

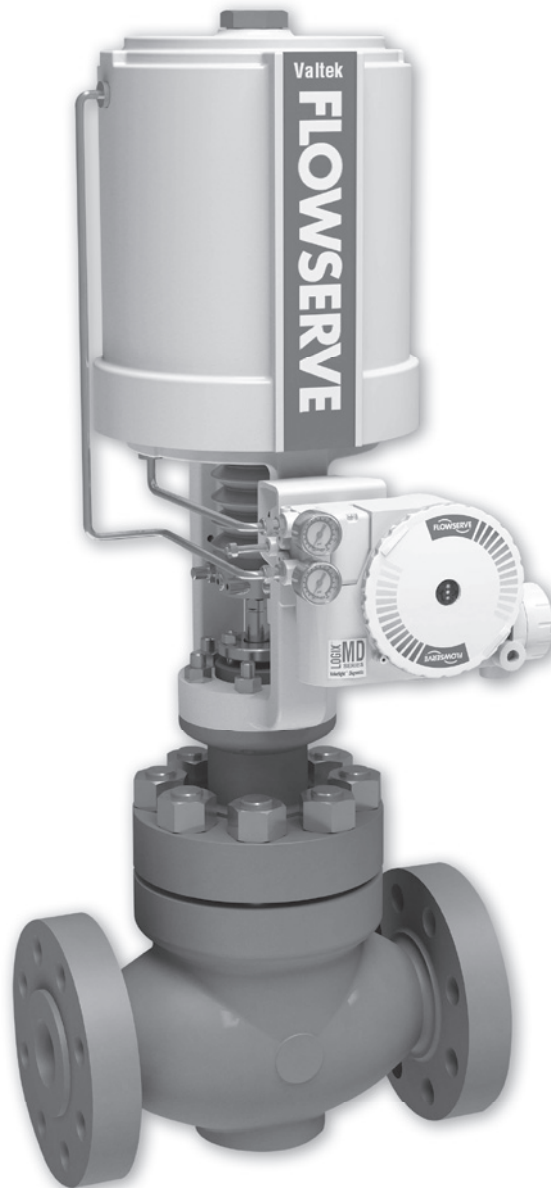


# *USER INSTRUCTIONS*

## *Valtek Mark 200 Globe & Angle Control Valve*

FCD VLENIM0200-00 – (12/12)

*Installation  
Operation  
Maintenance*



## Valtek Mark 200 High Pressure Control Valve

The Mark 200 high pressure globe control valve designed to handle the most extreme severe service applications also offers high competitive flow capacity. The Mark 200's large galleries include longer stroke lengths which provide finer control and result in more stages of severe service protection in smaller size valves. With a clamped-in (DIN, screwed-in) seat ring, the Mark 200 has been designed for easy maintenance and flexibility. The seat retainer/cage (DIN, seat ring) in the Mark 200 can be changed out to provide an exceptional variety of severe service options, including anti-cavitation and anti-noise.

Further sizing details are available in Performance!, Flowserve's control valve sizing & selection software program (please contact your local Flowserve representative for further details). The plug is typically pressure-balanced to allow smaller and more economical actuators. Flow over or under the plug is available.

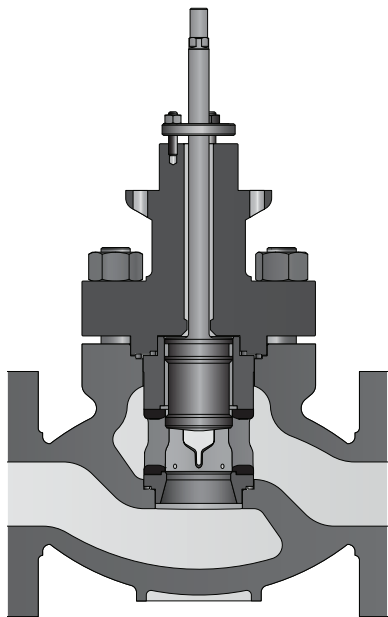


Figure 1: ASME Mark 200 Maximum Capacity Control Valve

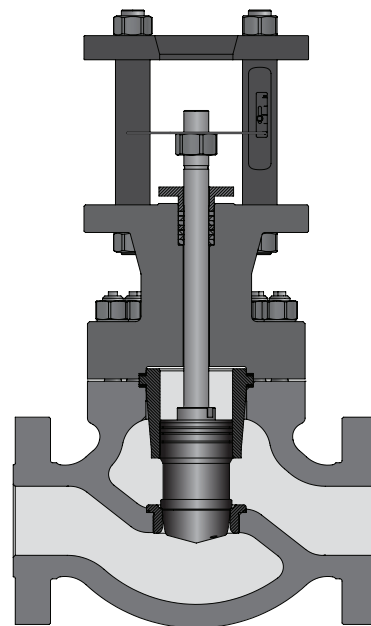


Figure 2: DIN Mark 200 Maximum Capacity Control Valve

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## 1 General Information

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Flowserve Mark 200 control valves. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance on the valve. Separate Installation, Operation, and Maintenance instructions cover additional features (such as special trim, actuators, handwheels, packing and positioners.)


To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly followed. Modifying this product, substituting non-factory parts or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment and may void existing warranties.


 **WARNING: Standard industry safety practices must be adhered to when working on this or any other process control product. Specifically, personal protective and lifting devices must be used as warranted.**

**NOTE ON FASTENERS:** Selecting the proper fastener material is the responsibility of the customer. Typically, the supplier does not know what the valve service conditions or environment may be. Flowserve’s standard body bolting material is B7/2H. B8 (stainless steel) is optional for applications more than 800°F / 425°C and with stainless steel or alloy-body valves. The customer therefore must consider the material’s resistance to stress corrosion cracking in addition to general corrosion. As with any mechanical equipment, periodic inspection and maintenance is required. For more information about fastener materials, contact your Flowserve representative.

## 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 emphasized notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g., in the operating instructions, 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.

### 3 ASME Valve Unpacking

1. While unpacking the valve, check the packing list against materials received. Lists describing valve and accessories are in each shipping container.
  2. Take care to position lifting straps to avoid damage to the tubing and mounted accessories.
- ⚠ WARNING: When lifting a valve using the lifting lugs, be aware that the center of gravity may be above the lifting point. Therefore, support must be given to prevent the actuator from rotating. Failure to do so can cause serious injury to personnel, damage to the valve or nearby equipment.**
3. Contact your shipper immediately if there is shipping damage.
  4. Should any problem arise, call your Flowserve representative.

### 4 ASME Valve Installation

- ▲ CAUTION: The valve must be installed and commissioned by qualified staff. Qualified staff is defined as personnel who are familiar with the installation, commissioning and operation of this product and possess the relevant qualifications in their field of activity.**
1. Before installing the valve, clean the line of dirt, welding chips, scale or other foreign material.
  2. Whenever possible, the valve should be installed in an upright position. Vertical installation permits easier valve maintenance. When vertical installation is not possible contact your Flowserve representative.
- ▲ CAUTION: Do not insulate extension bonnets that are provided for hot or cold services.**
3. Be sure to provide proper overhead clearance for the actuator to allow for disassembly of the plug from the valve body. Refer to Table 1 for the necessary clearance needed for valve disassembly.
  4. Double-check flow direction to be sure the valve is installed correctly. Flow direction is indicated by the arrow attached to the body.
  5. If welding the valve into the line, use extreme care to avoid excess heat buildup in the valve.
  6. Connect the air supply and instrument signal lines. Throttling control valves are equipped with a valve positioner. Refer to the appropriate positioner bulletin for connections, maximum air supplies, and maintenance instructions.\*
- ▲ CAUTION: On valves equipped with air filters, the air filter must point down to perform properly. \***

Table 1: ASME Valve Disassembly Clearance

Valve Size (inches)	Clearance	
	inches	mm
2	5	127
3	6	152
4	8	203
6	11	279
8	12	305
10	16	406
12	17	432
14	21	533
16	22	559

**NOTE:** In some cases, the air supply must be limited to less than 150 psi (10.3 bar). This is indicated on a sticker or type plate found near the upper air port on the actuator cylinder. An air regulator should be installed to ensure the supply pressure does not exceed the line pressure indicated on the sticker.\*

### 4.1 ASME Valve Quick-check

Prior to start-up, check the control valve by following these steps:

- ⚠ WARNING: Due to the risk of injury, it is prohibited to work between the yoke/columns while the valve is in operation.**
1. Stroke the valve and observe the plug position indicator on the stem clamp compared to the stroke indicator plate. The plug should change position in a smooth, linear fashion.
- NOTE:** Due to excessive friction, graphite packing can cause the plug stem to move in a jerky fashion.
2. Check for full stroke by making appropriate instrument signal change.
  3. Check all air connections for leaks.\*
  4. Check packing box bolting for the correct adjustment. Refer to the packing installation manual for specific details on maintaining the style of packing supplied.
- ▲ CAUTION: Do not overtighten packing. This can cause excessive packing wear and high stem friction that may impede plug movement.**
5. Make sure the valve fails in the correct direction in case of air failure. This is done by turning off the air supply and observing the failure direction.\*\*
  6. After a temperature excursion has occurred, bonnet flange bolting should be retorqued to ensure bonnet gaskets do not leak. See Table 2.

Table 2: Recommended ASME Body Bolt Torque Values

Bolt Size (inches)	Bolt/Stud Material			
	Carbon Steel		Stainless Steel	
	ft lb	N m	ft lb	N m
1-1/8	520	691	380	447
1-1/4	730	990	460	624
1-3/8	1000	1356	630	854
1-1/2	1320	1790	840	1139
1-5/8	1710	2318	1080	1464
1-3/4	2170	2942	1400	1898
1-7/8	2700	3660	1700	2305
2	3350	4542	2100	2847
2-1/4	4050	5491	2530	3430
2-1/2	4850	6575	3010	4081
2-3/4	5900	8000	4400	5960
3	7273	9860	5913	8015

## 5 ASME Valve Maintenance

At least once every six months, check for proper operation by following the preventative maintenance steps outlined below. These steps can be performed while the valve is in-line and, in some cases, without interrupting service. If an internal problem is suspected, refer to the “Valve Disassembly and Reassembly” section.

1. Look for signs of gasket leakage through the end flanges and bonnet. Retorque flange and bonnet bolting (if required). See Table 2.
2. Check for fluid leakage to the atmosphere through the body drain plug, if applicable.
3. Examine the valve for damage caused by corrosive fumes or process drippings.
4. Clean valve and repaint areas of severe oxidation.
5. Check packing box bolting for proper tightness. Refer to the packing installation manual for specific details on maintaining the style of packing supplied.

**▲ CAUTION: Do not overtighten packing. This can cause excessive packing wear and high stem friction that may impede stem movement.**

6. If the valve is supplied with a lubricator fitting, check lubricant supply and add lubricant if necessary. See product documentation or contact the Flowserve representative.
7. If possible, stroke the valve and check for smooth, full-stroke operation. Unsteady stem movement could indicate an internal valve problem.

**NOTE:** Due to excessive friction, graphite packing can cause the plug stem to move in a jerky fashion.

**⚠ WARNING: Keep hands, hair and clothing away from all moving parts when operating the valve. Failure to do so can cause serious injury.**

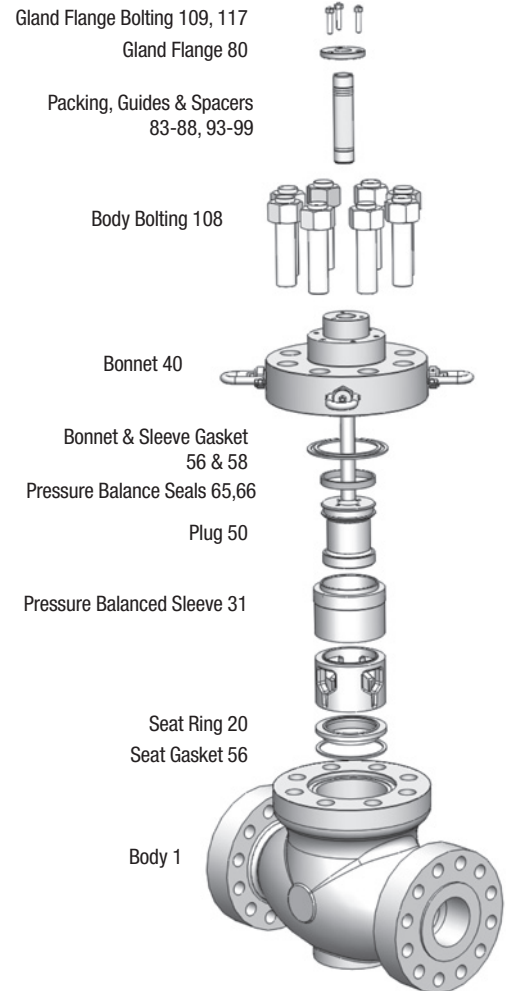
8. Make sure positioner linkage and stem clamp or coupling pieces are securely fastened. If the stem clamp or coupling pieces are loose, check plug thread engagement (refer to the “Reassembling the Body” section for the correct procedure on aligning the plug with the seat.) Tighten stem clamp nut or counter nut.
9. Ensure all accessories, brackets and bolting are securely fastened.
10. If possible, remove air supply and observe actuator for correct fail-safe action.\*
11. Check rubber actuator bellows for splits, cuts or wear.\*
12. Check tightness of the actuator. Spray a soap solution around the cylinder actuator retaining ring, adjusting screw and actuator stem guide to check for air leaks through the O-rings.\*
13. Clean any dirt and other foreign material from the plug stem.
14. If an air filter is supplied, check and replace cartridge if necessary.\*

\* Pneumatic operated control valves

\*\* Pneumatic operated control valves with safety function

Figure 3 – Exploded Drawing of an ASME Mark 200, pressure balanced with cage

Part	Item	Available Materials	
Body	1	Carbon Steel (WCC) , 316 SS (CF8M), CrMo (WC9, C12A), Duplex SS	
Seat Ring*	20	316 SS, 316 SS / Alloy 6, 410 SS HT, 416 SS HT, 420 SS HT	
Plug*	50	316 SS, 316 SS / Alloy 6, 416 SS HT, 420 SS HT, CrMo/Alloy 21	
Plug Stem	51	316 SS, 316 SS / Alloy 6, 416 SS HT, 17-4PH SS	
Cage	30	316 SS , 416 SS HT, CrMo/Nitrided	
Pressure Balanced Sleeve	31	316 SS, 410 SS, 410 SS HT, 420 SS HT**, 316 SS / Alloy 6, CrMo/Nitrided	
Bonnet	40	Carbon Steel, 316 SS, CrMo, Duplex SS	
Seat Gasket	55	PTFE, Spiral Graphite	
Sleeve Gasket	56	PTFE, Spiral Graphite	
Bonnet Gasket	58	PTFE, Spiral Graphite	
Seal Types	O-Ring Seal	65	Buna, Vitor®, EPDM, Perfluoroelastomer
	Back-up Ring	66	Carbon-Filled PTFE, PEEK, Vespel®, Ryton®
	PTFE Seal	65	PTFE, Glass-Loaded PTFE
	Metal Multi-Seal	65	Rene 41®, Inconel® X-750
	Carbon Seal	65	Carbon (Single & Triple)
Gland Flange	80	Carbon Steel <sup>1</sup> , Stainless Steel <sup>2</sup>	
Gland Flange Bolting	109, 117	Carbon Steel <sup>1</sup> , Stainless Steel <sup>2</sup>	
Lower Guide	83	316 SS / GL PTFE <sup>1,2</sup> , 316 SS / Graphite, Bronze C93200, Alloy 6, Ultimet	
Upper Guide	87	316 SS / GL PTFE <sup>1,2</sup> , 316 SS / Graphite, Bronze C93200	
Packing	88	PTFE V-Ring <sup>1,2</sup> , PTFE / Glass V-Ring, Quick-Set 9001, Braided PTFE, AFPI, Graphite Rib/Braid, Safeguard, Sureguard, 1303 FEP, Chesterton 5800E, Sureguard XT, TA-Luft Double Graphite	
Body Bolting	108	B7-2H Zinc-coated <sup>1</sup> , B7-2H Oxide-coated, B7M-2HM (NACE), B8-8 (304 SS) <sup>2</sup> , B8M-8M (NACE), L7-7, L7M-7M (NACE), B16-7L, L7M-7M Uncoated (NACE)	
Packing Spacers	93-99	316 SS <sup>1,2</sup>	



\* The seat ring and plug have hard facing of alloy 6 or other materials on the seating and guiding surfaces

\*\* Internal Sleeve Only

<sup>1</sup>Standard for Carbon Steel Body Construction

<sup>2</sup>Standard for Stainless Steel Body Construction

## ASME Disassembly and Reassembly

### 6.1 Disassembling the Body

To disassemble the valve body, refer to Figure 3 or 4 then proceed as follows:

**⚠ WARNING:** Depressurize line to atmospheric pressure and drain all fluids before working on the valve. Failure to do so can cause serious injury.

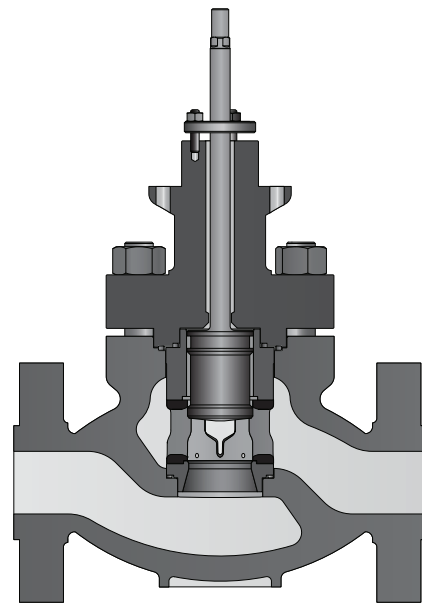
1. Fully retract the plug until the stem clamp indicator points to the open position.
2. Remove the bonnet flange bolting and lift the actuator, bonnet and plug out of the valve body.

**⚠ WARNING:** Danger exists in removing the actuator, bonnet and plug, especially if PTFE plug seals are used. The sleeve may stick to the plug and fall during disassembly, causing possible serious injury and damage to the valve or nearby equipment. If sleeve is observed sticking to the plug, steps 3–5 should be consulted.

**⚠ CAUTION:** Heavy actuators may require a hoist. Lift the actuator with the yoke legs using a lifting strap and a hoist. Great care should be taken to lift the actuator and plug straight out of the body to avoid damage to the plug and seat.

3. If the sleeve is observed sticking to the plug during removal, fully extend the plug by applying air above the piston, allowing the sleeve to remain in the body and the bonnet to rise above the body.
4. In the gap between the top of the sleeve and the bottom of the bonnet, place wooden blocking of equal thickness in at least three places. The wooden blocks must not extend in far enough that they interfere with plug movement. The plug must be allowed to stroke up to the bonnet.
5. By applying air below the piston, retract the plug until the plug head is freed from the sleeve. Once the plug is free from the sleeve, remove the plug and bonnet assembly from the body.
6. Lift the sleeve out of the valve body using lifting points on the top of the sleeve.
7. Remove cage, seat ring and gaskets from the valve body.
8. Remove the plug seals from the plug head.
9. Check to see the seating surfaces on both the seat ring and plug are free of damage to ensure tight shutoff. Make sure the gasket surfaces on the seat ring, bonnet and body are clean and undamaged. Inspect the pressure balanced sleeve for scratches or other damage.
10. Loosen the stem clamp and gland flange. Remove the yoke bolts.

Figure 4 – ASME Mark 200 Cutaway Drawing



**⚠ CAUTION:** If a rubber bellows is attached to the gland flange, the gland flange must be removed prior to removing the actuator.

11. Turn the actuator off the plug and bonnet without allowing the plug to rotate within the bonnet. Pull the plug carefully through the packing box. Inspect the plug stem for damage or scoring.

**NOTE:** With air-to-close, fail-open valves, it may be necessary to apply a small amount of air to the top of the actuator to move the plug away from the bonnet. Otherwise, plug galling may occur.

**⚠ CAUTION:** To avoid scoring guides and plug stem, follow the above procedure exactly.

12. If the seat surfaces need remachining, both surfaces on plug and seat ring must be reworked. The seat angle on the plug is 36 degrees and the seat ring is 33 degrees. Lapping is not necessary if proper assembly procedures are followed.

**⚠ CAUTION:** If remachining, protect the stem while turning. Ensure concentricity of the seat surface with the plug stem (or outside diameter of the seat ring, if machining the seat).

13. To replace packing or change the packing box configuration, push out packing, spacer and guides with a dowel slightly larger than the plug stem from underneath the bonnet.



## 6.2 Reassembling the Body

To reassemble the valve body, refer to Figure 3 or 4 then proceed as follows:

1. Install new bonnet and seat gaskets with the beveled edge up on fluoropolymer gaskets.
 

**NOTE:** All gaskets should be replaced whenever the valve is disassembled.
2. Relocate the seat ring. Carefully install the cage and then the sleeve with the indexing feature provided, taking care to ensure they install with the correct ends up.
3. Replace the plug seals on the plug, referring to Figure 5 and 6, and observing the following directions:

**⚠ WARNING: Gloves should be worn to help prevent the hands from being pinched or burned.**

**PTFE Seals** Heat one seal to 300°F (150°C) and slip it over the plug into the seal groove. Thermal expansion causes the ring to stretch, thereby making it relatively easy to slide over the plug head.

Care must be taken to prevent the seal from rolling, rather than sliding over the plug. The second seal can be installed following the same procedures as the first. If for any reason the second seal cannot be slipped onto the plug, cut the seal at approximately a 30° angle (see Figure 6) and place over the plug. Make certain the cut seal is on the low-pressure side.

### Carbon Seals

**Single Seals** Each seal must be scored on a face with a sharp knife at two places, 180 degrees apart. Holding the ring gently in a padded vise, pull gently on the ring, breaking the ring on the score marks into two equal pieces. Install the two pieces into the plug seal grooves with the score marks on the pressure side.

**Triple Seals** Gently insert one end of seal and wrap the seal into groove. Install the inside ring first, followed by the two outside rings with joints offset 120 degrees on all three rings (see Figure 5).

**⚠ CAUTION: Install rings starting with one end and working the ring carefully into place. Do not spread ring more than necessary. Spreading the ring too much can cause the ring to break.**

Figure 5 – Seal Designs

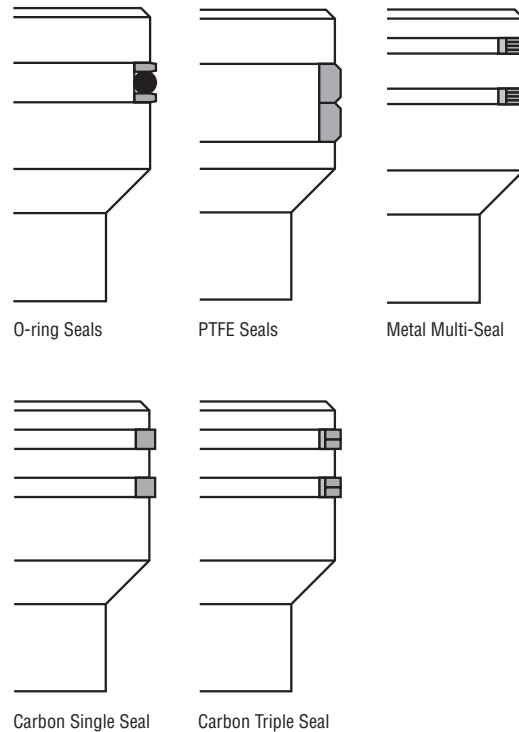
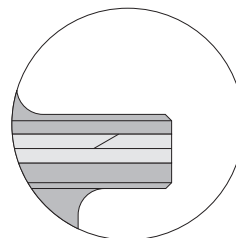


Figure 6 – PTFE Seal Cutting Detail



**Metal Multi-Seals** Install wave spring followed by four seal rings. Stagger ring openings by at least 90 degrees. Take care not to bend the seal rings as they are installed.

**O-ring with Back-up Rings** The O-ring can stretch over plug and into place. Spread scarf cut back-up rings until they fit on each side of O-ring as shown in Figure 5.



4. Lower the plug into the body and sleeve. Care should be taken with the plug seals to avoid scoring or galling the sealing surface while fitting them into the sleeve bore. With metal multi-seals and carbon triple seals, use a ring compressor on the rings. A suitably sized screw-type hose clamp will also serve to compress the rings for reassembly.
5. Install sleeve gasket by centering on sleeve.
6. Lower the bonnet onto the plug and body, taking great care to avoid scoring the plug stem.
7. Once the bonnet is resting squarely in the valve body, finger-tighten the bonnet flange bolting.
8. Reinstall the packing and guides referring to the appropriate packing installation manual and reinstalling new packing exactly as shown. Make sure at least 1/8" (3 mm) is left at the top of packing box for the top guide to enter. Different spacer lengths permit a wide variety of packing configurations, such as twin seal and vacuum-pressure packing

**⚠ WARNING: Valves with extended bonnets must not have lower packing installed. Instead, lower packing rings should be installed with the upper set. Lower packing installed in extended bonnets will diminish the integrity of the packing assembly.**

**NOTE:** Graphite guide liners should be replaced each time the valve packing is replaced. Do not rebuild the valve without new graphite liners in the guides.

9. Replace and tighten the packing gland and bolting. Refer to the packing installation manual for specific details on maintaining the style of packing supplied. Make sure gland flange is level after 3 nuts are tightened.
10. Turn actuator back onto the body assembly, without turning the plug inside the bonnet. Leave a 3/32" to 1/8" (2 mm to 3 mm) gap between the mating surfaces of the bonnet and yoke. Tighten yoke bolting to close this gap. Firmly tighten the yoke bolting.
11. Using the actuator, seat the plug two or three times to center the seat ring using pressure on the top of the actuator.
12. Tighten the body bolting, following the bolting sequence outlined in Figure 7. Use a minimum of four steps to reach the suggested bolt torque values shown in Table 2. Never exceed more than 30% of the suggested bolt torque value in a single step.

13. Slowly stroke the plug up and down to check the alignment of the plug with the sleeve.

**⚠ CAUTION: If binding or sticking is observed, discontinue stroking the valve and reassemble using the above steps. Failure to do so could cause serious valve damage. Contact your Flowserve representative if binding cannot be resolved.**

14. Perform a Quick Check as described in section 4.1.

Figure 7 – Bolt Patterns

Bolts	Cross Bolt Tightening Pattern
4 bolts 90° apart	
8 bolts 45° apart	
12 bolts 30° apart	
16 bolts 22,5° apart	

### 6.3 ASME Valve Troubleshooting Chart

Problem	Possible Cause	Corrective Action
Stem motion impeded	1. Overtightened packing.	1. Refer to proper maintenance instructions and readjust.
	2. Service temperature is beyond operating limits of trim design.	2. Reconfirm service conditions and contact factory.
	3. Inadequate air supply. *	3. Check for leaks in air supply or instrument signal system; tighten loose connections and replace leaky lines.
	4. Malfunctioning positioner. *	4. Refer to positioner maintenance instructions.
Excessive leakage	1. Improperly tightened bonnet flange bolting.	1. Refer to step 11 of “Reassembling the Body” section for correct tightening procedure.
	2. Worn or damaged seat ring.	2. Disassemble valve and replace or repair seat ring.
	3. Worn or damaged seat or bonnet gasket.	3. Disassemble and replace gaskets.
	4. Inadequate actuator thrust.	4. Check for adequate air supply to actuator; if air supply is adequate, reconfirm service conditions and contact factory.
	5. Incorrectly adjusted plug.	5. Refer to step 9 of “Reassembling the Body” section for correct plug adjustment.
	6. Improper flow direction.	6. Refer to original specifications or contact factory.
	7. Improper handwheel adjustment; handwheel acting as a limit-stop. *	7. Adjust handwheel until plug seats properly.
Inadequate flow	1. Improper plug adjustment, limiting stroke.	1. Refer to step 9 of “Reassembling the Body” section for correct plug adjustment.
	2. Malfunctioning positioner. *	2. Refer to positioner maintenance instructions.
	3. Service conditions exceed trim design capacity.	3. Verify service conditions and consult factory.
Plug slams	1. Incorrect plug adjustment allowing improper cushion of air between actuator piston and yoke.*	1. Refer to step 9 of “Reassembling the Body” section for correct plug adjustment.
	2. Inadequate air supply. *	2. Check air supply to actuator; repair leaks and remove any restrictions in supply line.
	3. Trim sized too large for flow rate.	3. Install reduced trim.
Valve does not fail in correct position	1. Incorrect flow direction.	1. Reconfirm direction and, if necessary, correct flow direction through valve.

\* Pneumatic operated control valves

## 7 DIN Valve Unpacking

1. Careful loading and transport arrangements are required to avoid the product suffering impact and jolting movements. Under no circumstances should lifting gear be attached to the valve stem, travel indicator or any peripheral units, if applicable. We recommend the use of a length of rope that is looped around the valve head underneath the yoke. Promptly touch up any damage to the corrosion protection.
  2. Upon arrival on site, store the control valve on a solid base in a closed room. Until its installation, the valve must be protected from the weather, dirt or other potentially harmful influences. Under no circumstances should the valve remain in storage for more than 6 months, as the impregnation in the stuffing box packing evaporates and leaks may develop. Do not remove the plugs protecting the flanges and the inside of the control valve until it has arrived at its place of installation.
  3. While unpacking the valve, check the packing list against materials received. Lists describing valve and accessories are in each shipping container.
- ⚠ WARNING: When lifting a valve using the rope, be aware that the center of gravity may be above the lifting point. Therefore, support must be given to prevent the actuator from rotating. Failure to do so can cause serious injury to personnel, damage to the valve or nearby equipment.**
4. Contact your shipper immediately if there is shipping damage.
  5. Should any problem arise, call your Flowserve representative.
  6. The export packaging follows the packaging guidelines according to the HPE standards. The nonreturnable package is based on 90% recyclable materials (cardboard box, wooden pallet etc.).

## 8 DIN Valve Installation

- ⚠ CAUTION: The valve must be installed and commissioned by qualified staff. Qualified staff is defined as personnel who are familiar with the installation, commissioning and operation of this product and possess the relevant qualifications in their field of activity.**
1. Before installing the valve, clean the line of dirt, welding chips, scale or other foreign material.
  2. Whenever possible, the valve should be installed in an upright position. Vertical installation permits easier valve maintenance. When vertical installation is not possible contact your Flowserve representative.
- ⚠ CAUTION: Do not insulate extension bonnets that are provided for hot or cold services.**
3. Be sure to provide proper overhead clearance for the actuator to allow for disassembly of the plug from the valve body. Refer to Table 3 for the necessary clearance needed for valve disassembly.

Table 3: DIN Valve Disassembly Clearance

Valve Size	Clearance	
	inches	mm
50	7	180
80	7	180
100	7	180
150	7	180
200	7	180
250	7	180
300	7	180
400	7	180

4. Double-check flow direction to be sure the valve is installed correctly. Flow direction is indicated by the arrow attached to the body.
5. If welding the valve into the line, use extreme care to avoid excess heat buildup in the valve.
6. Connect the electric power supply according the wiring diagram (see removable actuator cover or manufacturer’s actuator documentation).

## 8.1 DIN Valve Quick-check

Prior to start-up, check the control valve by following these steps:

**⚠ WARNING: Due to the risk of injury, it is prohibited to work between the yoke/columns while the valve is in operation.**

1. Stroke the valve and observe the plug position indicator on the stem clamp compared to the stroke indicator plate. The plug should change position in a smooth, linear fashion.

**NOTE:** Due to excessive friction, graphite packing can cause the plug stem to move in a jerky fashion.

2. Check for full stroke by making appropriate instrument signal change.
3. Check packing box bolting for the correct adjustment. Refer to the packing installation manual for specific details on maintaining the style of packing supplied.

**⚠ CAUTION: Do not overtighten packing. This can cause excessive packing wear and high stem friction that may impede plug movement.**

4. After a temperature excursion has occurred, bonnet flange bolting should be retorqued to ensure bonnet gaskets do not leak. See Table 4.

Table 4: Recommended DIN Body Bolt Torque Values

Bolt Size	PN 160 / Body Material					
	1.0619, 1.5419		1.7357		1.7379	
(mm)	ft lb	N m	ft lb	N m	ft lb	N m
M24	265	360	265	360	300	405
M27	385	525	385	525	410	555
M30	410	555	415	565	480	650
M33	630	860	650	885	740	1000
M39	1220	1650	1220	1650	1250	1700
M42	1400	1900	1400	1900	1550	2100
M52	3250	4400	3250	4400	3250	4400

Bolt Size	PN 250 / Body Material			
	1.0619, 1.5419, 1.7357		1.7379	
(mm)	ft lb	N m	ft lb	N m
M24	265	360	280 (300)*	380 (410)*
M30	427	580	500	680
M39	1150	1570	1220	1660
M45	2060	2800	2060	2800
M48	2500	3400	2500	3400
M56	4050	5500	4050	5500
M72	8550	11600	8550	11600

\* Nominal Size DN 80 only

## 9 DIN Valve Maintenance

At least once every six months, check for proper operation by following the preventative maintenance steps outlined below. These steps can be performed while the valve is in-line and, in some cases, without interrupting service. If an internal problem is suspected, refer to the “Valve Disassembly and Reassembly” section. If multiple checks in line without claim (record) it is allowed to extend the maintenance interval by risk of plant operator.

1. Look for signs of gasket leakage through the end flanges and bonnet. Retorque flange and bonnet bolting (if required). See Table 4.
2. Check for fluid leakage to the atmosphere through the body drain plug, if applicable.
3. Examine the valve for damage caused by corrosive fumes or process drippings.
4. Clean valve and repaint areas of severe oxidation.
5. Check packing box bolting for proper tightness. Refer to the packing installation manual for specific details on maintaining the style of packing supplied.

**⚠ CAUTION: Do not overtighten packing. This can cause excessive packing wear and high stem friction that may impede stem movement.**

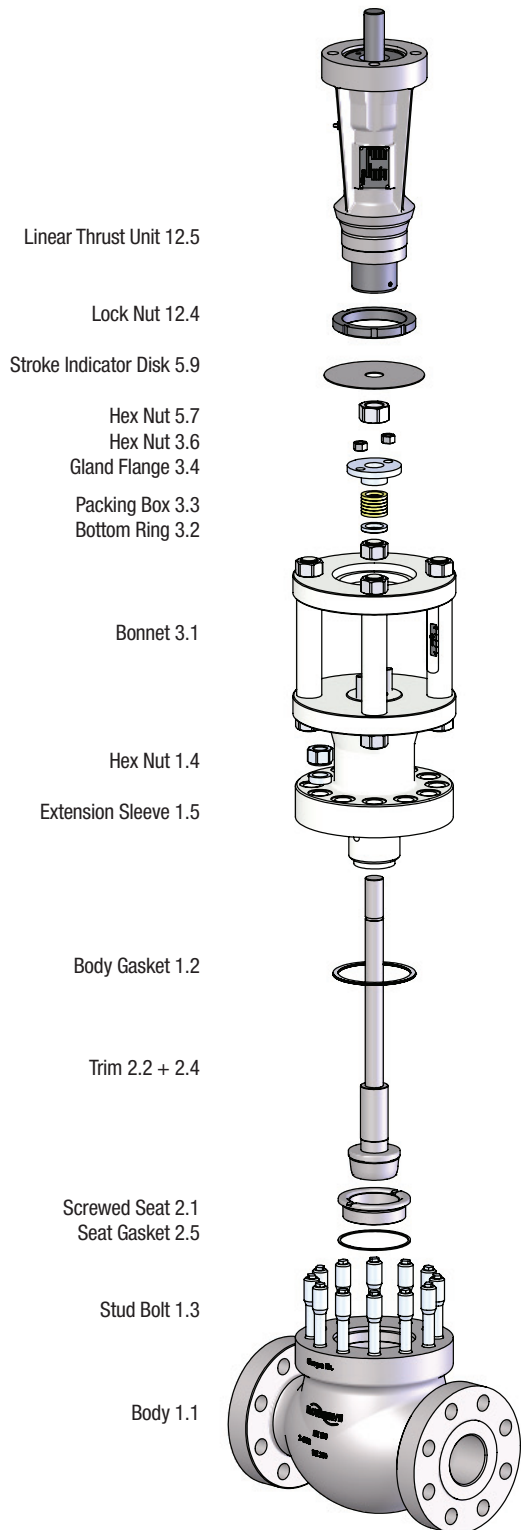
6. If the valve is supplied with a lubricator fitting, check lubricant supply and add lubricant if necessary. See product documentation or contact the Flowserve representative.
7. If possible, stroke the valve and check for smooth, full-stroke operation. Unsteady stem movement could indicate an internal valve problem.

**NOTE:** Due to excessive friction, graphite packing can cause the plug stem to move in a jerky fashion.

**⚠ WARNING: Keep hands, hair and clothing away from all moving parts when operating the valve. Failure to do so can cause serious injury.**

8. Make sure positioner linkage and stem clamp or coupling pieces are securely fastened. If the stem clamp or coupling pieces are loose, check plug thread engagement (refer to the “Reassembling the Body” section for the correct procedure on aligning the plug with the seat.) Tighten stem clamp nut or counter nut.
9. Ensure all accessories, brackets and bolting are securely fastened.
10. Clean any dirt and other foreign material from the plug stem.

Figure 8 – Exploded drawing of a DIN Mark 200 with screwed-in seat ring; mounting shown for electric actuator



Part	Item	Available Materials			
		1.0619	1.5419	1.7357	1.7379
Body	1.1	1.0619	1.5419	1.7357	1.7379
Bonnet Gasket	1.2	Pure Graphite on Support Plate from C-276			
Stud Bolt	1.3	1.7218 (KG)	1.7709 (GA)	1.4923 (V)	
Hex Nut	1.4	1.7218 (KG)	1.7709 (GA)	1.4923 (V)	
Extension Sleeve	1.5	1.7218 (KG)	1.7709 (GA)	1.4923 (V)	
Screwed Seat	2.1	1.4122	1.4922		
Contoured Plug	2.2	1.4122	1.4922		
Spring Pin	2.3	A2			
Stem	2.4	1.4122	1.4922		
Profil Ring	2.5	Pure Graphite			
Bonnet	3.1	1.0460	1.5415	1.7335	1.7383
Bottom Ring	3.2	1.4922			
Packing Box	3.3	Pure Graphite Rings			
Gland Flange	3.4	1.4922			
Stud Bolt	3.5	1.4923 (V)			
Hex Nut	3.6	1.4923 (V)			
Yoke Rod	5.1	1.4122			
Flange	5.2	1.0460			
Hex Nut	5.3	A2 - 70			
Stroke indicator scale	5.4	Aluminium			
Hex Bolt	5.5	A2 - 70			
Washer	5.6	A2			
Hex Nut	5.7	A2 - 50			
Stroke indicator Disk	5.9	1.0038			
Threaded Ring	5.10	1.0460			
Set Screw	5.11	45 H			

## DIN Disassembly and Reassembly

### 10.1 Disassembling the Body

To disassemble the valve body, refer to Figure 8 or 9 then proceed as follows:

**⚠ WARNING: Depressurize line to atmospheric pressure and drain all fluids before working on the valve. Failure to do so can cause serious injury.**

1. Fully retract the plug until the stem clamp indicator points to the open position.
2. Remove the actuator bolting and lift the actuator out of the linear thrust unit.

**⚠ CAUTION: Heavy actuators may require a hoist.**

3. Unlock the hex nut (5.7) counter clockwise.
4. Unlock the linear thrust unit - lock nut counter clockwise.
5. Unscrew the complete linear thrust unit counter clockwise.
6. Measure the distance from stroke indicator disk (5.9) to the stem (2.4) top edge. Make a note of the dimension, you will need it for reassembling.
7. Remove the stroke indicator disk (5.9) and unscrew the hex nut (5.7).
8. Unscrew hex nuts (5.3) and remove the extension sleeves (1.5).
9. Unscrew hex nuts (3.6).
10. Remove gland flange (3.4).
11. Turn the special tool (ring nut, see Table 10.3) on the stem and put in place slowly.

**⚠ WARNING: Danger exists in removing the bonnet and plug with piston ring balancing. The balanced ring may stick to the plug and fall during disassembly, causing possible serious injury and damage to the valve or nearby equipment.**

12. Remove flat gasket (1.2).
13. Insert special tool (change seat tool, see Table 10.3) in the body and remove using a suitable torque wrench (see table 5).
14. Remove screwed seat (2.1) and profile ring (2.5).
15. Remove plug - unit (2.2, 2.3, 2.4) from the bonnet.
16. Remove packing (3.3) and bottom ring (3.2) with special tool (packing driver tool, see Table 10.3).

Figure 9 – DIN Mark 200 Cutaway Drawing

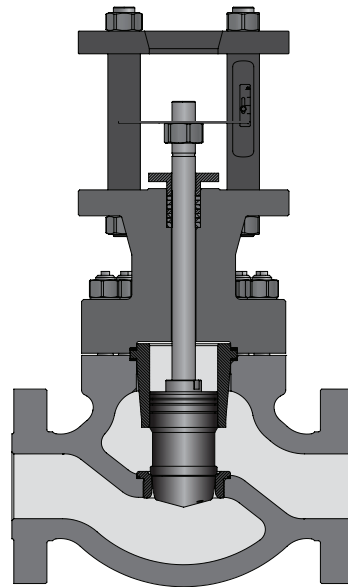


Table 5: DIN Mark 200 Required Torque for Screwed-in Seat Ring

DN	PN160 Moment [Nm] Torque [ft lb]	PN250 Moment [Nm] Torque [ft lb]
50	190 140	420 310
80	590 435	1290 950
100	880 650	1930 1420
150	2200 1620	4800 3540
200	3700 2730	8150 6000
250	6100 4500	13400 10000
300	8900 6550	19600 14400
400	12000 8850	26400 19400

## 10.2 Reassembling the Body

To reassemble the valve body, refer to Figure 8 or 9 then proceed as follows:

1. Install new profile ring (2.5) and screwed seat (2.1).

**NOTE:** Clean and inspect all sealing surfaces, threads and remove damaged parts. Always use new gaskets whenever the valve is disassembled.

2. Insert special tool (change seat tool, see Table 10.3) in the body and turn using a suitable torque wrench (see Table 5).
3. Lower plug unit (2.2, 2.3, 2.4) in the body and put it in the screwed seat.

**NOTE:** Check the stem surface for damage. A damaged stem must be replaced.

4. Install new flat gasket (1.2).
5. Lower the bonnet (3.1) onto the plug unit and body carefully.

**NOTE:** Take great care to avoid scoring the stem.

6. Fit the extension sleeves (1.5) onto the stud bolts (1.3) and fingertighten the nuts (1.4).
7. Tighten the nuts (1.4) in four steps (crosswise with 30%, 60%, 100% and all round 100%) according to the pattern (Figure 10).

**NOTE:** Check the movement of the plug by lifting (10 mm) between the steps. If it is hard to move, loosen the nuts and start again.

8. Lower the bottom ring (3.2) and the new packing (3.3).

**NOTE:** Instal one ring after the other. To do this, use a tamper and push in each ring individually, carefully and complete. When inserting the other rings, rotate them each by 180° from their overlapping points.

9. Lubricate the thread and all bearing surfaces (underside of the nuts) with a suitable, approved lubricant.
10. Place the gland flange (3.4) back on and tighten the nuts (3.6), alternating evenly in accordance with the instructions from the packing manufacturer.

**NOTE:** Tightening unevenly can cause the packing gland follower to jam, which can result in stem damage.

11. Screw the hex nut (5.7) onto the stem (2.2) and replace the stroke indicator disk (5.9). Recall the distance between top edge of stem and replace it.
12. Lower the linear thrust unit. Lock nut onto the stroke indicator disk and screw the complete linear thrust unit onto the stem clockwise.

13. Screw on the linear thrust unit. Lock nut onto the linear thrust unit clockwise and secure it. Do the same with the hex nut (5.7).

**NOTE:** The stroke indicator disk should be shown in the open position on the stroke indicator plate.


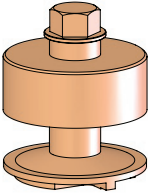

14. Replace the multi turn actuator.
15. After replacing the valve in the pipe, perform three full strokes and check the thightening torque of the nuts (3.6). Retighten the nuts as necessary.
16. Log the maintenance interval and the work performed.

Figure 10 – Bolt Patterns

Bolts	Cross Bolt Tightening Pattern
8 bolts 45° apart	
12 bolts 30° apart	
16 bolts 22,5° apart	
20 bolts 18° apart	



### 10.3 Special Tools

Special Tools	Use
	<p>Ring Nut Tool                      Recommended tool for disassembling and reassembling                      For part no. see spare parts catalog</p>
	<p>Seat Change Tool                      Recommended tool for disassembling and reassembling the screwed in seat                      For part no. see spare parts catalog</p>
	<p>Packing Driver Tool                      Recommended tool for disassembling the packing                      For part no. see spare parts catalog</p>

## 11 DIN Valve Troubleshooting Chart

Problem	Possible Cause	Corrective Action
Stem motion impeded	1. Overtightened packing.	1. Refer to proper maintenance instructions and readjust.
	2. Service temperature is beyond operating limits of trim design.	2. Reconfirm service conditions and contact factory.
Excessive leakage	1. Improperly tightened bonnet flange bolting.	1. Refer to step 11 of “Reassembling the Body” section for correct tightening procedure.
	2. Worn or damaged seat ring.	2. Disassemble valve and replace or repair seat ring.
	3. Worn or damaged seat or bonnet gasket.	3. Disassemble and replace gaskets.
	4. Inadequate actuator thrust.	4. Check for adequate multi turn actuator, reconfirm service conditions and contact factory.
	5. Incorrectly adjusted plug.	5. Refer to step 9 of “Reassembling the Body” section for correct plug adjustment.
	6. Improper flow direction.	6. Refer to original specifications or contact factory.
Inadequate flow	1. Improper plug adjustment, limiting stroke.	1. Refer to step 9 of “Reassembling the Body” section for correct plug adjustment.
	2. Service conditions exceed trim design capacity.	2. Verify service conditions and consult factory.
Plug slams	1. Trim sized too large for flow rate	1. Install reduced trim.



Pages available for technician's notes.



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