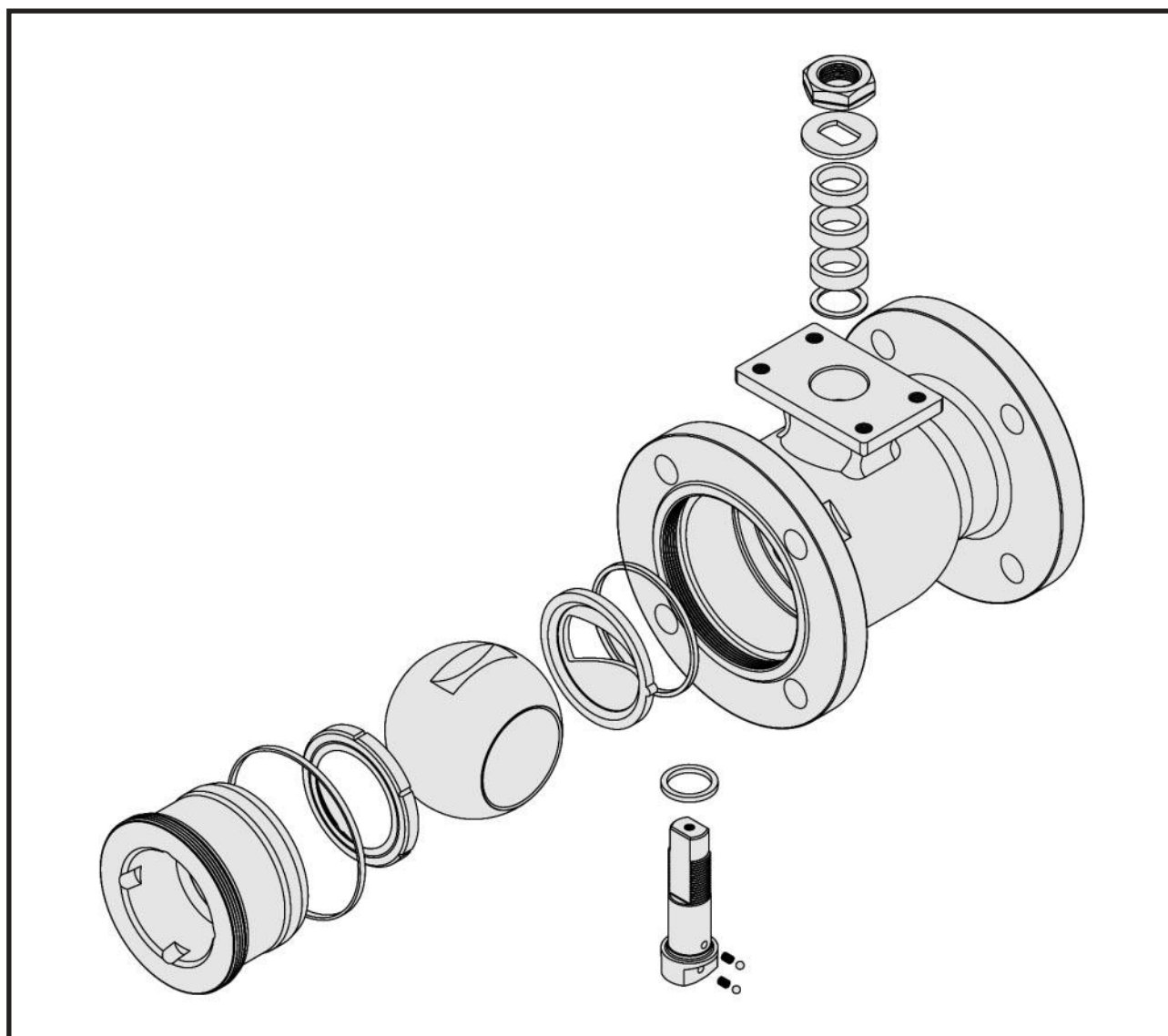




Flow Control Division

Installation, Operating & Maintenance Instructions

Worcester V-Flow: 51 / 52 Series Reduced Bore



1 **STORAGE AND PRESERVATION**

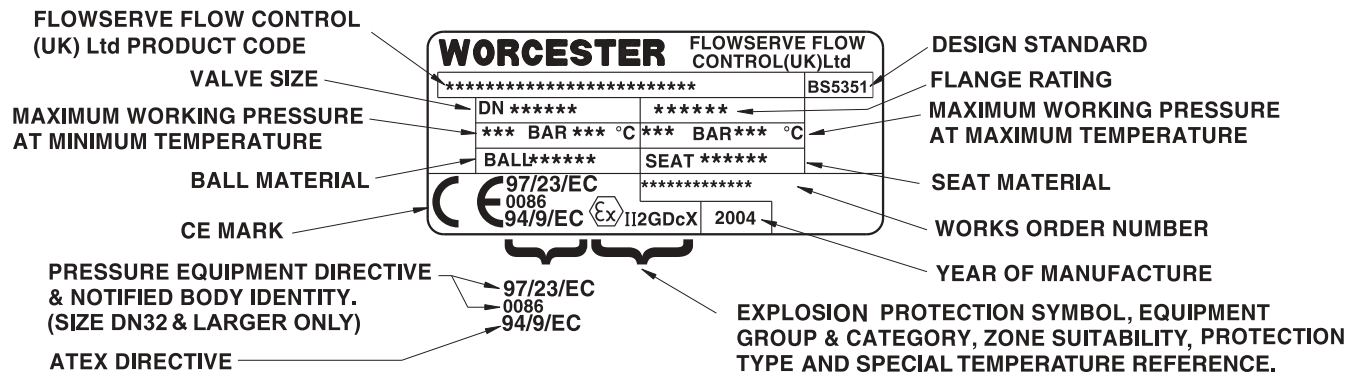
All valves are despatched in the open position and it is recommended that they are left in this position during storage. All protective packaging should remain in position until the valve is to be installed.

Valves should be stored in a clean, dry environment.

Carbon steel valves are manganese phosphated and coated with a de-watering oil. This coating is non-toxic and is quite safe on edible or potable products.

2 VALVE MARKINGS

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



2.1 Pressure Equipment Directive: If the identity plate carries the Pressure Equipment Directive number '97/23/EC' and the Notified Body identity number '0086' beside the 'CE' mark, the product complies with the Pressure Equipment Directive 97/23/EC and the Pressure Equipment Regulations 1999 (SI 1999/2001). Without these numbers, 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: If the identity plate carries the ATEX Directive number '94/9/EC' followed by the Explosion Protection Symbol and codes identifying the equipment group and category, the zone suitability and protection type beside the CE mark, the product complies with the ATEX Directive and The Equipment and Protective Systems for Use in Potentially Explosive Atmospheres Regulations 1996.

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 BS EN 13463-1:2001 paragraph 14.2g, 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 (UK) Ltd. Technical Sales for details.

2.4 Material traceability markings are hard marked on the valve body.

2.5 When applicable for valves up to and including 50mm, a further metal label indicates that the valve is in accordance with GBE/V6 Part 2.

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 (UK) Ltd Technical Sales for performance curves or further information.
- h) Never modify or alter valves unless the manufacturer has been consulted or recommends such changes.
- i) 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 that it is correctly supported in its final operating location.
- j) 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).
- k) Before equipment is installed in areas which may be subject to seismic activity or extreme climatic conditions consult Flowserve Flow Control (UK) Ltd. Technical Sales.
- l) End Flanges: The end flange design of this product has been verified by either 2001 (2003 addenda) ASME Boiler and Pressure Vessel Code Section VIII Division 1 calculation method, by Finite Element Analysis in accordance with 2001 (2003 addenda) ASME Boiler and Pressure Vessel Code Section VIII Division 2 - Alternative Rules, or by experimental testing as defined in BS EN 12516-3 Valves Design Strength - Part 3 Experimental Method.

Gaskets: The gaskets used in all methods are Spiral Wound to BS4865 for PN rated flanges, and ASME B16.20 for Class rated flanges. These have Gasket Factors and Design Stresses of 2.5 and 10000psi respectively for Carbon Steel gaskets, and 3.0 and 10000psi for Stainless Steel gaskets as defined in the 2001 (2003 addenda) ASME Boiler and Pressure Vessel Code Section VIII Division 1.

If gaskets are used with higher Gasket Factors and Design Stresses than those stated above, please consult FlowserveFlow Control (UK) Ltd Technical Sales.

Bolting: End flanges have been verified by the methods stated above, using bolt design stress values based on those for ASTM A193 B8 Cl.2 (i.e. 25000/20000psi - dependant on the bolt size) for Stainless Steel valves, and ASTM A320 L7 (25000psi) for Carbon Steel valves as defined in 2001 (2003 addenda) ASME Boiler and Pressure Vessel Code Section II - Materials - Part D - Properties.

3 HEALTH AND SAFETY (cont.)

- 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 (UK) Ltd Technical Sales.
- n) If the processes or environments that the products are used in are likely to cause temperatures (high or low) that may cause injury to personnel if touched, then adequate insulation/protection must be fitted.
- o) If the equipment is to be used on unstable gas duty, ensure that the operational parameters as indicated on the product identification plate 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 flanges, connections, etc.

4 PREPARATION FOR INSTALLATION

When despatched, V-Flow control valves contain special lubricants which aids the bedding in of the valve and ensures smooth modulating operation. This will ensure long life on control valves with metal seats.

Some valves contain a Silica gel bag inside the ball cavity to absorb humidity during storage. These must be removed before installation, as must all other protective packaging.

For valves up to and including 50mm it is important to ensure that the gland nut locking clip is retained at all times. 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.

The working area should be clean and clear of any debris which could contaminate the valve.

5 INSTALLATION INSTRUCTIONS

- a) Valves fitted with a flow arrow are uni-directional and must be installed with the arrow pointing downstream. Valves without flow arrows are bi-directional and may be installed in either direction.
- b) Installation of flanged valves should follow prevailing site standards. Where such standards not exist, the following should be used as a guideline.
 - i) Flanged joints require compressive loading onto the gasket material as the normal line pressure forces tend to separate the joint. There should be no misalignment between the valve and mating faces.
 - ii) Pipework should have the correct gap to allow for the valve face to face length plus assembled gasket material thickness.
 - iii) Ensure the pipeline and flange faces are clean and free of any debris which may be detrimental to flange sealing.
 - iv) Bolting should be of the correct size, length and material for the duty.
 - v) Locate the valve between the pipe ends and slide in the gaskets. It may be necessary to lever the mating flanges gently apart to allow for easy fitting of the gasket. Care should be taken to prevent damage to the sealing surfaces. Correct lifting equipment must be used when handling valves for operator safety.
 - vi) Assemble all bolts and loosely tighten. Diametrically and evenly tighten the bolts to the correct torque required for the specific gasket material.
- c) It is recommended that the valves are left in the open position during fitting.

6 OPERATION

6.1 USE

Worcester control valves fitted with a metal seat downstream provide shut off to FCI 70-2-1998 Class VI.

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

6.2 REMOTE OPERATION

Worcester control valves are designed to be automated with either electric or pneumatic actuators. Flowserve Flow Control (UK) Ltd. can supply these to cover a wide range of operating torque requirements.

Operation of these will be in accordance with the Installation, Operation & Maintenance Instructions for the relevant actuator.

7 MAINTENANCE

7.1 GENERAL

With self wipe ball / seats and patented pressure equalising slots (resilient seat only), 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 of this I.O.M.).
- 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, insert, ball or seat sealing surfaces and it will be necessary to repair it (refer to Section 9 & 10).

NOTE: Metal seats fitted downstream provide shut off to FCI 70-2-1998 Class VI.

7.3 STEM LEAKAGE

Remove the actuator (as detailed in the relevant actuator I.O.M.), followed by the gland nut locking clip (valves up to and including 50mm) and retighten the gland nut to the recommended torque.

If the leakage persists then it will be necessary to dismantle the valve to establish the cause and/or replace gland packings and thrust seals. (See section 9 & 10).

7.4 BODY/INSERT LEAKAGE

If leakage occurs here, it will be necessary to remove the valve from line. Remove the insert and establish whether the body and insert seal faces have been damaged. Replace the body seal, refit and tighten the insert to to the recommended torque value. (See section 9 & 10).

8 REPAIR KITS

Repair kits are available for all Worcester control valves. Control valves have special features over standard valves and as such repair kits for standard valves must not be used. 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 is 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 (UK) Ltd will accept no responsibility if the valve is altered in any way without the consent of Flowserve Flow Control (UK) Ltd.

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.

Ball and stem: 15mm to 50mm control valves are fitted with matched ball and stem to reduce backlash (hysteresis). If either the ball or stem needs replacing, then both items must be replaced with another matched pair.

When despatched, V-Flow control valves contain special lubricants which aids the bedding in of the valve and ensures smooth modulating operation. This will ensure long life on control valves with metal seats.

V-Flow characterised seats i.e. 30°V, 60°V, etc, must be properly orientated for proper function: A location pin is provided in the body, and a groove in the seat, to ensure proper alignment is accomplished, although on sizes 80mm & 100mm from 1996 onwards the seats have a male pip on the outside diameter that locates in a groove in the body. Ensure that the replacement seats are of the same design as the originals.

Only valve sizes up to and including 100mm can be fitted with characterised metal seats. Above this size only round port metal seats are available.

All of the following rebuilding instructions refer to valves with metal seats fitted in one end. If the valve is fitted with resilient seats (i.e. 'Fluorofill') in both ends or metal seats in both ends, then the procedure for pre-compression of seat seals is NOT required and should be ignored.

9.1 SIZE 15mm - 50mm (½" - 2")

9.1.1 DISMANTLING

- a) Ensuring that it is correctly supported, remove the valve from the pipeline by extracting the flange bolting from each end.
- b) With the valve securely clamped and in the open position, undo the insert using the appropriate drive adaptor. It will be necessary to use a heavy mallet on the tommy bar of the insert tool to break the metal to metal seal.
- c) Remove the insert to allow access to the cavity.
- d) Remove the body seal and discard. Close the valve and using a soft drift through the body port, tap out the ball and insert seat being careful not to damage the characterised metal seat.
- e) Turn the stem back to the open position and, using a suitable hook, pull out the body seat being careful not to damage the seat sealing face of the valve body.
- f) To dismantle the stem assembly remove:
Gland Nut Locking Clip
Gland Nut
Disc Springs
Gland
- g) Withdraw the stem from inside the body (N.B. with 15mm (½") valves the gland packing protector and gland packing must be removed and the flats of the stem must be aligned across the valve to allow withdrawal of the stem). The gland packing protector, gland packing and thrust seal can now be removed from their recesses, being careful not to damage the seal faces.
- h) All components not replaced by items in the repair kit should be thoroughly cleaned and stored in a clean secure area. All sealing faces on the body, insert and ball must be checked for corrosion, erosion and scratches. If damage is found or there is any doubt, replace the component.
- i) Cleaning the valve parts should be carried out using a suitable degreasing agent. Hard deposits can be removed using stainless steel wire wool. Care should be taken on all seal faces to avoid damaging them.

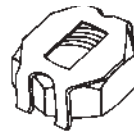
9 REFURBISHMENT INSTRUCTIONS (cont.)

9.1.2 REBUILDING

- a) 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.
- b) Fit a new thrust seal on to the stem shoulder and insert the stem through the valve body from inside the valve cavity. (On 15mm (½") valves, tweezers will make the job easier).
- c) Temporarily fit two metal glands, and one pair of disc springs (with their outer edges touching) followed by the gland nut. Tighten the gland nut until the disc springs are flat. Operate several times to bed in the thrust seal.
- d) Remove the gland nut, disc springs and temporary glands.
- e) Coat the graphite gland packing with Bentone Grease No.1 and fit into the body recess, followed by the gland packing protector (tan in colour), metal gland and new disc springs.
- f) Fit the gland nut, and using a wrench (or other means) to prevent the stem from turning, tighten it down to compress the disc springs. Operate the stem several times, then tighten the gland nut to the torque specified in Section 10.
- g) The locking clip must be fitted correctly: either across the corners or the flats of the gland nut. The gland nut can be tightened to the next position to correctly locate the clip (see below).
NOTE: Over tightening will only reduce the life of the stem assembly.



Correct



Correct



Incorrect



Incorrect

- h) Fit the graphite or PTFE seal into the recess in the back face of the metal seat. Apply Bentone Grease No.1 to both sides of the seat and the exposed back face of the seal. Fit the metal seat into the valve body. If the seat is characterised (i.e. 30°V), ensure that the slot in the outside diameter locates onto the orientation pin in the body.
- i) Apply Dow Corning DC200 to the metal seated side of the ball only and assemble into the valve body.
- j) Fit the original or a spare metal seat ring complete with compressed graphite seal (pre-compression aid) in the other end. Replace the insert, and with the ball in the open position, fully tighten to the torque specified in section 10.
- k) Remove the insert and the spare seat ring.
- l) Fit the new 'Fluorofill' seat ring and the new body seal, then replace the insert and tighten to the torque specified in section 10.
- m) It is important that on stainless steel valves an anti-scuffing compound such as Rocol 'Copperslip' is used on the insert threads. It is advisable, though not mandatory, to use it on carbon steel valves as well.
- n) If practical, leak tightness and operating torque should be checked prior to refitting the valve in line.

9 REFURBISHMENT INSTRUCTIONS (cont.)

9.2 SIZE 80mm - 200mm (3" - 8")

9.2.1 DISMANTLING

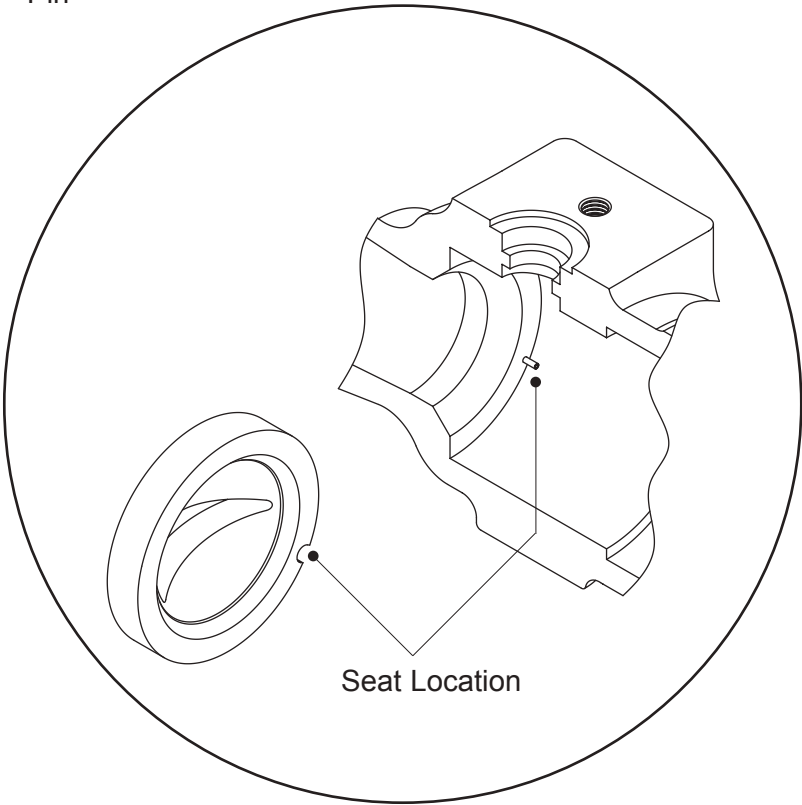
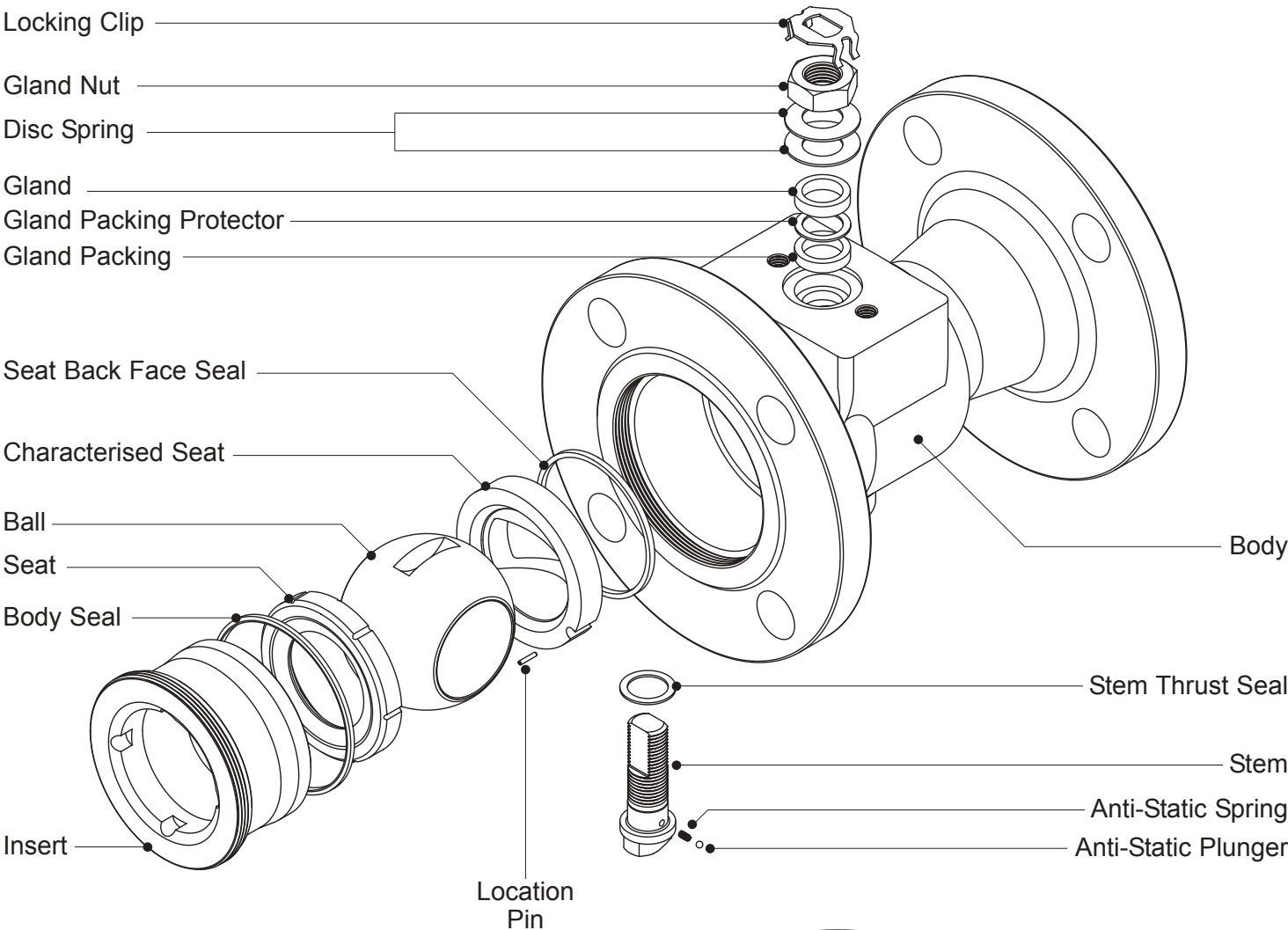
- a) Ensuring that it is correctly supported, remove the valve from the pipeline by extracting the flange bolting from each end. Large pipelines have a tendency to spring the flanges together making removal difficult. If necessary, remove or loosen elbows, couplings or pipe supports to get extra manoeuvrability.
- b) With the valve securely clamped and in the open position, undo the insert using the appropriate drive adaptor. Considerable force will be required to move the insert initially and it is recommended that a suitable hydraulic torque drive is utilised.
- c) When fully undone lift the insert squarely out of the body otherwise its seal face may be damaged.
- d) With the valve in the closed position pull the ball out of the valve cavity. If there is a large build up of scale in the cavity it may be necessary to tap it out using a soft drift, being careful not to damage the characterised metal seat.
- e) Using a suitable hook to get under the seat face, remove the seats from the insert and the body
- f) With a scribe or sharp bladed screwdriver, dig into the body seal at an angle far enough to provide positive location. Lever out one section of the body seal from its recess being careful not to damage the sealing surfaces of the body. Grip this section with long nosed pliers and pull out the seal.
- g) To dismantle the stem assembly remove:
Gland Nut
Anti-back off washer
Gland
- h) Tap the stem down into the valve cavity and withdraw. The valve gland packing, location washer and thrust seal can now be removed.
- i) All components not replaced by items in the repair kit should be thoroughly cleaned and stored in a clean secure area. All sealing faces on the body, insert and ball must be checked for corrosion, erosion and scratches. If damage is found or there is any doubt, replace the component.
- j) Cleaning the valve parts should be carried out using a suitable degreasing agent. Hard deposits can be removed using stainless steel wire wool. Care should be taken on all seal faces to avoid damaging them.

9 REFURBISHMENT INSTRUCTIONS (cont.)

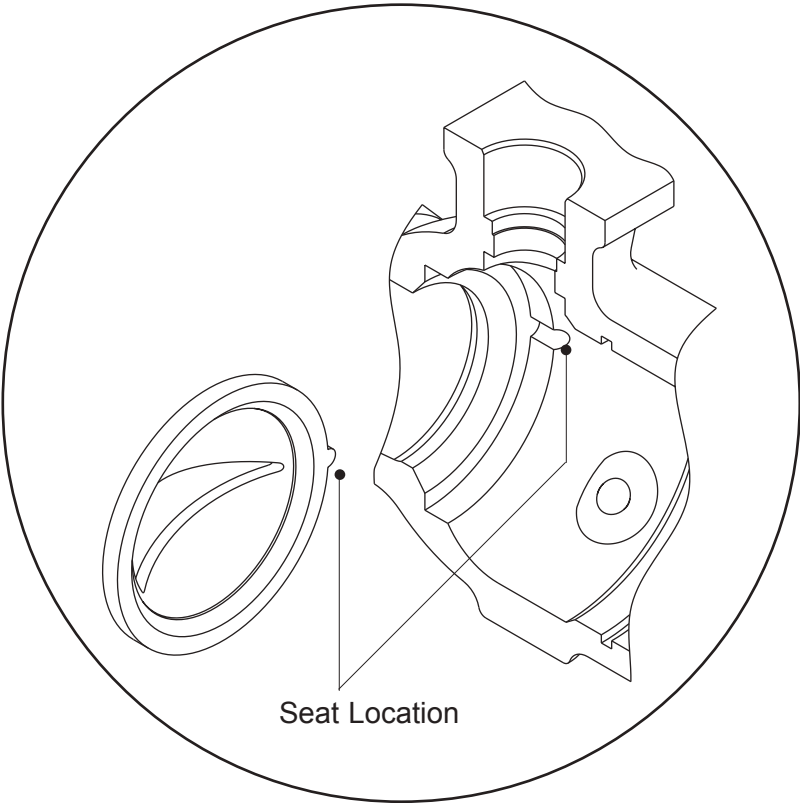
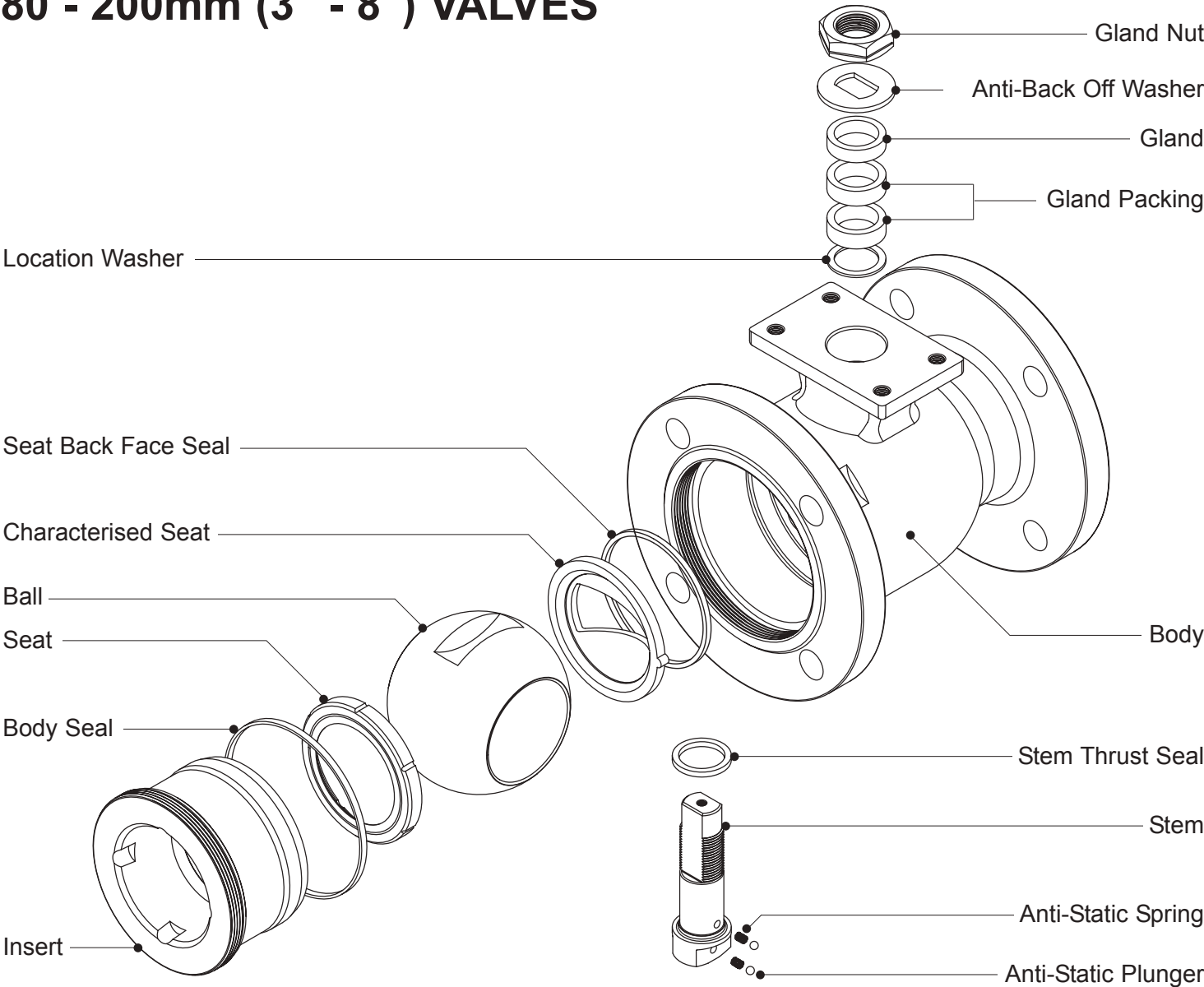
9.2.2 REBUILDING

- a) Before rebuilding, ensure the repair kit and/or components used are suitable for the valve requirement. When rebuilding, cleanliness is essential for long life.
- b) Fit a new thrust seal onto the stem shoulder and insert the stem through the valve body from inside the valve cavity.
- c) Place the location ring into the bottom of the gland housing, followed by the gland packing (coated with Bentone Grease No.1), the gland, anti-back off washer and the gland nut. With self locking gland nuts, Rocol 'Copperslip' or a similar anti-scuffing agent should be applied to the stem thread.
- d) Tighten the gland nut until the specified stem assembly torque has been achieved. Over tightening of the gland nut will only reduce the life of the stem assembly and can seriously increase torque (see Section 10).
- e) With the stem in the valve closed position, secure the valve in the vertical position.
- f) Fit the graphite or PTFE seal into the recess in the back face of the metal seat. Apply Bentone Grease No.1 to both sides of the seat and the exposed back face of the seal. Fit the metal seat into the valve body. If the seat is characterised (i.e. 30°V), ensure that it is located in the body to give the correct orientation.
- g) Apply Dow Corning DC200 to the metal seated side of the ball only and assemble into the valve body.
- h) Fit the original or a spare metal seat ring complete with compressed graphite seal (pre-compression aid) in the other end. Replace the insert, and with the ball in the open position, fully tighten to the torque specified in section 10.
- i) Remove the insert and the spare seat ring. Remove the ball to allow for assembly of the body seal.
- j) Push the outside diameter of the body seal in towards the centre with the index finger to produce a heart shape. The body seal can now be fitted into its annular groove. Once in place firmly push the seal into the recess to ensure there are no large protrusions into the insert bore.
- k) Slide the ball into the body, locating the stem drive tang, and operate to valve open.
- l) It is important that on stainless steel valves an anti-scuffing compound such as Rocol 'Copperslip' is used on the insert threads. It is advisable, though not mandatory, to use it on carbon steel valves as well.
- m) Apply Bentone Grease No. 1 to the back and front face of the insert seat. Locate it firmly in the insert housing. With the grease on the back face preventing the seat from falling out, screw the insert into the body. Only approximately 1½ turns will be achieved screwing in by hand. (The insert has then reached the body seal.)
- j) Using a hydraulic torque drive, tighten the insert to the specified torque (see Section 10).
NOTE: If hydraulic torque equipment is not available, it is essential the insert is metal to metal with the valve body. To do this, tighten the insert into the body with no seats or seals fitted. When it is at the metal to metal condition mark the radial position of the insert to body and measure the insert protrusion.
- k) When the valve is finally assembled meeting these datums will ensure correct assembly.
- l) The valve is now ready to be put back into line. If practical, leak tightness and operating torque should be checked.

15 - 50mm (1/2" - 2) VALVES



80 - 200mm (3" - 8") VALVES



10 VALVE ASSEMBLY TORQUES

DEFINITIONS

Insert Torque - The torque required to fully tighten the insert of one piece valves.

Stem Assembly Torques -The torque required to operate the assembled stem before the ball and seats are fitted to the valve.

Gland Nut Torques -The tightening torques to be applied to the gland nuts to achieve the above figures. **NOTE:** these figures are for tightening plain galnd nuts fitted with locking clips and **must not** be used for tightening self locking gland nuts.

NOMINAL SIZE	INSERT TORQUES (Nm)	GLAND NUT TORQUES (Nm)		STEM ASSEMBLY TORQUES (Nm)
		GRAPHITE BUILD	PTFE BUILD	
15mm (½")	65 - 75	5 - 7	6 - 9	3 - 5
20mm (¾")	65 - 75	5 - 7	6 - 9	3 - 5
25mm (1")	70 - 80	6 - 10	8 - 12	4 - 6
32mm (1¼")	70 - 80	6 - 10	8 - 12	4 - 6
40mm (1½")	80 - 90	8 - 12	13 - 18	6 - 8
50mm (2")	90 - 100	8 - 12	13 - 18	6 - 8
80mm (3")	700 - 740			18 - 22
100mm (4")	900 - 1065			18 - 22
150mm (6")	1500 - 1700			23 - 28
200mm (8")	1800 - 2000			23 - 28



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