

Worcester Cryogenic 3-Piece Valves (R7 & R8 Version)

C44 UP TO AND INCLUDING 50mm (2")

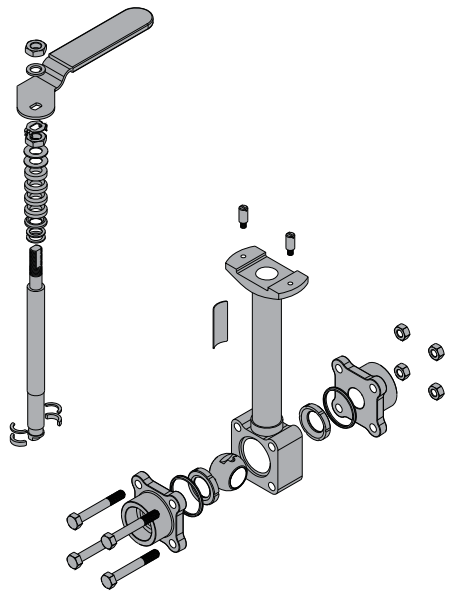
C59 UP TO AND INCLUDING 40mm (1½")

Installation

Operation

Maintenance

WCEIM0030-02



Experience In Motion



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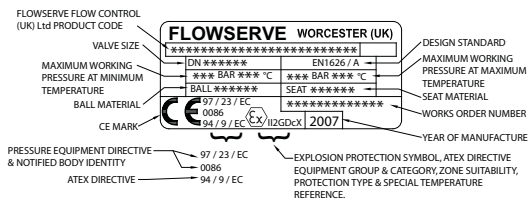
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1 STORAGE AND PRESERVATION

When despatched, all valves are in the open position, and it is recommended that they be left in this position during storage. All protective packaging, end port plugs/caps, flange covers etc. should remain in position until the valve is due to be installed. Valves should be stored in a clean, dry environment.

2 VALVE MARKINGS

Each valve has one of the following identification information plate attached to the body:



- 2.1 Pressure Equipment Directive: The product will be deemed to be in compliance with the Pressure Equipment Directive 97/23/EC and the Pressure Equipment Regulations 1999 (SI 1999/2001) **only** if the 'CE' mark and the Notified Body identity number '0086' appears on the label. Otherwise the product is classified as 'SEP' (Sound Engineering Practice) and may only be used within the limitations defined in tables 6, 7, 8 & 9 of Schedule 3 of the Pressure Equipment Regulations.
- 2.2 ATEX Directive: The product will be deemed to be in compliance with the ATEX Directive 94/9/EC and The Equipment and Protective Systems for Use in Potentially Explosive Atmospheres Regulations 1996 **only** when the 'CE' mark and the Explosion Protection Symbol and codes identifying the equipment group and category, the zone suitability, protection type and the temperature class appears on the label.
Definition of identity plate marking above:
'II' = Equipment Group; '2' = Equipment Category; 'G' = Gas Zone suitability (Zones 1 & 2);
'D' = Dust Zone suitability (Zones 21 & 22); 'c' = type of protection i.e. constructional safety (BS EN 13463-5).
'X' = Special temperature reference (Surface Temperature: As per EN 13463-1:2001(E) paragraph 14.2.g, the temperature class or maximum surface temperature cannot be marked on the product, as it is dependant on the operating conditions. However, the maximum/minimum allowable operating temperatures for the product are marked on the identification plate.
- 2.3 Should the valve soft trim materials be changed during the course of its operational life it is necessary for this change to be reflected on the identification plate i.e. material change may impact pressure and temperature limitations. Refer to Flowserve Flow Control Technical Sales for details.
- 2.4 Material traceability markings are hard marked on the valve body and connectors.
- 2.5 There is a safety information label placed over the wrench.

5 INSTALLATION INSTRUCTIONS

5.1 GENERAL

When positioning into line, care must be taken to ensure that when in the closed position, the relief hole in the ball is on the upstream side and that the valve's direction arrow is pointing downstream. The valve stem axis can be positioned anywhere between vertical to 45° above the horizontal. For stem axis angles between 45° and 25° from horizontal refer to Flowserve Flow Control.

Stem leakage may be found on valves after initial installation due to the contraction of the stem components at cryogenic temperatures, therefore adjustment after initial installation may be required, see section 7.3 for further instruction.

5.2 SCREWED END VALVES

Do not dismantle these valves to install. Ensure that the pipeline and valve end threads are clean. Apply a suitable thread sealant to the pipe threads and screw into the valve being careful not to over tighten tapered threads. Do not use the valve wrench or stem as a lever to tighten the valve onto the pipe thread.

5.3 WELD END VALVES

- a) Fully assembled weld end valves (butt and socket), must only be tack-welded into position, as the full weld heat will damage the seats and seals. Note: the ball must be in the open position.
- b) After tack welding, remove the body assembly as per section 9.1 a-c. Store in a clean, secure location.
- c) Complete the welding procedure after protecting the connector end faces from weld spatter.
- d) When cool, clean the valve connector end faces and then fit the new body seals (supplied) into the body. Replace the body assembly as per section 9.2 h-k.

3 HEALTH AND SAFETY

When installing or maintaining valves:

- a) Conduct a risk assessment and eliminate or reduce hazards to an acceptable level.
- b) Work in accordance with Safe Systems of Work.
- c) Observe all site Health and Safety Rules in particular Permit to Work and Hot Work procedures.
- d) Wear all necessary Personal Protective Equipment.
- e) Never remove or maintain a valve or joint unless the line has been fully de-pressurised, drained and where necessary, purged of toxic / explosive / flammable media. Always operate the valve to the open position to ensure that no trapped pressure exists within the cavity.
- f) Never handle valves that have been used on harmful substances unless they have been completely decontaminated and certified safe to handle.
- g) Never use a valve on a duty, which exceeds its prescribed operating parameters. Refer to Flowserve Flow Control Technical Sales for performance curves or further information.
- h) Never modify or alter valves unless the manufacturer has been consulted and/or recommends such changes.
- i) The valve wrenches are designed only for use in operating the valves and must not be used for carrying them. Failure to observe this warning may result in operator injury.
- j) Due to the large physical size and weight of some sizes of this product, always use correct lifting methods and equipment when installing, removing and maintaining the product, and ensure that it is correctly supported in its final operating location.
- k) Due to the variety of duties on which this product can be employed, it is the end users responsibility to ensure the compatibility of the media with the materials of construction of the product for each specific application (i.e.corrosion and erosion which may affect the integrity of the pressure-containing envelope).
- l) Before equipment is installed in areas which may be subject to seismic activity or extreme climatic conditions consult Flowserve Flow Control Technical Sales.
- m) Lethal Service. In accordance with the design verification code (2001 (2003 addenda) ASME Boiler and Pressure Vessel Code Section VIII Division 1) a casting quality factor of 1.0 is allowable for all products. Those intended for 'lethal service' must have had non-destructive examination carried out in accordance with Appendix 7 of the code. Refer to Flowserve Flow Control Technical Sales.
- n) Valves for cryogenic service can be used at temperatures down to -196°C and contact with the skin may cause serious injury. The product **must** be suitably insulated and protected to prevent such risk of injury and **all** personnel having access to the products **must** be trained in the correct safe usage and handling of cryogenic systems and equipment.
- o) If the equipment is to be used on unstable gas duty, ensure that the operational parameters as indicated on the product identification plate, or in the product brochure, or as advised by Flowserve Flow Control Technical Sales cannot be exceeded.
- p) This equipment should be protected by other devices to prevent over-pressurisation (i.e. caused by external fire etc).
- q) This equipment must be installed in a system that is designed to prevent excessive forces acting on the connections.
- r) These valves are not suitable for end of pipeline use.

6 OPERATION

6.1 USE

Worcester ball valves provide bubble tight shut off when used in accordance with Worcester's published pressure / temperature chart.

It is not good practice to leave a soft seated ball valve in the partially open (throttled) position as this will damage the seats and reduce valve life. Flow control ball valves, which contain seats suitable for this purpose, are available from Flowserve Flow Control.

Any media, which may solidify, crystallise or polymerise, should not be allowed to stand in the ball cavity, as this is detrimental to valve performance and life.

6.2 MANUAL OPERATION

When operating the valve, avoid using excessive side loading on the wrench.

The operation of the valve consists of turning the wrench a quarter turn clockwise to close. When the handle and the flats of the stem are in line with the pipeline the valve is open.

6.3 REMOTE OPERATION:

Where automation of the valve is necessary, Flowserve Flow Control can supply pneumatic and electric actuators to cover a wide range of operating torque requirements.

4 PREPARATION FOR INSTALLATION

The working area should be clean and clear of any debris that would contaminate the valve.

It should be noted that Cryogenic valves are supplied in a degreased condition for oxygen compatibility and that these conditions must prevail when installing the valve.

Protective packaging may contain a silica gel bag to absorb humidity during storage. Before installation, ensure that this and all of the packaging is removed.

If the wrench has been removed for storage (or actuation) it is important to ensure that the gland nut locking clip is retained. If, during installation, it is noted that the locking clip is not in place, the gland nut must be adjusted to the correct torque and a new locking clip fitted.

Significant problems can arise with any valve installed in an unclean pipeline. Ensure that the pipeline has been flushed free of dirt, weld spatter etc. before installation.

PTFE coated stainless steel body seals are used, care must be taken when handling them to avoid scratching the PTFE coating and also to ensure that their widest face is sitting on the valve body seal recess.

If transit seals are fitted inside the valve, these must be discarded and replaced with the additionally supplied body seals.

7 MAINTENANCE

7.1 GENERAL

Any maintenance undertaken on a cryogenic valve should take place at room temperature.

With self wipe ball / seats and patented pressure equalising slots, Worcester valves have long, trouble free lives and maintenance is seldom needed. The following checks will help extend life further and reduce plant problems: Routine checks / maintenance:

- i) Every 25000 cycles or 3 months: Check for any signs of leakage (see 7.2, 7.3 & 7.4 below) and that all fasteners (including the gland nut) and joints are tightened to their correct torque value (see Section 10).
- ii) Infrequent operation: The valve should not be left standing without operation for more than 1 month. After this period the valve should be operated through three full cycles.

7.2 IN-LINE LEAKAGE

Check that the valve is fully closed. If it is, then any leakage will be due to damage to the body, connector, ball or seat sealing surfaces and it will be necessary to repair it (refer to Section 9 & 10).

7.3 STEM LEAKAGE

Cryogenic valves with extended stem/gland assemblies normally operate with the gland at a higher temperature than the valve body. As a result, there will be a frost line approximately two thirds of the way up the extension. A gland covered in frost is indicative of stem leakage and rectification will be required. Remove the wrench assembly or the actuator (as detailed in the relevant actuator I.O.M.), and gradually tighten the self-locking gland nut. If leakage still persists, then it will be necessary to dismantle the valve to establish the cause and/or to replace the stem thrust seal and Chevron seals. When tightening the gland nut, take care that the valve torque does not increase excessively. Over tightening will also reduce the life of the stem assembly.

Stem adjustment may be carried out on R8 variants at working temperatures, stem adjustment of R7 variants should be conducted with the valve at ambient temperature.

7.4 BODY / CONNECTOR JOINT LEAKAGE

Check the tightness of the body bolting and tighten to the recommended torque values if necessary. If leakage still occurs it will be necessary to remove the valve from line to replace the body seal and to establish whether the seal faces of the body and connector have been damaged (see Section 9 & 10).

8 REPAIR KITS

Repair kits are available for all Worcester valves. Details of their contents can be found on the instruction sheet supplied with the kit.

If other parts are required, it is usually recommended that the complete valve be replaced (although piece parts are available). Parts from different sized/rated valves must not be interchanged.

Only Worcester authorised spare parts should be used. This includes basic components such as fastenings. Flowserve Flow Control will accept no responsibility if the valve is altered in any way without the consent of Flowserve Flow Control.

The R6 or R7 cryogenic valves can use the V82 packing for high cycle or special applications. This requires the substitution of graphite chevrons for the top and bottom PTFE chevrons.

Sizes 1/4" (02) to 1" (10) require 2 PTFE chevrons sandwiched between graphite stem seals. The 1 1/2" (15) and 2" (20) use only one PTFE chevron.

The lubrication used for the stem assembly is dow corning molycote 321 sprayed lightly on the stem, only in the seal area below the threads, and on the graphite chevrons (allow to cure > 4 hours before assembly).

9 REFURBISHMENT INSTRUCTIONS

Prior to commencing any work on the valve or removing it from line, refer to the 'Health & Safety' Instructions. NEVER remove or maintain a valve or joint unless the line has been fully de-pressurised, drained and where necessary, purged of toxic / explosive / flammable media.

9.1 DISMANTLING

- There are two methods of removing a valve from the pipeline. In both cases:
 - The valve must be in the open position (with the wrench / stem flats in-line with the pipeline) to prevent the ball protruding out of the body and fouling on the body connectors when the body is removed, and,
 - The body connectors must be sprung apart slightly to prevent scoring of the machined faces.
- Method 1: 'Slide-out' method: (see Figure 1). Extract all of the body bolts and slide the body complete from the two body connectors. Care must be taken not to damage the connector sealing faces.
- Method 2: 'Swing-out' method: (see Figure 2). If only partial removal from the pipeline is required (i.e. to change seats, seals or ball only), then extract all of the body bolts bar one, which is only loosened. The body may then be rotated from between the two body connectors using the last remaining bolt as a pivot.

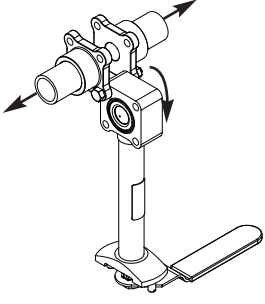


Figure 2: 'Swing-out' method

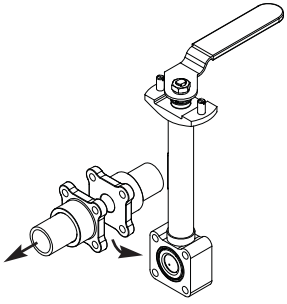


Figure 1: 'Slide-out' method

- Once the body is clear of the connectors, half close the ball, remove and discard the seats. Complete the closing turn and the ball may be removed. This must be done with care, otherwise the ball may mark against the body.
- The body seals can now be removed and discarded. Again care must be taken not to damage the machined faces on which they seal. Note: If the valve is being dismantled to cure through leakage (i.e. to replace ball and seats), and there is no stem leakage, then it is not necessary to go any further with dismantling.

9 REFURBISHMENT INSTRUCTIONS (cont.)


9.1 DISMANTLING (cont.)

- To dismantle the extended stem assembly, remove the wrench assembly, followed by the locking clip, gland nut, disc springs and the top follower.
- Push the stem down into the valve body cavity and remove the split rings.
- Draw the stem out through the top of the extension housing and remove the chevron seals, lower follower and thrust seals.
- All components not replaced by items in the repair kit should be thoroughly cleaned (using a suitable degreasing agent and wire wool for hard deposits) and checked for signs of corrosion, erosion or damage and be replaced if necessary. Cleanliness is essential for long valve life.
- All Worcester spares kits for this application are supplied in a degreased condition for oxygen compatibility, and similar conditions must prevail for all components during rebuild.

9 REFURBISHMENT INSTRUCTIONS (cont.)

9.2 REBUILDING

- Before rebuilding, ensure the repair kit and/or components used are suitable for the valve requirement. When rebuilding, cleanliness is essential for long valve life.
- Insert the stem through the extension housing into the valve cavity and fit the split thrust bearing and split ring onto the stem shoulder, then draw up into the housing.
- For new thrust washers, lower follower, chevron seals, top follower, followed by the disc springs (with outer edges touching) and the self-locking gland nut. For manually operated valves, 2 disc springs are required, automated valves require 4 disc springs to be assembled in the configuration shown in the general arrangement drawing below.

Due to the addition of a fourth chevron packing on the R8 stem build, for sizes 1/4" (02) to 1" (10), the top graphite chevron should not be included in the initial assembly.
- Tighten the self-locking gland nut until the recommended stem assembly torque is achieved (see section 10). Over tightening will only reduce the life of the stem assembly. Upon initial compression of packings in the R8 stem build, size 1/4" (02) to 1" (10), the self-locking gland nut, disc springs and follower should be removed to allow the top chevron packing to be installed. Standard assembly practice, as outlined in section 9.2 c) & d), should then be followed.
- Fit the wrench, spring washer and wrench nut to the stem assembly and turn to the closed position (wrench / stem flats across the pipeline).
- Insert the ball into position by sliding it onto the stem tang. **NOTE:** the pressure relief hole of the ball must be on the upstream side of the valve relative to the flow direction arrow on the side of the valve. These assemblies have an alignment pin in the stem that locates in an indent in the slot in the ball. Turn the ball to the valve open position to stop the ball from falling out and from fouling the end connectors when the valve is placed back into the pipeline.
 
- The new seats and body seals can now be fitted. The application of a little suitable lubricant (such as Fomblin RT15 or similar) to the seats and seals will help hold them in position and aid 'bedding in' of the valve assembly. **NOTE:** Ensure that the lubricant used is compatible with the pipeline media.
- The body connectors must have their faces cleaned before refitting of the valve can proceed. As with removal, the body connectors must be sprung apart slightly to get the body assembly into position and avoid damaging the seats, seals and sealing faces.
- Centralise the body, replace the body bolts and tighten diagonally and evenly to the torque specified in Section 10.
- If practical, check for leak tightness and operating torque.

10 VALVE ASSEMBLY TORQUES

10.1 BODY BOLTING TORQUES

It is a requirement of all body bolts to give a metal to metal contact between the body and the inner surface of the body connectors.

Hexagonal Headed Bolts		
Valve Nominal Size		Recommended Torque (Nm)
Reduced Bore	Full Bore	
DN15 (1/2")	-	11 - 13
DN20 (3/4")	DN15 (1/2")	13 - 15
DN25 (1")	DN20 (3/4")	24 - 28
DN32 (1 1/4")	DN25 (1")	28 - 32
DN40 (1 1/2")	DN32 (1 1/4")	33 - 37
DN50 (2")	DN40 (1 1/2")	38 - 42

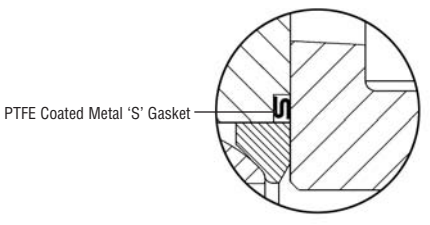
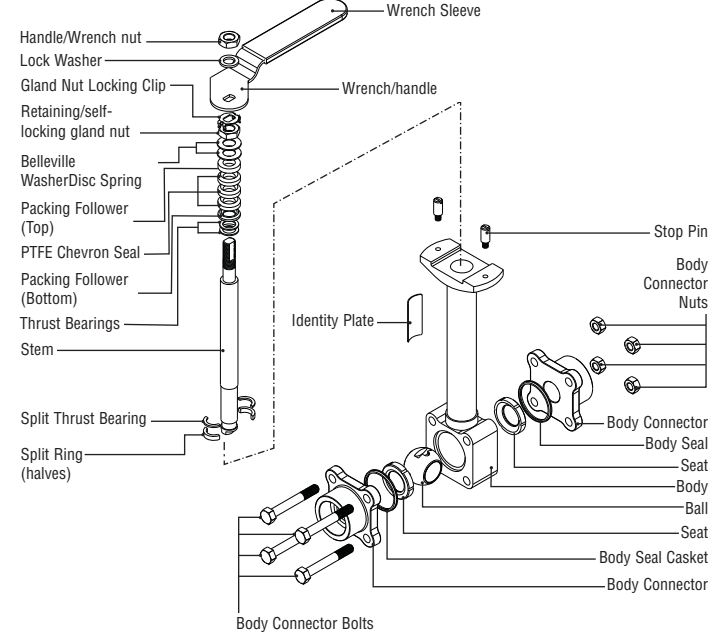
10.2 STEM ASSEMBLY TORQUES

The torques quoted are those to operate the stem assembly only i.e. before the ball and seats are fitted.

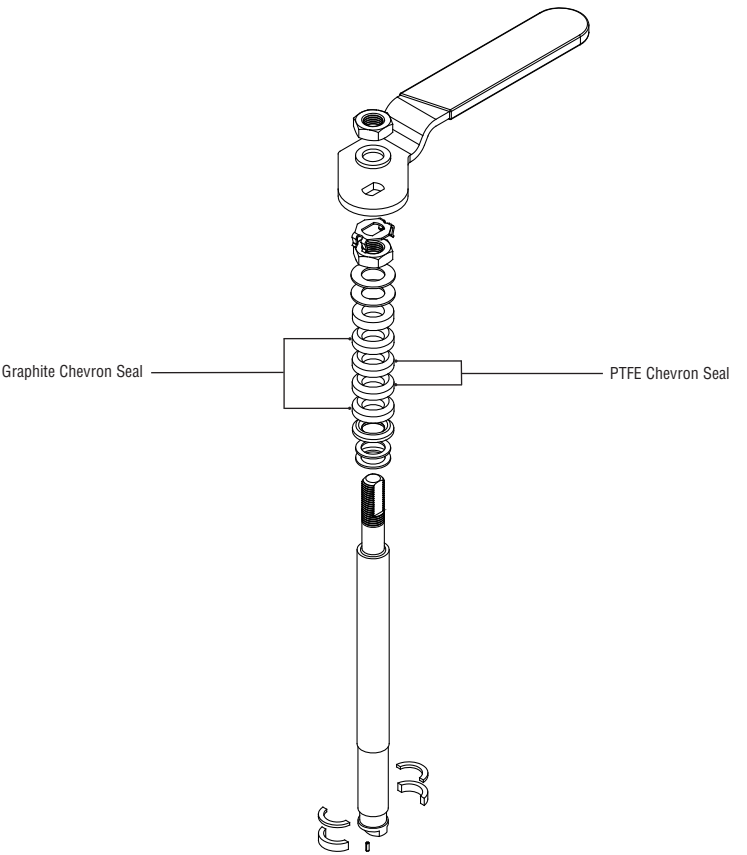
Valve Nominal Size		Recommended Torque (Nm)	
Reduced Bore	Full Bore	R7 Version	R8 Version
DN15 (1/2")	-	3 - 5	8 - 10
DN20 (3/4")	DN15 (1/2")	3 - 5	8 - 10
DN25 (1")	DN20 (3/4")	4 - 6	8 - 10
DN32 (1 1/4")	DN25 (1")	4 - 6	8 - 10
DN40 (1 1/2")	DN32 (1 1/4")	6 - 8	12 - 13
DN50 (2")	DN40 (1 1/2")	6 - 8	12 - 13

EMPIRICAL ADJUSTMENT
Where conditions do not easily allow the assembly of components to the figures quoted in the table above, the gland shall be tightened until the disc springs are flat and the gland nut shall be backed off 1 flat (1/6th of a turn).

TYPICAL 3-PIECE CRYOGENIC VALVE WITH R7 VERSION EXTENDED STEM ASSEMBLY



R8 VERSION STEM CONFIGURATION REDUCED BORE DN15-DN32 (1/2" - 1/4") FULL BORE DN15-DN25 (1/2" - 1")



R8 VERSION STEM CONFIGURATION REDUCED BORE DN40 - DN50 (1 1/2" - 2") FULL BORE DN32-DN40 (1 1/4" - 1 1/2")

