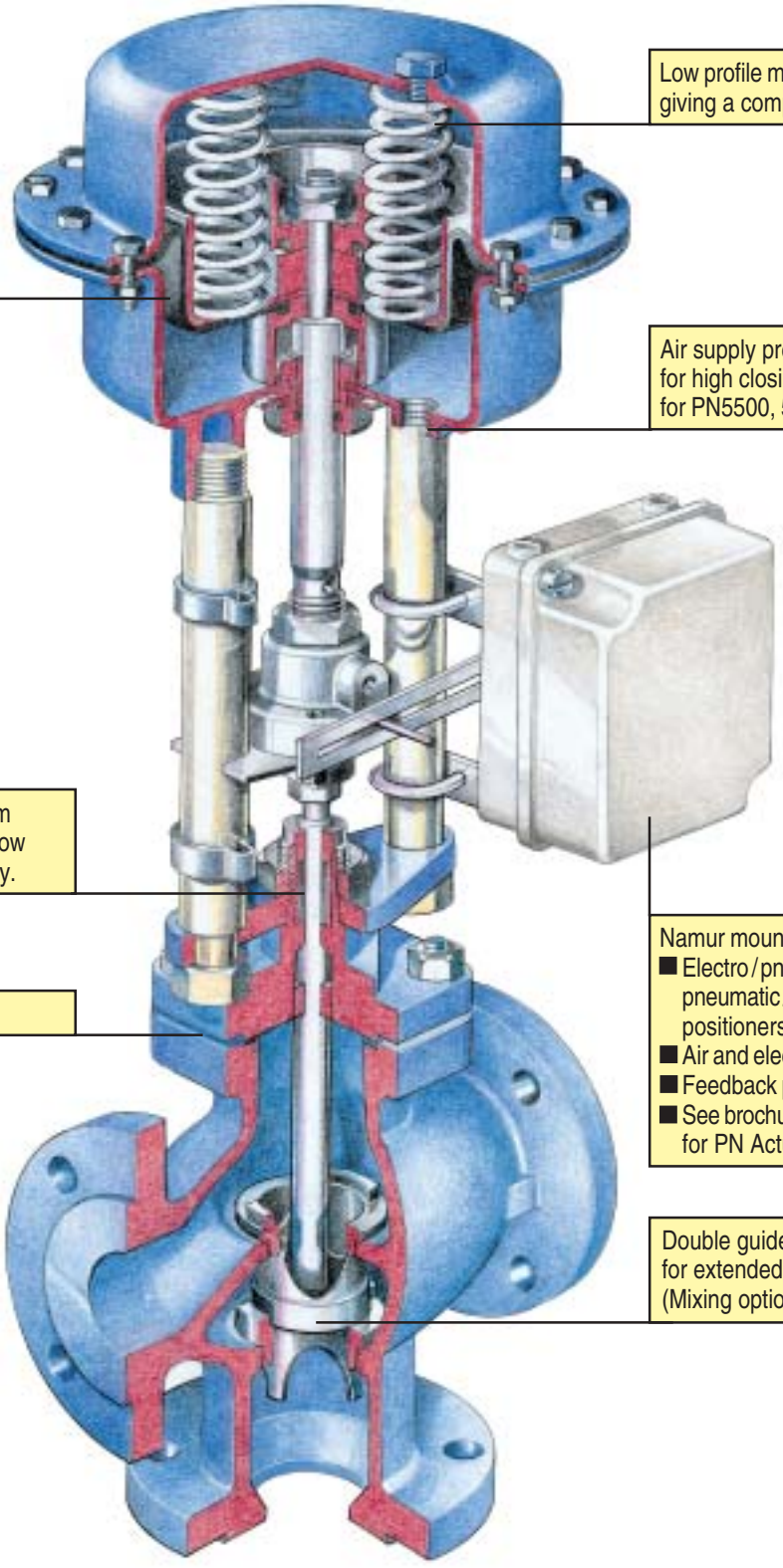
pneumatically actuated

spirax sarco

Pneumatically actuated valves for quality and accuracy in fluid control

The Spirax Sarco range of QL valves and pneumatic actuators are designed to give a comprehensive selection of control valves for use on water, oils, and most industrial fluids.

With valve body ratings up to 40 bar and a range of body materials to select from, the Spirax Sarco QL valve, coupled to either the PN5000 or PN6000 pneumatic diaphragm actuator, provides the complete solution for most flow, pressure or temperature control application.



Air-to-open or air-to-close by simply inverting actuator internals.

Low profile multi-springs giving a compact design.

Rolling diaphragm for friction free operation.

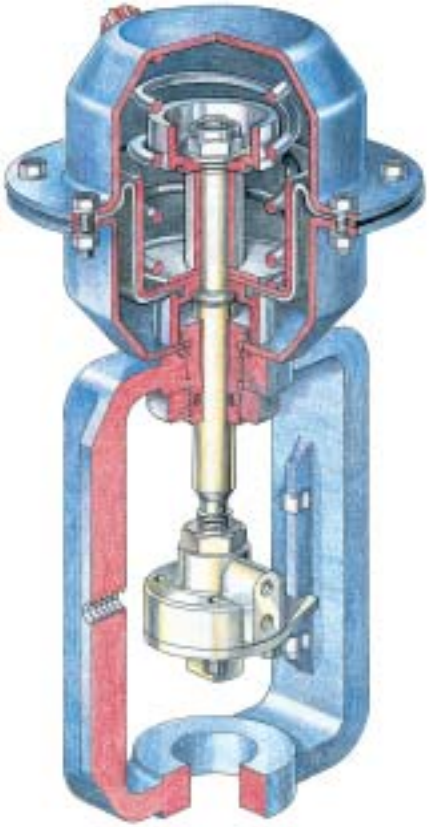
Air supply pressure up to 6 bar g for high closing force. 2.5 bar g for PN5500, 5600, 6500, 6600.

Self-adjusting chevron stem seals giving long life and low friction for control accuracy.

Namur mounted:
- Electro/pneumatic and pneumatic/pneumatic positioners.
- Air and electrical switch boxes.
- Feedback potentiometer.
- See brochure Valve positioners for PN Actuators.

Asbestos free gaskets.

Double guided stem and plug for extended valve life. (Mixing option depicted)



Compact single spring units for use with DN15 to DN25 valves.

User benefits

- Full range of control options for total solutions to most process control applications.
- One actuator for both air-to-open or air-to-close operation by inverting internals - simplifies selection and reduces both service and stocking costs.
- Range of control valve materials to match individual applications.
- The ability to mix and match valves to actuators makes selection easy and reduces both service and stocking costs.
- Rugged construction for extended reliability and minimum on line maintenance.
- High actuator pressure ratings give high closing forces at a competitive price.
- Spirax Sarco range uses clean dry factory air and saves the cost of instrument air.

Valve options

Operation	Model	Size DN	Material	Connections	Maximum differential pressure	Maximum operating temperature
Mixing	QL73	15 - 100	SG iron	Flanged BS 4504 PN25	25 bar	250°C
	QL43	15 - 100	Cast steel	Flanged BS 4504 PN40	40 bar	250°C
Diverting	QL73D	15 - 100	SG iron	Flanged BS 4504 PN25	25 bar	250°C
	QL43D	15 - 100	Cast steel	Flanged BS 4504 PN40	40 bar	250°C

Note: See operating range charts on page 7

Control options

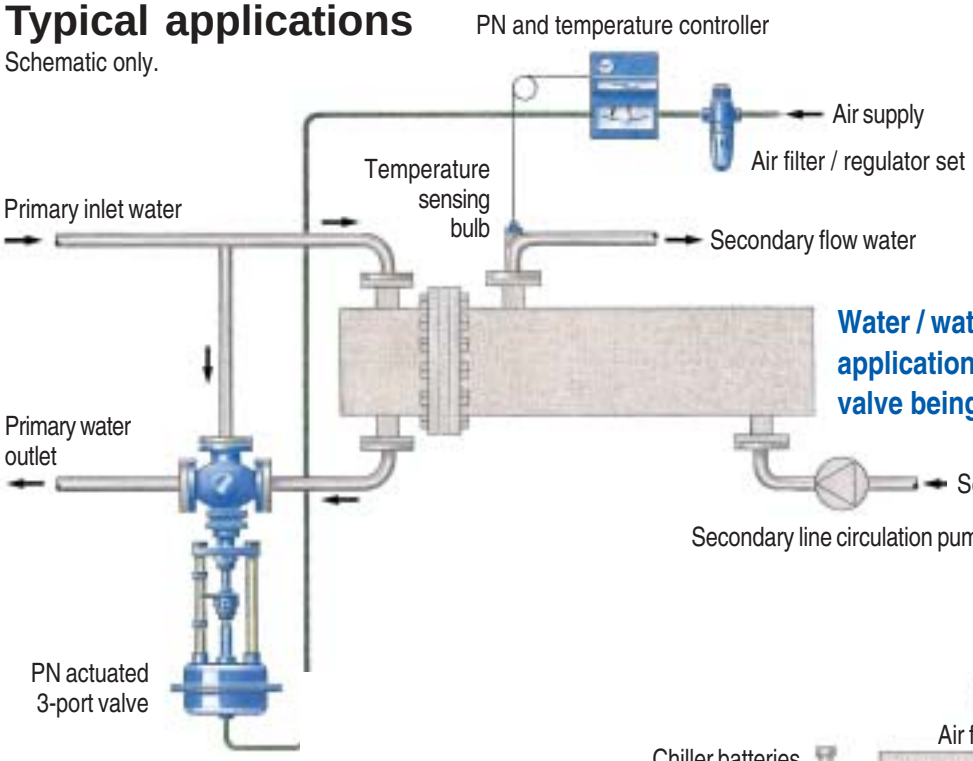
Electronic controllers:-
For pressure, temperature and flow control in processes which need a high level of control intelligence.

Pneumatic controllers:-
safe and simple control of pressure and temperature of industrial processes.

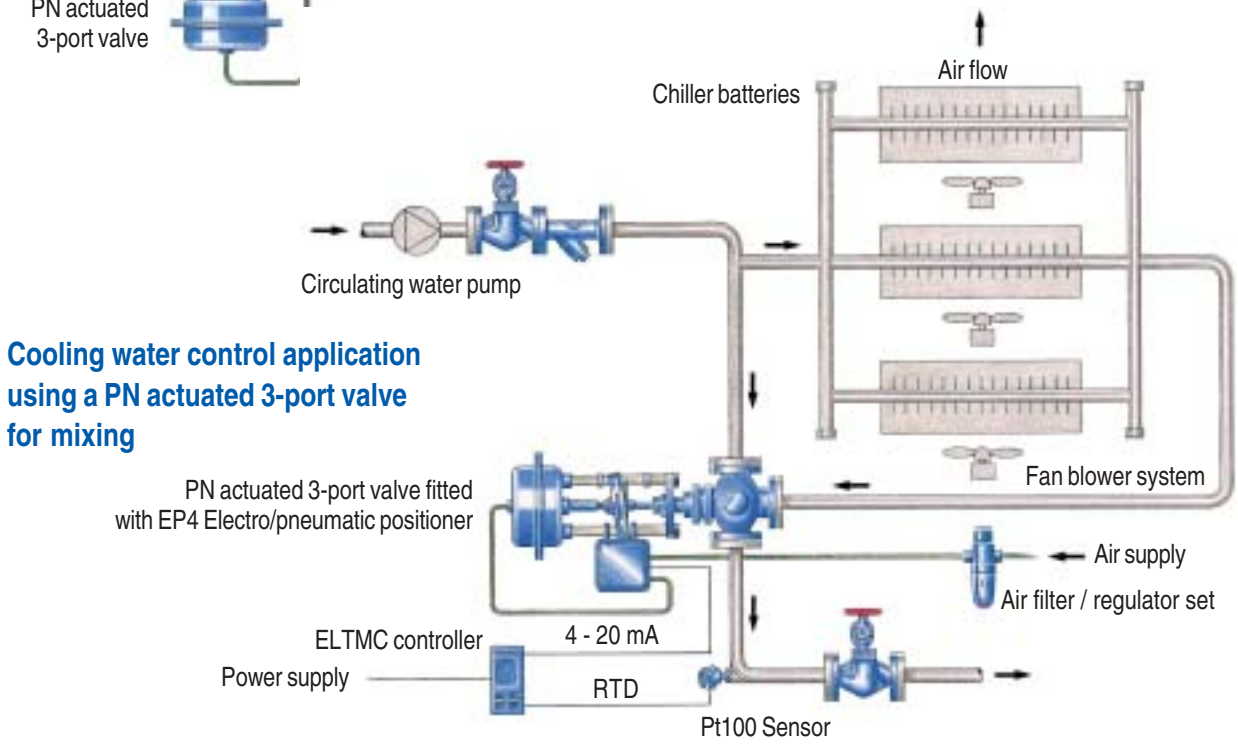
Sensor for temperature

Typical applications

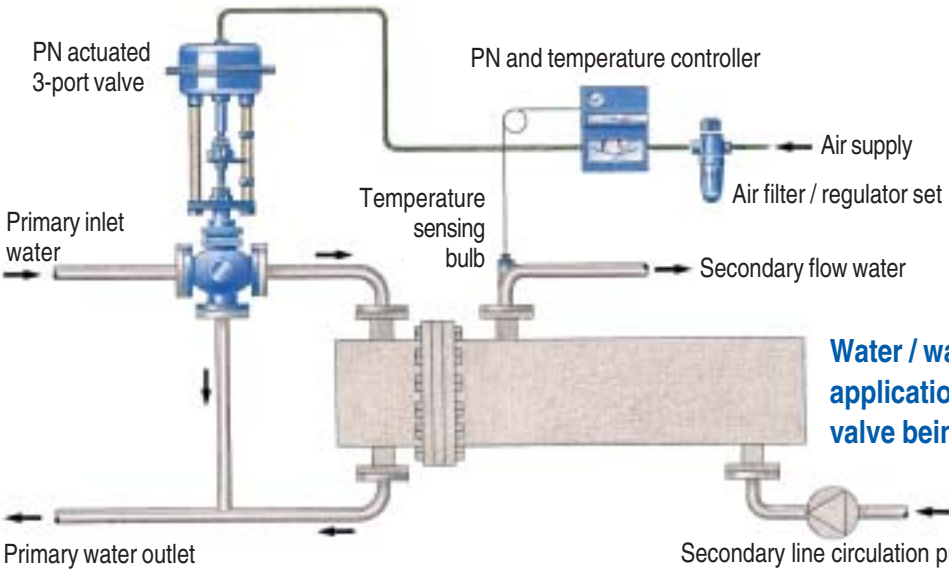
Schematic only.



Water / water calorifier diverting application with PN actuated 3-port valve being used for mixing



Cooling water control application using a PN actuated 3-port valve for mixing



Water / water calorifier diverting application with PN actuated 3-port valve being used for diverting

Valve sizing and selection for water

Note: For other liquids, the specific gravity (zg) must be taken into account.

Valve authority

The ratio of pressure drop across the valve when fully open to that across the complete circuit is termed the 'valve authority' (N) and is expressed as:-

$$N = \frac{P_1}{P_1 + P_2}$$

Where:- N = Valve authority
P_1 = Pressure drop across fully open valve
P_2 = Pressure drop across remainder of circuit

The following diagrams illustrate P_1 and P_2 more fully.
Valve authority is a means of selecting a valve size on a water system with due regard to economic viability and good control. When selecting a valve size, the valve authority should be between 0.2 and 0.5 (and preferably 0.5). This will ensure that each small valve movement will influence some authority over the flow whilst not excessively increasing pumping power costs. Valve authority will always relate to the circuit which has a varying flowrate.

How to use the chart

The sizing chart below can be used to determine the K_V value of the required control valve for most water applications by plotting:-

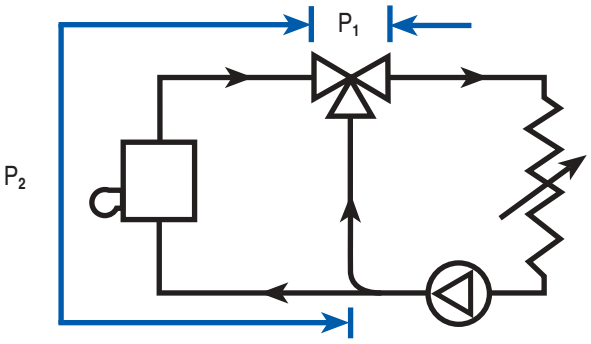
- Inlet water pressure
- Valve pressure drop
- Water flow

Where the K_V value is already known, the chart can be used to determine valve pressure drop for any given flowrate. Having selected the valve K_V move to actuator and valve selection on pages 6 and 7.

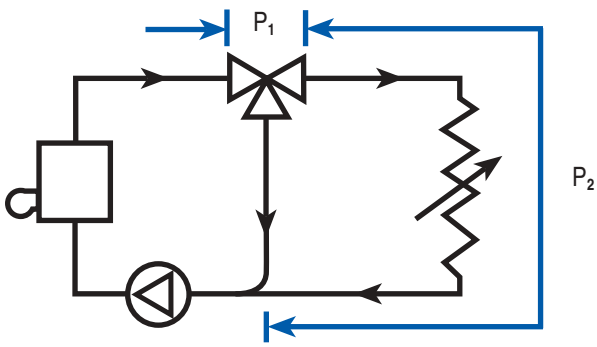
K_V selection example

Heat exchanger has a MTHW demand of = 3.6 l/s
Full load pressure drop Δp = 0.6 bar (established from valve authority)
Go to selection chart below
Draw horizontal line from 3.6 l/s. Run a vertical line from 0.6 bar until it crosses 3.6 l/s line. K_V is given at this crossing point. i.e. K_V = 17
For valve size and actuator selection turn to pages 6 and 7.

$Q = K_V \sqrt{\Delta p}$ Q = Water flow m³/h Δp = Pressure drop bar

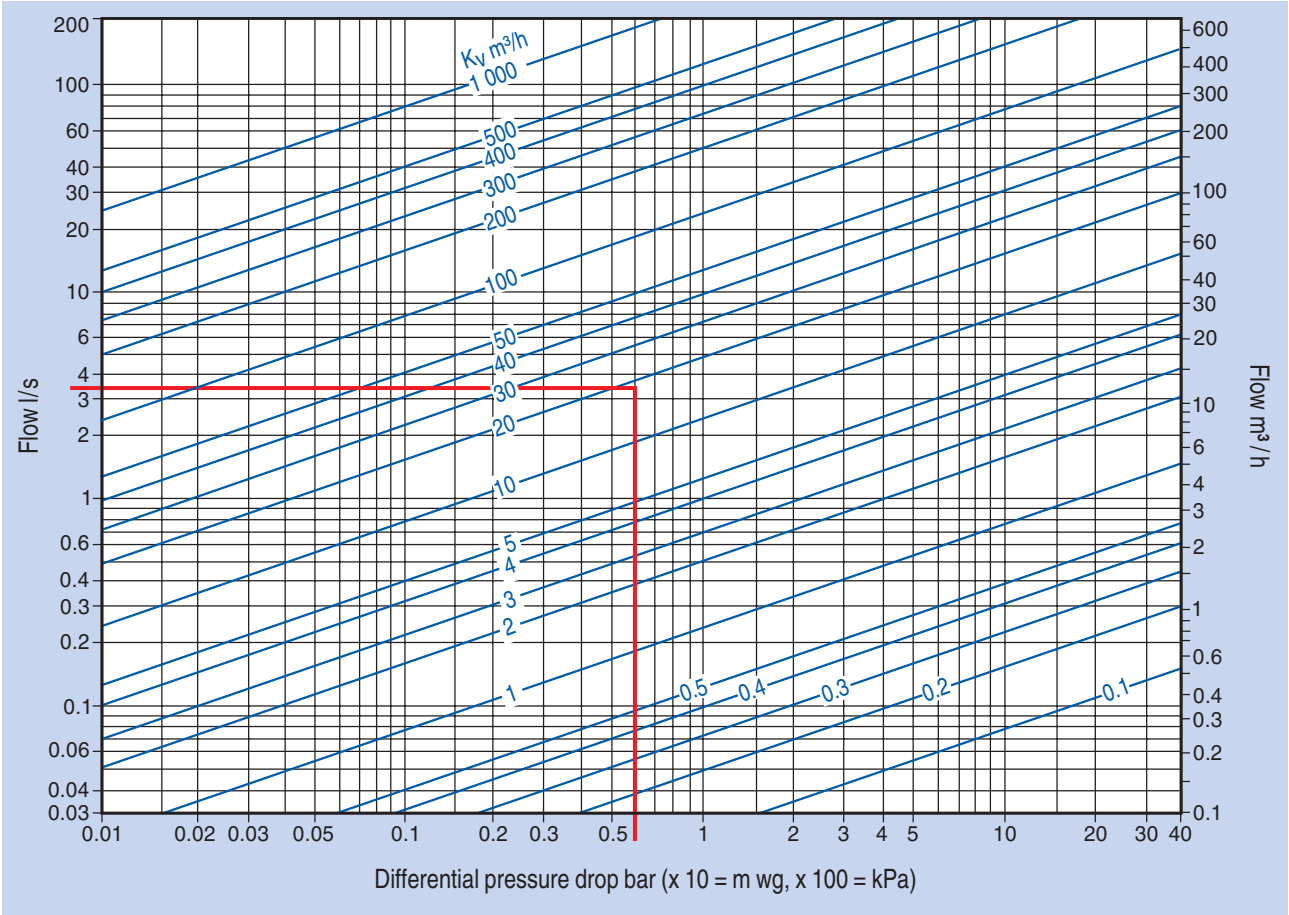


Valve authority - Three-port mixing valve



Valve authority - Three-port diverting valve

Water sizing chart



Actuator selection

Having selected the K_V value, the valve and actuator size can be determined from the selection chart below, starting in the K_{VS} value row and moving horizontally until the next highest value to the selected K_V is seen. By moving vertically upwards the valve size is determined and vertically downwards until the closed valve maximum differential pressure is found. Moving horizontally left will indicate whether a positioner is required and will determine the appropriate actuator and the minimum air pressure required to actuate the valve.

Actuator selection example

Valve K_V = 17 Air pressure available = 2 bar g
Maximum differential pressure 0.6 bar
Entering the chart at the K_{VS} row, the next highest value to the selected K_V is 17 which has a valve size of DN32. Moving vertically downwards the differential pressure selection 2.3 bar for both the spring extend and spring retract actuators.
Air pressure required is 1.2 bar g and positioners are optional.
Final selection = DN32
QL valve with either PN5220 or PN6220 actuator. Where the first selection does not match available air pressure, select a larger actuator.

Differential pressures for QL valves and PN5000 / 6000 series actuators

PN5000 series spring extend (plug down)

PN6000 series spring retract (plug up)

QL valves

5000 series Fail close	6000 series Fail open	Spring range	Minimum air pressure required bar g	Positioner required	Size DN 15	20	25	32	40	50	Size DN 65	80	100
					20 mm travel						30 mm travel		
					K_{VS} value 4	6	10	17	25	35	K_{VS} value 62	100	130
					Maximum valve differential pressure (Δp)bar								
5120*	6120*	0.2 - 1.0	1.2	Optional	3	3	1.0	-	-	-	-	-	-
		0.4 - 1.2	1.6	Optional	7	7	3.4	-	-	-	-	-	-
5121*	6121*	0.2 - 0.6	1.2	Yes	3	3	1.0	-	-	-	-	-	-
5122*	6122*	0.6 - 1.0	1.6	Yes	11	11	5.9	-	-	-	-	-	-
5123*	6123*	2.0 - 4.0	6.0	Yes	38	38	23	-	-	-	-	-	-
5125*	6125*	0.4 - 2.0	2.5	Yes	7	7	3.4	-	-	-	-	-	-
5220	6220	0.2 - 1.0	1.2	Optional	7	7	4	2.3	1	-	-	-	-
		0.4 - 1.2	1.6	Optional	17	17	10	6	3.5	1.7	-	-	-
5221	6221	0.2 - 0.6	1.2	Optional	7	7	4	2.3	1	-	-	-	-
5222	6222	0.6 - 1.0	1.6	Optional	26	26	16	9.5	5.8	3.2	-	-	-
5223	6223	2.0 - 4.0	6.0	Yes	40	40	40	34	22	13	-	-	-
5225	6225	0.4 - 2.0	2.5	Yes	17	17	10	6	3.5	1.7	-	-	-
5320	6320	0.2 - 1.0	1.2	Optional	11	11	7	4	2	1	-	-	-
		0.4 - 1.2	1.6	Optional	26	26	15	9.5	5.5	3	-	-	-
5321	6321	0.2 - 0.6	1.2	Optional	11	11	7	4	2	1	-	-	-
5322	6322	0.6 - 1.0	1.6	Optional	40	40	24	15	9	5	-	-	-
5323	6323	2.0 - 4.0	6.0	Yes	40	40	40	40	34	20	-	-	-
5325	6325	0.4 - 2.0	2.5	Yes	25	25	15	9.5	5.5	3	-	-	-
5330	6330	0.4 - 1.2	1.6	Optional	-	-	-	-	-	-	0.7	-	-
5333	6333	2.0 - 4.0	6.0	Yes	-	-	-	-	-	-	11	7	4
5335	6335	0.4 - 2.0	2.5	Yes	-	-	-	-	-	-	0.7	-	-
5420	6420	0.2 - 1.0	1.2	Optional	19	19	10	6.5	3.6	2	-	-	-
		0.4 - 1.2	1.6	Optional	40	40	23	14	9	5	-	-	-
5421	6421	0.2 - 0.6	1.2	Optional	19	19	10	6.5	3.6	2	-	-	-
5422	6422	0.6 - 1.0	1.6	Optional	40	40	36	22	14	8	-	-	-
5423	6423	2.0 - 4.0	6.0	Yes	40	40	40	40	40	30	-	-	-
5425	6425	0.4 - 2.0	2.5	Yes	40	40	23	14	9	5	-	-	-
5430	6430	0.4 - 1.2	1.6	Optional	-	-	-	-	-	-	2.3	1.3	0.5
5433	6433	2.0 - 4.0	6.0	Yes	-	-	-	-	-	-	18	12	7
5435	6435	0.4 - 2.0	2.5	Yes	-	-	-	-	-	-	2.3	1.3	0.5
5520	6520	0.2 - 1.0	1.2	Optional	40	40	21	14	8.5	5	-	-	-
		0.4 - 1.2	1.6	Optional	40	40	40	29	18	11	-	-	-
5524	6524	0.8 - 1.5	2.3	Yes	40	40	40	40	40	23	-	-	-
5525	6525	0.4 - 2.0	2.5	Yes	40	40	40	29	18	11	-	-	-
5530	6530	0.2 - 1.0	1.2	Optional	-	-	-	-	-	-	2.4	1.3	0.5
		0.4 - 1.2	1.6	Optional	-	-	-	-	-	-	6	4	2
5534	6534	0.8 - 1.5	2.3	Yes	-	-	-	-	-	-	14	9	5
5535	6535	0.4 - 2.0	2.5	Yes	-	-	-	-	-	-	6	4	2
5620	6620	0.2 - 1.0	1.2	Optional	40	40	33	20	13	7.6	-	-	-
		0.4 - 1.2	1.6	Optional	40	40	40	40	26	16	-	-	-
5624	6624	0.8 - 1.5	2.3	Yes	40	40	40	40	40	33	-	-	-
5625	6625	0.4 - 2.0	2.5	Yes	40	40	40	40	26	16	-	-	-
5630	6630	0.2 - 1.0	1.2	Optional	-	-	-	-	-	-	3.8	2.3	1
		0.4 - 1.2	1.6	Optional	-	-	-	-	-	-	9	6	3
5634	6634	0.8 - 1.5	2.3	Yes	-	-	-	-	-	-	20	13	7
5635	6635	0.4 - 2.0	2.5	Yes	-	-	-	-	-	-	9	6	3

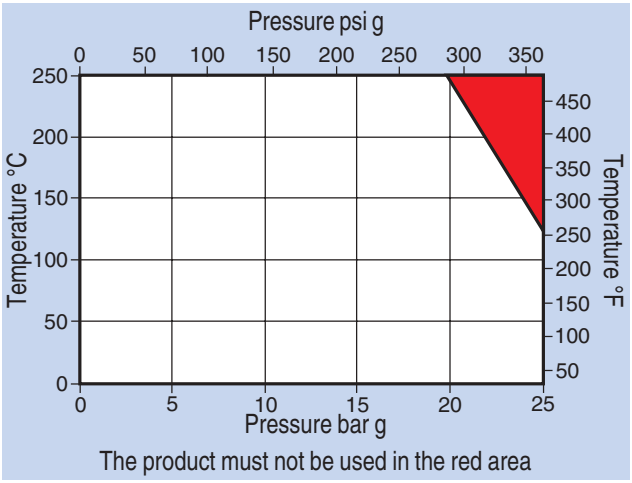
***Note:** 5100 and 6100 series are single spring actuators

Technical information

Technical data valves

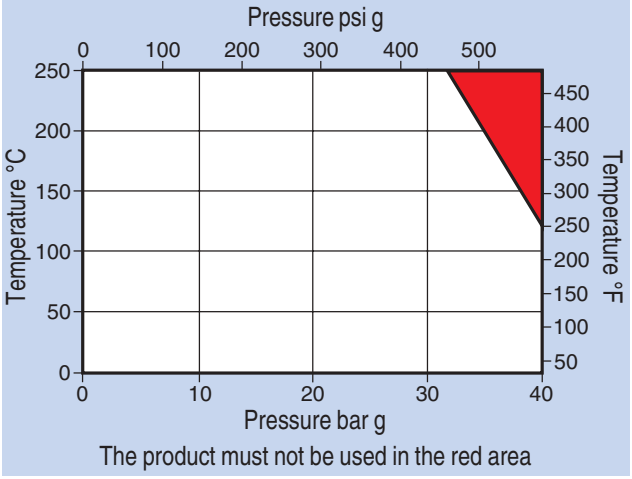
Plug design		Parabolic vee port
Maximum leakage		<0.01 % of K_V
Flow characteristic		Linear
Rangeability		30:1
Travel	DN15 to 50	20 mm
	DN65 to 100	30 mm

Operating range QL73



The product must not be used in the red area

Operating range QL43



The product must not be used in the red area

Materials for all valves

Valve plug	Stainless steel	BS 970 431 S29
Valve seat	Stainless steel	BS 970 431 S29
Valve stem	Stainless steel	BS 970 431 S29
Gland rings	PTFE chevrons	25 % Carbon / graphite
Bonnet gasket	Reinforced exfoliated graphite	

QL73 Range

Body	SG iron	DIN 1693 GGG 40.3
Bonnet	SG iron	DIN 1693 GGG 40.3

QL43 Range

Body	Cast steel	DIN 17245 GS C25
Bonnet	Forged steel	DIN 16 Mn Cr5

Maximum valve differential pressures

QL73	25 bar
QL43	40 bar

Technical data actuators

Maximum air operating pressure	
5100 and 6100 series*	6.0 bar
5200 and 6200 series	6.0 bar
5300 and 6300 series	6.0 bar
5400 and 6400 series	6.0 bar
5500 and 6500 series	2.5 bar
5600 and 6600 series	2.5 bar

Temperature range	-20 to 110°C
Linearity	2 %
Hysteresis	3 % max

Air supply connection

Actuator type	Connection
5100 and 6100 series*	⅛" BSP
5200 and 6200 series	⅛" BSP
5300 and 6300 series	¼" BSP
5400 and 6400 series	¼" BSP
5500 and 6500 series	¼" NPT
5600 and 6600 series	¼" NPT

Compressed air consumption

Actuator type	Travel	Volume - Ltrs normal
5100 and 6100 series*	20 mm	0.33
5200 and 6200 series	20 mm	0.99
5300 and 6300 series	20 mm	1.39
	30 mm	1.65
5400 and 6400 series	20 mm	2.36
	30 mm	2.78
5500 and 6500 series	20 mm	6.20
	30 mm	7.10
5600 and 6600 series	20 mm	8.40
	30 mm	9.60

Materials

Diaphragm housing		Pressed steel
Rolling diaphragm		Fabric reinforced nitrile rubber
Spring		Spring steel
Yoke	5100 and 6100 series only*	Aluminium
Pillars	excluding 5100 and 6100 series	Steel
Spindle		Stainless steel

***Note:** 5100 and 6100 series are single spring actuators only.

Typical specification

The pneumatic control shall be a DN65 Spirax Sarco QL43 cast steel 3-port control valve with all stainless steel internals and parabolic vee flow characteristics flanged to BS 4504 PN40 and coupled to a Spirax Sarco PN5333 actuator.

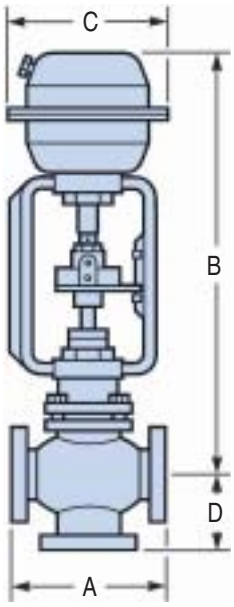
The actuator shall incorporate low profile springs and rolling diaphragm and be designed to provide on site conversion from 'plug up' to 'plug down' operation.

Pneumatic to pneumatic positioners shall be provided with 'NAMUR' standard mountings.

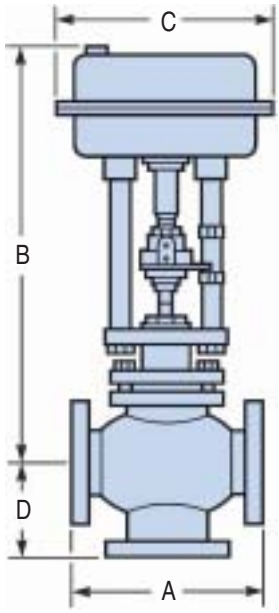
Technical information

Dimensions approximate in mm

PN5100
PN6100



Single spring actuators



PN5200
PN6200

PN5300
PN6300

PN5400
PM6400

PN5500
PN6500

PN5600
PN6600

Multi-spring actuators

QL73 and QL43 3-port valves

	Size	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100
Flanged valve	**A**	130	150	160	180	200	230	290	310	350
	D	90	95	100	105	115	125	145	155	175

PN 5100/6100 series actuator - single spring

B	393	393	397	-	-	-	-	-	-
C	147	147	147	-	-	-	-	-	-
Total weight	9 kg	10.3 kg	12.2 kg	-	-	-	-	-	-

PN5200/6200 series actuator - multi-spring

B	429	429	433	448	461	467	-	-	-
C	217	217	217	217	217	217	-	-	-
Total weight	11.6 kg	12.9 kg	14.8 kg	17 kg	20.5 kg	24.5 kg	-	-	-

PN 5300/6300 series actuator - multi-spring

B	435	435	439	454	467	473	490	495	510
C	251	251	251	251	251	251	251	251	251
Total weight	14.9 kg	16.2 kg	18.1 kg	20.3 kg	23.8 kg	27.8 kg	40.3 kg	50.1 kg	57.8 kg

PN5400/6400 series actuator - multi-spring

B	472	472	476	491	504	510	527	537	547
C	305	305	305	305	305	305	305	305	305
Total weight	21.6 kg	22.9 kg	24.8 kg	27 kg	30.5 kg	34.5 kg	47 kg	56.8 kg	64.5 kg

PN 5500/6500 series actuator - multi-spring

B	505	505	509	524	537	543	560	565	580
C	405	405	405	405	405	405	405	405	405
Total weight	31.6 kg	32.9 kg	34.8 kg	37 kg	40.5 kg	44.5 kg	57 kg	66.8 kg	74.5 kg

PN5600/6600 series actuator - multi-spring

B	505	505	509	524	537	543	560	565	580
C	465	465	465	465	465	465	465	465	465
Total weight	41.6 kg	42.9 kg	44.8 kg	47 kg	50.5 kg	54.5 kg	67 kg	76.8 kg	84.5 kg

Some of the products shown may not be available in certain markets.

Spirax-Sarco Limited, Charlton House,
Cheltenham, Gloucestershire, GL53 8ER UK.
Tel: +44 (0)1242 521361 Fax: +44 (0)1242 573342
E-mail: Enquiries@SpiraxSarco.com
Internet: www.SpiraxSarco.com