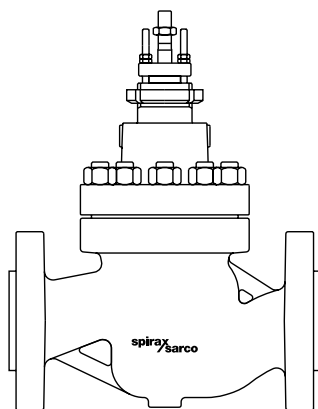


**'C' Series
Control Valves**
Installation and Maintenance Instructions



- 1. Safety information*
- 2. General product information*
- 3. Installation and Commissioning*
- 4. Maintenance*
- 5. Spare parts*

1. Safety information

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

1.1 Intended use

Referring to the Installation and Maintenance Instructions, name-plate and Technical Information Sheet, check that the product is suitable for the intended use/application. The products listed below comply with the requirements of the European Pressure Equipment Directive 97/23/EC and carry the CE mark when so required. The products fall within the Pressure Equipment Directive categories as shown in Table 1 and 2:

Table 1 DIN products for the 'C' series

Product		Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
CE43 CE63 CE83	PN100	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
CE43 CE63 CE83	PN63	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
CE43 CE43B CE63 CE83 CE83B	PN40	DN25	SEP	SEP	SEP
		DN40	2	1	SEP
		DN50 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
		DN300	3	3	1
CE43 CE43B CE63 CE83 CE83B	PN25	DN25	SEP	SEP	SEP
		DN40	1	SEP	SEP
		DN50 - DN100	2	1	SEP
		DN125	2	2	2
		DN150 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
CE43 CE43B CE63 CE83 CE83B	PN16	DN25	SEP	SEP	SEP
		DN40 - DN50	1	SEP	SEP
		DN65 - DN125	2	1	SEP
		DN150 - DN200	2	1	2
		DN250 - DN300	3	2	2

Table 2 ANSI products for the 'C' series

Product		Group 1 Gases	Group 2 Gases	Group 1 Liquids	Group 2 Liquids
CE43	ANSI 600	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
	ANSI 300	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
	ANSI 150	DN25	SEP	SEP	SEP
		DN40 - DN50	1	SEP	SEP
		DN65 - DN100	2	1	SEP
		DN125-DN150	2	1	2
		DN200 - DN250	3	2	2
		DN300	3	3	2
CE63	ANSI 600	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	1
		DN300	3	3	2
	ANSI 300	DN25	SEP	SEP	SEP
		DN40	2	1	SEP
		DN50 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	2
	ANSI 150	DN300	3	3	2
		DN25	SEP	SEP	SEP
		DN40 - DN50	1	SEP	SEP
		DN65 - DN100	2	1	SEP
		DN125 - DN150	2	1	2
		DN200 - DN250	3	2	2
CE83	ANSI 600	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	2
		DN300	3	3	2
	ANSI 300	DN25	SEP	SEP	SEP
		DN40 - DN100	2	1	2
		DN125 - DN200	3	2	2
		DN250	3	2	2
		DN300	3	3	2
	ANSI 150	DN25	SEP	SEP	SEP
		DN40 - DN50	1	SEP	SEP
		DN65 - DN100	2	1	SEP
		DN125 - DN150	2	1	2
		DN200 - DN250	3	2	2
		DN300	3	3	2

-
- i) The products have been specifically designed for use on water, steam, diathermic oil, air or condensate which are in Group 2 of the above mentioned Pressure Equipment Directive. The products' use on other fluids within Group 2 or fluids within Group 1 may be possible but, if this is contemplated, Spirax Sarco should be contacted to confirm the suitability of the product for the application being considered.
 - ii) Check material suitability, pressure and temperature and their maximum and minimum values. If the maximum operating limits of the product are lower than those of the system in which it is being fitted, or if malfunction of the product could result in a dangerous overpressure or overtemperature occurrence, ensure a safety device is included in the system to prevent such over-limit situations.
 - iii) 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 protective covers from all connections and protective film from all nameplates, where appropriate, before installation on steam or other high temperature applications.

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.

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 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 232°C (450°F).

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.

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 'C' series is a range of carbon steel (CE43), alloy steel (CE83) or stainless steel (CE63) two port, cage trim, control valves conforming to ANSI B 16.34 and ASME VIII standards. The valves are available in sizes 1" to 8" (DN25 to DN200), with ANSI and PN flange connections. When used in conjunction with a pneumatic linear actuator the 'C' series valve will provide characterised modulating or on/off control.

Compatible actuators and positioners:

Pneumatic actuators	PN1000 series, spring-to-close
	PN2000 series, spring-to-open
Positioners	PP5 (pneumatic)
	EP5 (electropneumatic)
	SP200 (smart electropneumatic)

Note: For further details reference the relevant Technical Information Sheet.

2.2 Sizes and pipe connections

1", 1½", 2", 2½", 3", 4", 5", 6" and 8" (DN25, 40, 50, 65, 80, 100, 125, 150 and 200).
 Flanged to ANSI 150, ANSI 300, ANSI 600 (Raised face or ring type joint) or
 PN16, PN25, PN40, PN63, and PN100 (Raised face with ANSI face-to-face dimension).
 1", 1½" and 2" socket weld.

2.3 Options

Trim	Equal %, linear, fast opening (on/off) characteristics, soft seat, hard faced, low noise and anti-cavitation (single and multi-cage).
Stem seal	PTFE chevron, graphite packing and bellows.
Plug	Balanced or unbalanced to ANSI Class IV, V or VI shut-off.

See 'C' series valve options Technical Information Sheet TI-F12-23.

2.4 Technical data

Plug design	Unbalanced plug		
	PTFE sealed balanced plug		
	Graphite sealed balanced plug		
Trim design	Cage trim with equal percentage, linear and fast opening flow characteristic options.		
Leakage	Class IV	Metal-to-metal seat	IEC 534-4
	Class IV & V	Hard face stellite	IEC 534-4
	Class VI	PTFE soft seat	IEC 534-4
Flow characteristic	CE valves	Equal percentage	
	CF valves	Fast opening	
	CL valves	Linear	
	CM valves	Modified equal percentage	
Rangeability	50:1 Equal percentage		
	30:1 Linear		
Travel	1" and 1½"	(DN25 and DN40)	¾" (20 mm)
	2"	(DN50)	1⅞" (30 mm)
	2½" and 3"	(DN65 and DN80)	1½" (38 mm)
	4"	(DN100)	2" (50 mm)
	5" and 6"	(DN125 and DN150)	2½" (65 mm)
	8"	(DN200)	3" (75 mm)

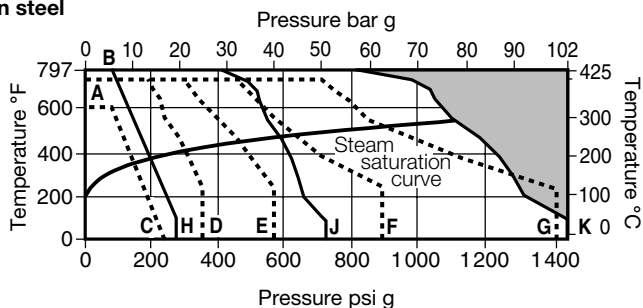
2.5 Limiting conditions


Body design conditions		ANSI 300 and ANSI 600			
Design temperature	Standard PTFE chevron stem seals	CE43	14°F to +482°F	(-10°C to +250°C)	
		CE63	-20°F to +482°F	(-29°C to +250°C)	
		CE83	14°F to +482°F	(-10°C to +250°C)	
	Graphite packing stem seals	Standard bonnet	CE43	14°F to +572°F	(-10°C to +300°C)
			CE63	-20°F to +572°F	(-29°C to +300°C)
			CE83	14°F to +572°F	(-10°C to +300°C)
		Extended bonnet	CE43	14°F to +797°F	(-10°C to +425°C)
			CE63	-20°F to +1004°F	(-29°C to +540°C)
			CE83	14°F to +1004°F	(-10°C to +540°C)
	Graphite sealed balanced plug	Class IV	CE43	797°F	(425°C)
			CE63	1004°F	(540°C)
			CE83	1004°F	(540°C)
	PTFE sealed balanced plug	Class VI		356°F	(180°C)
	Designed for a maximum cold hydraulic test pressure of:	ANSI 300	CE43	1110 psi g	(76.6 bar g)
CE63			1080 psi g	(74.5 bar g)	
CE83			1125 psi g	(77.6 bar g)	
ANSI 600		CE43	2220 psi g	(153.0 bar g)	
		CE63	2160 psi g	(149.0 bar g)	
		CE83	2250 psi g	(155.0 bar g)	
Maximum differential pressure See relevant actuator TI					

2.6 Operating range for body material and flange type only.

Note: See limiting conditions for stem and plug limitations.

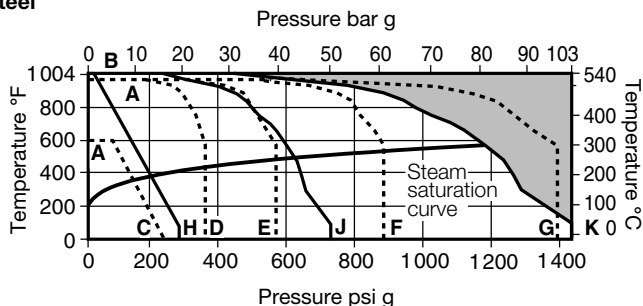
CE43 Carbon steel



 The product must not be used in this region.

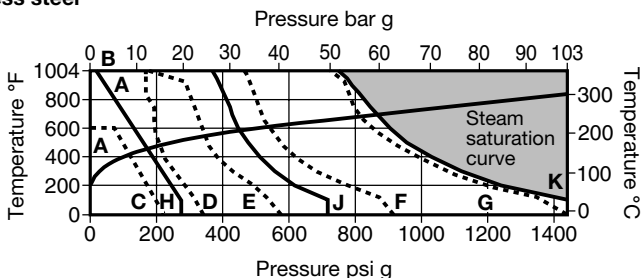
A-C PN16, A-D PN25, A-E PN40, A-F PN63, A-G PN100,
B-H ANSI 150, B-J ANSI 300, B-K ANSI 600

CE83 Alloy steel



A-C PN16, A-D PN25, A-E PN40, A-F PN63, A-G PN100,
B-H ANSI 150, B-J ANSI 300, B-K ANSI 600

CE63 Stainless steel



A-C PN16, A-D PN25, A-E PN40, A-F PN63, A-G PN100,
B-H ANSI 150, B-J ANSI 300, B-K ANSI 600

2.7 Weights (approximate) in lbs and (kg)

Valve size	1" DN25	1½" DN40	2" DN50	2½" DN65	3" DN80	4" DN100	5" DN125	6" DN150	8" DN200
Weights	29 (13)	48 (22)	59 (27)	92 (42)	130 (59)	213 (97)	264 (120)	396 (180)	660 (300)

2.8 Valve flow coefficients at 100% lift

C_v (US) for single stage trims (K_{vs} shown in brackets).

F_L = Flow recovery factor

Valve size	1" DN25	1½" DN40	2" DN50	2½" DN65	3" DN80	4" DN100	5" DN125	6" DN150	8" DN200
Equal % C _v (K _{vs})	19 (16)	35 (30)	63 (54)	95 (81)	130 (111)	216 (185)	293 (250)	385 (330)	560 (480)
F _L	0.94	0.94	0.94	0.94	0.90	0.89	0.85	0.85	0.85

Three reduced C_v are available for equal percentage and linear trims, for further details see: TI-F12-23, 'C' series valve options.

For conversion

$$C_v (\text{UK}) = C_v (\text{US}) \times 0.833$$

$$K_{vs} = C_v (\text{US}) \times 0.855$$

2.9 Part numbers, description and materials

No. Part		Material	
1	Body	CE43	Carbon steel ASTM A216 WCB
		CE63	Stainless steel ASTM A351 CF8M
		CE83	Alloy steel ASTM A217 WC6
2	Bonnet	CE43	Carbon steel ASTM A216 WCB
		CE63	Stainless steel ASTM A351 CF8M
		CE83	Alloy steel ASTM A217 WC6
3	Valve plug	Stainless steel	
4	Valve cage	Stainless steel AISI 316 ENP	
5	Valve seat	Stainless steel	
6	Valve stem	Stainless steel AISI 316	
7	Valve plug sealing rings	Graphite	
8	Lock-nut	Stainless steel AISI 316	
9	Mounting nut	Zinc plated carbon steel	
10	Gland spring	Stainless steel AISI 302	
11	Gland seal	PTFE chevron or graphite	
12	Bonnet gasket	Stainless steel/graphite (3 elements)	
13	Bonnet studs	CE43	Carbon steel ASTM A193 B7
		CE63	Stainless steel ASTM A193 Gr. B8M
		CE83	Alloy steel ASTM A193 B16
14	Bonnet nuts	CE43	Carbon steel ASTM A194 2H
		CE63	Stainless steel ASTM A194 Gr. 8M
		CE83	Alloy steel ASTM A194 GRD4
15	Stuffing box studs	Stainless steel ASTM A193 Gr. B8M	
16	Stuffing box nuts	Stainless steel ASTM A194 Gr. 8M	
17	Stem scraper	Glass filled PTFE	
18	Stuffing box bush	Stainless steel AISI 316	
19	Stuffing box ring	Stainless steel AISI 316	
20	Valve stem wiper	Fluoroelastomer	
21	'O' ring	Fluoroelastomer	
27	Cage adaptor	Stainless steel	

High temperature packing

22	Gland seal	Graphite
23	Gland follower	Stainless steel
25	Belleville washers	Steel

Fig. 1
'C' series valve with single stage cage trim

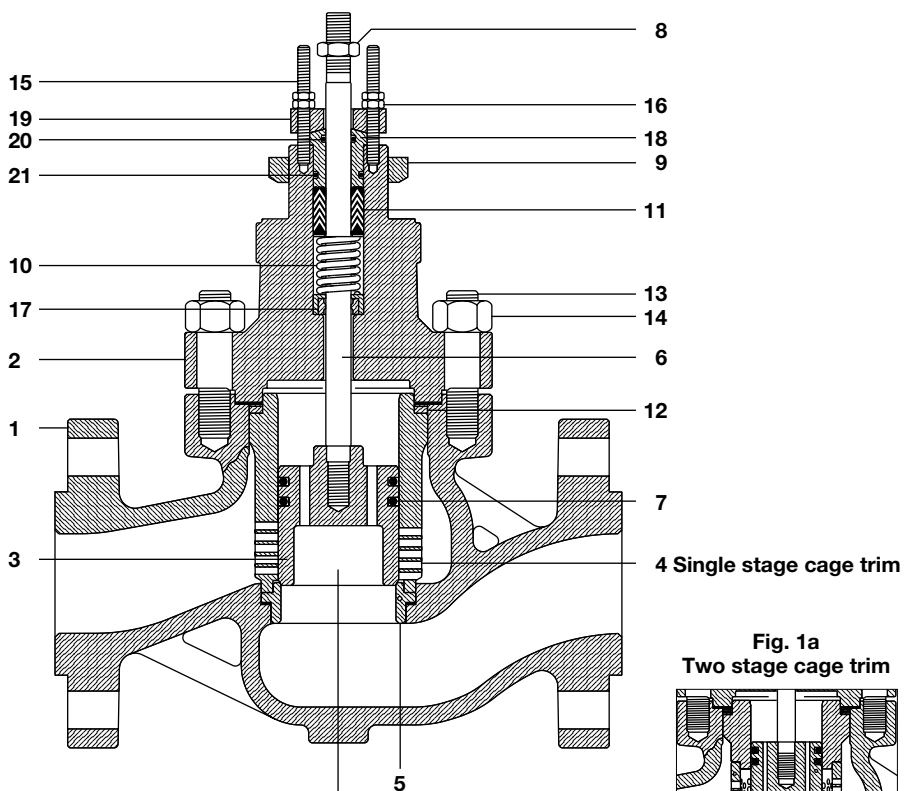


Fig. 1a
Two stage cage trim

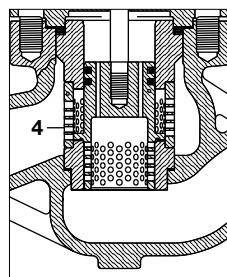


Fig. 1b
Three stage cage trim

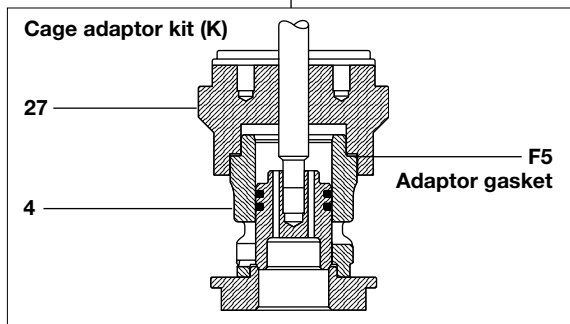
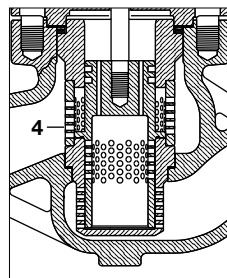


Fig. 1c
Cage adaptor kit (K)

— 3. *Installation and Commissioning* —

Note: Before actioning any installation, observe the 'Safety information' in Section 1.

3.1 General

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

Remove the flange protectors and fit the valve into the pipeline taking notice of the direction of flow arrow on the valve body.

Care should be taken to prevent any strain being imposed on the valve body due to pipe misalignment. Tighten flange bolts evenly. Check flange bolts for tightness after 24 hours of operation. Care should be taken to ensure that the valve/actuator spindle is not painted or coated with any other substance.

When carrying out maintenance of the valve care should be taken to avoid damage to the valve plug, stem and seat.

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 instruction refer to the Installation and Maintenance Instructions, covering Spirax Sarco actuators.

4. Maintenance

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

4.1 General

Valve parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends on the severity of service conditions. This Section gives instructions for packing lubrication, packing maintenance, trim maintenance, and bellows seal replacement. All maintenance operations can be performed with the valve body in the line.

4.2 Routine maintenance procedures

24 hours operation

After 24 hours service check pipework connections and flange bolts for tightness.

For valves which have high temperature graphite packed gland seals; the gland nut should be tightened by approximately $\frac{1}{4}$ of a turn taking care not to overtighten as this may cause excessive friction on the valve stem.

3 months operating intervals

After every 3 months of normal service, visually check the gland seals for signs of leakage and if necessary take the following corrective action:

- For valves having the chevron gland seals, remove and replace the PTFE chevron seal (refer to Section 4.3).
- For valves having the high temperature graphite packed gland seals, tighten the gland nut approximately $\frac{1}{4}$ of a turn taking care not to overtighten as this may cause excessive friction on the valve stem. If no adjustment is remaining, replace the graphite gland seal (refer to Section 4.4).

Annually

The valve should be inspected for wear and tear replacing any worn or damaged parts such as valve plug and stem, valve seat and gland seals. Refer to 'Spare parts' Section 5 for 'Available spares'.

High temperature graphite packed gland seals are subject to wear during normal operation. It is therefore recommended that the graphite packing is replaced during this routine inspection to prevent premature failure of the gland seals during normal operation.

4.3 Procedure for renewing chevron gland seals

For spring-loaded single PTFE chevron gland seals, the gland spring (10) maintains a sealing force on the packing. If leakage is noted around the stuffing box bush (18) check to be sure the shoulder on the bush is touching the bonnet. If the shoulder is not touching the bonnet, tighten the stuffing box nuts (16), until the shoulder is against the bonnet. If leakage cannot be stopped in this manner, the gland seals will need replacing.

If the leakage comes from the outside diameter of the seals, it is possible that the leakage is caused by damage to the stuffing box wall. If performing any of the following procedures, inspect the valve stem and packing box wall for damage.

4.3.1 Replacing chevron gland seals:

1. Isolate the control valve from the pressure, and release pressure from the valve body.
2. Disconnect the operating lines from the actuator and any leak-off piping from the bonnet. Disconnect the valve stem (6) from the actuator and then remove the actuator from the valve by unscrewing the mounting nut (9).
3. Loosen the stuffing box nuts (16) so that the seals are not tight on the valve stem.
4. Unscrew the bonnet nuts (14).
5. Carefully lift the bonnet (2) and keep the spindle lock-nut (8) fitted to ensure that the plug comes out with the bonnet. **Please note:** When the lock-nut (8) has been removed carefully slide the plug stem from the bonnet without damaging it.
6. Cover the opening in the valve body to protect the gasket surface and prevent foreign material from getting into the body cavity.
7. Remove the stuffing box nuts (16), stuffing box ring (19), and stuffing box bush (18). Carefully push out all the remaining packing parts from the body side of the bonnet using a rounded rod or other tool that will not scratch the stuffing box wall. Clean the stuffing box and metal packing parts.
8. Inspect the valve stem threads and stuffing box surface for any sharp edges which might cut the packing. Scratches or burrs could cause damage to the new packing. If the surface condition cannot be improved using a light dressing paper, replace the damaged parts.
9. Remove the cover protecting the body cavity and install a new bonnet gasket set (F1, F2 and F3), making sure that the gasket seating surfaces are clean and undamaged. Then slide the bonnet over the stem and onto the bonnet studs (13) - see page 15.

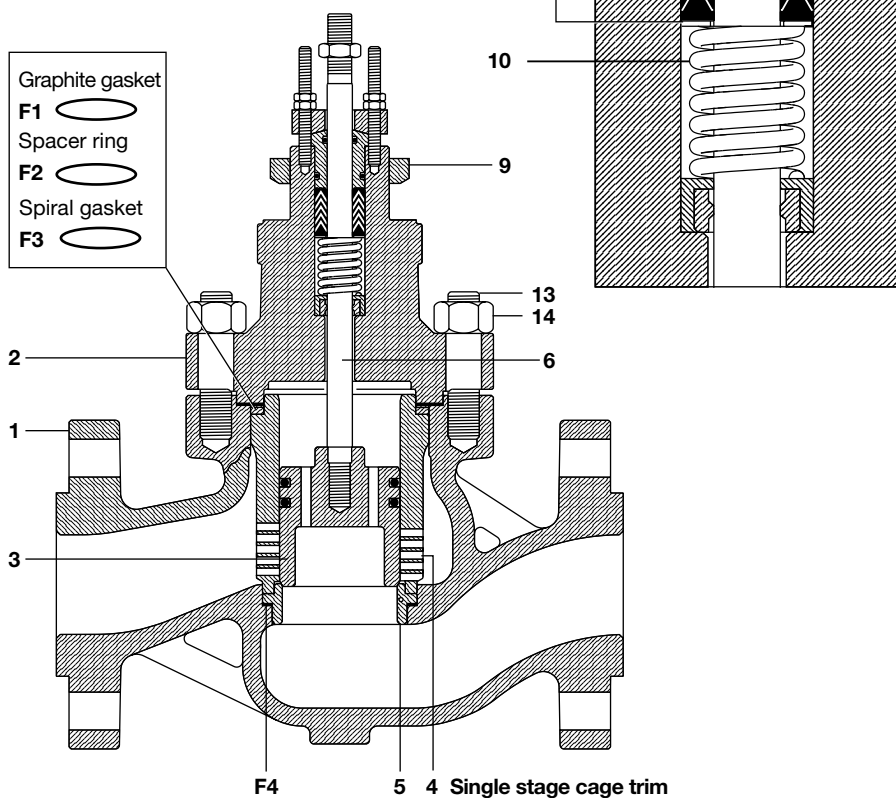
Note:

Proper tightening of the bonnet nuts compresses the bonnet gasket set (F1, F2 and F3) enough to both load and seal the seat ring gasket (F4). It also compresses the outer edge of the bonnet gasket enough to seal the body-to-bonnet joint.

Ensure that bolting threads are clean, and evenly tighten the nuts onto the studs in a diagonal pattern. Because of the bolt-up characteristics of spiral wound gaskets, a tightened nut may loosen an adjacent nut. Repeat the diagonal tightening pattern several times until each nut is tight and the body-to-bonnet seal is made. When the operating temperature has been reached, perform this torquing procedure once again.

10. Lubricate the studs (13) and tighten the nuts (14), using proper bolting procedures. (See Table 1 'Recommended tightening torques', page 22).
11. Tighten the stuffing box nuts (16) until the stuffing box ring (19) sits on the shoulder of the stuffing box bush (18).
12. Mount the actuator on the valve body assembly and reconnect the actuator and valve stem according to the procedure in the appropriate actuator Installation and Maintenance Instructions.

Fig. 2
'C' series valve with
single stage cage trim



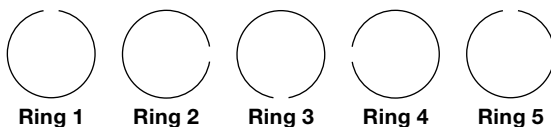
4.4 Procedure for renewing graphite gland seals

If there is undesirable packing leakage first try to limit the leakage and establish a stem seal by tightening the stuffing box nuts (16).

Note: If the packing is relatively new and tight on the stem, and if tightening the stuffing box nuts does not stop the leakage, it is possible that the valve stem is worn or damaged so that a seal cannot be made.

4.4.1 Replacing graphite gland seals:

13. Follow Steps 1 to 10 in Section 4.3.1, taking note when removing the belleville springs, of the position of each disc.
14. Install the packing components according to the order in Fig. 3.
Install the graphite rings (23) individually. Each ring should be pressed firmly to the bottom of the housing, using the follower and/or a spacer as required, ensuring that the join is staggered by at least 90° from the previous ring - see below.



15. Fit the packing follower (22), refit the belleville washers (25) following the original order, and stuffing box ring (19) into position. Lubricate the stuffing box nuts (16). Install and tighten the packing flange nuts finger tight.
16. Mount the actuator on the valve body assembly and reconnect the actuator and valve stem.
17. The packing should now be compressed by a nominal 10%. Mark a line on the follower 3 mm above the top of the gland housing. Then tighten the packing flange nuts, until the line on the follower reaches the top of the housing (See Figs. 3a and 3b opposite).
18. With the packing initially compressed to a nominal 10%, check the torque on the stuffing box nuts. At this point it is beneficial to perform at least 5 settling cycles, with the nut torque being restored during each cycle.
Therefore, operate the valve through approximately 5 cycles, and retorque the nuts at both the top and the bottom of the stroke.

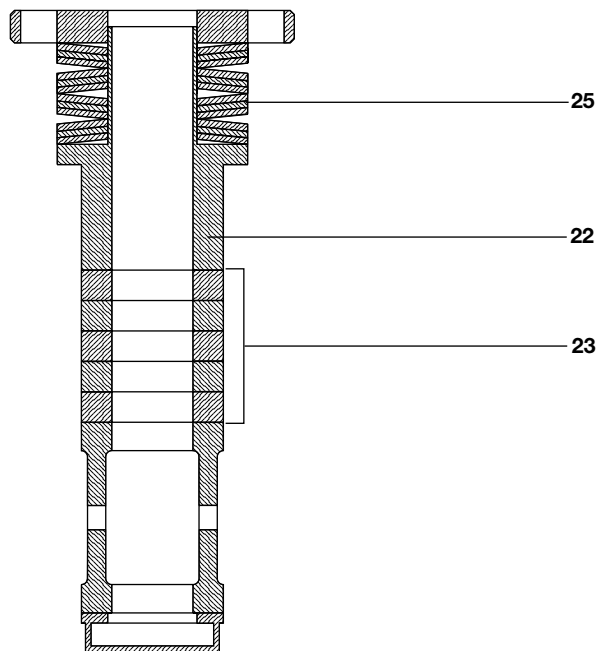


Fig. 3 Graphite gland seal assembly

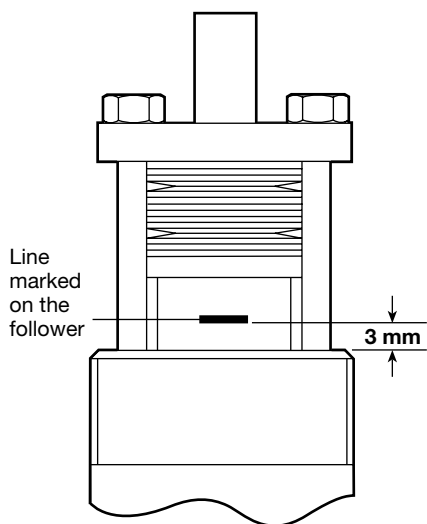


Fig. 3a

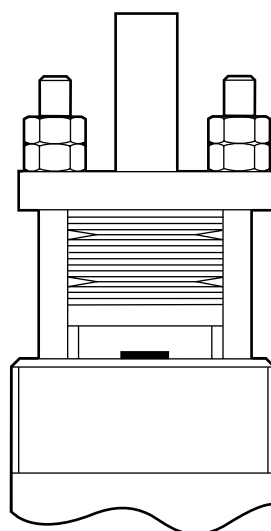


Fig. 3b

4.5 Trim maintenance

4.5.1 Disassembly of valves with standard bonnet and temperature extension bonnet:

1. Remove the actuator and the bonnet according to Steps 1 to 5 of the replacing chevron seals procedure (see Section 4.3.1).

Caution:

When lifting the valve plug stem (6) and attached valve plug (3) out of the body, be certain that the cage (4) remains in the body (1). This will prevent cage damage that might be caused by the cage dropping back into the body after being lifted part way out.

2. Packing parts can be removed if desired. Replace these parts as described in the replacing packing procedure, (see Section 4.3.1). Remove the cage adaptor (27) from any restricted-trim body, and wrap it for protection.
3. Lift the valve plug and stem assembly out of the valve body and set it on a protective surface. If the valve plug is to be reused, protect the valve plug seating surface to prevent any scratches.
4. Remove the cage and the associated gaskets (F1, F2 and F3), (see Fig. 4).
5. Remove the seat (5) and seat gasket (F4).
6. Inspect parts for wear or damage which would prevent proper operation of the valve. Replace where necessary.

4.5.2 Disassembly valves with bellows sealed bonnet (refer to Fig. 5):

1. Remove the actuator and the bonnet according to Steps 1 to 5 of the replacing chevron seals procedure (see Section 4.3.1).
2. Unscrew the nuts (14) securing the bonnet to the bellows housing (31) and remove the bonnet assembly.
3. Unscrew the nuts (30) securing the bellows housing to the valve body and remove the housing complete with stem and plug.
Carefully supporting the bellows housing, remove the pin fixing the valve head to the stem (26). Remove the valve head and the cage adaptor (27) (see Fig. 4c) for restricted trim valves and withdraw the stem / bellows assembly (18) from the bellows housing.
4. Remove the cage and the associated gaskets (F1, F2, and F3), (see Fig. 4).
5. Remove the seat (5) and seat gasket (F4).
6. Inspect parts for wear or damage which would prevent proper operation of the valve. Replace where necessary.

Fig. 4
'C' series valve with single stage cage trim

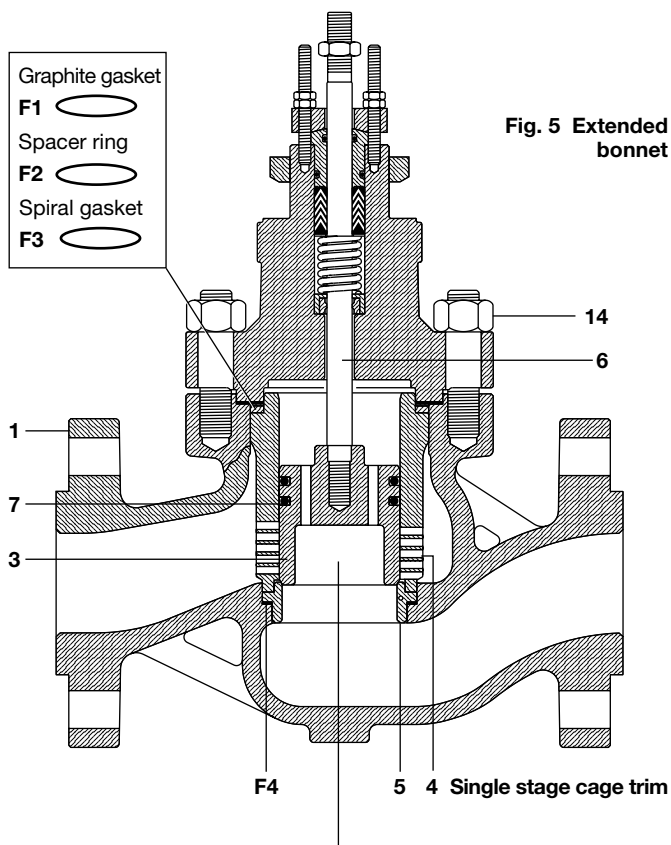


Fig. 5 Extended bonnet

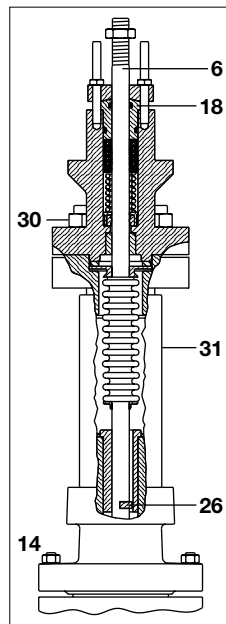


Fig. 4a
Two stage cage trim

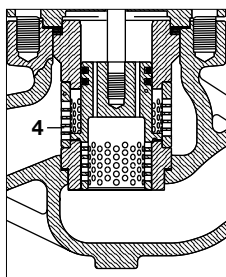
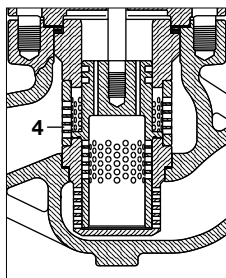


Fig. 4b
Three stage cage trim



Cage adaptor kit (K)

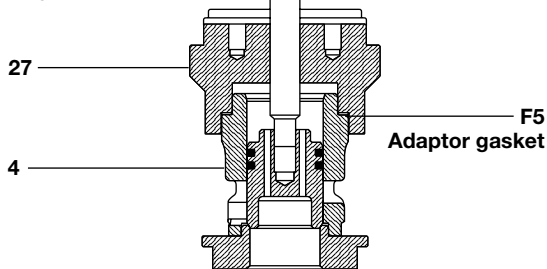


Fig. 4c
Cage adaptor kit (K)

4.6 Valve plug and stem maintenance:

Caution:

When replacing the valve plug sealing rings (7), be careful not to scratch the surfaces of the ring grooves in the valve plug, the surfaces of the replacement ring, may not seal properly.

1. Remove the valve plug (3) in accordance with the instructions in trim maintenance, (see Section 4.5, page 18).

4.6.1 Assembly standard and extension bonnet valves (unbalanced)

1. Install the seat ring gasket (F4), and seat (5) - See Section 4.5, page 18.
2. Install the cage (4) - see Section 4.5, page 18.
3. Slide the valve plug (3) and stem assembly into the cage. Make sure the valve plug sealing rings (7) are evenly engaged in the entrance chamfer at the top of the cage (4) to avoid damaging the rings - see Section 4.5, page 18.

4.6.1.1 Assembly standard and extension bonnet valves (balanced)

When required, graphite balance seals should be fitted – Seals (7) are supplied as two matching halves. Two complete rings (4 halves) should be fitted. Check for the fit of each half ring (as shown in Picture A). These seal rings will de-laminate easily and should not be fitted using any force, it should be possible to easily slide each ring around the groove as shown in Pictures A and B.

Picture A



Picture B



If the seal ring is a tight fit, some material can be carefully removed using abrasive paper (shown for example in Picture C). This process should be repeated until each half ring can easily slide around the groove.

Picture C



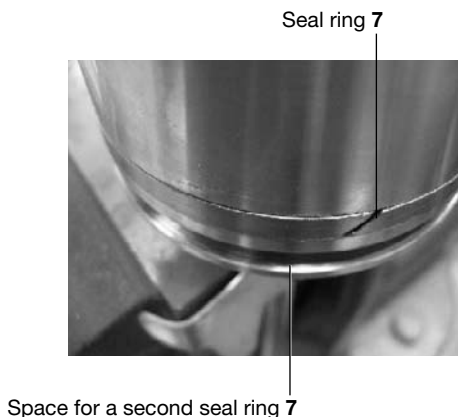
Before fitting each seal half ring lightly remove sharp edges and burrs, leaving a radius of approximately 1 mm all around the outside diameter - Picture D.

Picture D



Fit two matching half rings in the correct orientation and check for a gap by sliding the two halves around the groove (see Picture E). It should be easy to move the rings around as stated previously. A gap of approximately 2 mm should be present at one end when the two halves are pushed together. If this is not the case then some material can be carefully removed from the ends.

Picture E



Please note – The gaps in each seal ring set (7) must be turned through 90° relative to each other. This will avoid a direct vertical leak path.

It is important to be very careful, the seal ring will de-laminate if excessive force is applied. If there is any sign of de-lamination, the seal half ring should be rejected. Remove any burrs or ragged edges before testing for the gap again. Repeat this procedure for the end of each seal half ring until the gap is adequate.

Picture F



Please note – The gaps in each seal ring set (7) must be turned through 90° relative to each other (see Picture E). This will avoid a direct vertical leak path.

4.6.1.2 Fitting the plug assembly

In every case it should be possible to fit the plug assembly in the cage or balance seal housing on the bench before fitting it to the valve (see Picture G). A light smear of silicone based grease e.g. MS383 should be applied to the bore of the cage first.

It is advisable to have assistance at this point. Each seal should be held in place to allow compression into the cage bore. Any evidence of seal damage at this stage must be avoided.

Damaged seals must be rejected.

The fit of the cage over the seals should not be excessively tight. Under no circumstances should a heavy blow be required to compress the seals. Firm hand pressure applied all around should be adequate (see Picture G). **WARNING - A hammer, mallet or hard drift must never be used!**

It should be possible for the cage to move under its own weight once the seals are compressed. Where the plug assembly is inserted into the cage i.e. on single stage trims, the plug assembly should move under its own weight once the seals are compressed.

If it does not move easily by hand, the fit is too tight. In this case the plug assembly should be removed and each seal half ring can be reduced in diameter as shown in Picture H.

Some material can be removed very carefully from the outside surface of each seal half ring (Picture H). This procedure must not be done with the seal assembled to the plug head because light marks will appear on the metal surface. It should not be necessary to remove excessive amounts of material. A good fit should be found providing each ring is treated the same.



Picture G

Before fitting each seal half ring lightly remove sharp edges and burrs, leaving a radius of approximately 1 mm all around the outside diameter.

Repeat the process above and test for a free moving fit as before (Picture G).



Picture H

4.6.1.2 Fitting the plug assembly (continued)

Stuffing box nuts (16) must be screwed in to the following torque: for M6 thread 12 N m, for M8 thread 20 N m. A light smear of silicone based grease e.g. MS383 should be applied to the bore of the gland housing.

If a cage adaptor (27) is to be used, install the adaptor gasket (F5) and place it on top of the cage. Place the gaskets (F1, F2, and F3) on top of the cage or cage adaptor, (see Fig. 6).

Caution:

If the packing is to be reused and was not removed from the bonnet, use care when installing the bonnet to avoid damaging the packing with the valve stem threads.

Mount the bonnet on the body and complete assembly according to Steps 10 to 12 of the procedure for replacing chevron gland seals Section 4.3, page 14, omitting Step 11 if new packing is not being installed, and being sure to observe the 'Note' prior to Step 10.

4.7.2 Assembly bellows sealed bonnet valves

1. Install the seat gasket (F4), and seat (5), (see Fig. 6).
2. Install the cage (4). Rotation of the cage or assembly with respect to the is acceptable. Place the gaskets (F1, F2, and F3) on top of the cage.
If a cage adaptor (27) is to be used, install the adaptor gasket (F5).
3. Insert replacement stem / bellows assembly (6) with new lower bellows flange gasket (29) ensuring that the anti-rotation pin (26) locates in the slot in the bellows housing (31) and taking great care not to damage the bellows. If a cage adaptor (27) is to be used, place it onto the stem before sliding on the gaskets (F1, F2 and F3).
4. Fit the valve plug (3) and the head pin (26). Peen the entrance to the head pin bore to prevent the pin working loose in operation.
By sliding the valve plug into the cage, refit the bellows housing (31) on the valve body. When the cage adaptor is used, fit it on the top of the cage.
Replace the nuts (14) and tighten to the recommended torque (see Table 1, page 22).
Using a new gasket (32) refit the bonnet (2) on the bellows housing (31). Replace the four nuts (30) and tighten to the recommended torque (see Table 1, page 22).

Caution:

If the packing is to be reused and was not removed from the bonnet, use care when installing the bonnet to avoid damaging the packing with the valve stem threads.

5. Mount the bonnet on the body and complete assembly according to Steps 10 to 14 of the procedure for replacing chevron gland seals Section 4.3, omitting Steps 11 and 12 if new packing is not being installed, and being sure to observe the 'Note' prior to Step 10.

Fig. 7 Extended bonnet

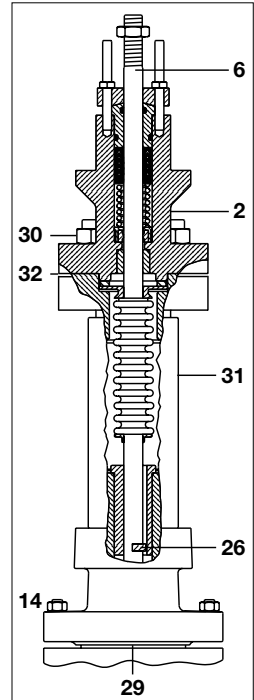
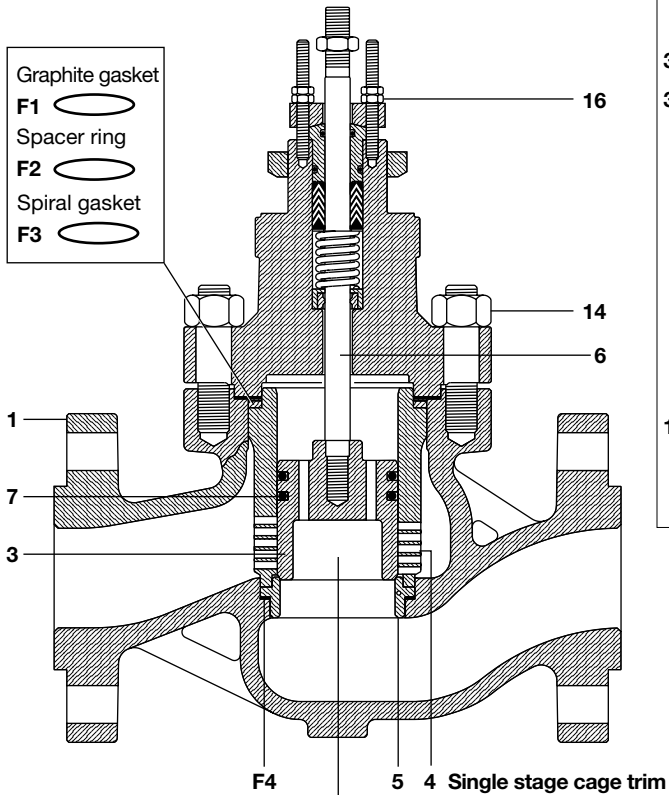


Fig. 6
'C' series valve with single stage cage trim



Cage adaptor kit (K)

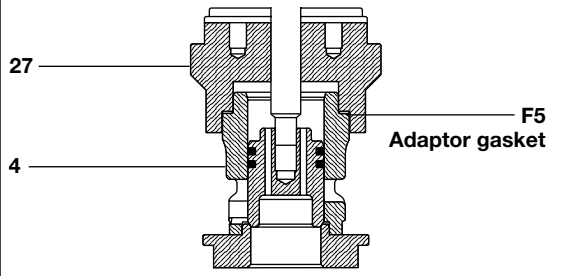


Fig. 6c
Cage adaptor kit (K)

5. Spare parts

The spare parts available for the CE43, CE63 and CE83 valves, 1" to 8" (DN25 to DN200), are detailed below. No other parts are supplied as spares.

Available spares

Actuator clamping nut		A
Gland seal kit	PTFE seal set	B
	Graphite packing set	C
Valve plug and stem assembly		D, E
Valve gasket kit	Graphite gasket	F1
	Bonnet Spacer	F2
	Spiral wound gasket	F3
	Seat gasket	F4
	Adaptor gasket (single stage reduced trim only)	F5
Piston seal kit	Graphite	G
Valve seat		I
Valve cage		J
Cage adaptor kit (seat, cage and reduction adaptor)		K

Note: A 'valve gasket kit' should be ordered with the above items.

Table 1 Recommended tightening torques

Bonnet nuts (14)

Valve size	Nut size	Nut torque lbf ft (N m) minimum to maximum	
1"	½"	22.1 to 29.5	(30.0 to 40.0)
1½"	3"	38.3 to 45.7	(52.0 to 62.0)
2"	3"	46.8 to 54.2	(63.5 to 73.5)
2½"	¾"	81.5 to 96.2	(110.5 to 130.5)
3"	¾"	72.6 to 87.4	(98.5 to 118.5)
4"	4"	116.5 to 131.3	(158.0 to 178.0)
5"	4"	140.1 to 154.9	(190.0 to 210.0)
6"	1"	169.6 to 184.4	(230.0 to 250.0)
8"	11"	184.4 to 199.1	(250.0 to 270.0)

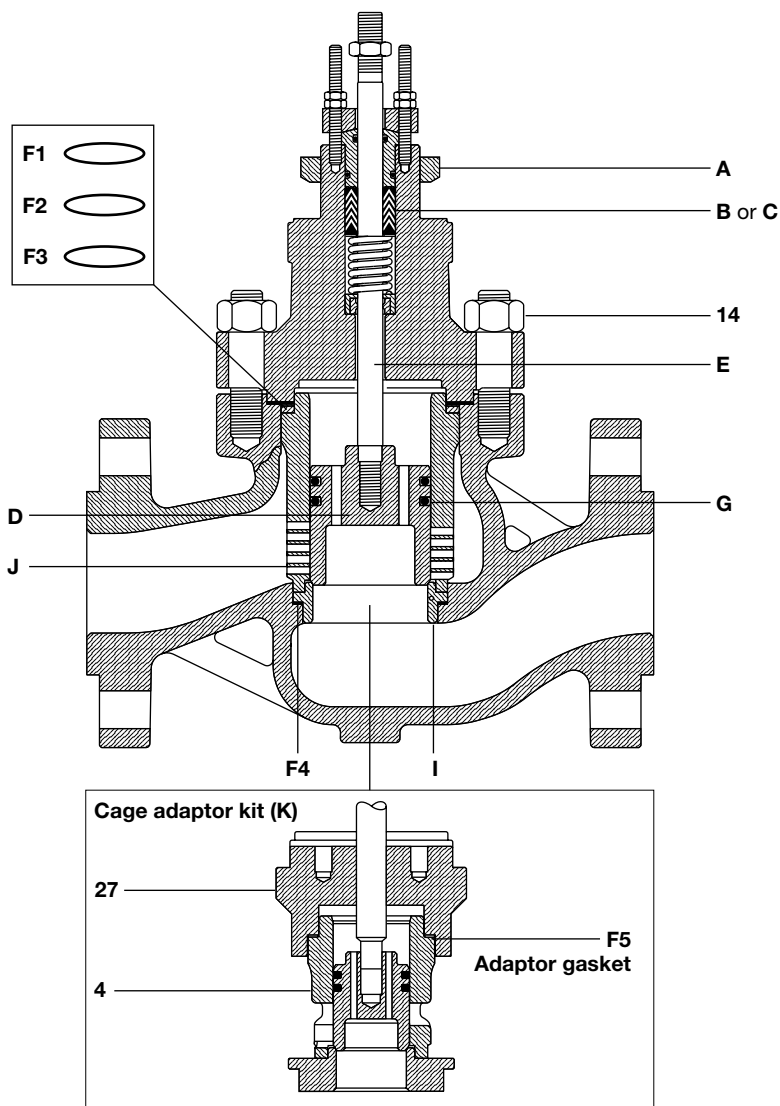
Valve stem to plug connection

Valve stem size ins (mm)	Bolt torque min. to max. lbf ft (N m)	Groove pin replacement Drill size ins (mm)
½" (12.7)	59.0 to 73.7 (80 to 100)	0.08" (2)
¾" (20.0)	169.6 to 199.1 (230 to 270)	0.08" (2)

Bellows seal bonnet packing flange nuts (30)

Valve size	Bolt torque min. to max. lb ft (N m)
1" to 4"	36.9 to 44.3 (50 to 60)
5" to 8"	51.6 to 59.0 (70 to 80)

Fig. 8 Spare parts - 'C' series valve with single stage cage trim



Note:

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

How to order spares

Always order spares by using the description given in the column headed 'Available spares'. Also state the information shown in the 'C' series valve selection guide (See page 28), the serial number, and date code of the valve.

'C' series valve selection guide

Valve size	1", 1½", 2", 2½", 3", 4", 5", 6" and 8" DN25, 40, 50, 65, 80, 100, 125, 150 and 200	2"
Valve series	C = Cage trim	C
Valve characteristic	E = Equal percentage F = Fast opening L = Linear M = Modified equal percentage	E
Body material	4 = Carbon steel 6 = Stainless steel 8 = Alloy steel	4
Connections	2 = Butt weld (1" to 8") 3 = Flanged 4 = Socket weld (1" to 4")	3
Stem sealing options	P = PTFE chevron H = Graphite B = Bellows	P
Seating options	T = AISI 431 hardened G = PTFE soft seat W = Hard faced stellite AISI 316	T
Type of trim	C = Standard cage P = Noise reducing perforated cage A = Anti-cavitation cage	C
Number of stages	1 = One 2 = Two 3 = Three Other = To be specified	1
Trim balancing	B = Balanced U = Unbalanced	U
Bonnet type	S = Standard H = Extended for high temperature L = Extended for low temperature	S
Reduced trim	0 = No reductions 1 = 1 Reduction 2 = 2 Reductions 3 = 3 Reductions	1
C_v	To be specified	C_v 35
Connection type	To be specified	ANSI 300

2" **C** **E** **4** **3** **P** **T** **C** **1** **U** **S** **1** **C_v 35** **ANSI 300**

How to order

Example: 1 off 2" CE43PTC1US1 C_v 35 flanged to ANSI 300.