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INSTALLATION, OPERATION AND MAINTENANCE MANUAL

CRYOGENIC GATE, GLOBE, AND SWING CHECK VALVES

WILLIAMS VALVE CORP.
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Revision	Effective Date	Description	Prepared by	Approved by
00	Jul. 1,2024	Revised and updated	Judy Xu	Eric Chen

SAFETY GUIDELINES

Before commencing any maintenance or service work on cryogenic gate, globe, or swing check valves, ensure that all necessary piping and equipment have been properly locked out, isolated, and depressurized to establish a safe working environment.

Work on the valve should only begin when it is confirmed that it is safe to do so.

Follow all site-specific safety protocols, lockout procedures, and work permit requirements. Be aware that, with certain valves such as cryogenic gate, globe, and swing check valves, the valve body cavity may retain pressure even after the process lines have been depressurized. Therefore, exercise caution and confirm that all valve cavities have been fully depressurized prior to beginning any service work.

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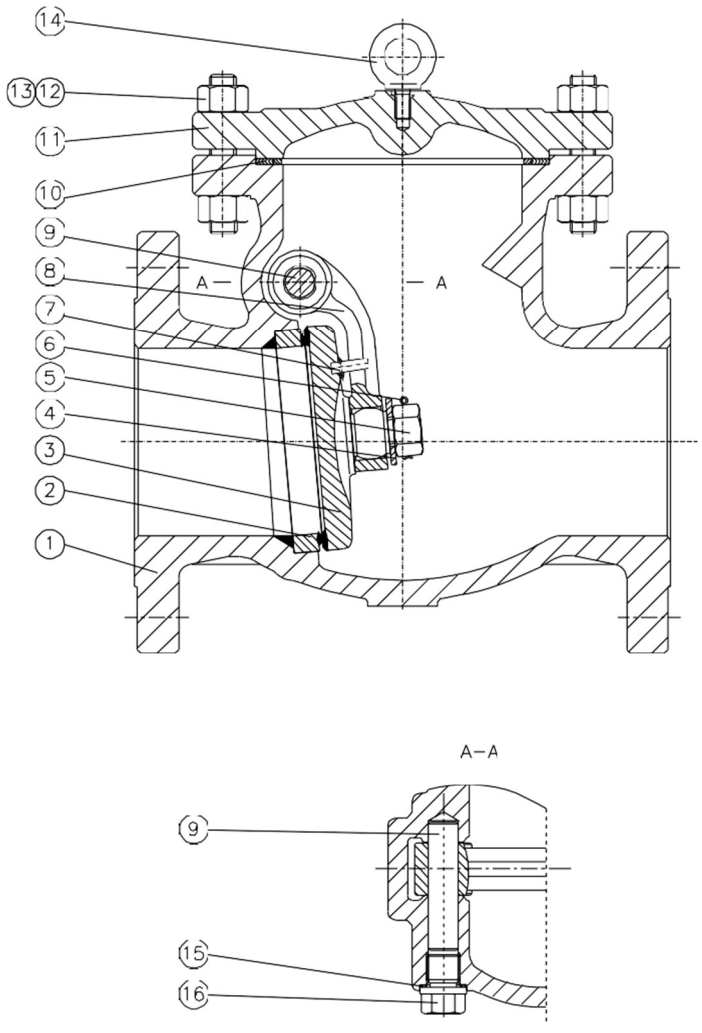
1. FOREWORD

Improper installation, operation, or maintenance of a valve can pose significant risks to personnel and the environment. The following instructions serve as a reference to assist the valve user in the installation, maintenance, and operation of WILLIAMS Cryogenic Gate, Globe, and Swing Check Valves. This document provides basic information and should not replace an understanding of the specific application. It is not intended to serve as a comprehensive guide for inexperienced valve users.

2. VALVE COMPONENTS

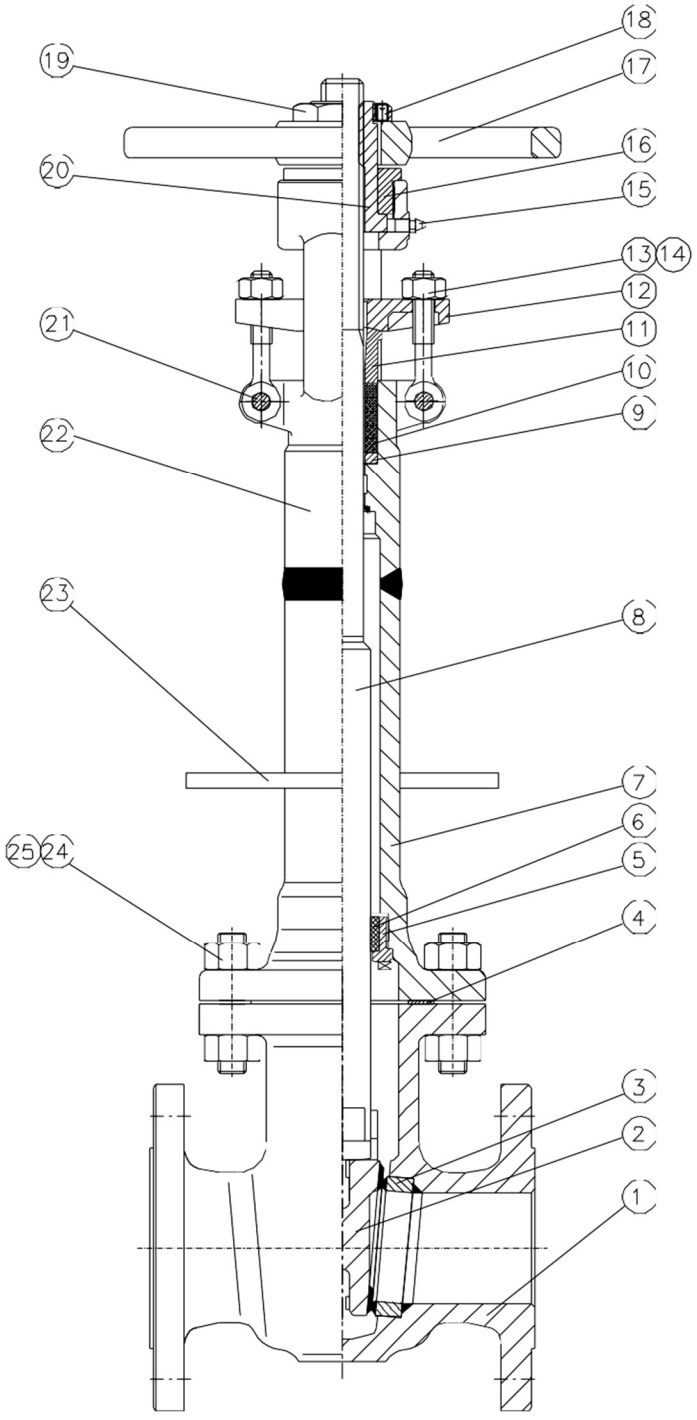
2.1 Cryogenic Swing Check Valves



CRYOGENIC CHECK	
ITEM	**NAME**
1	BODY
2	SEAT
3	DISC
4	WASHER
5	NUT
6	SPLIT PIN
7	ANTI-ROTATION PIN
8	HINGE ARM
9	HINGE PIN
10	GASKET
11	COVER
12	BOLT
13	NUT
14	EYEBOLT
15	GASKET
16	PLUG

Note： A. The end connections may include Raised Face, RTJ and butt welding.

2.2 Cryogenic Gate Valves

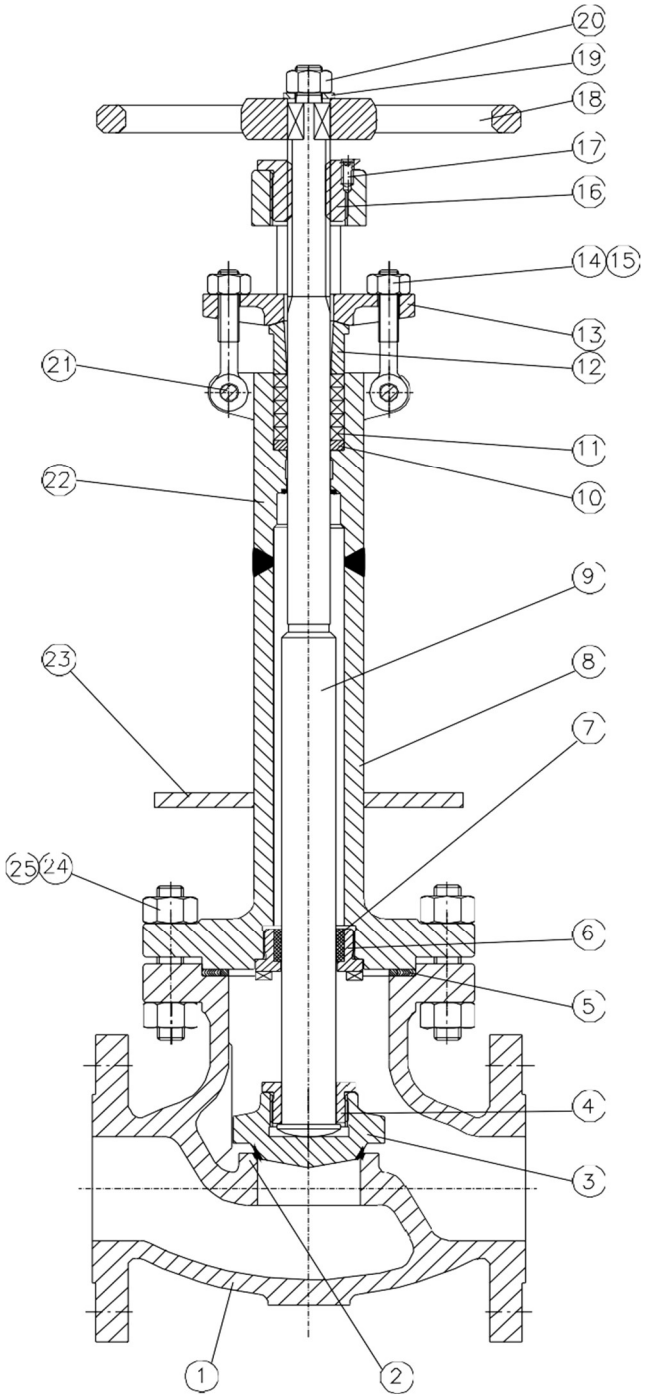


CRYOGENIC GATE	
ITEM	**NAME**
1	BODY
2	SEAT
3	FLEXIBLE WEDGE
4	GASKET
5	GUIDE HOLDER
6	GUIDE SLEEVE
7	BONNET
8	STEM
9	PACKING SPACER
10	PACKING
11	GLAND
12	GLAND FLANGE
13	EYE BOLT
14	NUT
15	GREASE FITTING
16	GLAND NUT
17	HANDWHEEL
18	SCREW
19	HANDWHEEL NUT
20	STEM NUT
21	PIN
22	BONNET
23	DRIP PLATE
24	BOLT

Note: A. The end connections may include Raised Face, RTJ, and butt welding.

B. A gearbox and electric actuator are alternatives options for valve actuation.

2.3 Cryogenic Globe Valves



CRYOGENIC GLOBE	
ITEM	**NAME**
1	BODY
2	SEAT
3	DISC
4	DISC BUSHING
5	GASKET
6	GUIDE HOLDER
7	GUIDE SLEEVE
8	BONNET
9	STEM
10	PACKING SPACER
11	PACKING
12	GLAND
13	GLAND FLANGE
14	EYE BOLT
15	NUT
16	STEM NUT
17	SCREW
18	HANDWHEEL
19	WASHER
20	NUT
21	PIN
22	BONNET
23	DRIP PLATE
24	BOLT
25	NUT

Note: A. The end connections may include Raised Face, RTJ, and butt welding.

B. A gearbox and electric actuator are alternatives options for valve actuation.

3. RECEIVING INSPECTION

3.1 Upon receipt, valves should be inspected for any shipping damage. The areas to inspect include the pressure-retaining shell, valve ends, and valve operating mechanisms such as handwheel, actuator, stem, etc. Any observed damage should be documented in an inspection report. Significant damage should be reported to WILLIAMS for further guidance on repair or replacement.

3.2 Valves should be stored in a sheltered environment that provides adequate protection from weather, dirt, and damage. Protective materials attached during shipment should not be removed until the time of installation.

3.3 Valves should be handled only with equipment capable of safely supporting the valve's weight. Slings should never be placed around the handwheel, stem, or gland adjustment parts. Protect valve ends by leaving end protectors in place until removal is necessary. Valves are shipped either in the open or closed position, depending on the valve type, to protect seating surfaces. If possible, these positions should be maintained until installation is complete.

4. TRANSPORTATION AND STORAGE

4.1 Transportation

4.1.1 Before shipping, inspect packaging according to relevant standards. Immediately repair any damaged packaging.

4.1.2 Ensure the valve is shipped in the fully open position. After cleaning the seat ring and disc/wedge sealing surface, close the valve if necessary. Contact WILLIAMS for the recommended cleaning procedure if necessary.

4.1.3 Electric actuators should be packaged separately from the valve.

4.1.4 Prior to transportation, ensure rigging, lifting slings, and vehicles are appropriately prepared, as valves are heavy metal products. Never drag the valve across the ground. For lifting the valve, see Section 5.2. Do not attach slings to the handwheel or stem. Care must be taken during transport to prevent damage.

4.1.5 During shipment, ensure that the valve’s paint, nameplate, flange faces, and sealing surfaces are properly protected.

4.2 Storage

4.2.1 Store valves in a well-ventilated, dry environment and never expose them to outdoor elements. Protect end connections with covers.

4.2.2 Valves not yet installed should be stored in a manner that protects them from rain and dirt.

4.2.3 During storage, avoid stem scratches. If valves are stored on shelves, ensure that eye bolts, gland flanges, and stuffing boxes are not exposed to the shelf.

4.2.4 Gate and globe valves should be stored in the fully closed position.

4.2.5 Ensure sealing surfaces remain clean and free of scratches, particularly during long-term storage. If a valve has been stored for over six months, inspect, clean, and pressure-test it before re-use. Consult WILLIAMS for specific pressure test methods.

5. VALVE INSTALLATION AND OPERATION

5.1 Pre-installation Inspection

5.1.1 Carefully check the valve identification before installation to ensure it matches the purchase list. Additionally, inspect the flow direction sign to confirm the correct orientation for installation.

5.1.2 Inspect the valve bore, sealing surface, stem, and stuffing box before installation. Any dirt or debris should be removed with a soft cloth.

5.1.3 Verify that the actuator responds quickly to prevent jamming during operation.

5.1.4 The valve must be in the fully closed position before installation.

5.1.5 If a pressure test is required before installation, consult the WILLIAMS Aftersales Service Department for appropriate testing methods.

5.2 Lifting

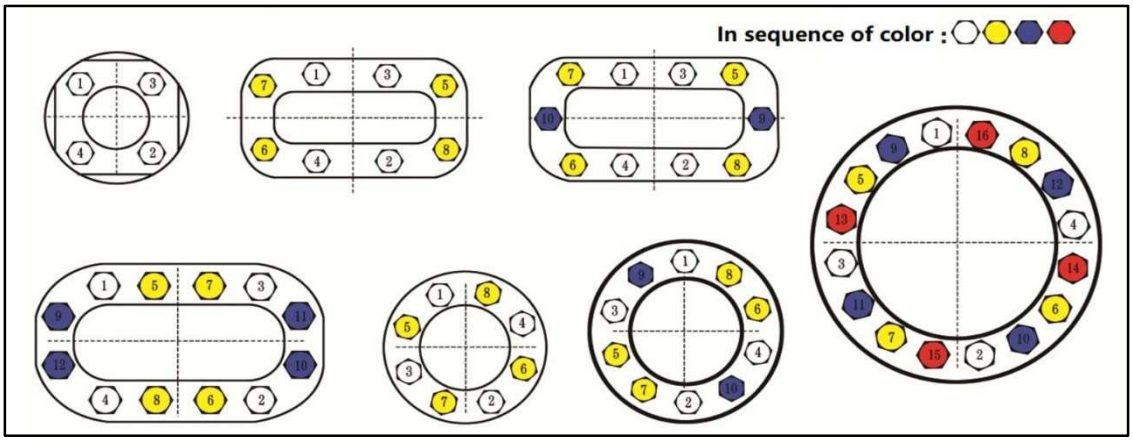
5.2.1 While handling the valve, ensure that the flange protective coverings remain in place to prevent damage to the sealing surface from foreign particles entering the cavity.

5.2.2 When lifting the valve, attach slings (ropes or chains) to the valve body or yoke to keep the valve vertical.

5.2.3 **Warning:** Do not attach lifting slings to the handwheel, gearbox, or actuator. If no lifting device is available, nylon slings may be used around the neck of the end connections. Care must be taken during handling to avoid dropping the valve.

5.3 Installation of Flange-ended Valves

For flange-ended valves, tighten the bolts in a crisscross sequence to secure proper gasket compression, as shown in the figure below.

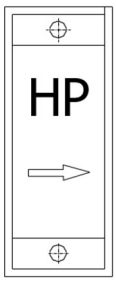


5.4 Installation of Butt-welded Valves

When installing butt-welded valves, ensure that the bevel is clean and free of foreign particles before welding.

5.5 Installation and Operation of Cryogenic Gate Valves

5.5.1 If there is a pressure relief hole at the wedge of the cryogenic gate valve, carefully inspect the flow indicator to ensure correct orientation, as shown in the figure below.



5.5.2 WILLIAMS recommends mounting the gate valve with the stem upright. For valves in cryogenic service, a vertical offset of no more than 30° is permissible. Upside-down installation is not allowed. Non-vertical installation is generally not optimal. If the installation requires an angle significantly deviating from vertical, please contact the WILLIAMS Aftersales Service Department for guidance.

5.5.3 When welding the valve into the pipeline, ensure the valve is in the fully closed position to avoid welding slag and debris from damaging the sealing surface.

5.5.4 Warning: Gate valves should not be used for throttling. They should only be in fully open or closed positions. Operating the valve with the disc partially open can shorten the service life of the sealing surface, stem, and guide hole.

5.5.5 During installation, ensure that the areas around the gland and stem are protected to prevent debris from entering the stuffing box, which could damage the stem or packing.

5.5.6 When insulating valves, restrict the height of the thermal insulation for the cap extended parts and keep it below the drip plate to ensure tight shutoff by preventing low temperature packing when the system is operating.

5.5.7 When operating the valve, never use tools that apply excessive force, as this could damage the valve trims.

5.6 Installation and Operation of Cryogenic Globe Valves

5.6.1 The flow direction of a globe valve features "downside entry, upside leaving," meaning one port is located under the disc for fluid to enter, and one port is above the disc for fluid to exit.

5.6.2 The flow direction is stamped on the valve body. Verify that the valve is installed in the correct orientation.

5.6.3 For valves in cryogenic service, a vertical offset of no more than 30° is permissible. Upside-down installation is not allowed. Non-vertical installation is generally not optimal. If the installation requires an angle significantly deviating from vertical, please contact the WILLIAMS Aftersales Service Department for assistance.

5.6.4 When welding the valve into the pipeline, ensure the valve is in the fully closed position to avoid damage to the sealing surface from welding slag and debris.

5.6.5 During installation, ensure that the areas around the gland and stem are protected to prevent debris from entering the stuffing box, which could cause damage to the stem or packing.

5.6.6 Typically, insulation is not used in globe valves. Ensure the valve is not exposed to freezing temperatures when cryogenic fluids are flowing.

5.6.7 When insulating the valve, restrict the height of the thermal insulation for cap extended parts and keep it below the drip plate to ensure tight shutoff by preventing low temperature packing when the system is in operation.

5.6.8 When operating the valve, never use tools that apply excessive force, as this could damage the valve trims.

5.7 Installation and Operation of Cryogenic Check Valve

5.7.1 Swing check valves can be applied in horizontal, vertical, and inclined pipeline layouts. When installing, rotate the valve 0 to 90° counterclockwise.

5.7.2 Under normal conditions, the centerline of the cover should not be offset more than 5° for swing and lift check valves installed on horizontal pipelines. If a larger angle is required, contact the WILLIAMS Aftersales Service Department.

5.7.3 It is inappropriate to install a lift check valve on vertical pipelines.

5.7.4 All check valves should be located at least 10 times the pipe diameter away from upstream pumps, elbows, devices, or equipment. If a shortened distance is necessary, contact the WILLIAMS Aftersales Service Department for advice.

5.7.5 Before installation, verify that the valve orientation matches the flow direction stamped on the valve body.

5.8 Bolt Re-tightening

5.8.1 After the valve is mounted on the pipeline, it is preferable to recheck the torque and re-tighten the flange bolt/nut in accordance with the body-bonnet bolt/nut torque specifications. Refer to Section 5.3 for the re-tightening procedure.

Torque (B8, B8M, B8C, B8A, B8MA)				Torque (B8/B8M-Class 2)	
Thread Specification	Torque (N. M)	**Thread Specification**	Torque (N. M)	**Thread Specification**	Torque (N. M)
1/2-13UNC	48~60	**1-5/8-8 UN**	1543~1929	**1/2-13UNC**	78~98
9/16-12 UNC	58~72	**1-3/4-8 UN**	1951~2439	**9/16-12 UNC**	113~142
5/8-11 UNC	80~100	**1-7/8-8 UN**	2426~3032	**5/8-11 UNC**	141~176
3/4-10 UNC	142~178	**2-8 UN**	2971~3714	**3/4-10 UNC**	223~279
7/8-9 UNC	230~287	**2-1/4 -8UN**	4296~5370	**7/8-9 UNC**	287~359
1-8 UNC	345~431	**2-1/2-8UN**	5966~7457	**1-8 UNC**	486~607
1-1/8-8 UN	507~634	**2-3/4-8UN**	7447~9309	**1-1/8-8 UN**	585~731
1-1/4 -8UN	714~893	**3-8UN**	9748~12185	**1-1/4 -8UN**	823~1029
1-3/8-8 UN	970~1213	**3-1/4-8UN**	12480~15601	**1-3/8-8 UN**	1048~1310
1-1/2-8 UN	1282~1602	**3-1/2-8UN**	15682~19602	**1-1/2-8 UN**	1321~1652

5.8.2 **Warning:** Do not locate the valve at the end of the piping or purge it in a partially open/closed position, as this can cause damage to the valve.

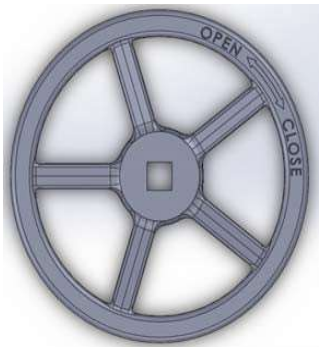
5.9 Pipeline Purging

5.9.1 To prevent damage to the new valve, perform pigging before the hydrostatic test of the pipeline system. Keep the wedge and disc fully open during lifting to facilitate purging of foreign objects from the pipeline. Clean and dry nitrogen should be used for purging if service fluids are below -196°C. After purging, ensure that the pipeline is free of debris and cycle the valve to protect the sealing surface from damage.

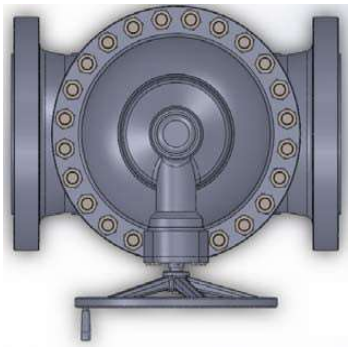
5.9.2 It is recommended to purge the pipeline with transition piping instead of valves. Hydrostatic tests may be conducted separately. If purging or a hydrostatic test must be done after the valve is installed on the piping system, ensure the test fluids are clean and dry nitrogen (only for service fluids below -196°C). It is important to avoid using test fluids that are above the freezing point of the pipeline fluids, such as water, as this can lead to freezing and impact the valve's sealing capacity.

5.10 Operation

5.10.1 For manually actuated valves: To open, turn counterclockwise (CCW); to close, turn clockwise (CW). Manual actuators include handwheels, gearbox handwheels, and electric/pneumatic device handwheels. The handwheel arm indicates the direction of opening and closing, as shown in the illustration below.



5.10.2 Unless specified otherwise, WILLIAMS assumes the orientation in the following figure for the gearbox installation direction. The orientation can be adjusted as needed. The angle can be 90° or 180° from the orientation shown below.



5.10.3 Refer to the actuator provider’s instructions for the operation of electric or other actuators.

6. ROUTINE INSPECTION AND MAINTENANCE

Routine inspection and maintenance are essential for ensuring the optimal performance of the valve.

6.1 Periodic Inspection

6.1.1 Seal Capability Inspection: Regularly inspect the cleanliness and wear allowance of the sealing surface.

6.1.2 Wall Thickness Examination: The wall thickness of the valve body and bonnet should be checked every three months to ensure safe valve operation. The valve should be replaced immediately if the thickness is below the values indicated in the table below.

	20bars 150lb	***50bars 300lb***	***100bars 600lb***	***150bars 900lb***	***250bars 1500lb***	***420bars 2500lb***
DN50(2")	**8.6**	**9.7**	**11.2**	**19.1**	**19.1**	**22.4**
DN65(2-1/2")	**9.7**	**11.2**	**11.9**	**22.4**	**22.4**	**25.4**
DN80(3")	**10.4**	**11.9**	**12.7**	**19.1**	**23.9**	**30**
DN100(4")	**11.2**	**12.7**	**16**	**21.3**	**28.7**	**35.8**
DN125(5")	**11.5**	**14.5**	**17.6**	**23.8**	**38.1**	**—**
DN150(6")	**11.9**	**16**	**19.1**	**26.2**	**38.1**	**48.5**
DN200(8")	**12.7**	**17.5**	**25.4**	**31.8**	**47.8**	**62**
DN250(10")	**14.2**	**19.1**	**28.7**	**36.6**	**57.2**	**67.6**
DN300(12")	**16**	**20.6**	**31.8**	**42.2**	**66.8**	**86.6**
DN350(14")	**16.8**	**22.4**	**35.1**	**46**	**69.9**	—
DN400(16")	**17.5**	**23.9**	**38.1**	**52.3**	**79.5**	—
DN450(18")	**18.3**	**25.4**	**41.4**	**57.2**	**88.9**	—
DN500(20")	**19.1**	**26.9**	**44.5**	**63.5**	**98.6**	—
DN600(24")	**20.6**	**30.2**	**50.8**	**73.2**	**114.3**	—

6.1.3 Body-Bonnet Torque Inspection: Inspect the torque on the body-bonnet bolts/nuts every 12 months to ensure proper tightness.

6.2 Re-tightening Procedure for Body-Bonnet Bolt and Nut

6.2.1 To apply greater preload on the cavity gasket, apply grease to the material-stamped end of the stud and the body flange's outer face, where holes are located.

6.2.2 When retightening, ensure that the nuts on the opposite side are secured with either an open-ended wrench or a box-end wrench.

6.2.3 When increasing the torque, retighten the nuts twice. For the first retightening, use a crisscross sequence as illustrated in Section 5.3. Apply only 80% of the achieved torque to the nuts for the first retightening.

6.2.4 Nuts (N in number, see the table below) should be tightened with a torque wrench (manual, pneumatic, electric, or hydraulic). For the torque values, refer to Section 5.8.1.

Bolt Qty	≤ 10	12 ~ 18	20 ~ 26	≥ 28
Retightened Nut Qty	2	4	6	8

6.3 Valve Lubrication

6.3.1 To prevent damage to threads and an increase in valve operating torque, lubricate the stem, stem nut, stem thread, and gearbox at least every six months. Ensure that the valve is cycled at least once a month if it has not been in service for a long time.

6.3.2 The recommended lubricant for the stem, stem nut, and stem thread is Krytox-GPL206, with Molybdenum disulfide lubricator.

6.4 Packing Replacement

Use packing of the same specification as the original. Packing replacement should be performed every two to three years, even if there is no leakage, as failure to do so may lead to reduced torque and potential damage to the stem. It is best to carry out this replacement during routine valve inspections. The steps for packing replacement are as follows:

6.4.1 Loosen and lift the gland flange nut and packing gland to provide adequate space for operation.

6.4.2 Replace the packing using the appropriate tools. During the removal process, take care not to damage the stem or sealing surface of the stuffing box.

6.4.3 Clean the stem and stuffing box thoroughly.

6.4.4 Cut new packing rings at a 45° angle and stagger the joints of successive packing at 90°. Insert them into the stuffing box.

6.4.5 After fitting half of the packing (normally two to three rings), tamp it with the gland before continuing to install the rest.

6.4.6 Retighten the gland nuts once the final packing ring is installed.

6.4.7 Perform a closure test on the valve (For detailed test methods, consult WILLIAMS Aftersales Service Department). If leakage occurs through the packing, evenly tighten the nuts on both sides of the gland until the leakage is stopped.

6.4.8 WILLIAMS recommends not replacing packing while the valve is online. Please contact us to obtain the configuration details and obtain our consent if required.

6.4.9 **Warning:** Replacing packing under pressure without permission presents significant hazards to the operator or owner.

6.5 Failures and Corrective Measures

The table below outlines common malfunctions that may occur after prolonged use, along with possible causes and corrective actions.

Trouble	Possible Causes	Possible Remedies
Leakage around stem	Loosened packing gland nuts	Evenly tighten nuts to compress packing
	Insufficient packing rings	Increase the number of packing rings
	Packing failure	Replace the packing
	Impaired stem surface in contact with the packing	Perform periodic repairs on the stem
Leakage around sealing surface	Contaminants on sealing surface	Clean the sealing surface to remove contaminants
	Damaged sealing surfaces	Reprocess the sealing surfaces
	Insufficient closing torque	Increase closing torque (apply impact when using impact handwheel)
Excessive operating torque	Over-compressed packing	Loosen the gland flange nut appropriately
	Severely impaired thread of stem nut	Replace the stem nut
	Bent stem	Adjust or replace the stem
	Foreign objects between stem nut, packing gland, gland, and stem	Clean foreign objects from the area
Body flange leakage	Loosened body flange nut	Tighten body flange nut
	Gasket failure	Replace gasket
Leakage caused by body and cap damage	Water hammer	Smooth on-off for avoiding sudden pumping termination and fast valve closing
	Fatigue failure	Replace the valve if it has exceeded its service lifespan or shows signs of premature fatigue
	Freeze crack	Ensure that valves not in use during winter are free of water and service fluids
Failure to open disc	Wedge stuck in the body	Apply the proper force to close valve. Avoid using long wrenches.
	Wedge stuck due to expansion of heated stem	With elevated temperature, remove the stem when the gate is in the closed position and rotate the handwheel counterclockwise (CCW) at small intervals

7. WARRANTY

7.1 All valves sold by WILLIAMS are warranted for 18 months from the date of delivery or 12 months from the date of installation (whichever occurs first). WILLIAMS's responsibility is limited to valve parts/components found to be defective due to material or quality issues under correct usage. WILLIAMS is not responsible for products subjected to improper installation, maintenance, repair, alteration, or modification.

7.2 The user must notify WILLIAMS upon discovering any defects. WILLIAMS reserves the right to recall the defective valves for investigation and analysis.

7.3 WILLIAMS' warranty covers only the following:

7.3.1 Material repair costs
7.3.2 Costs for part replacement and materials used
7.3.3 Compensation for the user's purchase costs of defective products

7.4 WILLIAMS is not responsible for losses resulting from unforeseen disasters, such as earthquakes or hurricanes, or other causes beyond WILLIAMS's control.

7.5 Any warranties beyond this scope will be decided through consultation between the user and WILLIAMS.

7.6 WILLIAMS may provide on-site installation and adjustments, if specified in the contract.

7.7 WILLIAMS will monitor product quality and provide services in accordance with user requirements.

7.8 Any removal and/or disassembly for repairs without prior authorization from WILLIAMS will void the warranty, whether expressly claimed or implied.