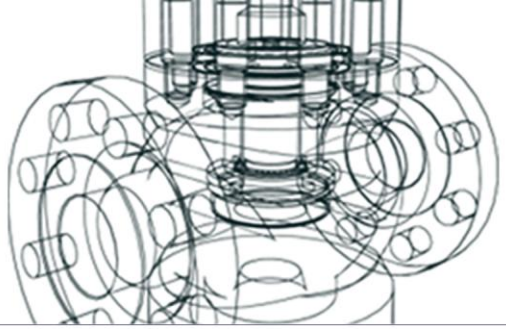


SEVERN

Severn Glocon is now part of Valmet

Installation, Operation, and Maintenance Instructions for 4000 Series Cryogenic Control Valves

TYPICAL UN-BALANCED VALVE – PARTS

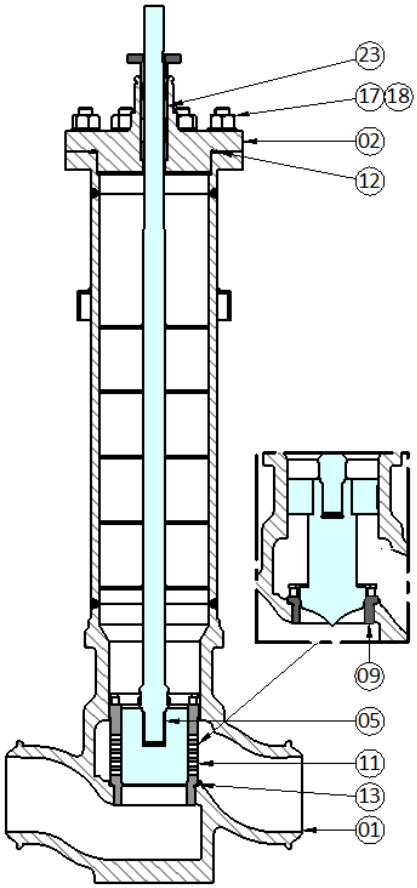


Figure 1: Severn 4000 Series Control Valve – (Unbalanced) Cut section view.

Table 1:

Item No	Description
01	Body
02	Bonnet
05	Plug
09	Metal Seat*
11	Integral Seat/Cage**
12	Body Gasket
13	Seat Gasket
17	Stud
18	Nut
23	Stuffing Box Components***

Note:
* For Contoured/Micro spline Trim
** For Caged Trim
*** Refer Figure 3

INFORMATION

The purpose of this manual is to guide the process of unpacking, installation and maintenance of 4000 series Severn control valves. It is highly recommended that the users and personnel responsible for maintenance. Read the manual before proceeding to install, operate, or perform any procedures on the valve. Ensure instructions as per the manual are followed to avoid mishaps and injuries. For further information, the User shall refer to 'BS6683' – Guide to installation and use of valves.

General Inspection of Parts

Stuffing Box Components (ITEM 23) – Not re-useable,

STEM GAITERS - Examine for general condition and renew if necessary.

Advanced maintenance items are:
Items 12,13,15 & 23 for both balanced & Unbalanced valves.

Advanced Inspection – (to be carried out by trained personnel only)

GASKETS (Body & Seat Gasket, Body & Bonnet Gasket) - Not re-useable.

BALANCE SEAL (Cage) - Not re-useable

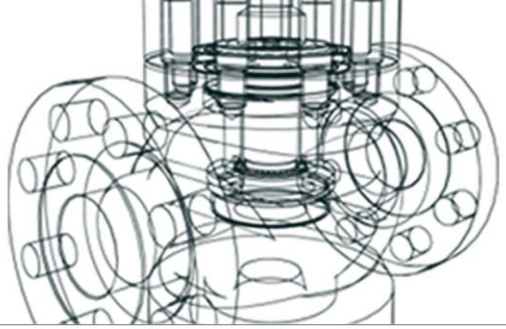
BALANCE SEAL (Plug) - Not re-useable, To Replace entire plug assembly for balanced plug.

UNBALANCED PLUG / SEAT – If damaged contact Severn for advice on repair or whether replacement is needed.

INTEGRAL SEAT/CAGE - Examine for general condition and renew if necessary.

INTENDED USE

Reference is to be made to the Control Valve Specification Sheet, Installation and Operation Instructions, and nameplate to check the product is suitable for the intended use/application.



SEVERN

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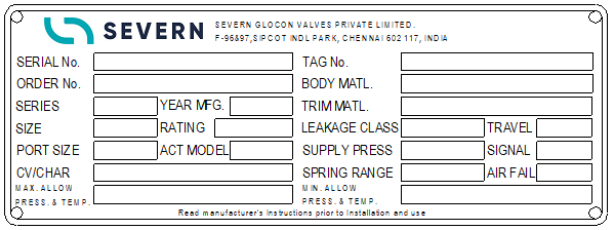
Installation, Operation, and Maintenance Instructions for 4000 Series Cryogenic Control Valves



A sample nameplate is shown above, showing maximum and minimum pressure/temperature. Notified body number is applicable for PED only.

TYPICAL BALANCED VALVE – PARTS

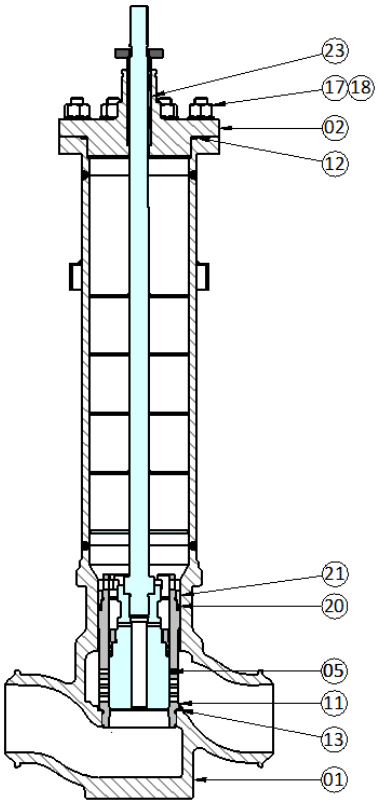


Figure 2: Severn 4000 Series Control Valve – (Balanced) Cut section view.

Table 2:

Item No	Description
01	Body
02	Bonnet
05	Plug*
11	Integral Seat/Cage
12	Body Gasket
13	Seat Gasket
17	Stud
18	Nut
20	Balance Seal
21	Cage Seal Retainer
23	Stuffing Box Components**

Note: * Includes (item 20) as integral part.
** Refer Figure 3

Warning: Standard industry safety practices are to be strictly followed.

Always wear appropriate PPE and ensure that the local lifting plan is followed

Always ensure a safe working environment when lifting

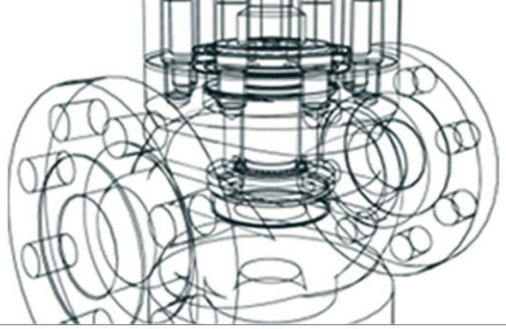
Always isolate the valve before maintenance. Always use lockout methods to ensure safety.

Caution: The valve may be extremely hot or cold. Caution: Do not put your hands inside the valve

Always use the correct tools. Do not over-tighten. Do not use extension bars to force movement.

Poison risk: Do not incinerate PTFE. Do not smoke whilst handling PTFE.

Always read the manual. If any doubts exist, contact Severn quoting the valve serial number.



Installation, Operation, and Maintenance Instructions for 4000 Series Cryogenic Control Valves

WARNING: When ordered, the control valve configuration and materials of construction are selected to meet particular pressure, temperature, pressure drop, and controlled fluid conditions. Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if the control valve or its ancillaries are over-pressured or installed where service conditions exceed the valve design limits. To avoid such injury or damage, provide a relief valve for overpressure protection as required by accepted industry or local codes and good engineering practice. Do not apply other conditions to the valve without written approval from Severn.

WARNING: Before performing any maintenance operation: Isolate the control valve from process pressure. Relieve process pressure from both sides of the control valve. Drain the process media from both sides of the valve. If the control valve is to be removed from the line decontaminate any process fluid remaining in the valve to make it safe.

Disconnect and isolate any operating lines providing air pressure, electric power, or a control signal to the actuator. Vent the air pressure from the actuator. Be sure that the actuator cannot suddenly open or close the valve (Note by disconnecting the air and or power lines the actuator will move the valve to its power failure position). Ensure persons are at a suitable distance from moving parts.

Use lock-out procedures to be certain that the above measures stay in effect whilst work is carried out on the control valve.

MACHINERY DIRECTIVE 2006/42/EC INCORPORATED INTO A MACHINE

Severn valves must not be put into service until the machinery into which they are to be incorporated has been declared in conformity with the provisions of the Machinery Directive. Severn valves must not be used as Safety Components (Emergency Shutdown Valves) within the meaning of the Machinery Directive without prior notification to Severn.

ATEX DIRECTIVE 2014/34/EU

Under the ATEX Directive, a risk assessment is necessary by the end user to justify the basis of safety.

PRESSURE EQUIPMENT DIRECTIVE PED 2014/68/EU

It is a requirement of the PED that both the maximum and minimum working pressures and temperatures of the valve are recorded on the nameplate. Refer to the actual nameplate attached to the valve and the Severn Valve Specification Sheet (CVSS) issued with the valve to check the valve is suitable for its intended use.

Attention must be paid to the combined pressure and temperature characteristics of the appropriate valve material group as stated in ASME B16.34, API 6A, or relevant international standards.

Reference is to be made to the Control Valve Specification Sheet, Installation and Operation Instructions, and nameplate to confirm product suitability for the application.

BALANCED TRIM VALVES (see HSE safety notice 11/2005 Potential catastrophic failure of pressure balanced cage guided control valves and chokes)

Balanced trim valves are dependent upon the pressure balance ports within the valve. It is essential that there is no possibility of these ports becoming blocked. (See HSE notice available from the HSE website).

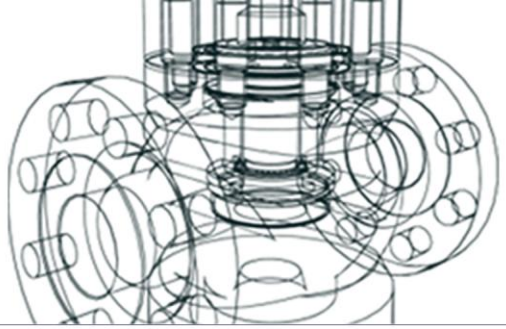
The user must be aware that for valves having a pressure-balanced design, the operating media must not be capable of blocking the pressure balance ports or be capable of producing scale on metallic components that would eventually block the pressure balance ports. Also, during the installation and any line cleaning, these ports must not become blocked. If in doubt remove the valve trim before cleaning.

If any doubts exist, contact Severn quoting the valve serial number.

SCOPE OF THIS MANUAL - INSTALLATION – GENERAL

This manual includes installation, operating, and maintenance information for Globe and Angle body valves. Please refer to separate manuals for instructions covering the actuator, positioner, and any accessories. Where the valve is operated by electric, hydraulic, or electro-hydraulic actuation, follow the IOM instructions provided with the actuator.

Only persons qualified through training and or experience should install, operate, and maintain this product. In case



of questions about these instructions or the valves please contact the nearest Severn office before proceeding.

Instructions in the following paragraphs describe the installation procedures for the control valve. Instructions not included are to be performed in accordance with standard industry-acceptable practices as may be required by local codes, specifications, and or regulations.

Users should refer to BS 6683 “Guide to installation and use of valves”.

SPARE PARTS

It is highly recommended that original parts from the manufacturer be used for servicing Severn valves.

UNPACKING

The valve may contain some important accessories and delicate components such as pressure gauges.

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts.

INSTALLATION

Note: Prior to installation ensure the available valve about to be installed is the one allotted for the respective application.
Warning: Ensure the air supply pressure does not exceed the maximum permissible design pressure of the actuator indicated on the respective Nameplate.

1. The first step in installing the control valve is to ensure the valve is free from any foreign matter, welding chips, dirt, etc. Since 4000 series valves are installed in cold box insulation of these valves is its first priority.
2. Ensure installation is preferably always done in a vertical position which enables relatively easy maintenance. When it comes to cryogenic applications the vertical positioning of the valve is of high importance but the installation of valves in a cold box requires an inclined position so isolation of packing from process fluid needs to be ensured.
3. The weight of valves and Accessories orientation are to be considered while installing in the pipeline along the inclined position. For such cases support structures are to be provided in cold boxes.
4. Flow direction is to be indicated properly using tag plates and proper care is to be taken while fixing it.
5. Excess caution is to be taken during welding the valve to the pipe to ensure no heat is built up in the valve.
6. Ensure the pipeline that the valve is welded to is free from stress due to misalignment.
7. Ensure leak-free connections. If a positioner is present in the valve set-up, ensure an air filter regulator is fitted onto the set-up when the pressure exceeds 7 bar this is to ensure the safety of the valve set-up.
Warning: Failure to position the half-ring can be a source of serious mishaps.
8. The air filter regulator must always point down for performance, safety, and efficiency purposes.

STORAGE

Unless specified by the contract, the valve will be packed for indoor storage at the job site.

For Short-term storage, the valve should be installed in a fire-resistant weather-tight, and well-ventilated building. The valve should be kept at a temperature of -20F (-28deg.C) to +120F (48deg.C). The area should be constructed and suited so that it will not be subjected to flooding, the floor should be level, firm, protected, and well-drained. Valves should be on the pallets or shouting to permit air circulation.

HANDLING

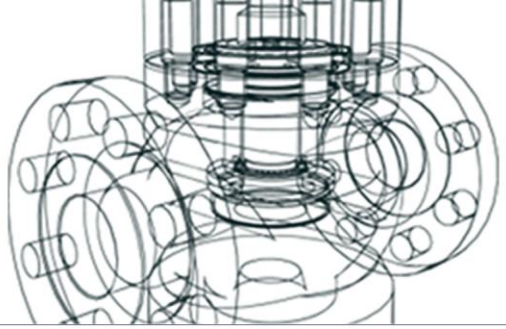
Applicable codes regulations and industry practices must be followed when handling or lifting valves. Care should be exercised to protect instrumentation and ancillary equipment. Severn lifting guidelines are available on request.

FLUSHING

The Control valve will have been cleaned at the factory and sealed for dispatch with protective covers.
However, before installing the control valves inspect
The control valve body cavity to ensure it is free of foreign matter, dirt, grit, etc.
When the valve is to be installed in a system suspected to be contaminated the system should be flushed to prevent damage to control valve trim and soft parts. It is recommended this be done before installation of the valve or if not possible, special flushing trims should be purchased from Severn.

QUICK-CHECK

1. Subject the valve to the full Stroke length and ensure the pointer in the valve indicates the correct stroke length



in the travel indicator plate. The plug should have a smooth linear motion.
Note: If graphite packing, the plug might provide a jerky movement due to friction ensure to lubricate the packing is for smooth movement (lubricant must be compatible with Oxygen service if O2 valves are applied)
2. Ensure appropriate working of the positioner by subjecting the valve set up to various positioner ranges like (4-20 mA).
3. Ensure leak-free connections. Ensure proper tightening of the bolts and all-important connections.
Caution: Over-tightening of packing causes excess wear and high stem friction that may cause damage to the plug.
4. Ensure the valve closes/opens in the correct direction according to the actuator and the flow direction.
5. Retightening of the flange ends is done to make sure the bonnet gaskets do not leak.
6. Ensure the actuator fail position is attained as required.
7. Ensure bonnet extensions for cold service applications are not insulated.

VALVE MAINTENANCE

Control valve parts are subject to normal wear and tear and must be inspected and replaced as necessary. Inspection and maintenance frequency depends upon the severity and importance of the service. This section covers instructions for gland packing maintenance only. This can be carried out with the control valve in the line.

Whenever a valve is disassembled, it is mandatory that all consumable parts are replaced before re-assembly.

Consumable parts are considered as all soft parts with the addition of the metal seal if used in place of a body gasket. Severn takes great care in its selection and quality control in meeting all manufacturing requirements (heat treatment, dimensional tolerances, etc.). Use only genuine replacement parts supplied by Severn.

RECOMMENDED SPARE

Table 3: Spare parts for Valve

Sl.no	Description	Quantity
1	Body Gasket	1
2	Seat Gasket	1
3	Upper stem Guide	1
4	Gland Packing	1
5	Gland Follower	1
6	Packing Spacer	1

Note: *if the valve is balanced

OXYGEN SERVICE LUBRICANTS

Since 4000 Series valves are Cold Box/oxygen service valves the lubricants used need to be oxygen compatible. The lubricants are verified and approved by the purchaser and end-user prior to valve installation and use. Failure to use these oxygen service lubricants may cause fire, injury, and death.

The list of oxygen-compatible lubricants is as follows:

1. KLUEBERALFA YV 93-1202
2. HALOCARBON 25-10M
3. TURMOXYGEN LOC 36
4. GLEITMO 599
5. FLUOROLUBE GR-554
6. KRYTOX NRT 8908

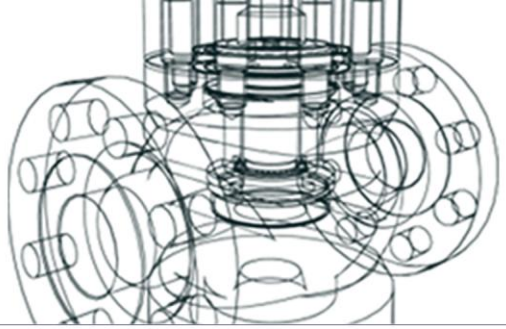
COLD BOX INSTALLATION PROCEDURE:

Prior to installation in the cold box, the valve needs to be disassembled. Looking for any physical damage. The following steps are to be carried out.
1. Remove the body bolt and washer
2. The Actuator and its extension are supported while removed from the body.
3. The exposed internals are covered to avoid contamination; this can be done with the help of covering with end caps or with plastic wrap.
4. After the valve is welded with the pipeline reassemble the actuator and its extension with the valve.
5. While reassembling the valve with the actuator use a new body gasket.
6. The appropriate torque needs to be applied to the body nut as per Table 4.
7. Check the operation of the valve, and inspect for leakage at all ends
8. After the valve is installed in the pipeline the valve is kept at a fully open position to clean the system to flush out the remove the debris.

VALVE DISASSEMBLY

Warning: Ensure the entire setup is depressurized and the respective process fluids are drained out, Temperature comes to atmospheric before the disassembly of the valve to avoid serious injuries and mishaps.

1. Remove all the body-bonnet nuts and washers. Ensure no damage is caused to the sealing region on the valve



body or bonnet. The bonnet is removed from the valve assembly along with the plug intact onto it. The bonnet may comprise of stem guide, packing spacer, packing & and gland follower. The plug lock nut is tightened to ensure the plug is intact to the bonnet.
2. Remove the plug (unbalanced), Integral seat/cage, and seat following seat gasket using special tools.
3. Special tools are used since the seat and integral seat/cage are threaded into the body.
4. The special tools are available in the table 7 & 8**.**
5. In the case of a balanced integral seat/cage care should be taken because the provision of lesser wall thickness, and hand torque is recommended.
6. Ensure the seating face of the seat and the plugs are free from damage.
Note: Apply small amounts of air to remove the plug from the bonnet. Ensure the plug doesn't rotate within the bonnet to avoid scoring and galling.
7. Both the seat and plug are machined if re-machining is required by either part. Concentricity of the plug and seat to be ensured during machining. The seat angle on the plug is approximately 32 degrees.
Caution: Ensure proper measures are taken to protect the plug stem during machining.
8. The gland follower, packing, packing spacer, and guides are removed from the bonnet and the packing is replaced if required.
9. The body gasket and seat gasket are carefully replaced to ensure no leakage occurs in the set-up.

VALVE REASSEMBLY

In case of graphite packing and gaskets replace them to ensure the integrity and performance of the packing in the valve.

1. The first and foremost step would be to clean all parts and fully degrease where required. Lubricate the valve body studs bolts, nuts, washers, and the surface on the bonnet where the bolts and nuts are placed.
2. Place the seat gasket on the valve body respectively position the seat. If there is any difficulty in placing the seat gasket in the body seat area, it is recommended to stick the gasket in the seat / integral cage and place it in the seat area.
3. Locate the plug on the assembly with care ensuring neither galling nor scoring occurs.
4. Place the bonnet onto the body ensuring extreme care is taken while retracting the bonnet onto its position.
5. Place the guides, spacers, packing& and gland follower onto the bonnet-plug set-up.
6. Fit the body washers and body nuts and finger-tighten down all the bolts evenly around the bonnet flange.
7. Ensure concentricity, free movement of the plug, and orientation of the alignments before final tightening.
8. Fully tighten the body nuts alternately using a cross-circular pattern with a 25 ft/lb torque wrench. Follow the required steps until the correct bolt torque loading is reached. Refer to torque values in Table 4.
Note: Ensure free up and down movement of the plug and proper seating of the plug onto the seat.

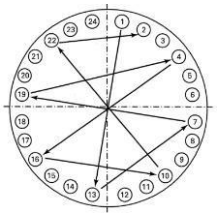
BODY TO BONNET BOLT TORQUE SETTING STANDARD BOLTING

[S]Aust. Stainless Bolting (Torque to induce 28.2 ksi)

Table 4: Body Bonnet Bolt Torque details

Stud size & TPI	Austenitic Stainless Steel (torque to induce 28200 psi)	
Inches	Nut Torque	
	ft/lb	NM
3/8-16	11	15
1/2-13	28	39
5/8-11	56	76
3/4-10	94	128
7/8-9	150	204
1 -8	230	312
1 1/8-8	334	452

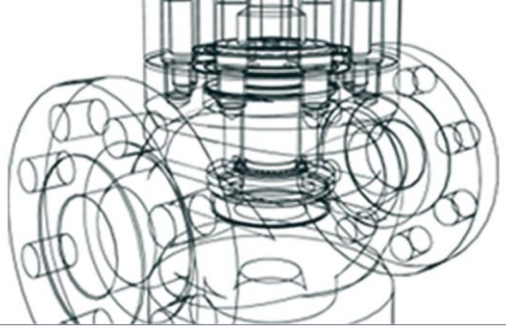
Note: For bolting sizes, thread types and/or materials not listed seek advice



24-bolt example of tightening sequence as per ASME PCC-1- 2010, Appendix F

GLAND PACKING MAINTENANCE (this section is not applicable to PTFE FE type, which does not require tightening)

A minor leak in the gland packing (item 18) may be stopped by adjustment of the gland nuts (item 21). Gland bolting may be adjusted by loosening lock nuts (if fitted) and tightening each primary nut evenly until the packing is firm. Take care not to overtighten as this may provide



excess friction and could reduce valve performance. Where locking nuts are provided these may now be re-fitted.

Take care to lock the primary nuts correctly without affecting any prior packing adjustment that may have been made.

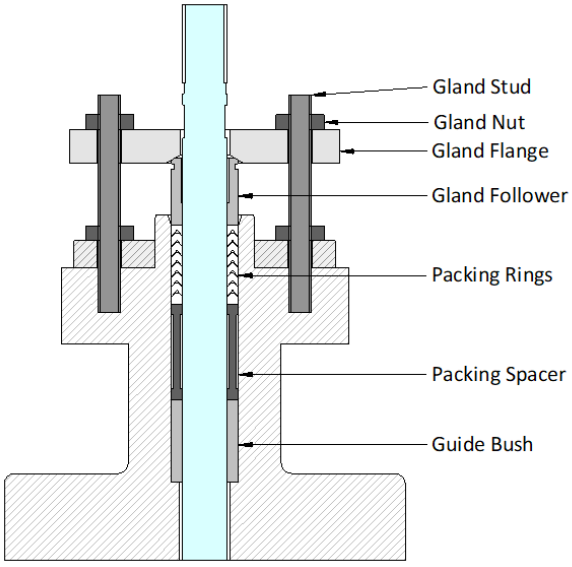


Figure 3: Stuffing Box & Gland Flange Components

Table 5: Gland Packing Torque Values

Gland Bolt Size	Recommended Packing Torque PTFE type*			
	Min. Torque		Max. Torque	
	lbf/in	Nm	lbf/in	NM
6 mm	15	1.7	23	2.6
10 mm	29	3.3	43	4.9
16 mm	80	9.1	120	13.5
3/4 UNC	80	9.1	120	13.5

Table 6: Gland Packing Torque Values:

Gland Bolt Size	Recommended Packing Torque Graphite			
	Min. Torque		Max. Torque	
	lbf/in	Nm	lbf/in	NM
6 mm	32	3.6	40	4.5
10 mm	60	6.8	90	10.2
16 mm	145	16.4	216	24.5
3/4 UNC	145	16.4	216	24.5

If the gland packing is relatively new and tight on the valve stem and tightening the gland bolt nuts does not stop the leakage, the valve stem or the bonnet housing may be worn or scratched. Replacement packing should be considered with an examination of the valve plug stem and bonnet bore.

Packing box maintenance may be performed as a part of major disassembly and repair or as a separate routine with the valve installed in the process line. In either case, the following steps should be closely adhered to, otherwise, serious injury or equipment damage could result.

REMOVING THE GLAND PACKING AND STEM GUIDES

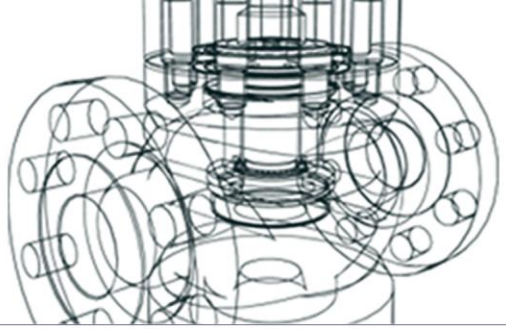
Ensure the valve is not pressurized. Remove the gland flange. A groove is machined on the outside of the gland follower to allow a screwdriver to be used to prise the gland follower loose. Remove gland packing. If the bonnet is not removed from the valve, a packing extractor tool may be required to dig out the packing.

Note: If the new packing rings are solid endless rings (i.e.: TFE V-ring, Grafoil, etc.), the actuator stem coupling will have to be disconnected. Refer to the actuator instructions for details of coupling removal. If the coupling is to be removed, the packing box flange and follower can be removed completely.

Moving the plug up and down may also loosen the packing rings. If a packing extractor tool is used take great care not to damage any surfaces on the valve plug or the valve bonnet bore.

Clean the gland packing bonnet bore and other metal parts. Scratches and burrs that could cause gland leakage or damage to new parts must be removed by light emery cloth or if this does not remove the defect replace the damaged parts. Inspect the parts for wear or any other damage that would prevent proper operation should these parts be reused. Gland packing and sealing gaskets should always be replaced with new, genuine Severn spare parts.

Pending their condition, it is recommended that stem gaiters are also replaced at the same time as packings, as both require access to the stem area. These are an optional spare.



Installation, Operation, and Maintenance Instructions for 4000 Series Cryogenic Control Valves

STANDARD GLAND PACKING MATERIALS ASSEMBLY

Use the correct cross-section of gland packing or die-formed gland packing rings to fit the assembly. Install one ring of gland packing at a time. Make sure it is clean and has not picked up any dirt in handling. Seat each gland packing ring firmly (except PTFE filament and graphite yarn packing, which should be snugged up very gently, then tightened gradually after operating the valve a few full strokes).

Joints of successive rings should be staggered and kept at least 90 degrees apart. Each ring should be seated with a tamping tool or suitable split bushing to the gland stuffing box. After the last gland packing ring is installed, tighten the gland bolts finger tight.

Do not jam the packing into place by excessive gland bolt loading. Operate the valve several times to set the packing. Re-tighten the gland a little after each full cycle until no noticeable drop-off in bolt torque is noted. Ensure that the gland flange is central and at 90 degrees to the valve plug stem. Re-fit locking nuts/half nuts if provided.

For Graphite yarn gland packing, tighten the gland flange nuts alternately in small equal increments until an initial compression of the gland height of 30% is reached. For a 6 ring 0.15-inch uncompressed square packing set this would equal 6 x 0.15” x 0.3 = 0.27 inch

Stroke the valve 3 to 5 full cycles and retighten as above. Ensure that the gland flange is central and at 90 degrees the valve plug stem. Re-fit locking nuts/half nuts if provided.

Graphite Low Emission FE, 7-ring Gland Packing Set

Install the gland packing set one ring at a time.
A braided ring is fitted first followed by the shaped rings. Fit these rings in the correct direction with the top braided ring last. Compress the gland packing set to a distance of 1 packing cross-section. Check the torque on the gland nuts to establish a reference torque. Actuate the valve plug stem in 3 or 4 full strokes. Check the gland nut torque and restore it to the original reference value. Repeat the full stoke and re-torque steps above at least 5 times until no significant amount of stud nut torque decay is noted after valve stem actuation. Ensure that the gland flange is central and at 90 degrees to the valve plug stem. Re-fit locking nuts/half nuts if provided.

PTFE BASED LOW EMISSION FE GLAND PACKING SET

Install the packing set by fitting the lip seal carefully first and then installing the chevrons carefully afterward. Note that the top of the lip seal section should be proud of the top of the bore when fitting the chevrons to avoid air entrapment between the lip seal and chevron sets.

No gland follower force needs to be applied to this packing other than to ensure the gland follower is fitted correctly and is holding the packing in its proper position within the packing box bore. Once fitted the locking nut/half nut should be used to lock the primary nut in position.

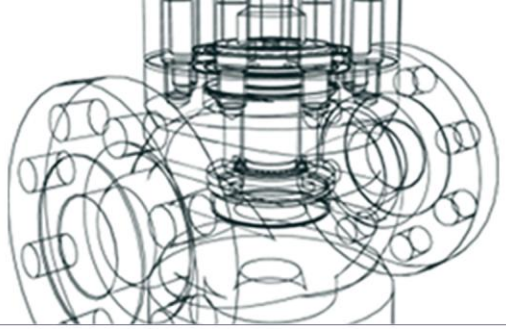
Note: This information should be used as a guide only as each manufacturer of gland packing has its own specific installation instructions that should be followed. For other gland packing types see individual specialized packing instructions.

ENVIRONMENTAL LEGISLATION & IPPC DIRECTIVE 2008/1/EC

All companies have an impact on the environment and as such are morally and legally responsible for managing these effects. Environment legislation has been developed over the years to ensure that any impact stays within acceptable limits this legislation tends to be complex and constantly changing.

The European Union defines the obligations with which highly polluting industrial and agricultural activities must comply. There are now a number of EU Directives of direct relevance. The Integrated Pollution Prevention and Control (IPPC) Directive 2008/1/EC establishes a procedure for authorizing these activities and sets minimum requirements to be included in all permits, it requires the Best Available Techniques (BAT) for minimizing pollution for various industries. Be also aware of the European Pollutant Emission Register (EPER) under the umbrella of the IPPC Directive which may also impact the operation of the product.

Control valves permanently installed by professionals in large-scale stationary industrial machines or systems consisting of a combination of equipment/or components, each of which is manufactured to be used in industry only, are explicitly excluded from the scope (Article 2) of the Directive.



2012/19/EU (WEEE). They are consequently also excluded from the scope (Article 2) of Directive 2011/65/EU (RoHS).

WARNING: Health & Safety at Work Act
Gland packing and/or internal seals made of or containing PTFE (Polytetrafluoroethylene) should not be incinerated. Do not smoke whilst handling PTFE.

DISPOSAL

Unless otherwise stated in the Installation and Maintenance Instructions, this product is recyclable, and no ecological hazard is anticipated with its disposal providing due care is taken.

RETURNING PRODUCTS

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

Note: This manual is to be read in conjunction with Severn's "Supplementary Installation, Erection, Maintenance, and Operating Procedures" document number DS610, specific conditions of use (SCofU) any other related O&M instructions relating to any accessories fitted to the Valve.

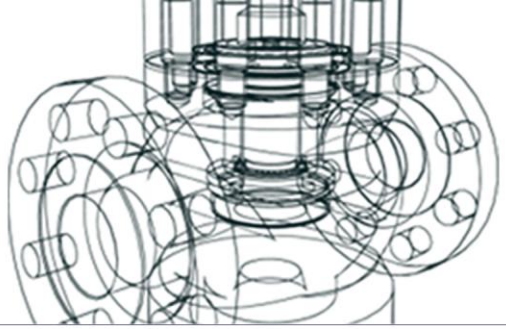
If any other maintenance work is required, please contact an approved service center for a quotation.

Disclaimer: Neither Severn nor any of its affiliated entities assumes responsibility for the selection, use, or maintenance of any product.
Responsibility for the proper selection, use, and maintenance of any product remains solely with the purchaser and the end user.

The content of this publication is presented for information purposes only, and while every effort has been made to ensure accuracy, they are not to be construed as warranties or guarantees, express or implied, regarding the products or services described herein on their use or applicability. We reserve the right to modify or improve the designs or specifications of such products at any time without notice.

Table 7: Seat Tools Combination

3: Seat Tool Combination: Valve Size	Seat bore	Seat part code	Seat holding tool	Seat tightening tool	Tool Stem
1"	0.381	2F090001	2F330006/02	2F330001/01	2F330009/02
	0.625	2F090002	2F330006/04		
	0.25	2F090003/01	2F330006/01		
	0.375	2F090003/02	2F330006/02		
	0.5	2F090003/03	2F330006/03		
	0.564	2F090003/04	2F330006/04		
	0.75	2F090003/05	2F330006/05		
	.875	2F090003/06	2F330006/06		
1.5"	0.25	2F090004/01	2F330006/01	2F330001/02	
	0.375	2F090004/02	2F330006/02		
	0.5	2F090004/03	2F330006/03		
	0.564	2F090004/04	2F330006/04		
	0.75	2F090004/05	2F330006/05		
	0.875	2F090004/06	2F330006/06		
	1	2F090004/07	2F330006/07		
	1.125	2F090004/08	2F330006/08		
	1.25	2F090004/09	2F330006/09		



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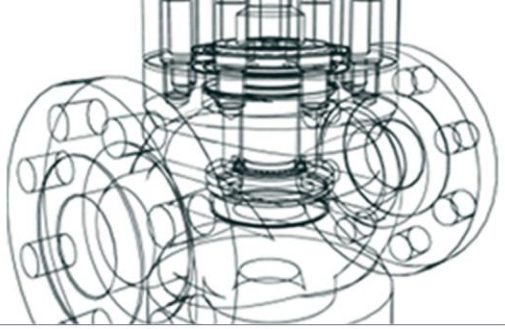
3: Seat Tool Combination: Valve Size	Seat bore	Seat part code	Seat holding tool	Seat tightening tool	Tool Stem
2”	0.25	2F090005/01	2F330006/01	2F330001/03	2F330009/02
	0.375	2F090005/02	2F330006/02		
	0.5	2F090005/03	2F330006/03		
	0.564	2F090005/04	2F330006/04		
	0.75	2F090005/05	2F330006/05		
	0.875	2F090005/06	2F330006/06		
	1.125	2F090005/08	2F330006/08		
	1.25	2F090005/09	2F330006/09		
	1.375	2F090005/10	2F330006/10		
	1.5	2F090005/11	2F330006/11		
	1.625	2F090005/12	2F330006/12		
3”	0.75	2F090006/01	2F330007/01	2F330001/04	2F330009/03
	0.875	2F090006/02	2F330007/02		
	1	2F090006/03	2F330007/03		
	1.25	2F090006/04	2F330007/04		
	1.375	2F090006/05	2F330007/05		
	1.625	2F090006/06	2F330007/06		
	2.2	2F090006/07	2F330007/07		
	2.625	2F090006/08	2F330007/08		
4”	1.25	2F090007/01	2F330007/04		
	1.625	2F090007/02	2F330007/06	2F330001/05/01, 2F330001/05/02	
	2.2	2F090007/03	2F330007/07		
	3	2F090007/04	2F330007/09		
	3.5	2F090007/05	2F330007/10		
6”	5.25	2F090008/01	2F330008/01	2F330001/06	2F330009/04

Table 8: Integral Seat/cage Tool Combination:

Valve size	Seat Bore	Integral seat/cage part code	Cage tightening tool	Tool stem
1”	0.438”	2F110001	2F330002/01	2F330009/02
		2F110002		
	0.625”	2F110003		
		2F110004		
		2F110005		
		2F110006		
	0.875”	2F110007		
		2F110008		
		2F110009		
		2F110010		
1.5”	1”	2F110011	2F330002/02	
		2F110012		
	1.25”	2F110013		
		2F110014		
		2F110015		
		2F110016		
		2F110017		
		2F110018		



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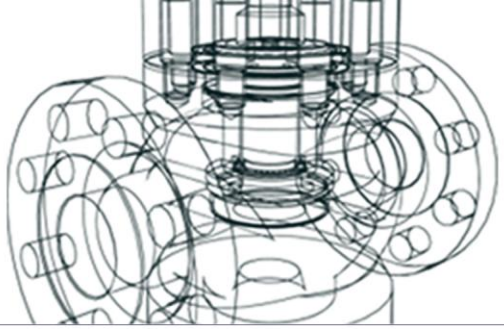
Valve size	Seat Bore	Integral seat/cage part code	Cage tightening tool	Tool stem
2”	1.25”	2F110019	2F330002/03	2F330009/02
		2F110020		
	1.625”	2F110021		
		2F110022		
		2F110023		
		2F110024		
		2F110025		
		2F110026		
		2F110027		
		2F110028		
	1.25”	2F110055		
3”	1.625”	2F110029	2F330002/04	2F330009/03
		2F110030		
		2F110031		
		2F110032		
	2.25”	2F110033		
		2F110034		
	2.625”	2F110035		
		2F110036		
		2F110056		
4”	2.25”	2F110037	2F330002/05	2F330009/03
		2F110038		
	2.265”	2F110039		
		2F110040		
	3.375”	2F110041		
		2F110042		
		2F110043		
		2F110044		
6”	3”	2F110045	2F330002/06	2F330009/04
		2F110046		
	4”	2F110047		
		2F110048		
		2F110049		
		2F110050		
		2F110057		
	5.25”	2F110051		
		2F110052		
		2F110053		



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