FLOWSERVE®

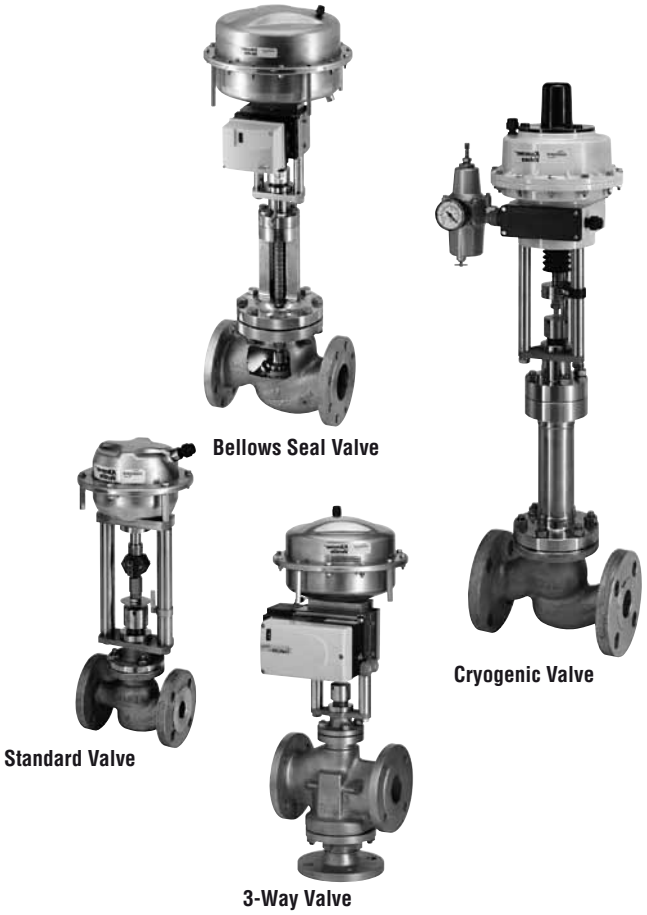
# USER INSTRUCTIONS

## *Total Flow Valves*

Series 035000, 033000, 031000

*KMEIM3501-01 04/14*

## *Installation*
## *Operation*
## *Maintenance Instructions*

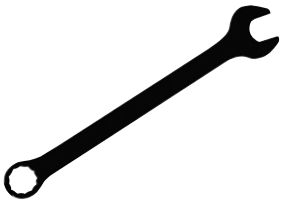


Bellows Seal Valve

Standard Valve

3-Way Valve

Cryogenic Valve



*Experience In Motion*

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## 1 USING KÄMMER VALVES AND ACTUATORS CORRECTLY

### 1.1 General

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Kämmer products. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance.

**DANGER:** *In most cases Kämmer valves and actuators are designed for specific applications (e.g. with regard to medium, pressure, temperature). For this reason they should not be used in other applications without first contacting the manufacturer.*

### 1.2 Terms concerning safety

The safety terms **DANGER, WARNING, CAUTION** and **NOTE** are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.

**DANGER:** *indicates that death, severe personal injury and/or substantial property damage will occur if proper precautions are not taken.*


**WARNING:** *indicates that death, severe personal injury and/or substantial property damage can occur if proper precautions are not taken.*

**CAUTION:** *indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.*

**NOTE:** *indicates and provides additional technical information, which may not be very obvious even to qualified personnel. Compliance with other, not particularly emphasised notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g. in the operating instruction, product documentation or on the product itself) is essential, in order to avoid faults, which in themselves might directly or indirectly cause severe personal injury or property damage.*

### 1.3 Protective clothing

Kämmer products are often used in problematic applications (e.g. extremely high pressures, dangerous, toxic or corrosive mediums). In particular valves with bellows seals point to such applications. When performing service, inspection or repair operations always ensure, that the valve and actuator are depressurised and that the valve has been cleaned and is free from harmful substances. In such cases pay particular attention to personal protection (protective clothing, gloves, glasses etc.).

### 1.4 Qualified personnel

Qualified personnel are people who, on account of their training, experience and instruction and their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the plant to perform the necessary work and who can recognise and avoid possible dangers.

### 1.5 Installation

**DANGER:** *Before installation check the order-no, serial-no. and/or the tag-no. to ensure that the valve/actuator is correct for the intended application.*

Do not insulate extensions that are provided for hot or cold services.

Pipelines must be correctly aligned to ensure that the valve is not fitted under tension.

### 1.6 Spare parts

Use only Kämmer original spare parts. Kämmer cannot accept responsibility for any damages that occur from using spare parts or fastening materials from other manufactures. If Kämmer products (especially sealing materials) have been on store for longer periods check these for corrosion or deterioration before using these products. Fire protection for Kämmer products must be provided by the end user.

### 1.7 Service / repair

To avoid possible injury to personnel or damage to products, safety terms must be strictly adhered to. Modifying this product, substituting non-factory parts, or using maintenance procedures other than outlined in this instruction could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties. Between actuator and valve there are moving parts. To avoid injury Flowserve provides pinch-point-protection in the form of cover plates, especially where side-mounted positioners are fitted. If these plates are removed for inspection, service or repair special attention is required. After completing work the cover plates must be refitted.

Apart from the operating instructions and the obligatory accident prevention directives valid in the country of use, all recognised regulations for safety and good engineering practices must be followed.


**WARNING**: *Before products are returned to Kämmer for repair or service Kämmer must be provided with a certificate which confirms that the product has been decontaminated and is clean. Kämmer will not accept deliveries if a certificate has not been provided (a form can be obtained from Kämmer).*

### 1.8 Storage

In most cases Kämmer Products are manufactured from stainless steel. Products not manufactured from stainless steel are provided with an epoxy resin coating. This means that Kämmer products are well protected from corrosion. Nevertheless Kämmer products must be stored adequately in a clean, dry environment. Plastic caps are fitted to protect the flange faces to prevent the ingress of foreign materials. These caps should not be removed until the valve is actually mounted into the system.

### 1.9 Valve and actuator variations

These instructions cannot claim to cover all details of all possible product variations, nor in particular can they provide information for every possible example of installation, operation or maintenance. This means that the instructions normally include only the directions to be

followed by qualified personal where the product is being used for is defined purpose. If there are any uncertainties in this respect particularly in the event of missing product-related information, clarification must be obtained via the appropriate FLOWSERVE sales office.

## 2 UNPACKING

2.1 Each delivery includes a packing slip. When unpacking, check all delivered valves and accessories using this packing slip.

2.2 Larger valves can be lifted using slings on the yoke rods or, if present, on the lugs provided for this purpose. If slings are used, attach them so that the outer tubing or attaching parts are not damaged.

**WARNING:** *If slings are used, be aware that the centre of gravity of the valve may be above the lifting point. In this case, secure or support the valve against rotating, to prevent damage or personnel injury.*

2.3 Report transport damage to the carrier immediately.

2.4 In case of discrepancies, contact your nearest FLOWSERVE sales office.

## 3 INSTALLATION

3.1 Clean tubing prior to installing.

3.2 If possible, install the valve in an upright position (actuator on top), to ease maintenance. An upright installation position is important with low-temperature applications, in order to keep the distance between the packing material and the medium as large as possible. The packing material then retains the ambient temperature as much as possible.

**NOTE:** *Do not insulate extension bonnets that are provided for hot or cold services*

3.3 Make sure that sufficient overhead clearance above the actuator is maintained, to allow for disassembly of actuator from the valve body (see following table).

| Actuator size | Clearance (mm) | Actuator size | Clearance (mm) |
|---|---|---|---|
| 37/47 | 95 | P2 | 140 |
| 38/48 | 140 | P3 | 140 |
| 39/49 | 140 | P4 | 140 |
| 39D/49D | 140 | P5 | 140 |

3.4 If the valve is to be welded into the line, make sure that the valve is shielded from excessive heat.

3.5 Connect supply pressure and signal lines. Control valves are supplied with a positioner. The end connections for supply pressure and signal are clearly marked.

**Warning:** Do not exceed the max. supply pressure:
Series 4 actuator = 4.2 bar (60 psi)
Series 2 actuator = 6.0 bar (90 psi)

If the supply pressure exceeds the pressure specified on the nameplate, a pressure reducing station is required. If instrument air is not available, install an oil separator/air filter in the air inlet line. All connections must be leak free.

## 4 QUICK CHECK:

Before operating, check the valve as follows:

4.1 Open and close the valve, and observe the movement of the actuator stem. The movement must be smooth and linear.

4.2 Check for maximum stroke through change of signal (for pneumatic positioners, 0.2 - 1.0 bar or corresponding split-range values; for IP positioners, 4-20). On three-way valves check that the valve seats correctly in both end positions.

4.3 Check all air connections for leaks.

4.4 Tighten packing nut (see table 1).

**NOTE:** *An excessively tightened gland nut can cause excessive packing wear and can hinder the free movement of the plug stem.*

| Thread | Torque Nm | |
|---|---|---|
| | PTFE | Grafoil |
| M20 x 1,5 | 1 | 3 |
| M30 x 1,5 | 6 | 15 |
| M38 x 1,5 | 15 | 35 |
| M45 x 1,5 | 17 | 40 |

**Table 1**

4.5 Check fail-safe position. To do this, close supply pressure and observe whether the valve opens or closes as defined.

4.6 After use at fluctuating temperatures, re-tighten all bolt connections and check for leaks.

## 5 MAINTENANCE

Check valves for correct functioning at regular intervals (at least once every 6 months) as follows. This check can be made when installed and in many cases without interrupting production. If internal defects are suspected, see section „Disassembly and Assembly of Valve“.

5.1 Examine gaskets for leaks and if necessary re-tighten bolts (see Fig. 1).

5.2 Check bellows gasket and test connection - if present - for external leaks.

5.3 Check valve for damage caused by corrosive residues or corrosive vapours.

5.4 Clean valve and repaint as necessary.

**Warning:** *To prevent a buildup of electrostatic charge clean the actuator/valve with a damp cloth only.*

5.5 Check gland nut for correct torque (see table 1).

**NOTE:** *An excessively tightened gland nut can cause excessive packing wear and can hinder the free movement of the plug stem.*

5.6 If possible, open and close valve and check for maximum

stroke and smooth movement of the plug stem. Irregular movement of the plug stem may indicate internal defects.

**NOTE**: With graphite packing, irregular movement of the plug stem is normal.

**WARNING:** *Keep hands, hair, clothing, etc. away from all moving parts. Failure to do so can lead to serious injury.*

5.7 Check all accessories for firm seating.

5.8 If possible, close supply pressure and check the fail-safe position.

5.10 Check stem boot for wear.

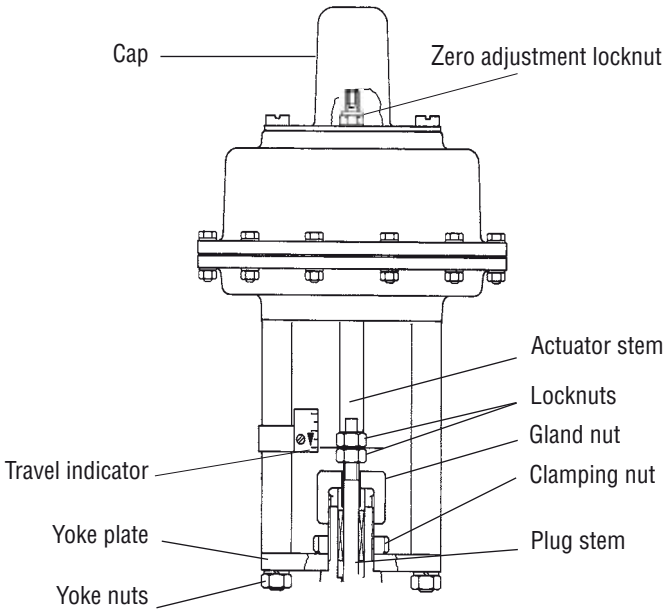
5.11 Check actuator for leaks. To do this, spray housing, air connections and plug stem guide with leak spray and check for any bubble formation.

5.12 Clean plug stem.

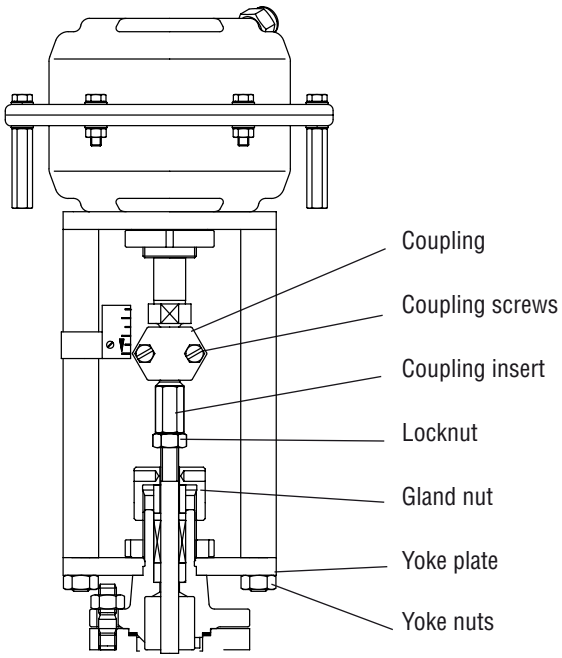
5.13 Check air filter, if present, and if necessary replace insert.

**NOTE:** *For further information regarding service and maintenance please contact your nearest FLOWSERVE office.*

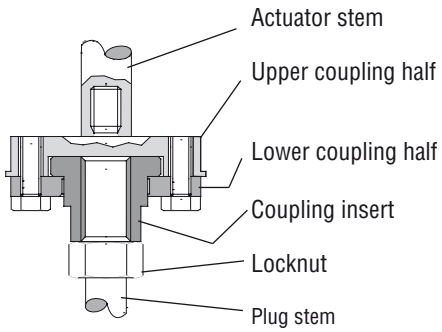
**DANGER:** *On actuators with aluminium cases the actuator springs must be renewed with original spare parts every 10 years or after 50.000 operating hours which ever occurs first.*




**Actuator series 4**
**Fig. 1**




**Actuator series 2**
**Fig. 1a**




**Actuator Series 4 with coupling**
**Fig. 1b**

## 6 REMOVE AND INSTALL ACTUATOR

### General Information

We recommend separating the actuator from the valve during all repair work. However, many maintenance and adjusting operations can be carried out in an installed condition.

### 6.1 Remove series 4 actuator

(see Fig 1 + 1b)

To remove series 2 actuator see 6.3

**DANGER**: *Depressurise the line to atmospheric pressure and drain all fluids from the valve before working on the actuator. Failure to do so can cause serious injury.*

For air-to-open actuators start with 6.1.1

For air-to-close actuators start with 6.1.2.1

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

### 6.1.2 Valve/actuator without coupling

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

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

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

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

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

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

**6.1.3 Valve/actuator with coupling**

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

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

**6.2 CONNECTING ACTUATOR TO VALVE BODY**

General Notes:

• The actuator must be calibrated before connecting it to the valve body.

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

**6.2.1 Valve/actuator without coupling**

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

6.2.1.2 „Air-to-open/fail-to-close“ actuators only:

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

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

„Air-to-close/fail-to-open“ actuators only:

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

6.2.1.3 Tighten the clamping nut and the packing gland nut (see 4.4 for torque values).

6.2.1.4 Adjust the valve plug for seat off by threading the plug stem further into or out of the actuator stem.

**NOTE**: *Do not rotate the plug stem while the valve is in the closed position. Open the valve first, make the adjustment while the valve is open, and then close the valve to check for seat-off.*

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

**6.2.2 Valve/actuator with coupling**

6.2.2.1 Place actuator onto valve.

6.2.2.2 Screw on and tighten yoke rod nuts.

6.2.2.3 Fit the coupling screws finger tight.

6.2.2.4 Adjust the valve plug for seat off by threading the plug stem further into or out of the coupling insert.

**NOTE**: *Do not rotate the plug stem while the valve is in the closed position. Open the valve first, make the adjustment while the valve is open, and then close the valve to check for seat-off*

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

**6.3 Remove series 2 actuator**

(see Fig. 1a)

For series 4 actuator see 6.1

6.3.1 Shut off air supply.

**DANGER:** *Depressurise the line to atmospheric pressure and drain all fluids from the valve before working on the actuator. Failure to do so can cause serious injury.*

6.3.2 Disconnect all tubing.

6.3.3 Remove 2 screws and remove coupling.

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

6.3.5 Remove coupling insert and it's locknut from plug stem.

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

**6.4 Install series 2 actuator**

(see Fig. 1a)

The actuator stem must be fully extended:

Actuators with air-to-open action must be fully vented. For actuators with air-to-close action apply supply pressure.

Manually depress the plug stem to ensure the plug is fully seated.

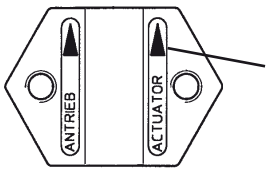
6.4.1 Screw coupling insert locknut and coupling insert as far as possible onto plug stem.

6.4.2 Place the actuator assembly on the valve engaging the yoke rod threads in the lower yoke plate and ensuring the actuator faces in the correct direction.

6.4.3 Unscrew the coupling insert until the yoke rods are raised from the lower yoke plate by around 2 mm.

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

6.4.4 Refit the coupling, ensuring that the arrows, embossed on the coupling halves, point upward towards the actuator, and secure with 2 retaining screws.




6.4.5 Apply supply pressure resp. vent actuator to half stroke and refit and tighten yoke rod retaining nuts.

6.4.6 Connect all tubing.

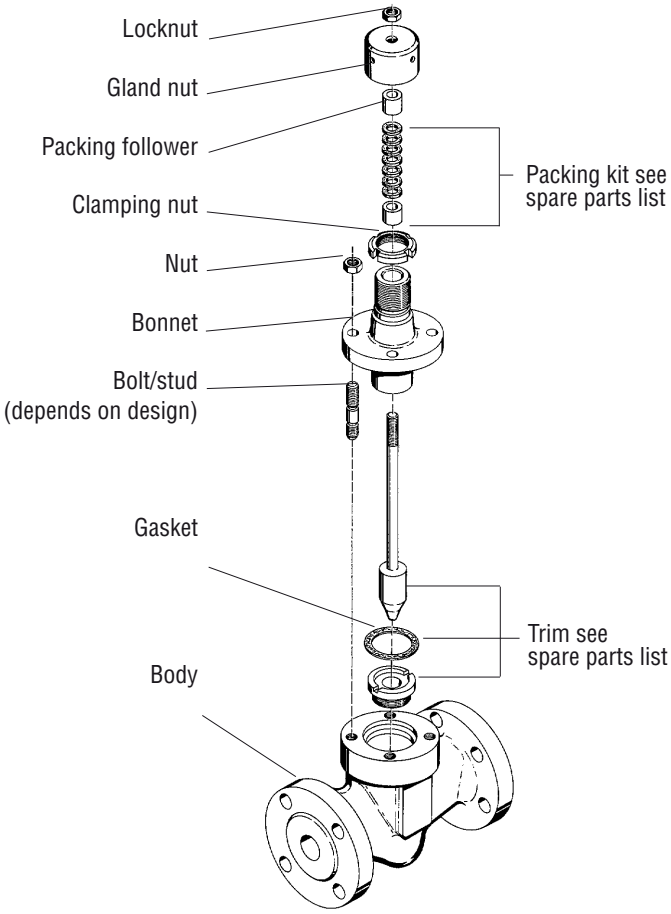



**Fig. 2: Standard Valve**

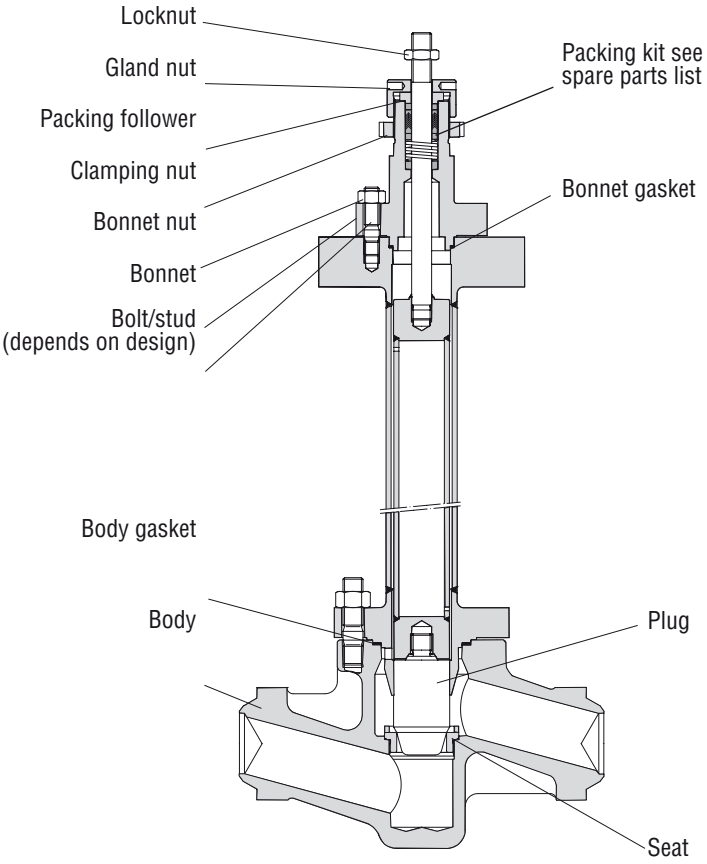



**Fig. 4: Cryogenic Valve**

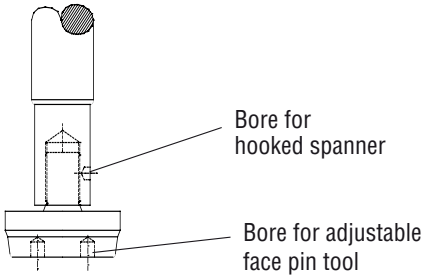



**Fig. 3: Threaded Plug Head**

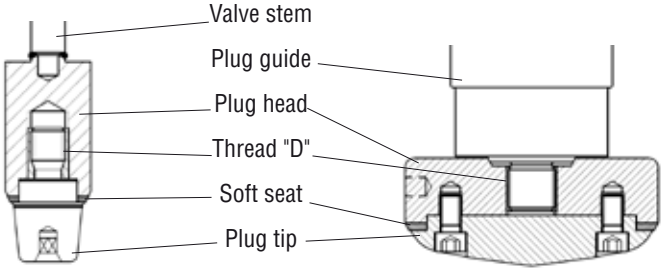



**Fig. 5: Soft Seat Designs**

## 7 DISASSEMBLE AND ASSEMBLE VALVE

### 7.1.1 Disassemble Valve (Standard, Cryogenic and Soft Seat)

(see Fig. 2 + 4)

7.1.1.1 Remove bonnet/extension to body flange bolting and raise bonnet/extension and plug assembly carefully from the valve.

**NOTE:** *heavy assemblies may require a hoist*

7.1.1.2 Unscrew seat ring using seat ring tool and carefully press plug stem evenly out of bonnet/extension.

7.1.1.3 On cryogenic valve unscrew bonnet nuts/screws and remove bonnet.

7.1.1.4 On valves DN 80 / kv 63 and larger, the plug head can be unscrewed (see Fig. 3). Remove plug head from stem by securing valve stem against rotation with a hooked spanner and turning plug head with an adjustable face pin tool.

7.1.1.5 Check seating faces of seat ring and plug for damage. On valves with soft seat check soft seat insert for damage.

**WARNING:** When the tip of the plug/soft seat is loosened, medium residue may be released, which has diffused through the soft seat insert.

7.1.1.6 Gasket surfaces must be clean and free of damage.

7.1.1.7 Remove the gland nut and packing follower from the bonnet and press out the guide and packing from below using a drift ( the drift must have a slightly larger diameter than the plug stem).

**NOTE:** *To prevent damage to the plug or plug stem, follow the above instructions precisely.*

7.1.1.8 If a seat surfaces need re-machining, seat **and** plug seating surfaces must be reworked. The seat angle on the plug is 30°, on the seat ring 25°. If the valve is correctly assembled, lapping is not required.

**NOTE:** *When re-machining the plug, protect plug stem from damage. The seat surface must be concentric to the plug stem. When re-finishing the seat, the seat surface must be concentric to the seat outer diameter.*

### 7.1.2 Assemble Valve

(see Fig. 2 + 4)

**DANGER:** *If the valve is subject to cleaning specifications (e.g. to be free of oil and grease) the valves are to be assembled oil and grease free. This is all the more important for oxygen applications because of the danger of an explosion.*

7.1.2.1 All worn or damaged parts must be replaced. Reusable parts must be clean. Expendable parts such as gaskets, packing and O-rings should always be replaced.

7.1.2.2 Insert seat ring and tighten. Torque as per following table:

| Size | Body material | Torque | |
|---|---|---|---|
| DN 15/25 (½ /1") | Cast<br>Forged | 125 Nm | 92 lbs-ft |
| DN 40/50 (1½ /2") | Cast<br>Forged | 200 Nm<br>255 Nm | 148 lbs-ft<br>188 lbs-ft |
| DN 80 (3") | Cast<br>Forged | 230 Nm<br>270 Nm | 170 lbs-ft<br>199 lbs-ft |
| DN 100 (4") | Cast<br>Forged | 400 Nm<br>500 Nm | 295 lbs-ft<br>369 lbs-ft |
| DN 150 (6") | Cast<br>Forged | 450 Nm<br>600 Nm | 332 lbs-ft<br>443 lbs-ft |

**Table 2**

7.1.2.3 If the soft seat is damaged replace with a new insert (see Fig 5). Ensure the new insert is centred on the plug tip. The bevel of new insert must be aligned with the mating surface of the seat ring.

**NOTE:** *To ensure proper valve function, use only Flowserve Original Spare Parts!*

7.1.2.4 As required, screw plug head back on to stem and torque as per following table:

| Thread D* | Torque | |
|---|---|---|
| M 6 | 10 Nm | 7.4 lbs-ft |
| M 8 | 20 Nm | 14.8 lbs-ft |
| M 10 | 35 Nm | 25.8 lbs-ft |
| M 12 | 60 Nm | 44.3 lbs-ft |

* See Fig 5

**Table 3**

7.1.2.5 Carefully guide plug stem through the bonnet/extension, to avoid damage.

7.1.2.6 Position new gasket on body.

7.1.2.7 Position bonnet/extension slowly and absolutely upright on body to avoid damage to seat/plug.

7.1.2.8 Tighten bonnet/extension flange bolts alternating crosswise finger-tight and then tighten with a wrench. Torque as per following table:

| Thread | Hex bolt. DIN 933 A2-70 | Waisted bolt DIN 2510 1.7709 | Waisted bolt DIN 939 1.7258 | Studs CK 35 |
|---|---|---|---|---|
| M 8 | 20 Nm | – | – | – |
| M 10 | 35 Nm | – | – | 20 Nm |
| M 12 | 60 Nm | 44 Nm | 36 Nm | 35 Nm |
| M 16 | 145 Nm | 115 Nm | 92 Nm | 80 Nm |
| M 20 | 280 Nm | – | – | – |
| M 24 | 250 Nm | – | – | 270 Nm |

**Table 4**

7.1.2.9 Replace packing by inserting packing rings one at a time tapping each one down with a suitable bushing.

**NOTE:** *ensure that the gaps in the packing rings are distributed evenly around the circumference in the packing box (gaps **not** in line).*

*Different packings and fitting sequences are shown in the spare parts list.*

7.1.2.10 Insert packing follower. Fit gland nut for transport purposes only. Gland nut to be fitted correctly and tightened down when actuator is mounted (see table 1).

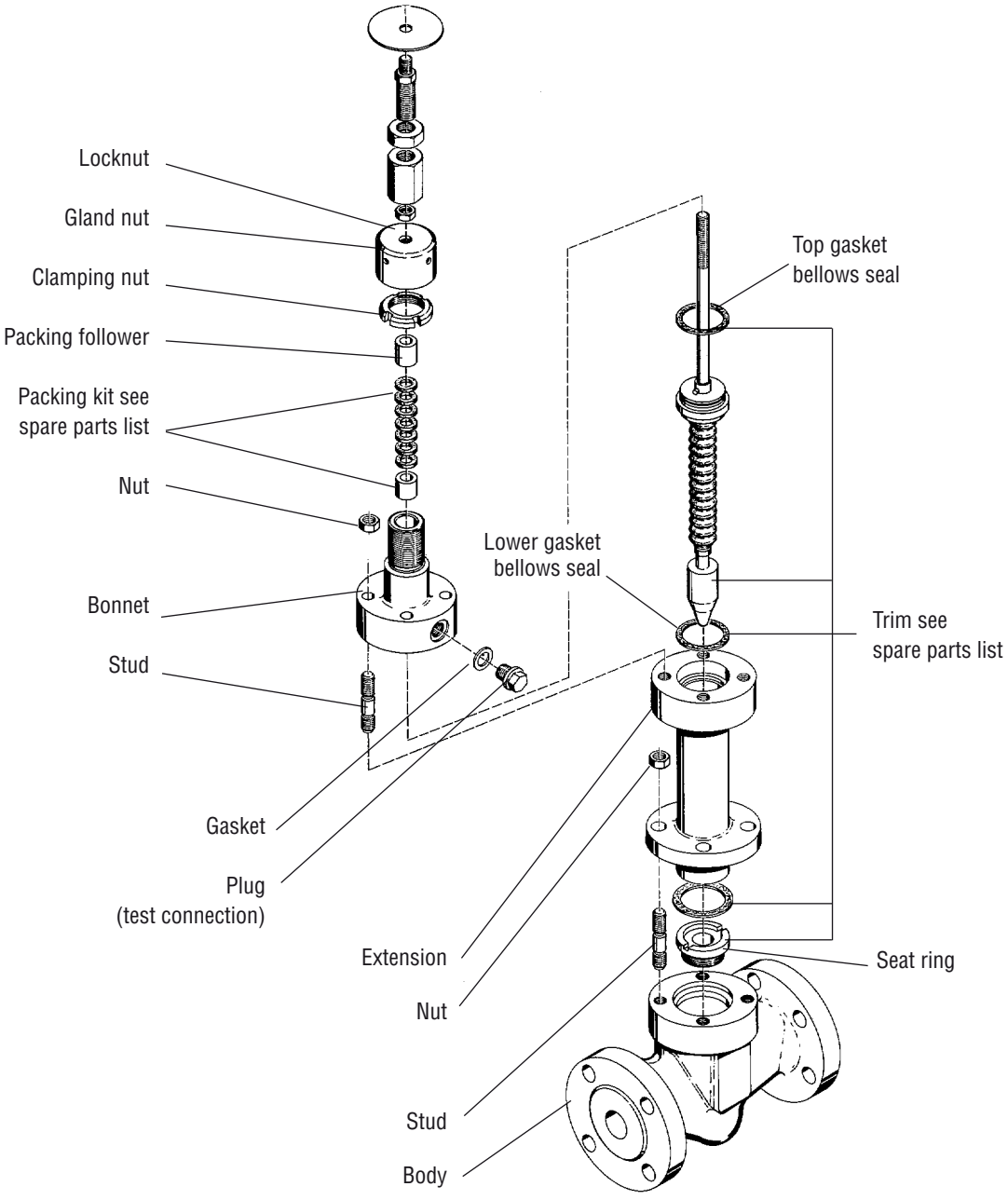



**Fig. 6: Bellows Seal Valve**

### 7.2.1 Disassemble Valve (Bellows Seal)

(see Fig. 6)

**WARNING**: *As poisonous or hazardous materials may be present, the system must be depressurized and all processing materials must be drained. If necessary, decontaminate the valve. Keep hands, hair, clothing, etc. away from all moving parts. Wear face and eye protection. Failure to do so can lead to serious injury.*

7.2.1.1 Carefully loosen test connection and check whether medium has collected in the bellows seal bonnet (defective bellows).

7.2.1.2 Remove bolts/nuts from bellows seal bonnet and remove bellows seal bonnet.

**NOTE:** *Due to the friction coefficient of the packing, the bellows usually also comes out when the bonnet is removed. In this case, hold the bellows to ensure that it does not drop and be damaged.*

7.2.1.3 If the bellows remains in the seal housing, the bellows can be carefully levered out using two screwdrivers inserted in the outer groove of the bellows upper part.

7.2.1.4 Without stretching the bellows, remove the plug/bellows assembly from the bonnet and remove carefully and upright out of the extension. Do not lose anti-rotation pin. Using a drift, press guides, packing and packing follower from below (the drift must have a slightly larger diameter than the plug stem).

7.2.1.5 With soft seat version, loosen plug tip with appropriate tool and remove soft seat gasket (see Figs 3 + 5).

**WARNING**: *When the plug/soft seat is loosened, medium residue may be released, which has diffused through the soft seat insert.*

7.2.1.6 Remove bellows seal extension bolts/nuts and remove extension.

7.2.1.7 Unscrew seat ring with seat ring tool.

7.2.1.8 Check seal faces of seat ring and plug for damage. Gasket surfaces must be clean and free from damage.

**WARNING**: *To prevent damage to the seat, plug or plug stem, follow the above instructions precisely.*

7.2.1.9 If a seating surface needs re-machining, seat and plug seating surfaces must be reworked. The seat angle on the plug is 30°, on the seat ring 25°. If the valve is correctly assembled, lapping is not required.

**WARNING:** *When re-machining the plug, protect plug stem and bellows from damage and support upper part of bellows towards plug stem. The seat surface must be concentric to the plug stem. When re-machining the seat, the seat surface must be concentric to the seat outer diameter.*

### 7.2.2 Assemble Valve

(see Fig. 6)

7.2.2.1 All worn or damaged parts must be replaced. Reusable parts must be clean. Expendable parts such as gaskets, packing and O-rings should always be replaced.

7.2.2.2 Insert seat ring and tighten. For torques see table 2.

7.2.2.3 If the soft seat is damaged replace with a new insert (see Figs 3 + 5). Ensure the new insert is centred on the plug tip. The bevel of new insert must be aligned with the mating surface of the seat ring. As required, screw plug head back on to stem and torque as per table 3.

**NOTE:** *To ensure proper valve function, use only Flowserve Original Spare Parts!*

7.1.2.4 Position new gasket on body.

7.2.2.5 Position bellows seal extension on body and uniformly tighten screws/nuts hand-tight, alternating crosswise.

7.2.2.6 Insert lower bellows gasket.

7.2.2.7 Carefully insert plug/bellows assembly in bellows seal extension and install anti-rotation pin.

7.2.2.8 Insert upper bellows gasket in bellows seal bonnet.

7.2.2.9 Using a torque wrench, gradually tighten all body/extension screws/nuts to the prescribed torques (see table 4), alternating crosswise.

7.2.2.10 Position bellows seal bonnet (test connection forwards) and uniformly tighten screws/nuts hand-tight, alternating crosswise.

7.2.2.11 Using a torque wrench, gradually tighten all screws/nuts to the prescribed torques (see table 4), alternating crosswise.

7.2.2.12 Replace packing by inserting packing rings one at a time tapping each one down with a suitable bushing.

**WARNING**: *ensure that the gaps in the packing rings are distributed evenly around the circumference in the packing box (gaps not in line).*

**Note**: different packings and fitting sequence is shown in the spare parts list.

7.2.2.13 Insert packing follower. Fit gland nut for transport purposes only. Gland nut to be fitted correctly and tightened down when actuator is mounted.

7.2.2.14 When performing subsequent pressure test, note the max. permissible pressure for the bellows. After the check for leaks, close off test connection with plug or suitable gauge.

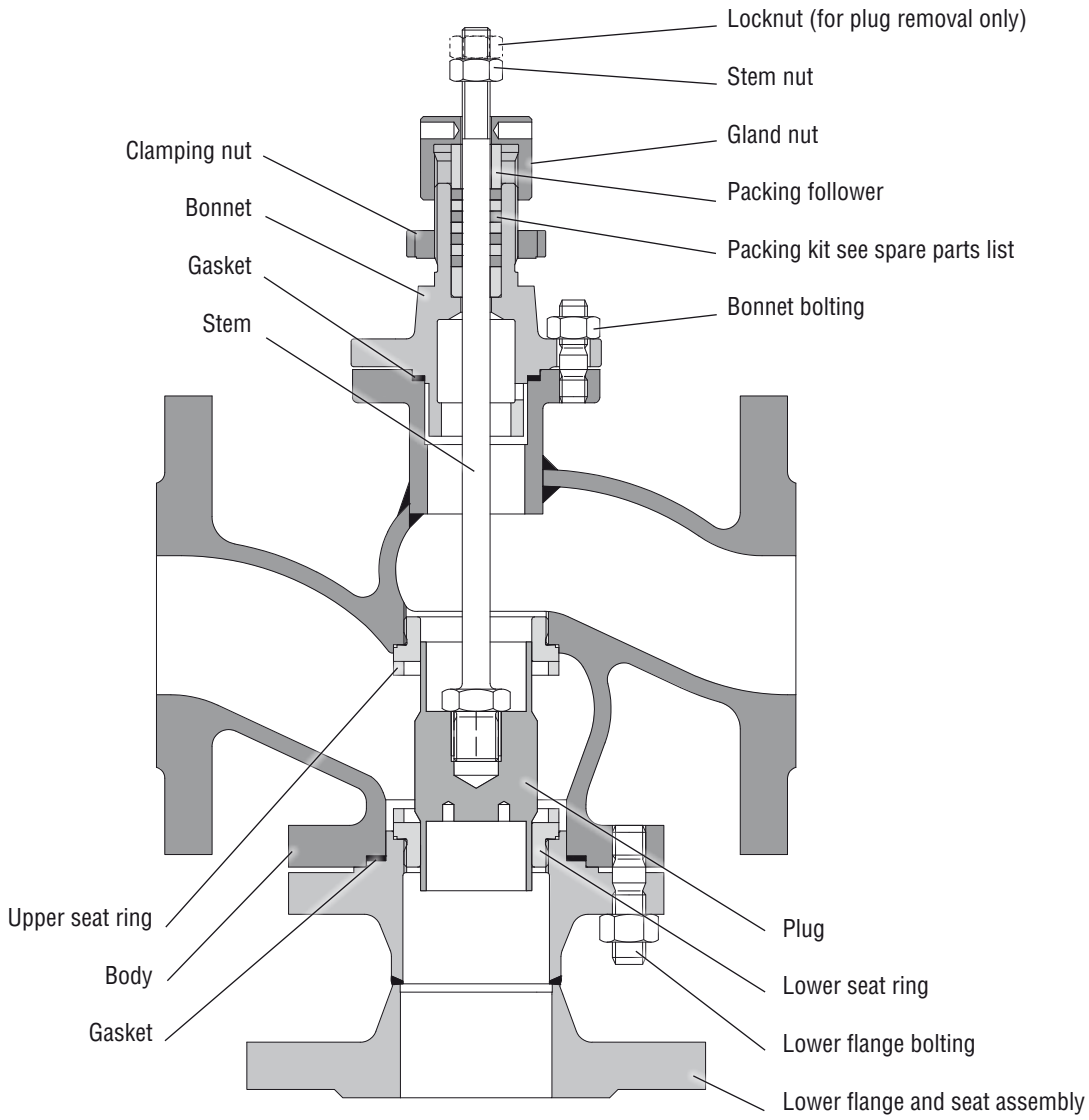



**Fig. 7: 3-Way Valve**

**7.3.1 Disassemble Valve (3-Way with and without bellows seal)**

(see Fig. 7)

**WARNING**: *As poisonous or hazardous materials may be present, the system must be depressurized and all processing materials must be drained. If necessary, decontaminate the valve. Keep hands, hair, clothing, etc. away from all moving parts. Wear face and eye protection. Failure to do so can lead to serious injury.*

7.3.1.1 On valves with bellows seal carefully loosen test connection and check whether medium has collected within the bellows seal bonnet (defective bellows).

7.3.1.2 Remove lower flange bolting and carefully remove lower flange and seat assembly from the body.

**NOTE:** *Remove lower flange and seat assembly parallel and with great care to avoid damaging the seat, plug or guide surfaces.*

7.3.1.3 Unscrew lower seat ring using seat ring tool

7.3.1.4 Thread a second nut onto the stem. Using two spanners lock it against the stem nut.

7.3.1.5 With a spanner on the stem nut, secure the stem against rotation. Using a special tool loosen the plug and remove it from the valve.

7.3.1.6 Remove the locknut and stem nut.

7.3.1.7 Unscrew upper seat ring using seat ring tool.

**On valves without bellows seal:**

7.3.1.8 Remove bonnet to body bolting and raise bonnet and stem assembly carefully from the valve.

7.3.1.9 Carefully press plug stem evenly out of bonnet

**On valves with bellows seal:**

7.3.1.10 Remove extension to body bolting and raise extension and bellows seal assembly carefully from the valve.

**NOTE:** *heavy assemblies may require a hoist*

7.3.1.11 Remove bolts/nuts from bellows seal bonnet and remove bellows seal bonnet.

**NOTE:** Due to the friction coefficient of the packing, the bellows usually remains in the bonnet when it is removed. In this case, hold the bellows to ensure that it does not drop and be damaged.

7.3.1.12 If the bellows remains in the extension housing, the bellows can be carefully levered out using two screwdrivers inserted in the outer groove of the bellows upper part.

7.3.1.13 Without stretching the bellows, remove the bellows assembly carefully and upright out of the extension. Do not lose anti-rotation pin.

**All valves**

7.3.1.14 Remove the gland nut and packing follower from the bonnet. Using a drift, press guide and packing from below out of the bonnet (the drift must have a slightly larger diameter than the plug stem).

7.3.1.15 Check seating faces of seat rings and plug for damage.

7.3.1.16 Gasket surfaces must be clean and free of damage.

7.3.1.17 If a seat surfaces need re-machining, seat **and** plug seating surfaces must be reworked. The seat angle on the plug is 30°, on the seat ring 25°. If the valve is correctly assembled, lapping is not required.

**NOTE:** *When re-machining the plug, protect plug stem from damage. The seat surface must be concentric to the plug stem. When re-finishing the seat, the seat surface must be concentric to the seat outer diameter.*

### 7.3.2 Assemble Valve

(see Fig. 2 + 4)

**DANGER:** *If the valve is subject to cleaning specifications (e.g. to be free of oil and grease) the valves are to be assembled oil and grease free. This is all the more important for oxygen applications because of the danger of an explosion.*

7.3.2.1 All worn or damaged parts must be replaced. Reusable parts must be clean. Expendable parts such as gaskets, packing and O-rings should always be replaced.

7.3.2.2 Insert upper seat ring and tighten. Torque as per table 2.

7.1.2.3 Position new gasket on body.

**On valves without bellows seal:**

7.3.2.4 Carefully guide plug stem through the bonnet to avoid damage.

7.3.2.5 Position bonnet slowly and absolutely upright on body to avoid damage to stem.

7.3.2.6 Tighten bonnet flange bolts alternating crosswise finger-tight and then tighten with a wrench alternating crosswise. Torque as per table 4.

**On valves with bellows seal:**

7.2.2.7 Position bellows seal extension on body and uniformly tighten flange screws/nuts hand-tight, alternating crosswise and then tighten with a wrench. Torque as per table 4.

7.2.2.8 Insert lower bellows gasket.

7.2.2.9 Carefully insert bellows assembly in bellows seal extension and install anti-rotation pin.

7.2.2.10 Insert upper bellows gasket in bellows seal bonnet.

7.2.2.11 Position bonnet (test connection forwards) and uniformly tighten screws/nuts hand-tight, alternating crosswise and then tighten with a wrench alternating crosswise. Torque as per table 4.

**All valves**

7.3.2.12 Thread stem nut and a second nut onto the stem. Using two spanners lock them together.

7.3.2.13 With a spanner on the stem nut, secure the stem against rotation. Using a special tool thread the plug onto the stem and secure tightly.

**NOTE:** *Ensure that the stem cannot rotate as this will destroy the bellows seal.*

7.3.2.14 Remove locknut

7.3.2.15 Position new lower flange gasket

7.3.2.16 Insert lower seat ring in lower flange and tighten. Torque as per table 2.

7.3.2.17 Carefully introduce the lower flange and seat assembly parallel into the lower body.

**NOTE:** *Replace lower flange and seat assembly parallel and with great care to avoid damaging to the seat, plug or guide surfaces.*

7.3.2.18 Tighten flange bolting alternating crosswise finger-tight and then tighten with a wrench alternating crosswise. Torque as per table 4.

7.3.2.18 Replace packing by inserting packing rings one at a time tapping each one down with a suitable bushing.

**NOTE:** *ensure that the gaps in the packing rings are distributed evenly around the circumference in the packing box (gaps **not** in line).*

*Different packings and fitting sequences are shown in the spare parts list.*

7.3.2.16 Insert packing follower. Fit gland nut for transport purposes only. Gland nut to be fitted correctly and tightened down when actuator is mounted (see table 1).

## 8 PREPARE VALVE FOR WELDING PROCESS

8.1.1 Note orientation of the positioner in relation to the stamped markings on the valve body. With a black permanent marker, apply a "tick mark" to the body and another on the bonnet so that proper orientation can be achieved during re-assembly of the valve.

8.1.2 Make note of the Action Failure mode of the actuator. This can be found on the Stainless Steel stamp that is on the side of the actuator. The three options are Fail Closed (FC), Fail Open (FO) and Fail in Place (FIP).

8.1.3 If the actuator is FC or FIP, apply air under the diaphragm. This step will insure that the plug is raised and is not in contact with the seat. If the actuator is FO, then air does not need to be applied to the actuator.


**WARNING:** *Keep hands, hair, clothing, etc. away from all moving parts. Failure to do so can lead to serious injury.*

8.1.4 Apply air under the diaphragm by removing the tubing that runs from the positioner to the base of the actuator. Install a "swage fitting" ball valve to the base of the actuator. Open the ball valve. Apply 40-50 psig air and visually observe that the stem rises. After the stem stops, close the ball valve. Remove the tubing that runs from your air source to the ball valve. The closed ball valve will retain the air pressure and hold the plug retracted from the seat.

8.1.5 Loosen the body/bonnet nuts alternating crosswise. Continue to loosen the nuts until all of the nuts are removed from the body/bonnet studs. Remove the washers from the body/bonnet studs. Put the nuts and washers in a plastic bag or box for safe storage.

8.1.6 With two people on each side of the valve, carefully grasp the actuator and yoke and lift straight up. Take care to stop the actuator from tilting to one side as this can damage the plug head as it is removed from the valve body.

**NOTE:** *Heavy assemblies may require a hoist.*

8.1.7 Place the complete actuator / positioner / bonnet / plug assembly to the side. DO NOT allow the plug head to strike anything. Wrap the plug head with a protective covering (bubble wrap, cloth rags, etc.) to prevent any accidental damage to the plug head. If the soft seat insert is damaged replace as in section 7.1.2.3.

8.1.8 Remove the old bonnet gasket from the body.

8.1.9 Inspect the seat in the valve body. The seat does NOT need to be removed unless there is visual damage. If removal of the seat is required, carefully insert the seat removal tool through the top of the valve body. Line up the cross bar in the seat removal tool with the slots in the seat. Unscrew the seat from the valve body.

8.1.10 To replace with a new seat, manually thread the new seat into the valve body hand-tight. Carefully insert the seat removal tool through the top of the valve body. Line up the cross bar in the seat removal tool with the slots in the seat. Screw the seat into the valve body, tightening the seat to the torque values provided in Table 2.

8.1.11 At this point, the valve body is ready for welding in-line.

### 8.2 Reassemble valve for operation

8.2.1 After welding and the body has cooled, install a new bonnet gasket in the valve body.

8.2.2 Re-confirm that there is air under the diaphragm, if the actuator is a FC or FIP actuator. If in doubt, release the air from the bottom of the actuator by opening the ball valve. Attach the tubing from your air source to the ball valve and apply 40-50 psig under the diaphragm. Make sure you observe that the plug head retracts. Close the ball valve and remove the tubing from the ball valve.

8.2.3 Remove the protective covering from the plug head

8.2.4 With two people, one on each side of the actuator, lift the actuator, positioner, bonnet and valve stem / plug head. Take care that the plug head does not strike anything. With the plug head pointing down, carefully lift the actuator and place the plug head inside the valve body. Lower the plug head, bonnet and actuator assembly down so that the bonnet bolt holes line up with the body-bonnet studs. Make sure you have aligned the orientation of the positioner so that your "tick marks" are lined up.

**NOTE:** *Heavy assemblies may require a hoist.*

8.2.5 Reinstall the washers and nuts on the body-bonnet studs. Hand-tighten the nuts.

8.2.7 Tighten the nuts alternating crosswise finger-tight. Tighten by ¼ turn for each nut until "snug", and then tighten with a wrench to recommended torque specs given in Table 4.

8.2.8 Open the ball valve so that the air is released. Verify valve plug lowers to the fully closed position.

8.2.9 Re-apply supply air, check valve for correct operation. Remove ball valve from actuator.


**WARNING:** *Valve may move, depending on actual supply pressure and control signal settings. Keep hands, hair, clothing, etc. away from all moving parts. Failure to do so can lead to serious injury.*

8.2.10 Reinstall the tubing from the positioner to the bottom of the actuator. Connect signal lines.

8.2.11 Valve installation is now completed and valve is ready for Start-up, commissioning.

## 9 TROUBLE-SHOOTING CHART

| Fault | Possible Cause | Remedy |
|---|---|---|
| **Stem motion impeded** | 1. Packing excessively tightened<br>2. Operating temperature too high for selected trim<br>3. Supply pressure inadequate<br><br><br>4. Positioner defective | 1. Tighten gland nut slightly more than „finger-tight“<br>2. Note operating data and contact dealer<br>3. Check system for leaks in the supply pressure or signal lines. Re-tighten the connections, if necessary replace leaky lines<br>4. See operating instructions for positioner |
| **Excessive leakage** | 1. Bonnet loose<br>2. Worn or damaged seat ring/plug<br>3. Gaskets damaged<br>4. Inadequate actuator thrust<br>5. Plug incorrectly adjusted<br>6. Incorrect direction of flow<br>7. Handwheel incorrectly adjusted (acts like end stop) | 1. See step 7.2.8 for correct tightening of bonnet.<br>2. Re-machine or replace seat ring/plug.<br>3. Replace gaskets<br>4. Check air feed. If air feed is OK, contact dealer.<br>5. Correctly adjust plug according to step 6.2.4<br>6. Check specification. Contact dealer<br>7. Adjust handwheel |
| **Inadequate flow** | 1. Plug incorrectly adjusted (short stroke)<br>2. Positioner defective<br>3. Operating requirements too high | 1. Correctly adjust plug according to step 6.2.4<br>2. See operating instructions for positioner<br>3. Check operating data. Contact dealer |
| **Plug slams** | 1. Plug adjustment incorrect<br>2. Inadequate supply pressure<br>3. Trim too large for flow rate | 3. Check operating data. Contact dealer<br>2. Check supply pressure, seal leaks, remove blockage<br>3. Replace trim |

**Flowserve Essen GmbH**
Schederhofstr. 71
45145 Essen
Deutschland
Tel.: +49 (0)201 8919 5
Fax: +49 (0)201 8919 662