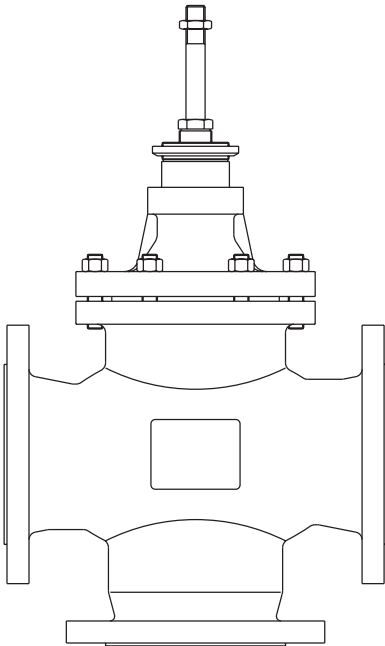

QLM and QLD Series DN15 to DN100
Three Port Control Valves
Installation and Maintenance Instructions



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

1. Safety information

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application. The products listed below comply with the requirements of the EU Pressure Equipment Directive / UK Pressure Equipment (Safety) Regulations. The products fall within the following Pressure Equipment Directive categories:

Product	Size	Group 2 Gases	Group 2 Liquids
QL33 PN16 - Cast iron	DN15 - DN25	SEP	SEP
	DN32 - DN50	SEP	SEP
	DN65 - DN100	1	SEP
QL73 PN25 - SG iron	DN15 - DN25	*SEP	*SEP
	DN32 - DN40	*SEP	*SEP
	DN50 - DN80	1	*SEP
	DN100	1	*SEP
QL43 PN40 - Carbon steel	DN15 - DN25	*SEP	*SEP
	DN32	*SEP	*SEP
QL63 PN40 - Stainless steel	DN40 - DN50	1	*SEP
	DN65 - DN100	1	*SEP

*SEP = not subjected to CE marking as per paragraph 3.3 of above Directive.

- I) The products have been specifically designed for use on thermal oil, compressed air and steam or condensate which are in Group 2 of the above mentioned Pressure Equipment Directive.
- II) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
- III) Determine the correct installation situation and direction of fluid flow.
- IV) Spirax Sarco products are not intended to withstand external stresses that may be induced by any system to which they are fitted. It is the responsibility of the installer to consider these stresses and take adequate precautions to minimise them.
- V) Remove protection covers from all connections before installation.

1.2 Access

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

1.3 Lighting

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

1.4 Hazardous liquids or gases in the pipeline

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

1.5 Hazardous environment around the product

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

1.6 The system

Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolation valves, electrical isolation) put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms. Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

1.7 Pressure systems

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

1.8 Temperature

Allow time for temperature to normalise after isolation to avoid danger of burns. Valves fitted with PTFE components must not be subjected to temperatures above 260 °C. Above these temperatures toxic fumes may be given off. Avoid inhalation of fumes or skin contact.

1.9 Tools and consumables

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

1.10 Protective clothing

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

1.11 Permits to work

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

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

Post 'warning notices' if necessary.

1.12 Handling

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

1.13 Residual hazards

In some cases the product is provided with pre-compressed springs. Any operation to open the spring housing is to be carried out strictly following the correct procedure given in the Installation and Maintenance Instructions. In normal use the external surface of the product may be very hot. If used at the maximum permitted operating conditions the surface temperature of some products may reach temperatures of 400 °C. Many products are not self-draining. Take due care when dismantling or removing the product from an installation (refer to 'Maintenance instructions').

1.14 Freezing

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

1.15 Disposal

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken. However, if the valve is fitted with a PTFE component special care must be taken to avoid potential health hazards associated with decomposition/burning of these parts.

PTFE:

- Can only be disposed of by approved methods, not incineration.
- Keep PTFE waste in a separate container, do not mix it with other rubbish, and consign it to landfill site.

Please visit the Spirax Sarco product compliance web pages

<https://www.spiraxsarco.com/product-compliance>

for up to date information on any substances of concern that may be contained within this product. Where no additional information is provided on the Spirax Sarco product compliance web page, this product may be safely recycled and/or disposed providing due care is taken. Always check your local recycling and disposal regulations.

1.16 Returning products

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

2. General product information

2.1 Description

The QLM and QLD are three port control valves which have linear characteristics for mixing or diverting service. They are available in four body materials: cast iron, SG iron, carbon steel or stainless steel. All valves can be supplied with the standard metal-to-metal seats, stellite facing for increased resistance to wear or soft seats for tight shut-off. The standard stem sealing is by spring adjusted PTFE chevrons but high temperature graphite seals or metal bellows with supplementary safety packing may also be specified.

The QLM and QLD three port control valves can be used with the following actuators:

Pneumatic:	PN3000 series	Electric:	AEL3
	PN4000 series		AEL7
	PN9000 series		

2.2 Sizes and pipe connections

All valve flanges referred to in this document are in accordance with EN 1092.

	Type	Body material	Connection	Size range
QLM: Mixing service	QL33M	Cast iron	PN16	DN15 to DN100
	QL43M*	Carbon steel	PN25/PN40	DN15 to DN100
	QL63M*	Stainless steel	PN25/PN40	DN15 to DN100
	QL73M	SG iron	PN16/PN25	DN15 to DN100
QLD: Diverting service	QL33D	Cast iron	PN16	DN25 to DN100
	QL43D*	Carbon steel	PN25/PN40	DN25 to DN100
	QL63D*	Stainless steel	PN25/PN40	DN25 to DN100
	QL73D	SG iron	PN16/PN25	DN25 to DN100

* **Note:** QL43M, QL43D, QL63M and QL63D three port control valves are also available with PN16 flanges by special order.

2.3 Technical data

Plug design	"V" Port	
Plug characteristic	Linear	
Leakage class	Metal- to-metal seal	IEC 534-4 Class IV (0.01% of Kv)
Rangeability	30:1	
Travel	DN15 - DN50	20 mm
	DN65 - DN100	30 mm

2.4 Product limitations

Material		Body		Bonnet: Standard			
				PTFE		Graphite	
Cast iron (PN16)	Pressure (bar)	16	13	16	13	16	13
	Temperature (°C)	-5/+120	200	-5/+120	200	-5/+120	200
SG iron (PN25)	Pressure (bar)	25	15	25	18.7	25	18
	Temperature (°C)	-10/+120	300	-5/+120	232	-5/+120	250
Carbon steel (PN40)	Pressure (bar)	40	21	40	33	40	32
	Temperature (°C)	-29/+120	400	-5/+120	232	-5/+120	250
Stainless steel (PN40)	Pressure (bar)	40	22.1	40	26.8	40	26.2
	Temperature (°C)	-29/+120	400	-5/+120	232	-5/+120	250

Material		Body		Bonnet: Extended			
				PTFE		Graphite	
Cast iron (PN16)	Pressure (bar)	16	13	-	-	-	-
	Temperature (°C)	-5/+120	200	-	-	-	-
SG iron (PN25)	Pressure (bar)	25	15	25	18	25	15
	Temperature (°C)	-10/+120	300	-10/+120	250	-10/+120	300
Carbon steel (PN40)	Pressure (bar)	40	21	40	32	40	21
	Temperature (°C)	-29/+120	400	-29/+120	250	-29/+120	400
Stainless steel (PN40)	Pressure (bar)	40	22.1	40	26.2	40	22
	Temperature (°C)	-29/+120	400	-29/+120	250	-29/+129	400

Material		Body		Bonnet: Bellows			
				PN16		PN25	
Cast iron (PN16)	Pressure (bar)	16	13	16	13	-	-
	Temperature (°C)	-5/+120	200	-5/+120	200	-	-
SG iron (PN25)	Pressure (bar)	25	15	16	11.0	25	15
	Temperature (°C)	-10/+120	300	-10/+120	300	-10/+120	300
Carbon steel (PN40)	Pressure (bar)	40	21	16	10	25	16
	Temperature (°C)	-29/+120	400	-10/+120	350	-10/+120	350
Stainless steel (PN40)	Pressure (bar)	40	22.1	16	10	25	16
	Temperature (°C)	-29/+120	400	-10/+120	350	-10/+120	350

Notes:

- Hydrostatic test pressure - 1.5 times the maximum working pressure.
- Maximum differential pressure - To establish maximum differential pressures see Spirax Sarco TIs for the relevant pneumatic or electric actuator.

2.5 Materials

2.5.1 Cast iron, SG iron and carbon steel valves

Type	No.	Part	Material	Material designation ASTM/DIN STD	
Cast iron	1	Body	Cast iron	EN-GJL-250	
	2	Standard bonnet	SG iron	EN-GJS-400-18	
		Extended bonnet	Carbon steel	1.0460	
SG iron	1	Body	SG iron	EN-GJS-400-18	
	2	Standard bonnet	SG iron	EN-GJS-400-18	
		Extended bonnet	Carbon steel	1.0460	
Carbon steel	1	Body	Carbon steel	1.0619	
	2	Standard bonnet	Carbon steel	1.7131	
		Extended bonnet	Carbon steel	1.0460	
Cast iron	3	Plug(s)	Stainless steel	BS 970 431 S29	
	4	Valve seats	Stainless steel	BS 970 431 S29	
	5	Valve stem	Stainless steel	BS 970 431 S29	
		Bellows	Stainless steel	AISI 316 L	
	6	Spacer	Stainless steel	AISI 304	
	7	Stuffing box gasket	Graphite		
	8	Lock-nut	Stainless steel	AISI 304	
	9	Stuffing box	Stainless steel	BS 970 431 S29	
	10	Mounting nut	Zinc plated steel	NFA 35553 XC 18S	
	11	Packing	PTFE/graphite	PTFE/graphite	
	SG iron	12	Spring	Stainless steel	BS 2056 316 S42
	Carbon steel	13	Bonnet gasket	Graphite	
		14	Stud	Carbon steel	A193 B7M
		15	Nut	Carbon steel	A194 Gr. 2H
		16	Lock-nut	Stainless steel	AISI 316
		17	Guide bush	PTFE	
		18	Stem guide bush	Stainless steel	Hardened AISI 440B
		19	Lock-nut	Stainless steel	AISI 316
		20	Pin	Stainless steel	AISI 316
		21	Gasket	Graphite	
		22	Anti-rotation screw	Stainless steel	AISI 304

Fig. 1 Mixing valve

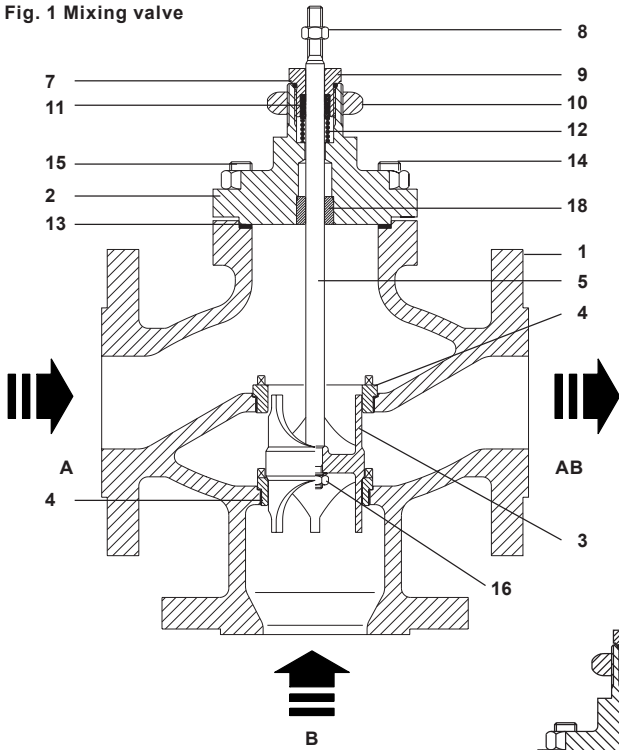
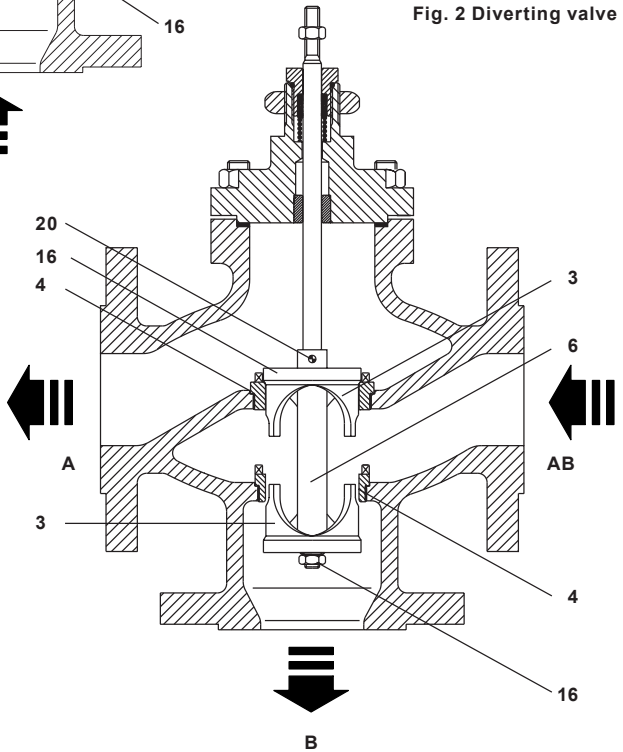


Fig. 2 Diverting valve



QLM and QLD Series DN15 to DN100 Three Port Control Valves

2.5.2 Stainless steel valves

Type	No.	Part	Material	Material designation ASTM/DIN STD
Stainless steel	1	Body	Stainless steel	1.4552
	2	Standard bonnet	Stainless steel	1.4552
		Extended bonnet	Stainless steel	ASTM A182 F316
	3	Valve plug	Stainless steel	ASTM A351 CF8M
	4	Valve seat	Stainless steel	ASTM A276 316L
	5	Valve stem	Stainless steel	ASTM A276 316L
		Bellows	Stainless steel	AISI 316 L
	6	Spacer	Stainless steel	AISI 316
	7	Stuffing box gasket	Stainless steel	AISI 304
	8	Lock-nut	Stainless steel	AISI 316
	9	Stuffing box	Stainless steel	AISI 316
	10	Mounting nut	Zinc plated steel	NFA 35553 XC 18S
	11	Packing	PTFE/graphite	PTFE/graphite
	12	Spring	Stainless steel	BS 2056 316 S42
	13	Bonnet gasket	Graphite	
	14	Stud	Stainless steel	A193 B8
	15	Nut	Stainless steel	A194 Gr. 304
	16	Lock-nut	Stainless steel	AISI 316
	17	Guide bush	PTFE	
	18	Stem guide bush	Stainless steel	Hard faced AISI 316
	19	Lock-nut	Stainless steel	AISI 316
	20	Pin	Stainless steel	AISI 316
21	Gasket	Graphite		
22	Anti-rotation screw	Stainless steel	AISI 304	

Fig. 3 Mixing valve

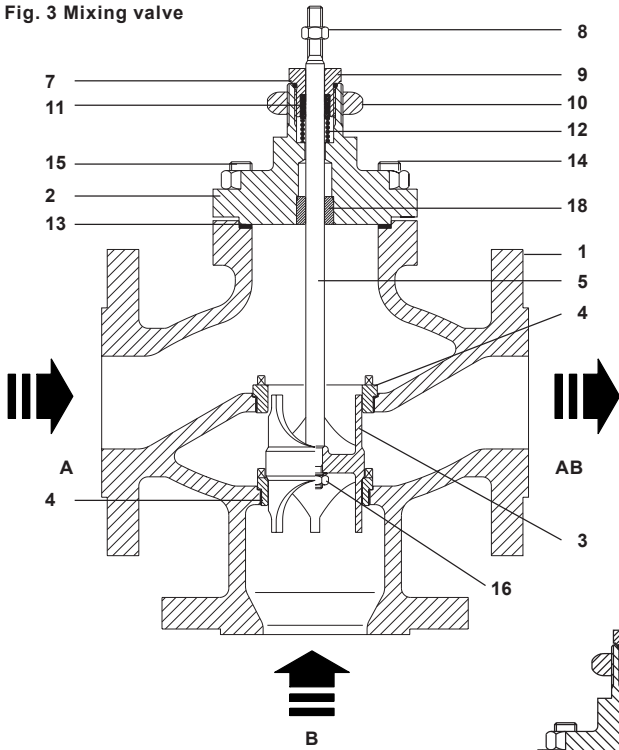
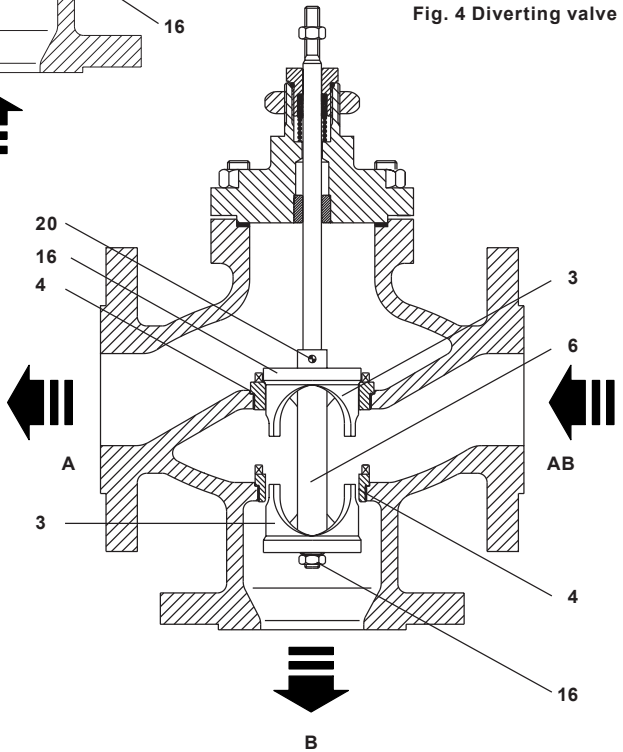


Fig. 4 Diverting valve



QLM and QLD Series DN15 to DN100 Three Port Control Valves

2.6 Dimensions and weights (approximate) in mm and kg

For all body materials

Size	Dimensions				Weights	
	A	B	C	C1*	Standard bonnet	Extended bonnet
DN15	130	90	105	166	6.5	7.9
DN20	150	95	105	166	6.9	8.3
DN25	160	100	109	170	8.8	10.2
DN32	180	105	124	185	11.0	12.4
DN40	200	115	137	190	14.5	15.9
DN50	230	125	143	196	18.5	20.0
DN65	290	145	160	357	31.0	33.0
DN80	310	155	165	361	40.8	42.8
DN100	350	175	180	373	48.5	50.5

* C1 dimension is relevant to valves with extended or bellows seal bonnet.

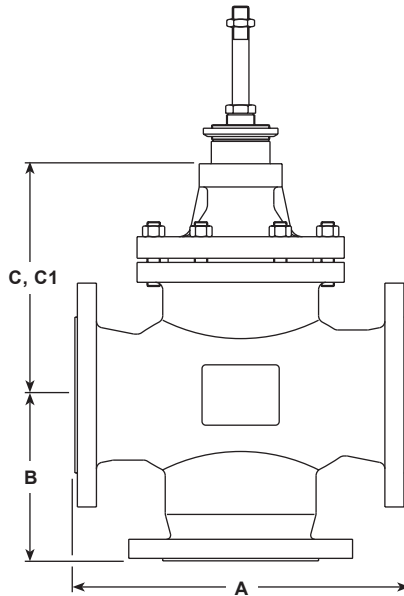


Fig. 5

3. Installation and commissioning

Note: Before commencing any installation please read the 'Safety information' in Section 1.

3.1 General rules

The valve should be installed in such a position as to allow full access to the valve and the actuator for maintenance purposes. Prior to fitting the valve to the pipework it should be flushed clear to remove any debris or other particles.

Remove the flange protectors and fit the valve into the pipeline ensuring that the direction of flow arrows on the body are correct.

Care should be taken to prevent any strain being imposed on the valve body due to pipe misalignment. Care should be taken to ensure that the valve/actuator spindle is not painted or coated with any other substance.

3.2 Bypass arrangements

It is recommended that isolating valves be fitted upstream and downstream of the control valve. A bypass can be fitted around the valve with a manual regulating valve allowing the process to be controlled whilst the control valve is isolated for maintenance.

3.3 Commissioning

For commissioning instructions refer to the Installation and Maintenance Instructions covering the Spirax Sarco actuators.

4. Maintenance

Note: Before commencing any maintenance please read the 'Safety information' in Section 1.

Safety note - Handling precautions

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. 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 polymer 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 PTFE particles lodged under the fingernails.

LAMINATED GASKETS

The metal foil sheet used to reinforce gaskets is very thin and sharp. Care should be taken when handling to avoid the possibility of cuts or lacerations to fingers or hands.

4.1 Periodic maintenance

After 24 hours of operation

After 24 hours of operation check the flange bolts for tightness.

On valves with graphite stem seal packing compress the gland seal packing by tightening the gland nut by $\frac{1}{4}$ of a turn. Care should be taken not to overtighten as this may cause the spindle to lock-up.

Every 3 months of operation

Every 3 months of normal operation check the stem gland seal for leakage. In the case of leakage proceed as follows:

- For valves with a PTFE gland seal renew the gland seal by following the procedure in Section 4.2.1
- For valves with a graphite stem seal packing compress the gland seal packing by tightening the gland nut by $\frac{1}{4}$ of a turn. If leakage cannot be eliminated, renew the graphite gland seal by following the procedure in Section 4.2.2.

Annually

Inspect the valve to check for wear or scale deposits. Worn or damaged parts, like the plug or seat may need to be replaced, as well as the gland seal packing.

The graphite packing is normally subject to wear. Therefore it is recommended to renew the packing rings annually.

4.2 Valves with packing stem seals

4.2.1 Procedure for renewing PTFE chevron gland seals (Refer to Figs. 1, 2 and 6)

- a) Isolate the valve on all three ports.
- b) Remove the actuator from the valve. Refer to the Installation and Maintenance Instructions covering Spirax Sarco actuators.

Caution: Care should be taken in removing the gland nut since fluid under pressure may be trapped between the isolating valves
- c) Remove the lock-nut (8).
- d) Unscrew the gland nut (9), withdraw the spring (12) from the stem; remove and discard the lower bush, gland seal set and the upper bush (17a + 11 + 17b), and the gland nut gasket (7).
- e) Examine the parts for signs of damage or deterioration and renew as necessary. Note that score marks or scaly deposit on the valve stem (5) will lead to the early failure of the seals.

Caution: Care should be taken in removing the gland nut since fluid under pressure may be trapped between the isolating valves. Clean the parts taking care to avoid scratching the stem or the inner surface of the gland nut. If the valve stem (5) needs to be replaced, see Sections 4.2.3 or 4.2.4.
- f) To renew the gland seal set, first fit the spring (12) over valve stem, and replace the gland nut gasket (7). The upper bush (17a only for valves DN15 - DN50), the new gland seal set (11) and the lower bush (17b), must be firmly inserted into the gland seal nut (9), as indicated in Figure 4, care being taken to avoid damage to the sealing edges. Refit the gland nut (9) over the valve stem, screwing down with care to ensure the gasket is bedded down onto the bonnet.
Tighten to the recommended torque as given in Table 1, page 22.
- g) Ensure the valve stem (5) moves freely.
- h) Refit the valve lock-nut (8).
- i) Refit the actuator and clamping nut. Connect the actuator to the valve stem following the actuator instructions.
- j) Bring the valve back into service.
- k) Check for leakage at the gland.

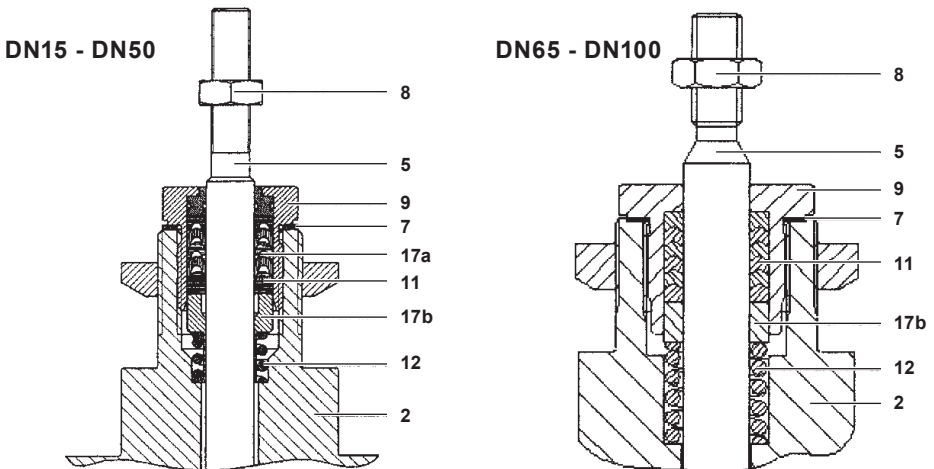


Fig. 6

4.2.2 Procedure for renewing graphite gland seals (Refer to Figures 1, 2 and 7):

- a) Isolate the valve on all three ports.
- b) Remove the actuator from the valve. Refer to the Installation and Maintenance Instructions covering Spirax Sarco actuators.
Caution: Care should be taken in removing the gland nut since fluid under pressure may be trapped between the isolating valves
- c) Remove the lock-nut (8).
- d) Unscrew the gland nut (9a) and the stuffing box (9).
- e) Remove the gland seal set (17b), and gland nut gasket (7).
- f) Examine the parts for signs of damage or deterioration and renew as necessary. Note that score marks or scaly deposit on the valve stem (5) will lead to early failure of the seals. Where the valve stem (5) needs to be replaced, follow instructions at point c) to g) of Section 4.2.3 or 4.2.4.
- g) Clean the parts taking care to avoid scratching the stem or the inside surface of the gland nut.
- h) Replace the gland nut gasket (7). Refit the stuffing box (9) over the valve stem, screwing down with care to ensure the gasket is bedded down onto the bonnet. Tighten to the recommended torque as given in Table 1.
- i) The replacement graphite gland seal should now be fitted. Note that the gland seal set contains a top and bottom support ring and a graphite pack. During fitting the order of the graphite pack should be maintained as supplied.

Place the bottom support ring into the stuffing box (9). One by one add the graphite rings and each time use the gland nut (9a) to drive down into the stuffing box. Ensuring the junction of the ring ends are rotated by 90°. Leave the gland nut (9a) loosely assembled so that the seals are not compressed.

Screw down the gland nut until it just starts to compress the packing. Compress the gland seal packing by tightening the gland nut by ¼ of a turn until 1½ turns.

Rise and lower the valve stem after each tightening of the gland nut to encourage the seals to bed down correctly.

- k) Refit the actuator and the clamping nut then connect the actuator to the valve stem.
- l) Stroke the valve a minimum of 5 times to ensure smooth operation.
- m) Tighten the gland nut (9a):
 - ¼ of a turn for DN15 to DN50 valves, and
 - ½ of a turn for DN65 to DN100 valves.
- n) Commission the actuator according to the Installation and Maintenance Instructions.
- o) Bring the valve back into service.
- p) 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 valve stem to lock-up.

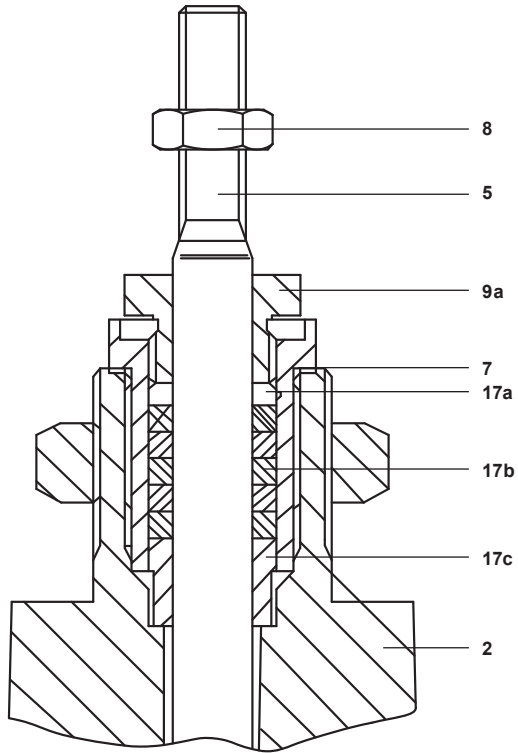


Fig. 7

4.2.3 Procedure for renewing valve stem, plug and seats on mixing valves (Refer to figures 6 to 8)

- a) Isolate the valve on all three ports.

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

- b) Remove the actuator from the valve.
- c) Remove the lock-nut (8).
- d) Ensure the valve stem (5) is held still by locating a spanner onto the machined flat on the valve stem and unscrew the plug lock-nut (16). Where the flat on the valve stem is not easily accessible, re-fit the nut (8) and a lock-nut onto the valve stem, tighten firmly and use this to locate the spanner.
- e) Unscrew the nuts (15) securing the bonnet (2). Remove the bonnet (2) and withdraw the valve stem (5). Remove the packing gland seal according to the procedure in Section 4.2.1 or 4.2.2.
- f) Unscrew and remove the top valve seat (4). Withdraw the valve plug (3), unscrew and remove the bottom valve seat (4).

Note: To remove and replace seat (4) a special tool is required which can be obtained from Spirax Sarco by quoting the valve size and type.

- g) Lightly smear the threads of the new seats with silicon grease. Insert the new bottom seat (4) into the body. Tighten to the recommended torque (see Table 1). Carefully insert the new valve plug (3). Insert the new top seat (4) into the body. Tighten to the recommended torque (see Table 1).
- h) Insert the new valve stem (5) into the plug (3). Ensure the valve stem (5) is held still by locating a spanner on to the machined flat on the valve stem. Replace the plug nut and lock-nut (16) and tighten to the recommended torque (see Table 1).
- i) Using a new bonnet gasket (13) refit the bonnet (2), taking care not to damage the valve stem (5). Replace and finger tighten the bonnet nuts (15).
- j) Fit the packing gland seal according to the procedure in Section 4.2.1 or 4.2.2, ensuring the valve stem (5) moves freely after assembly.
- k) Again loosen the bonnet nuts (15) and, while pushing the valve stem so that the valve plug is on the bottom seat, finally tighten them to the recommended torque (see Table 1).
- l) Refit the actuator and connect it to the valve stem.
- m) Bring the valve back into service.
- n) Check for leakage around all gasket joints.

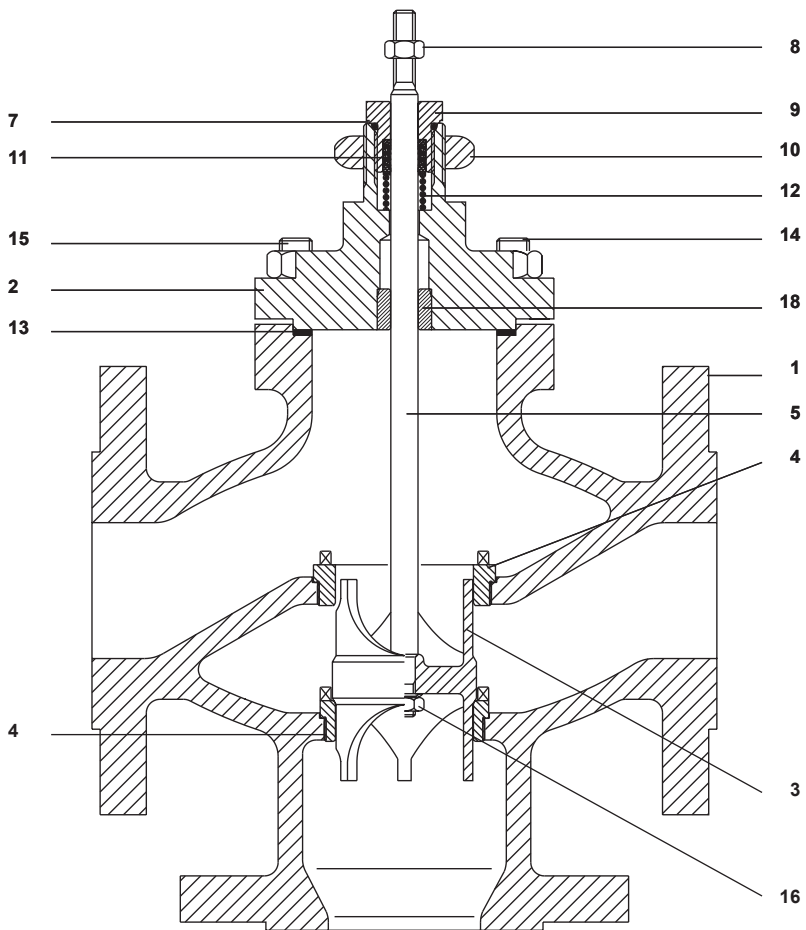


Fig. 8 Mixing valve

4.2.4 Procedure for renewing valve stem, plug and seats on diverting valves (Refer to Figures 6, 7 and 9)

- a) Isolate the valve on all three ports.

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

- b) Remove the actuator from the valve.
- c) Remove the lock-nut (8).
- d) Ensure the spacer (6) is held still by locating a spanner onto the machined flat on the valve stem and unscrew the plug lock-nut (16) of the lower valve plug (3) from the spacer (6). Where the flat on the valve stem is not easily accessible, re-fit the nut (8) and a lock-nut onto the valve stem (5), tighten firmly and use this to locate the spanner. Withdraw the lower valve plug (3).
- e) Unscrew the nuts (15) securing the bonnet (2). Remove the bonnet (2) with the valve stem and upper valve plug, and withdraw the valve stem (5). Remove the packing gland seal according to the procedure in Section 4.21 or 4.2.2.
- f) Unscrew and remove the top and bottom valve seat (4).

Note: To remove and replace the seat (4) a special tool is required which can be obtained from Spirax Sarco by quoting the valve size and type.

- g) Lightly smear the threads of the new seats with silicon grease. Insert the new bottom seat (4) into the body. Tighten to the recommended torque (see Table 1). Insert the new top seat (4) into the body. Tighten to the recommended torque (see Table 1).
- h) Unscrew the lock-nut (16) and remove the bottom plug from the new valve stem and plug assembly. Insert the new top plug (3) into the top seat (4). Insert the new bottom plug (3) into the bottom seat (4). Ensure the valve stem (5) is held still by locating a spanner on to the machined flat on the spacer. Replace the plug nut and lock-nut (16) and tighten to the recommended torque (see Table 1)
- i) Using a new gasket (13) refit the bonnet (2), taking care not to damage the valve stem (5). Replace and finger tighten the bonnet nuts (15).
- j) Fit the packing gland seal according to the procedure in Section 4.2.1 or 4.2.2, ensuring the valve stem (5) moves freely after assembly.
- k) Again loosen the bonnet nuts (15) and, while pushing the valve stem so that the valve plug is on the top seat, finally tighten them to the recommended torque (see Table 1).
- l) Refit the lock-nut (8). Refit the actuator and connect it to the valve stem.
- m) Bring the valve back into service.
- n) Check for leakage around all gasket joints.

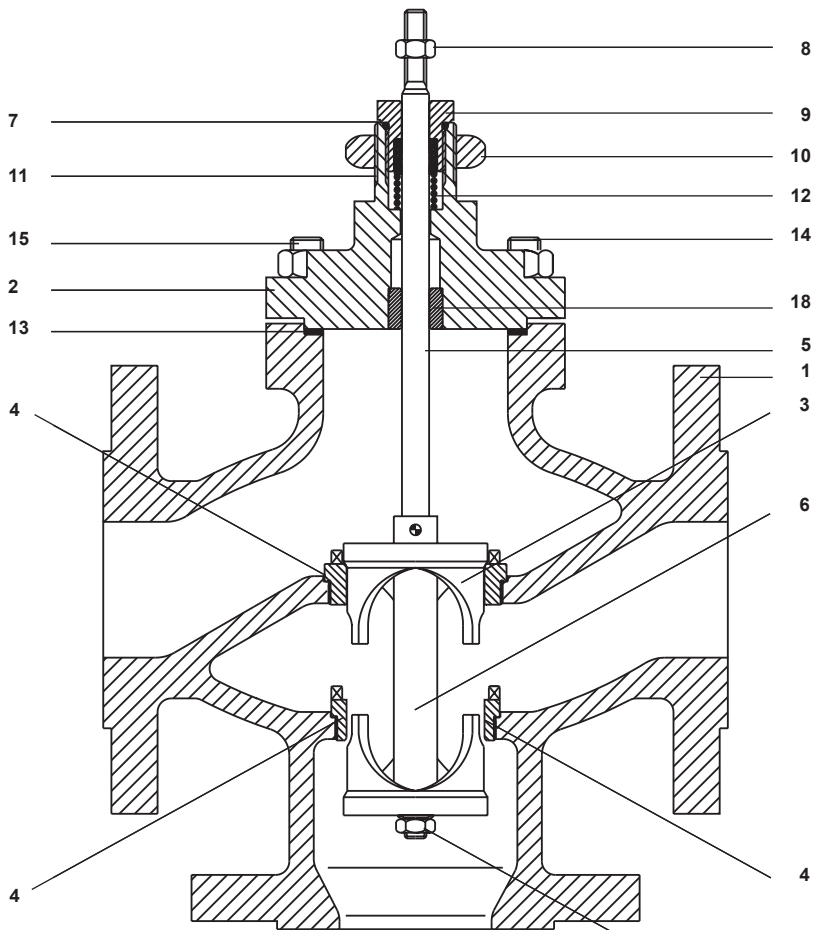


Fig. 9 Diverting valve

4.3 Bellows sealed valves

Note: These valves are fitted with a bellows stem seal as the primary seal together with a supplementary graphite stem seal. Any leakage from the stem will indicate a failure of the bellows seal. In normal service the supplementary graphite seal should be left finger tight and only tightened to provide a temporary stem seal if the bellows stem seal is leaking.

4.3.1 Procedure for renewing bellows stem seals (Refer to Figure 10)

- a) Isolate the valve on all three ports.

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

- b) Remove the actuator from the valve.

Caution: take care not to rotate the valve stem when removing the actuator from valve service, as this will damage the bellows. Refer to the Installation and Maintenance Instructions covering Spirax Sarco actuators.

- c) Remove the lock-nut (8).

- d) Unscrew the gland nut (9), remove and discard the gland seal set (11 + 17).

- e) Examine parts for signs of damage or deterioration and renew as necessary.

Note: the stem seal set on this valve is intended for emergency use in the event of bellows failure. Score marks or scaly deposits on the valve stem (5) will impair sealing efficiency.

- f) Clean parts taking care to avoid scratching the stem or the sealing surface for the bellows.

- g) A new graphite gland seal set (17) should be fitted to the valve, care being taken to avoid damage to the bellows (see Section 4.2.2 for details).

- h) Ensure the gland nut (item 9a, Figure 5) is only finger tight.

- i) Ensure that the valve stem (5) moves freely.

- j) Refit the valve lock-nut (8).

Table 1 Recommended tightening torques (Nm)

Valve size	Seat (4)	Bonnet housing nuts (15)	Bellows lock-nut (19)	Plug lock-nut	
				Mixing (16)	Diverting (16)
DN15	150 - 155	25 - 30	25 - 30	15 - 20	-
DN20	150 - 155	25 - 30	25 - 30	15 - 20	-
DN25	180 - 190	25 - 30	25 - 30	25 - 30	45 - 50
DN32	180 - 190	25 - 30	25 - 30	25 - 30	45 - 50
DN40	180 - 190	36 - 40	25 - 30	25 - 30	45 - 50
DN50	180 - 190	36 - 40	25 - 30	25 - 30	45 - 50
DN65	200 - 220	42 - 48	40 - 45	40 - 45	70 - 80
DN80	200 - 220	60 - 65	40 - 45	40 - 45	70 - 80
DN100	200 - 220	90 - 95	40 - 45	40 - 45	70 - 80

4.3.2 Procedure for renewing valve plug, seats and bellows assembly on mixing valves (Refer to Figure 11)

Note: Due to the delicate nature of the bellows assembly, it is highly recommended that when renewal is required of the stem/bellows assembly, valve plug and/or seats, that the complete valve is returned to Spirax Sarco service department.

- a) Isolate the valve on all three ports.
Caution: Care should be taken in removing the valve since fluid under pressure may be trapped between the isolating valves.
- b) Remove the actuator from the valve.
Caution: take care not to rotate the valve stem when removing the actuator from valve service, as this will damage the bellows. Refer to the Installation and Maintenance Instructions covering Spirax Sarco actuators.
- c) Remove the lock-nut (8).
- d) Ensure that the valve stem (5) is held still by locating a spanner onto the machined flat and unscrew the plug lock-nut (16) from the valve stem. Where the flat on the valve stem is not easily accessible, fit the nut (8) and a lock-nut onto the valve stem, tighten firmly and use the lock -nuts to locate the spanner. Unscrew the nuts (15) securing the bonnet (2).
- e) Withdraw the bonnet (2) together with the stem/bellows assembly (5).
- f) Remove the gland nut (9), gland bush (11), and the gland seal set (17). Unscrew the stem/bellows assembly lock-nut (19), loosen completely the anti-rotation screw (22) and withdraw the assembly from the bonnet.
- g) Unscrew and remove the top valve seat (4). Withdraw the valve plug (3), unscrew and remove the bottom valve seat (4).
Note: To remove and replace the top and bottom seats (4) a special tool is required which can be obtained from Spirax Sarco by quoting the valve size and type.
- h) Lightly smear the threads of the new seats with silicon grease. Insert the new bottom seat (4) into the body. Tighten to the recommended torque (see Table 1). Carefully insert the new valve plug (3). Insert the new top seat (4) into the body. Tighten to the recommended torque (see Table 1).
- i) Insert the replacement valve stem/bellows assembly (5) with new bellows flange gasket (21) into the bonnet (2) taking care not to damage the bellows. Replace and finger tighten lock-nut (19). Rotate the bellows assembly until the slot on the top end of the bellows aligns with the hole of the anti-rotation screw (22). Replace the anti-rotation screw (22) until it enters in the slot of the bellows end and finger tighten. Tighten the lock-nut (19) to the recommended torque (see Table 1); firmly tighten the anti-rotation screw (22).
- j) Using a new gasket (13) refit the bonnet and valve stem/bellows assembly on the valve body ensuring that the valve stem fits through the valve plug (3). Replace and finger tighten the bonnet nuts (15). Ensure the valve stem (5) is held still by locating a spanner on to the machined flat on the valve stem (5). Replace the plug nut (16) and lock-nut and tighten to the recommended torque (see Table 1). Again loosen the bonnet nuts (15) and, while pushing the valve stem so that the valve plug is on the bottom seat, finally tighten them to the recommended torque (see Table 1).
- k) Fit the new stem seal assembly (17) as described in Paragraph 4.3.1, ensuring the valve stem (5) moves freely after assembly.
- l) Refit the actuator and connect the actuator to the valve stem.
Caution: take care not to rotate the valve stem when fitting the actuator to the valve since this will destroy the bellows.
- m) Bring the valve back into service.
- n) Check for leakage around all gasket joints.

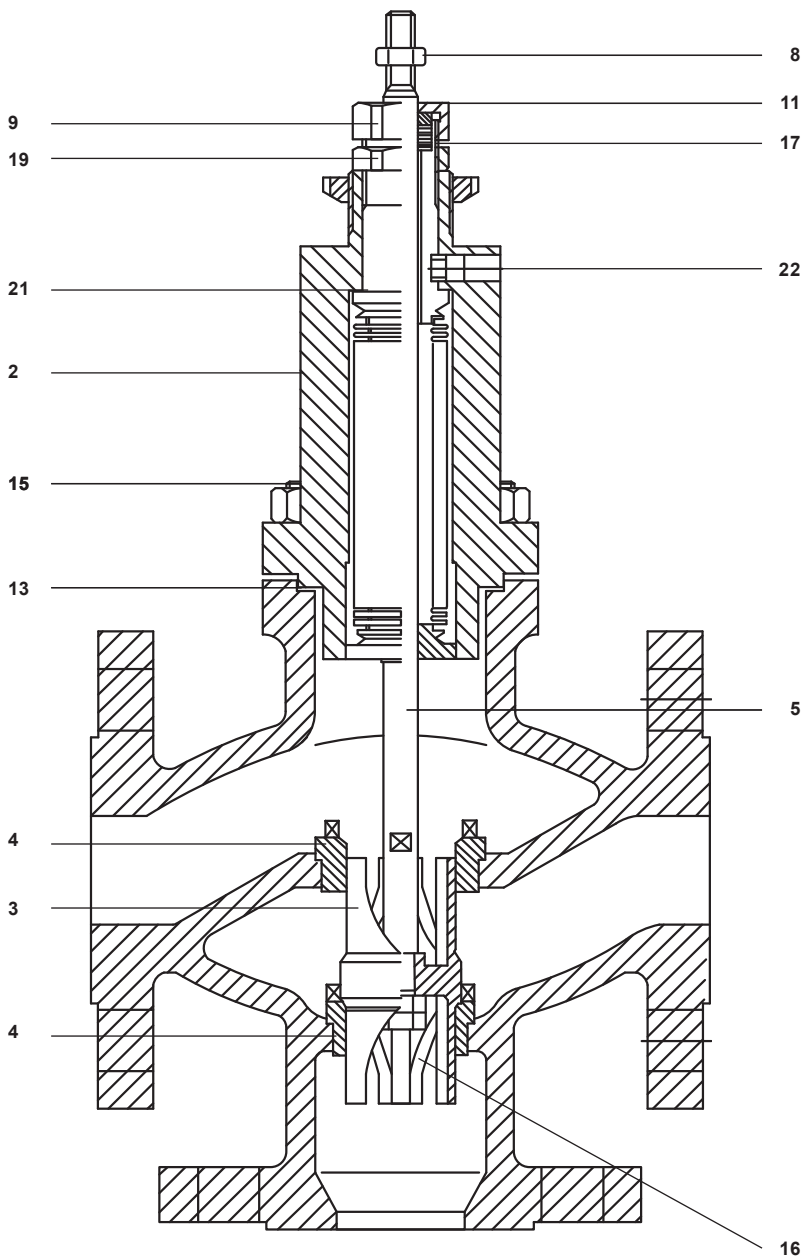


Fig. 11 Mixing valve

QLM and QLD Series DN15 to DN100 Three Port Control Valves

4.3.3 Procedure for renewing valve plug, seats and bellows assembly on diverting valves (Refer to Figure 12)

Note: Due to the delicate nature of the bellows assembly, it is highly recommended that when renewal is required of the valve stem/bellows assembly, valve plug and/or seats, that the complete valve is returned to Spirax Sarco service department.

- a) Isolate the valve on all three ports.
Caution: Care should be taken in removing the valve since fluid under pressure may be trapped between the isolating valves.
- b) Remove the actuator from the valve.
Caution: take care not to rotate the valve stem when removing the actuator from valve service, as this will damage the bellows. Refer to the Installation and Maintenance Instructions covering Spirax Sarco actuators.
- c) Remove the lock-nut (8).
- d) Ensure the stem (5) is held still by locating a spanner onto the machined flat on the spacer and unscrew the bottom plug lock-nut (16). Where the flat on the stem is not easily accessible, re-fit the nut (8) and a lock-nut onto the valve stem, tighten firmly and use the lock-nuts to locate the spanner. Withdraw the bottom plug (3) and spacer (6). Unscrew the nuts (15) securing the bonnet (2).
- e) Withdraw the bonnet (2) together with the valve stem/bellows assembly (5).
- f) Remove the gland nut (9), gland bush (11), and the gland seal set (17). Unscrew the valve stem /bellows assembly lock-nut (19), loosen completely the anti-rotation screw (22) and withdraw the assembly from the bonnet.
- g) Unscrew and remove the top valve seat (4), unscrew and remove the bottom valve seat (4).
Note: To remove and replace top and bottom valve seats (4) a special tool is required which can be obtained from Spirax Sarco by quoting the valve size and type.
- h) Lightly smear the threads of the new seats with silicon grease. Insert the new bottom seat (4) into the body. Tighten to the recommended torque (see Table 1). Insert the new top seat (4) into the body. Tighten to the recommended torque (see Table 1).
- i) Remove the bottom valve plug (3) from the new valve stem/bellows assembly (5). Insert the replacement valve stem/bellows assembly (5) with new bellows flange gasket (21) into the bonnet (2) taking care not to damage the bellows. Replace and finger tighten the lock-nut (19). Rotate the bellows assembly until the slot on the top end of the bellows aligns with the hole of the anti-rotation screw (22). Replace the anti-rotation screw (22) until it enters in the slot of the bellows end and finger tighten. Tighten the lock-nut (19) to the recommended torque (see Table 1); firmly tighten the anti-rotation screw (22).
- j) Using a new gasket (13) refit the bonnet and valve stem/bellows assembly on the valve body ensuring that the top valve plug fits into the seat (4). Replace and finger tighten the bonnet nuts (15). Refit the bottom plug (3), spacer (6) and lock-nuts (16). Ensure the stem (5) is held still by locating a spanner on to the machined flat. Tighten to the recommended torque (see Table 1).
- k) Loosen the bonnet nuts (15) and, while pushing the valve stem so that the valve plug is on the top seat, finally tighten them to the recommended torque (see Table 1).
- l) Fit the new stem seal assembly as described in Section 4.3.1, ensuring the valve stem (5) moves freely after assembly.
- m) Refit the actuator and connect the actuator to the valve stem.
Caution: take care not to rotate the valve stem when fitting the actuator to the valve, since this will destroy the bellows.
- n) Bring the valve back into service.
- o) Check for leakage around all gasket joints.

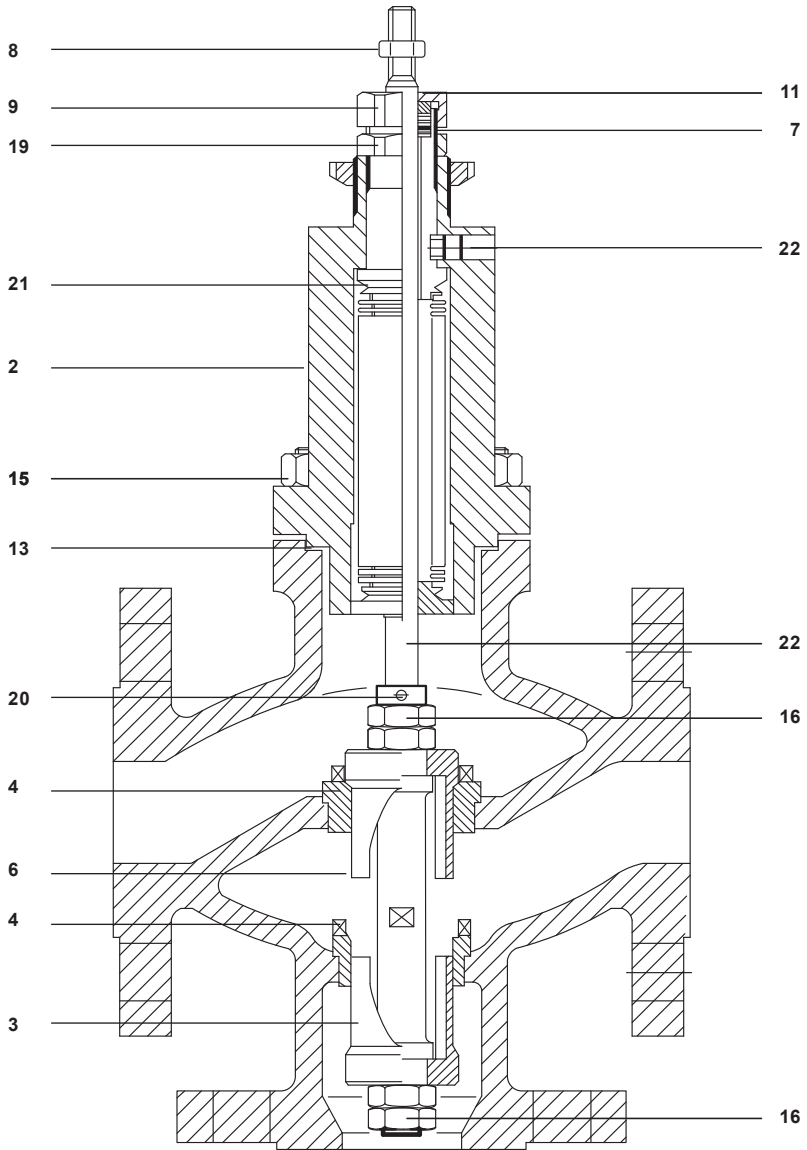


Fig. 12 Diverting Valve

QLM and QLD Series DN15 to DN100 Three Port Control Valves

5. Spares

5.1 Valves with packing gland seal

The spare parts available are in heavy outline.

Parts drawn in a grey line are not supplied as spares.

These spares are for the following valves:-

QL33M, QL43M, QL63M, QL73M	Mixing	DN15 to DN100
QL33D, QL43D, QL63D, QL73D	Diverting	DN25 to DN100

Available spares

Actuator clamping nut	A
PTFE gland seal kit for DN15 to DN50 only (gasket, chevrons, spring, upper and lower bearings and 'O' ring)	B
PTFE gland seal kit for DN65 to DN100 only (gasket, chevrons, guide bush, spring)	B1
Graphite gland seal kit for DN15 to DN100 (graphite stem seals and stuffing box gasket)	C
Stem, plug and bonnet gasket	D,E
Bonnet gasket (packet of 3)	E
Seats (1 off top and bottom)	F

Note: PTFE and graphite seal kits are suitable for stuffing box and extended bonnet versions.

How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the size and type of valve.

Example: 1 - PTFE gland seal kit for a Spirax Sarco DN25 QL73D Kv 10 PN25

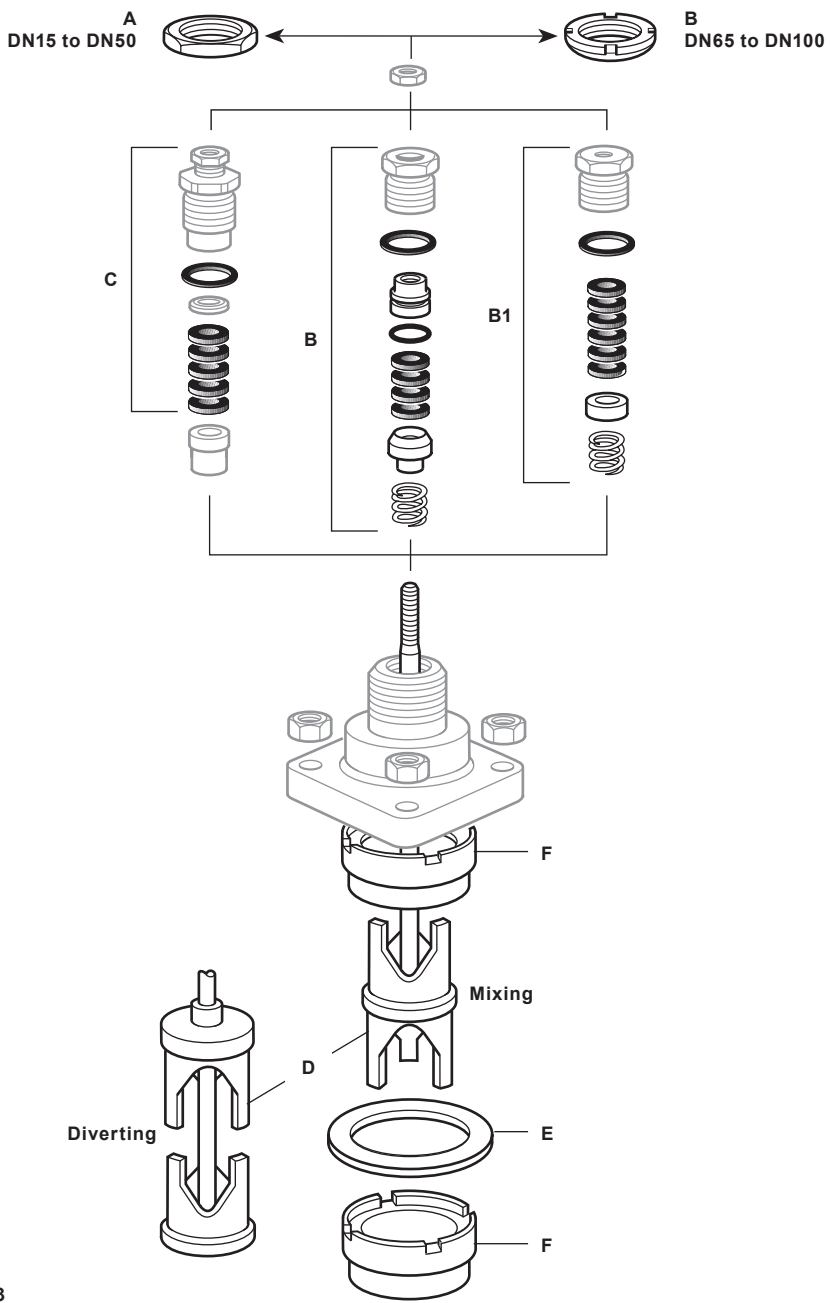


Fig. 13

QLM and QLD Series DN15 to DN100 Three Port Control Valves

5.2 Valves with bellows seal

Available spares

Graphite gland seal kit (packing set)	AS
Seats (2 items)	BS
Bonnet gasket (packet of 3)	CS
Bellows gasket (packet of 3)	DS
Spindle/bellows and plug assembly, gasket, for mixing valves	ES, CS, DS
Spindle/bellows and plug assembly, gasket, for diverting valves	FS, CS, DS

How to order spares

Always order spares by using the description given in the column headed 'Available spares' and state the size and type of valve.

Example: 1 - Graphite gland seal kit for a Spirax Sarco DN25 QL73DB1 Kv 10 PN25.

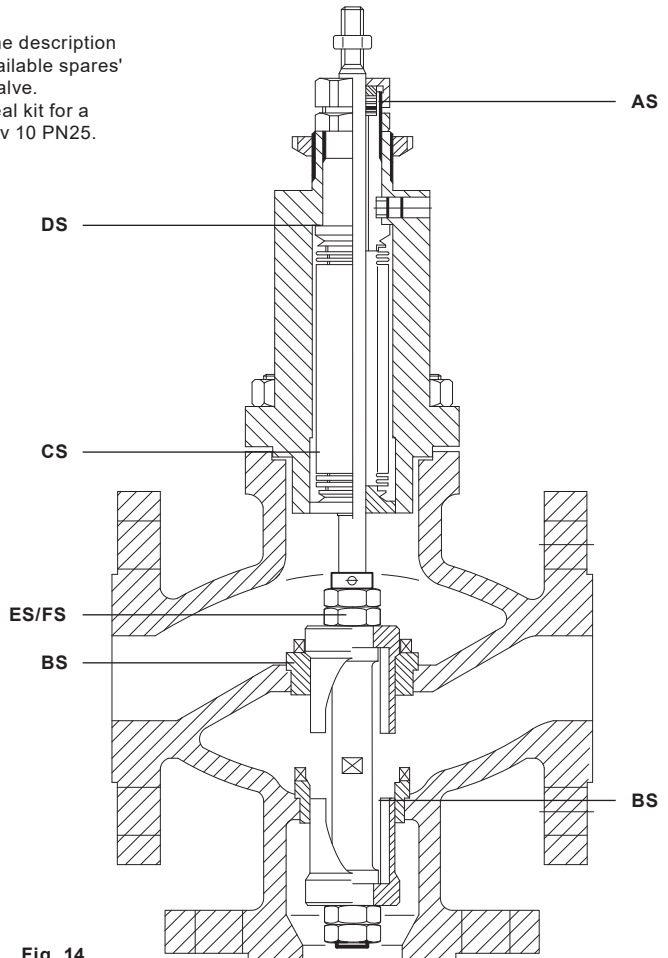


Fig. 14

