

# **G4XZ Valves**

Sleeveline® Plug Valves

**Installation  
Operation  
Maintenance**

VAIOM000321-00(EN)

*Original Instructions*

 ***These instructions must be read prior to installing, operating, and maintaining this equipment.***





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## **Document Version**

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# 1 General Information

## 1.1 Scope of manual



These instructions must be kept close to the product's operating location or directly with the product.



These instructions must be read prior to installing, operating, using, or maintaining the equipment in any region worldwide. The equipment must not be put into service until all of the safe operating conditions noted in the instructions have been met. **Failure to comply with the information provided in the User Instructions is considered to be misuse. Personal injury, product damage, delay in operation, or product failure caused by misuse are not covered by the Flowserve warranty.**

The following user information covers the Installation, Operation & Maintenance procedure for DURCO G4X SleeveLine® Plug Valves.

These instructions are intended to familiarize the reader with the product and its permitted use. Operating the product in compliance with these instructions is important to help ensure reliability in service and avoid risks. These instructions may not take into account all local regulations; ensure such regulations are observed by all, including those installing the product. Always coordinate repair activities with operations personnel, and follow all plant safety requirements and applicable safety and health legislation.

## 1.2 Disclaimer

Information in this User Instruction is believed to be complete and reliable. In spite of all Flowserve's efforts to provide comprehensive information and instructions, sound engineering and safety practices should always be used. Please consult with a qualified engineer.

Flowserve manufactures products to applicable International Quality Management System Standards as certified and audited by external Quality Assurance organizations. Genuine parts and accessories have been designed, tested, and incorporated into the products to help ensure continued product quality and performance in use. As Flowserve cannot test parts and accessories sourced from other vendors the incorrect incorporation of such parts and accessories may adversely affect the performance and safety features of the product. The failure to properly select, install, or use authorized Flowserve parts and accessories is considered to be misuse. Damage or failure caused by misuse is not covered by Flowserve's warranty. In addition, any modification of Flowserve products or removal of original components may impair the safety of these products in use.

## 1.3 Certification instruction

It is a legal requirement that machinery and equipment put into service within certain regions of the world shall conform to the Marking Directives applicable to Flowserve products (i.e. Machinery Directive, Low Voltage Directive, Electromagnetic Compatibility (EMC) Directive, Pressure Equipment Directive (PED), Equipment for Potentially Explosive Atmospheres (ATEX), etc.).


Note: Certificates defined in the Contract requirements are provided with these instructions where applicable. Examples of the certificates can be found in the Annex of this document. If required, copies of other certificates sent separately to the Purchaser should be obtained from the Purchaser for retention with this User Instruction.

### 1.4 Units

This document contains measurements in both the metric and English standard unit systems.

## 2 Safety Information

### 2.1 Intended use




 The product/system must not be operated beyond the parameters specified for the application. If there is any doubt as to the suitability of the product/system for the application intended, contact Flowserve for advice, quoting the serial number.

- Installing, operating, or maintaining the product/system in any way that is not covered in this User Instruction could cause death, serious personal injury, or damage to the equipment. This includes any modification to the product/system or use of the parts not provided by Flowserve.
- Only operate the product/system when it has successfully passed all inspection acceptance criteria
- Do not operate the product/system in a partially assembled condition.
- If the conditions of service on the customer's purchase order change (i.e. pumping fluid, temperature, or duty conditions) it is requested that the user seeks written agreement from Flowserve before start up.
- Observe equipment labels, such as arrows designating the direction of rotation, warning signs, etc., and keep them in a legible condition. Replace any damaged and/or illegible labels immediately.

### 2.2 Safety symbols and description

This User Instruction contains specific safety markings where non-observance of an instruction would cause a hazard. The specific safety markings are:

Table 1: Definition of safety symbols and markings

Symbol	Description
	<b>DANGER</b> This symbol indicates a hazardous situation which, if not avoided, will result in death or serious injury
	<b>WARNING</b> This symbol indicates a hazardous situation which, if not avoided, could result in death or serious injury
	<b>CAUTION</b> This symbol indicates a hazardous situation which, if not avoided, could result in minor or moderate injury







	<p><b>Safety Instruction</b> This symbol indicates specific safety-related instruction or procedures</p>
	<p><b>NOTICE</b> This symbol is used to address practices not related to physical injury</p>
	<p>This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.</p>

Table 2: Additional symbols

Symbol	Description
	<p><b>ELECTRICAL HAZARD</b> This symbol indicates electrical safety instructions where non-compliance would affect personal safety and could result in loss of life</p>
	<p><b>TOXIC HAZARD</b> This symbol indicates “hazardous substances and toxic fluid” safety instructions where non-compliance would affect personal safety and would damage the equipment or property</p>
	<p><b>ATEX EXPLOSION PROTECTION</b> This symbol indicates explosive atmosphere marking according to ATEX. It is used in safety instructions where non-compliance in the hazardous area would cause the risk of an explosion</p>

## 2.3 General hazard sources

### 2.3.1 Mechanical Hazards

#### a) Lifting limits and guidelines

Note: The load values mentioned in this section are Flowserve recommendations only. All lifting must be done in compliance with site safety protocol, local regulations, and related industry standards.

Many precision parts have sharp corners which require appropriate personal protective equipment during handling. Prior to any attempt to lift an item, employees must first determine the approximate weight and stability of the load.

- Large, unstable, or awkward loads should always be handled with the assistance of additional personnel or appropriate mechanical means.

- Loads in excess of 23kg (50 lb.) should only be lifted by appropriate mechanical means and in accordance with current local legislation or with the assistance of additional personnel.
- Lifting items less than 23kg (50 lb.) may be prohibited without assistance if the lift is repetitive and/or awkward (i.e., away from the body, above the shoulders or below the knees) thus placing excessive stress on the personnel.
- Repetitive lifting of any kind should be evaluated as part of a documented end-user safety program.
- Do not stand near the valve when it is lifted from ground. Keep some gap.
- Do not use bonnet bolting or pressure controlling parts to lift the valves.
- Do not vibration / Hammer stem and bonnet bolting while installing the valve.

## 2.4 Qualified personnel and targeted group

All personnel involved in the operation, installation and maintenance of the unit must be qualified to carry out the work involved. If the personnel in question does not already possess the necessary knowledge and skill, appropriate training and instruction must be provided. If required the operator may commission the manufacturer / supplier to provide applicable training.

Always co-ordinate repair activities with operation and health and safety personnel, and follow all plant safety requirements and applicable safety and health laws and regulations.

## 2.5 Industrial health and safety measures

Follow industry safety standards including the use of appropriate equipment in required areas.

## 2.6 Potential explosive areas



Measures are required to:

- Avoid excess temperature
- Prevent build-up of explosive mixtures
- Prevent the generation of sparks
- Prevent leakages
- Maintain the pump to avoid hazard

All instructions for equipment installed in potentially explosive atmospheres must be followed to help ensure explosion protection. For ATEX, both electrical and non-electrical equipment must meet the requirements of the European Explosion Protection Directive 2014/34/EU. Always observe the regional legal Ex requirements, e.g. Ex electrical items outside the EU may be required certified to other than ATEX e.g. IECEx, UL.



Use equipment only in the zone for which it is appropriate. Always check that all equipment is suitably rated and/or certified for the classification of the specific atmosphere in which they are to be installed.



## 2.7 Protective equipment

Wear the necessary protective equipment during the unpacking, installation, operation, and maintenance of valves.

## 3 Product Description

### 3.1 General product description

The Durco G4X product is a non-lubricated sleevelined quarter turn plug valve rated to ASME Class 150 and Class 300 designs at pressures to 51 bar (740PSI) and temperatures to 232 degrees C (450 F). The G4X product ranges in size from 1"- 6" offered with a variety of configurations with options and material alloy and packing.

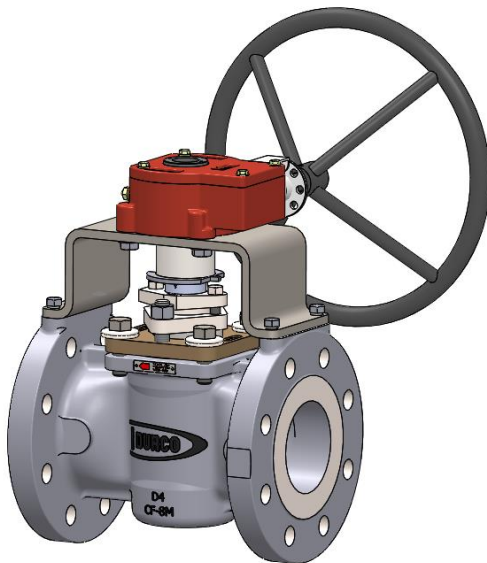


Figure 3.1: Isometric view of the G4X

### 3.2 Design

The G4 sleevelined valve is designed pursuant to ASME B16.34 for wall thickness, ASME B16.5 for flange requirements, ASME B16.25 and B16.11 for butt welds and socket welds and is designed to meet the pressure and temperature requirements of ASME B16.34.

### 3.3 Scope of delivery

The exact scope of the delivery is stated in the order documentation.

### 3.4 Function description

Isolation Valve

### **3.5 Connections**

- Raised Face Flange
- Screwed End
- But Weld
- Socket Weld
- Flat Face
- Ring Type Joint
- Small & Large Groove Flange
- Additional Connections upon request

#### **3.5.1 Electrical connections**

Applicable if electrical accessories are used. Please refer to those appropriate IOMs

#### **3.5.2 Pneumatic connections**

Applicable if pneumatic actuator or other pneumatic accessories are used. A pneumatic actuator typically requires a ¼ inch air supply of at least 60 psi (bar). Larger actuators will require a 3/8 inch air supply. Flow boosters will require ½ inch to ¾ inch independent air supply from the positioner. Limit switches or position indicators may be mounted external to a positioner. Please refer to those appropriate IOMs

#### **3.5.3 Mechanical connections**

Applicable if custom extensions are used. Please refer to those appropriate IOMs

#### **3.5.4 Auxiliary connections**

Applicable if custom auxiliary connections are used. Please refer to those appropriate IOMs

## **4 Packaging, Transportation and Storage**

### **4.1 Consignment receipt**

Immediately after receipt of the product/system it must be checked against the delivery/shipping documents for its completeness and that there has been no damage in transportation. Any shortage and/or damage must be reported immediately to Flowserve and must be received in writing within one month of receipt of the equipment. Later claims cannot be accepted.

## 4.2 Storage

### 4.2.1 Short Term Storage Instructions/Recommendation

- 4.2.1.1 The following instructions are recommended where valve storage is intended for valves that are to be stored on site prior to installation up to six months. Extended storage beyond six months may require additional instructions depending on the location.
- 4.2.1.2 During on-site storage, all valves with special cleaning and/or preparation, should be kept in original special packaging as shipped from Flowserve for protection from contamination.
- 4.2.1.3 Valves should be stored indoors, above ground and protected from harsh environments.
- 4.2.1.4 Always store valves in a clean dry location and away from dust, dirt, debris, corrosive materials and wet areas. Water must not be allowed to enter actuated pneumatic cylinder or electrical connections.
- 4.2.1.5 Keep the valves in a cool location and out of exposure to direct sunlight and excessive heat.
- 4.2.1.6 Ball and plug valves should be stored in the open position.
- 4.2.1.7 Actuated valves should be stored in a horizontal position.

### 4.2.2 Long Term Storage Instructions/Recommendation

- 4.2.2.1 In addition to short term instructions the following instructions are recommended where valve storage is intended for valves that are to be stored on site for periods exceeding six months.
- 4.2.2.2 Valves should be stored indoors, above ground and protected from harsh environments where temperature exceeds minimum of -20 degrees F or maximum of 180 degrees F to prevent seal compression set.

### 4.2.3 Recommended six-month maintenance for Long Term Storage

- 4.2.3.1 Visually inspect valve assembly ensuring valve original special packing as shipped from Flowserve is in its original condition.
- 4.2.3.2 Cycle manual valve three complete cycles.
- 4.2.3.3 Cycle automated valves using dry instrument air or dry Nitrogen.
- 4.2.3.4 Replace desiccants and reseal protective packaging.

### 4.2.4 Elastomers/Soft Goods

- 4.2.4.1 Per the manufacturers, "All mechanisms by which rubber deteriorates with time are attributed to environmental conditions. Therefore, storage conditions, not time, determine the life of rubber seals."
- 4.2.4.2 To preserve the physical properties of the components containing elastomers widely used in our valves, the following storage conditions must be adhered to:
  - Ambient temperatures not to exceed 120 degrees F.
  - Exclusion of all significant contaminants and foreign materials.
  - Exclusion of direct sunlight.
  - Exclusion of significant radiation.
  - Exclusion of significant ozone.

#### 4.2.5 Age control

- 4.2.5.1 It is recommended that users refer to the IOM for recommended adjustments to be performed prior to using shelf stored valves that fall within the short and long term conditions specified in this procedure.
- 4.2.5.2 Fasteners and packing nut torque checks are recommended to ensure fasteners and nuts remain per IOM published values prior to using stored valves.
- 4.2.5.3 For most commonly used elastomers used on Flowserve Cookeville Valves see Table below.

Description	Source	Projected shelf life
RUBBER	FLS	3 YRS
ETHYLENE PROPYLENE (EPDM)	FLS	6 YRS
VITON FLUORO-ELASTOMER	FLS	6 YRS
Butadiene Acrylonitrile (such as Buna N)	FLS	10 YRS
PFA	DuPont Co.	Unlimited
PTFE	DuPont Co.	Unlimited

Age Controls for different Elastomers

## 5 Installation

### 5.1 Inspection and preparation

#### 5.1.1 Material Selection

Selecting the proper fastener material is the ultimate responsibility of the customer because the supplier does not typically know in what service the valves will be used or what elements may be present in the environment. Flowserve normally supplies B7 (carbon steel) for ductile cast iron and carbon steel valves. For stainless steel and high alloy valves, B8 (stainless steel) fasteners are supplied as standard. All fasteners used must have a minimum yield strength of 40 000 PSI, a minimum elongation of 12% and be compatible with the process fluid. Determining compatibility to the process fluid goes beyond a material being resistant to general corrosion because the more important consideration is a material's resistance to stress corrosion cracking. Depending on the service, it may make sense to use B7 fasteners on high alloy valves. One such service would be marine environments because of stainless steel's susceptibility to stress corrosion cracking in chloride environments. Another key aspect of fasteners is frequent visual inspection. Because of the common practice of using steel fasteners rather than stainless steel to avoid chloride stress corrosion cracking, visual inspection is recommended to monitor the general corrosion of these fasteners. If jacketing or insulation is used on a valve, it must be periodically removed for visual inspection of the fasteners. If you wish assistance in determining the proper fasteners to use, please refer to the attached chart.

#### 5.1.2 Design & Type

The Flowserve valve design standards adopt ASME B18.2.1 (1996) as the standard for fastener type and design. This national standard requires that finished hex "head" cap screws be used when the head of the fastener is turned. A finished hex "head" cap screw and a heavy hex cap screw have a bearing surface under the head to minimize frictional resistance during tightening. They also comply to qualified body diameters and fully formed head dimensions. Cookeville Valve Operation policy is to use finished hex "head" and heavy hex "head" cap screws for all

pressure retaining fasteners. This includes top caps, packing adjusters, plug adjusters, bottom caps, body halves or other pressure retaining components. Compliance is made with NSI B18.2.2 (1987), Square and Hex Nuts, when studs and heavy hex nuts are required. Additional information on these items may be obtained from the Flowserve Corporation, Cookeville Valve Operation, Cookeville, Tennessee.

## 5.2 Installation

### 5.2.1 Flanged End Valves:

Installation of Flowserve flanged valves is best accomplished by locating valves in pipeline flanges, assuring all corrosion and foreign materials are removed from pipe flange, and then center gaskets with the valve flanges. Fastener or taper pins should be used to align holes and locate gaskets. Fasteners should be tightened to the corresponding valve and fastener size.

### 5.2.2 Weld End Valves:

Flowserve recommends using only qualified welding procedures and personal for weld installation of G4X valves. The following precautions should be observed:

1. The valve should be inspected prior to welding to assure that no foreign materials obstruct the flow passageway and that the weld preparation is free of corrosion and physical damage.
2. The valve should be in the open position while being welded. Open position is when the flats on the plug stem are parallel with the pipeline.
3. The valve body sleeve and diaphragm must not exceed maximum temperatures during welding. This includes preheats, interpasses, or post weld heat treatments, as applicable.
4. Welding of the G4X valve without disassembly may be accomplished with no damage to the sleeve and diaphragm. Precautions MUST be taken to cool the valve bowl and monitor temperature. The temperature of the center or bowl area of the valve must not exceed the listed temperature for the material. See Table 1.

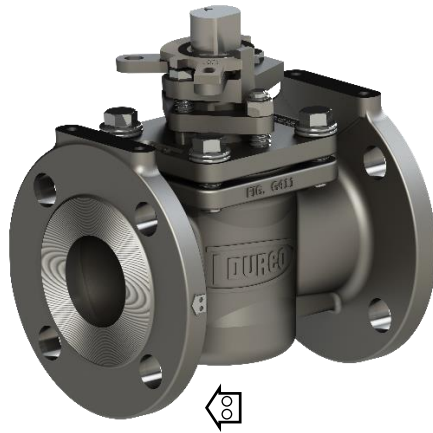
<b>TABLE 1 TEMPERATURE LIMITATIONS</b>	
<b>MATERIAL DESCRIPTION</b>	<b>MAXIMUM SERVICE TEMPERATURE</b>
Ultra High Molecular Weight Polyethylene (UMPE)	200°F (93°C)
Tetrafluoroethylene Polymer (PTFE)	400°F (204°C)
Durlon 2 (TFM)	450°F (232°C)
Duriron Durco 82 (DU-82)	275°F (135°C)

### 5.2.3 Flow Direction

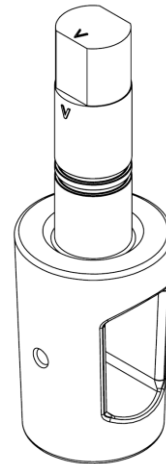
The G4X is vented to ensure integrity of valve cavity. The Plug is vented and is marked with a V on the top of the stem as well as the side of the stem.

Flow direction on the valve is indicated with an arrow on the end flange (if applicable).

Unless otherwise ordered, the vent will be arranged upstream when closed, opposite of indicated Flow direction on the valve.



Flow indicated by Arrow



Vent indicated by V  
(plug rotated 180 deg for illustration)

## 6 Commissioning

### 6.1 Prior to start-up

Check any auxiliary or accessory connections to ensure integrity of joint.

Check for full stroke by making the appropriate signal change or manual actuation.

Observe position indicator.

The position should rotate 90 degrees in a smooth, rotary fashion.

### 6.2 After short time operation

Check fasteners to ensure they are tight

Torque reading may be irregular due to use of thread locking compounds

## 7 Operation

### 7.1 Preparatory activities

(OPTIONAL: insert any additional preparatory activities required prior to start-up)

### 7.2 Start-up

(Describe step-by-step instructions for proper start-up the product/system. Include a checklist of actions to be completed prior to start-up of the product/system. Describe the necessary information related to the operational environment and awareness of the equipment during operation to promote proper operation. Detail the meaning of the different application signals for digital and automated products in this section.)

### 7.3 Normal operation

(List the product/system normal operating range, limits, and if applicable, any specific activities to properly operate the equipment.)

## 8 Maintenance

### 8.1 Schedule

**⚠ WARNING**

Do not attempt any maintenance of these valves while in operation or under pressure. Actuated valve air and/or electrical power supplies must be locked off and isolated prior to any maintenance work. To do otherwise may result in significant equipment damage, hazardous material discharge, or serious personal injury.

Table 3: Maintenance and service interval

No.	Service	Schedule / Cycles	Criteria	Action	
				Good	Inadequate
1	Visual inspection of valves	Yearly	If gasket leakage persists or if bolting is damaged	No action	Remove from service and replace body bolting immediately
2	Preventive change of the packing	Every 18months	Dependent upon result of the bi-weekly visual inspection on valve leakage	Minimum of once every 18 months	Immediately change of the packing
3	Preventive overhaul of the valve	Every 60 months	Dependent upon result of the bi-weekly visual inspection	Minimum of once every 60 months	

### 8.2 Adjustment

- 1. Top Cap** – Top Cap leakage can be eliminated by tightening the top cap bolts in a “criss-cross” pattern to the torque values provided in assembly tables. It is important that torque values fall within given range in order to maintain bolting integrity.
- 2. Stem** - Leakage due to wear of the packing can be eliminated by tightening the packing adjuster fasteners to the torque values provided in assembly tables.
- 3. Through line** – Through line or in line leakage can be eliminated by tightening the plug adjuster fasteners in ¼ turn increments. The fasteners must be tightened evenly for maximum adjustment. To prevent excessive operating torque, the valve should be cycled after each ¼ turn adjustment. If leakage persists after maximum adjustment is reached, the sleeve and diaphragm will require replacement.

### 8.3 Special tools

- Diaphragm guide
- Calibrated press
- Sleeve insertion tooling

### 8.4 Required replacement parts for maintenance

- Packing
- Diaphragms (metal and plastic)
- Thrust collar assembly
- Bolting
- O-rings

### 8.5 Disassembly

**⚠ WARNING**

**Do not attempt any maintenance of these valves while in operation or under pressure. Actuated valve air and/or electrical power supplies must be locked off and isolated prior to any maintenance work. To do otherwise may result in significant equipment damage, hazardous material discharge, or serious personal injury.**

Before disassembly, valves must be relieved of process fluid and pressure. In addition, personnel performing disassembly must be suitably protected and alert for emission of hazardous process fluid.

#### 8.5.1 Disassembly Instructions

**NOTICE** Refer to Figure 8.6 for parts identification. If an actuator or gearbox operates the valve, alignment marks should be noted to ensure correct orientation when re-assembled. This may best be accomplished by making matching marks on the plug stem and operator housing.

- 8.5.1.1 Remove wrench, stop collar, or gear/actuation.
- 8.5.1.2 Gradually loosen adjuster fasteners (Part 12A) – DO NOT REMOVE.
- 8.5.1.3 Rotate plug to allow trapped process fluid or material to vent. Plug should exhibit noticeable movement “up” when freed from sleeve compression.

**NOTICE** If there is no upward movement of the plug (Part 2), it will be necessary to devise a method of lifting the plug upward. This may require removal of the valve operator. This operation should be undertaken noting the above precautionary measures. Methods of plug removal must include protective measures on plug stem and plug end.

- 8.5.1.4 **⚠ WARNING** : Do not loosen or remove top cap fasteners when removing an operator. Remove the operator by unfastening it from the bracket.



- 8.5.1.5 Once the plug has lifted, the packing and plug adjuster fasteners can be completely removed.
- 8.5.1.6 Gradually loosen but do not remove the top cap fasteners. Rotate plug to completely free it from sleeve compression.
- 8.5.1.7 Remove top cap fasteners and top cap from the plug stem.
- 8.5.1.8 Remove plug assembly from body.
- 8.5.1.9 Remove packing gland, stem O-rings, thrust collar, packing wedge, and diaphragms from the plug stem.
- 8.5.1.10 Inspect sleeve for damage, especially near the top, bottom, and port areas. If wear is excessive, the sleeve should be replaced.
- 8.5.1.10.1 To remove the sleeve: Using a large screwdriver and mallet, cut the old sleeve through one of the port openings, top and bottom.
- 8.5.1.10.2 Grasp the sleeve with a pair of pliers while twisting and lift the sleeve from the body.
- 8.5.1.11 Thoroughly clean all valve parts and inspect parts for damage. Look for marred, scratched, or rough sealing surfaces on the valve plug (Part 2).

**NOTICE** Reinstallation of damaged or unclean parts will ruin any replacement seals installed into the valve.

### 8.6 Spare parts stocking recommendation

Recommended spare parts can be purchased as a kit, and are as follows:

- Packing
- Diaphragms (metal, plastic)
- O-rings
- Top Cap Gasket
- Sleeve
- Fasteners
- Thrust Collar
- Stop Collar Retainer

When ordering spare parts, the following information should be provided to Flowserve:

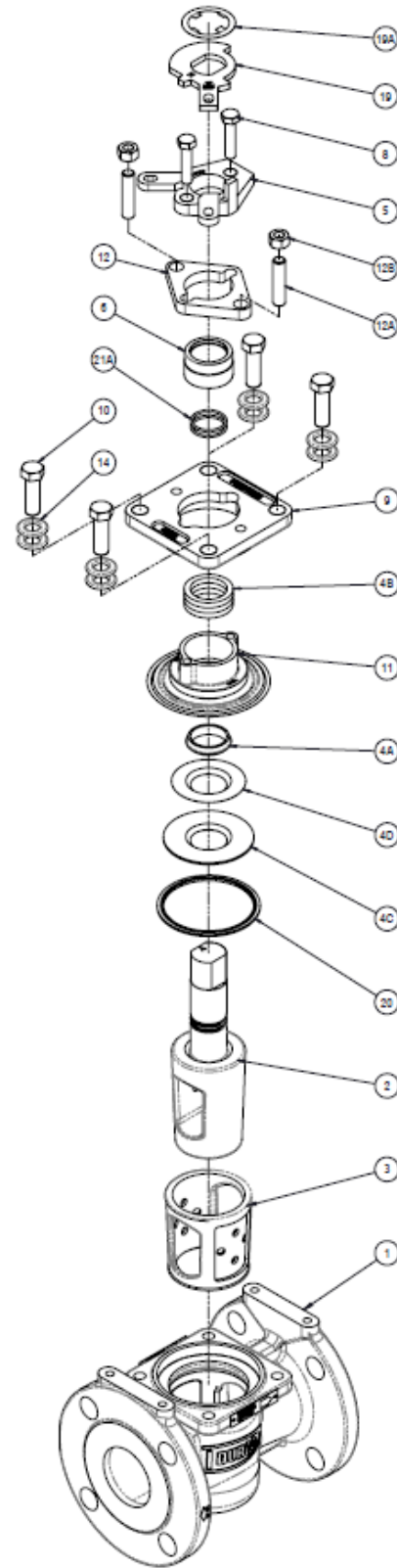
- a) Product smart code
- b) Number of the parts required

The product smart code is provided on nameplate.

To ensure continued satisfactory operation, replacement parts to the original design specification should be obtained from Flowserve. Any change to the original design specification (modification or use of non-standard part) will invalidate the product safety certification.

ITEM	DESCRIPTION
1	BODY
2	PLUG
3 *	SLEEVE
4A *	PACKING
4B *	PACKING
4C *	DIAPHRAGM
4D *	DIAPHRAGM - METAL
5	PACKING ADJUSTER
6	PACKING GLAND
8	PACKING ADJUSTER FASTENER
9	TOP CAP
10	TOP CAP FASTENER
11 *	THRUST COLLAR ASSEMBLY
12	PLUG ADJUSTER
12A	PLUG ADJUSTER FASTENER - STUD
12B	PLUG ADJUSTER FASTENER - HEX NUT
14	BELLEVILLE WASHER
19	STOP COLLAR - LOCKING
19A*	STOP COLLAR RETAINER
20 *	TOP CAP GASKET
21A *	O-RING

Spare parts denoted by \*



**Figure 8.6**

## 8.7 Reassembly: Plug Assembly

### Diaphragm Installation

1. Install PFA diaphragm with assistance of G4X diaphragm guide; install with reverse lip pointing down as shown in Figure 8.7.
2. For fire sealed valves, install an additional metal diaphragm. ID radius should follow PFA diaphragm downward.
3. Install stem seal over diaphragm(s).
4. Place thrust collar assembly on stem. The tapped holes on the thrust collar should align with plug ports.

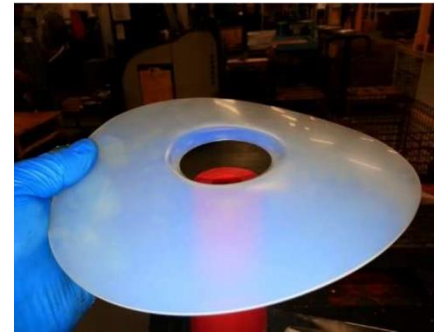


Figure 8.7

### Packing Installation

1. For fire sealed, seat graphite packing, one at a time, by applying force using a calibrated press with a packing ring pusher per the fire sealed packing load values specified in Table 8.7. Continue until all packing rings have been installed, alternating each split in packing ring 180 degrees from the previous.
2. Install stem O-rings prior to installing packing gland.
3. Place the packing gland over the plug stem and seat against packing.

**TABLE 8.7 FIRESEALED PACKING LOAD**

VALVE SIZE	0.5"/.75"	1"/1.5"	2"	3"	4"	6"	8N	8"	10N	10"	12N	12/14
LOAD ±5% (LBS)	1,300	1,900	3,800	6,400	7,900	11,000	11,500	11,500	17,000	17,000	17,000	17,000

## 8.8 Re-assembly: Sleeve Installation

1. Apply Durco seal 1028B to the inside of the tapered bore in the body and permit to dry before assembly. RAD-1 material is used for nuclear applications. Each coat should be allowed to dry completely. Durcoseal should be dry to the touch. NOTE: If a heat gun is used, the heat must be applied indirectly to prevent cracking.
2. Remove any Durcoseal that is within the radius behind the locking rib.
3. Prior to sleeve installation, all tooling for sleeve installation shall be wiped clean of visible particles, such as dirt, Durcoseal, etc. before each use. Verify that the surface finish is acceptable and that there are no nicks, positives, or scratches on the taper.
4. Mount the body in the assembly station.
5. Insert the coining die into the valve body counterbore.
6. Apply a thin coating of silicone or other approved lubricant to the inside taper of the coining die. Silicone is not required for installation of TFE sleeves.
7. For 1" and larger valves:
  - a. Align the sleeve in the coining die with the waterway, then rotate the coining die and sleeve clockwise to position the sleeve in the coining die so that the diagonal opposite sides of one side of the sleeve port will lock behind the metal lips in the body. (The other diagonal opposite sides will be locked in after insertion). See Figure 8.8.1.

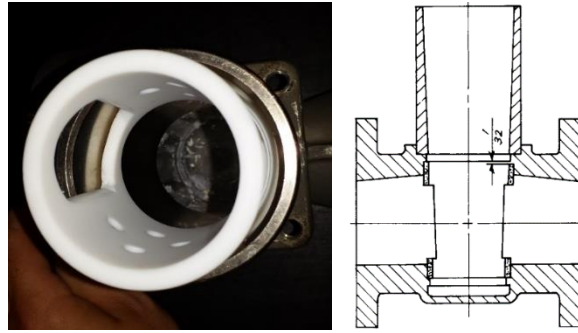


Figure 8.8.1

For 3" and larger valves, install sleeve "shoehorns" into the bowl/waterway in order to guide the sleeve past the lower part of the waterway opening without being damaged.

- b.** Push the sleeve using the plunger(s) until the sleeve drops below the top counterbore lip of the valve body. Control speed at end of travel to avoid sleeve going too far into bowl.
- c.** A special locking plug containing retractable or removable arms (see Figure 8.8.2) is lowered into the body with the arms retracted or removed. The arms are then extended or installed, and the plug is rotated counterclockwise until the opposite side port openings in the sleeve are locked behind the body ribs. In the 1", 1.5", and 2" sizes, a bar may be substituted for the locking plug.

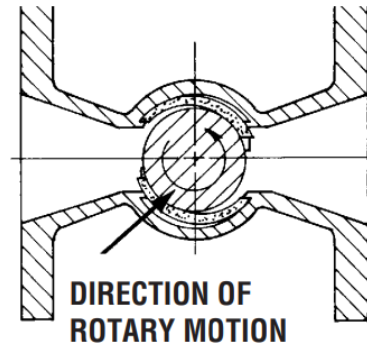


Figure 8.8.2

- d.** Rotate the locking plug back to center, and retract or remove the arms. Remove the locking plug, and inspect to ensure the sleeve is locked behind all 4 ribs. See Figure 8.8.3. Reinstall and lock again if required.

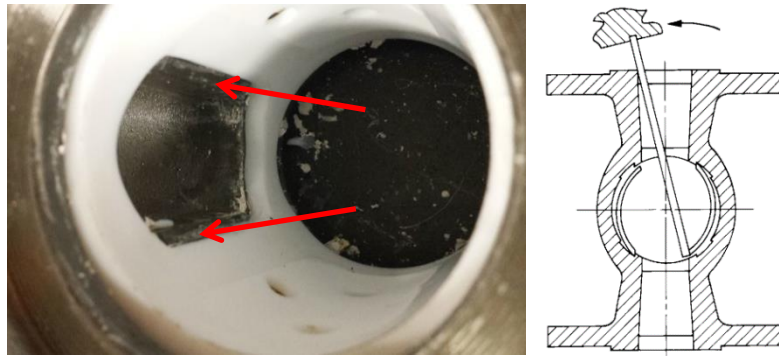


Figure 8.8.3

- e. Apply a thin film of silicone or other approved lubricant to the sizing plug. Push the sizing plug into the sleeve until it bottoms against the counterbore of the valve body. Allow the sizing plug to remain in position for one minute.
- 8. Remove sizing plug
- 9. Verify sleeve is locked in place behind all ribs. Trim any excess material which has sheared off or is over the ribs, taking care not to scratch the sleeve.

### 8.9 Re-assembly: Remaining Components

1. Place the top cap gasket in the valve body counterbore.
2. Apply a thin, even coat of silicone or other approved lubricant per on the entire surface of the plug taper.
3. Place the plug assembly into the bowl of the valve in the open position.
4. Place the top cap over the plug. Verify top cap and body alloys are both shown on the same side of the valve.
5. Using an arbor press, push down on the top cap until the plug port is 1/16 above to level with the sleeve port. (see Figure 8.5.1).
6. Hold the load on the valve, as relieving the force will allow metal diaphragm to radially ripple.
7. Insert each Top Cap Fastener into two oppositely positioned Belleville washers.
8. Apply a medium strength thread locker (Loctite 242 or equivalent) to the threads of the top cap bolts. The thread locker should cover the threads to a distance at least equal to the bolt diameter.
9. For HF valves or HF trim valves, studs and nuts should be used in the top cap. Verify alloy codes or markings on studs and nuts are seen from the top of the valve. High strength thread locker (Loctite 262 or equivalent) should be used on the threads.
10. FJG4X (full cast jacket) valves, studs and nuts will be used. Verify alloy codes or markings on studs and nuts are seen from the top of the valve. Medium strength thread locker (Loctite 242 or equivalent) should be used on the threads.
11. Tighten each Top Cap Fastener finger tight. Remove from arbor press.
12. Tighten the fasteners incrementally, from 50%, 80%, and then 100% of the values listed in Table 8.5. Bolts should be torqued in a criss-cross fashion to ensure even compression from the bolts.
13. Place plug adjuster over thrust collar. Insert plug adjuster studs into top cap.



Figure 8.5.1

14. Install nuts onto studs and torque to values listed in Table 8.5, while ensuring the adjuster is kept level with Thrust collar.
15. Place packing adjuster over stem and packing gland. Insert adjuster screws and tighten to finger tight.
16. Tighten packing adjuster fasteners to Table 8.5.
17. If required, install stop collar (or pointer) and retainer on plug stem.
18. Visually verify the four seal zones of the sleeve by looking for any extrusions.
19. If required, install gearbox with the plug set in the open position and the open position adjusting screw is locked. Careful attention is required to set the gearbox stop screw at 90° rotations for the closed position.

**Table 8.5: Torque requirements**

Valve Size	1"/1.5"	2"	3"	4"	6"
Top Cap (FT-LBS)	25	40	60	100	200
Plug Adjuster (FT-LBS)	8	10	23	45	110
Packing Adjuster (FT-LBS)	4	10	20	30	52

### 8.10 Post maintenance inspection

LEAK TESTING: Any time a valve has been modified in any manner, including fastener changes, it should be retested. Normal testing, using gas, should be at 150 PSI for Class 150 and 300 PSI for Class 300 valves from 1" through 6". It should be noted, however, that this test does not meet the requirements of ANSI, API or MSS. For test procedures complying with these specifications, refer to the appropriate published specification.

## 9 Troubleshooting Guide

Problems	Problem Descriptions	Possible Causes	Recommended actions
External Leakage	Leakage Through Top Cap gasket sealing	Body bolting loose	Tighten Top Cap bolting to recommended torque value.
		Body gasket not compressed as recommended	Tighten Top Cap bolting to recommended torque value.
		Damage in bonnet gasket	Valve repair will be required
	Leakage past Stem packing	Gland bolting loose	Tighten Packing Adjuster bolting to recommended torque value.
		Packing not compressed	Tighten Packing Adjuster bolting to recommended torque value.
		Packing damage	Check application design parameters against materials of construction

Problems	Problem Descriptions	Possible Causes	Recommended actions	
			Check for alignment of components, including side loading and extensions	
			Check for damage on stem, inside thrust collar, and inside Packing Gland	
			Remove stem packing from Thrust Collar and replace new stem packings. Refer disassembly / reassembly.	
	Leakage through Pipe Line connections	Flange gasket		Packing Adjuster has been overtightened and the packing is no longer functional. Valve Repair required.
				Tighten flange bolting using correct method
		Flange serrations		Check application design parameters against materials of construction
				Replace Flange Gasket
				Inspect Flange faces and have qualified facility re-machining the serrations.
	Leakage through welding connection	Welding not full penetration	Have a certified welder repair the connection.	
		Welding porosity	Have a certified welder repair the connection.	
Internal Leakage Past Plug	Large Leakage with Smooth Operation	Plug is not sealing against Sleeve	Use Plug Adjusters to improve sleeve to plug contact	
		Plug may not be in fully closed position	Check the orientation of the plug stem and ensure the flats on the stem are perpendicular to the pipeline	
		Sleeve is potentially scratched or damaged.	Valve will likely require repair	
	Large Leakage with Rough Operation	Plug and sleeve potentially have build-up or debris creating rough surfaces.	Valve needs repair and will likely continue to increase in leakage	
High Torque	Smooth Operation with significant Torque	Packing Adjustment may be overtightened	Reducing force on packing is not advised as this may cause an external leak. Valve should be repaired.	

Problems	Problem Descriptions	Possible Causes	Recommended actions
	Valve not operated for long time and Valve will not operate with standard torque	Plug Adjustment may be overtightened	A small Reduction of force on plug adjuster may be made to see if operation force is reduced; however, this may cause internal through leakage.
		Plastic components creep and create a set torque.	Additional force may be required for initial operation. This is accounted for in Valve Sizing Torques. If the value is above expected parameters, build up may exist
		Process media build up on components	Operation of valve may scratch components. If high torque exists after initial operation, build up may be causing further damage to the valve
		Galling may exist	Valve should be repaired immediately, as if galling causes the valve to seize, it is difficult to repair.  Additionally, care should be taken to try and identify source of galling. Potential actuation misalignment, side loading, foreign debris, water hammer, or other factors may need to be addressed before replacement.

## 10 Returns and Disposal

### 10.1 Returns

The product/system shall be emptied, cleaned, and preserved before returning the equipment to the manufacturer. The manufacturer will only open the returned equipment if the contamination declaration is present.

### 10.2 Disposal and recycling

At the end of the equipment service life, the relevant materials and parts should be recycled or disposed of using local environmental regulation methods. If the product contains substances which are harmful to the environment, then the removal or disposal of the equipment must be in



accordance with local/regional regulations. This includes any liquid and/or gas in the “seal system” or utility.



Refer to Safety Data Sheets and make sure that hazardous substances or toxic fluids are disposed of safely and that the correct personal protective equipment is used. All activities involving hazardous substances or toxic fluids must be in compliance with published safety standards.

## Annex A: Declaration of Conformity

If the product/system is being sold into a country which requires a Declaration of Conformity (DoC), an example of each DoC for the subject product/system must be included in this Annex.

(For additional information on regulatory compliance refer to CORP-ENG-0004.)

Below is an example of Declaration of Conformity for the product/system.



### EU declaration of conformity

SIHI® Pumps



**The manufacturer:** - Original -  
Sterling SIHI GmbH  
Lindenstraße 170  
D-25524 Itzehoe

**declares herewith that the product**

Pump: Boost CAXXXX X XX

Serial number: XX-XXXXXX-XXX

**fulfils all relevant provisions of the Directive machinery 2006/42/EC.**

**Furthermore the aforementioned product complies with the provisions of the EC directives:**

- Electromagnetic compatibility 2014/30/EU

**Harmonised standards used:**  
EN 1012-2  
EN ISO 12100

**Other technical standards and specifications used:**  
EN 61800-3

**Person authorised to compile the technical file:**  
Sönke Siebels  
Sterling SIHI GmbH  
Lindenstraße 170  
D-25524 Itzehoe

**Place, date:**  
Itzehoe, 10.11.2016

**Person empowered to draw up this declaration:**



**Flowserve factory contacts:**

Flowserve, Cookeville Valve Operations  
1978 Foreman Drive  
Cookeville, TN 38501  
1-931-432-4021  
www.flowserve.com

**FLOWSERVE REGIONAL SALES OFFICES:**

**United States**

Flowserve  
1978 Foreman Drive  
Cookeville, TN 38501  
USA  
Phone: 1 931 432-4021

**Germany**

Flowserve (Ahaus) GmbH  
Von Braun Strasse 19 a D-48683  
Ahaus Germany  
Phone: +49 2561 686-0

**India**

Flowserve India Controls Pvt. Ltd.  
B-8, MMDA Industrial Area,  
Maraimalai Nagar, Tamil Nadu  
India 603 0209  
Phone: +91 44 27452323

**Singapore**

Flowserve Pte. Ltd.  
12 Tuas Avenue 20  
Republic of Singapore 638824  
Singapore  
Phone: + 65 6879 8900

**Local Flowserve representative:**

*(Insert local Flowserve representative information in the text box)  
Delete text in the box if not needed*

To find your local Flowserve representative use the Sales Support Locator System found at [www.flowserve.com](http://www.flowserve.com)

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