



Flow Control Division

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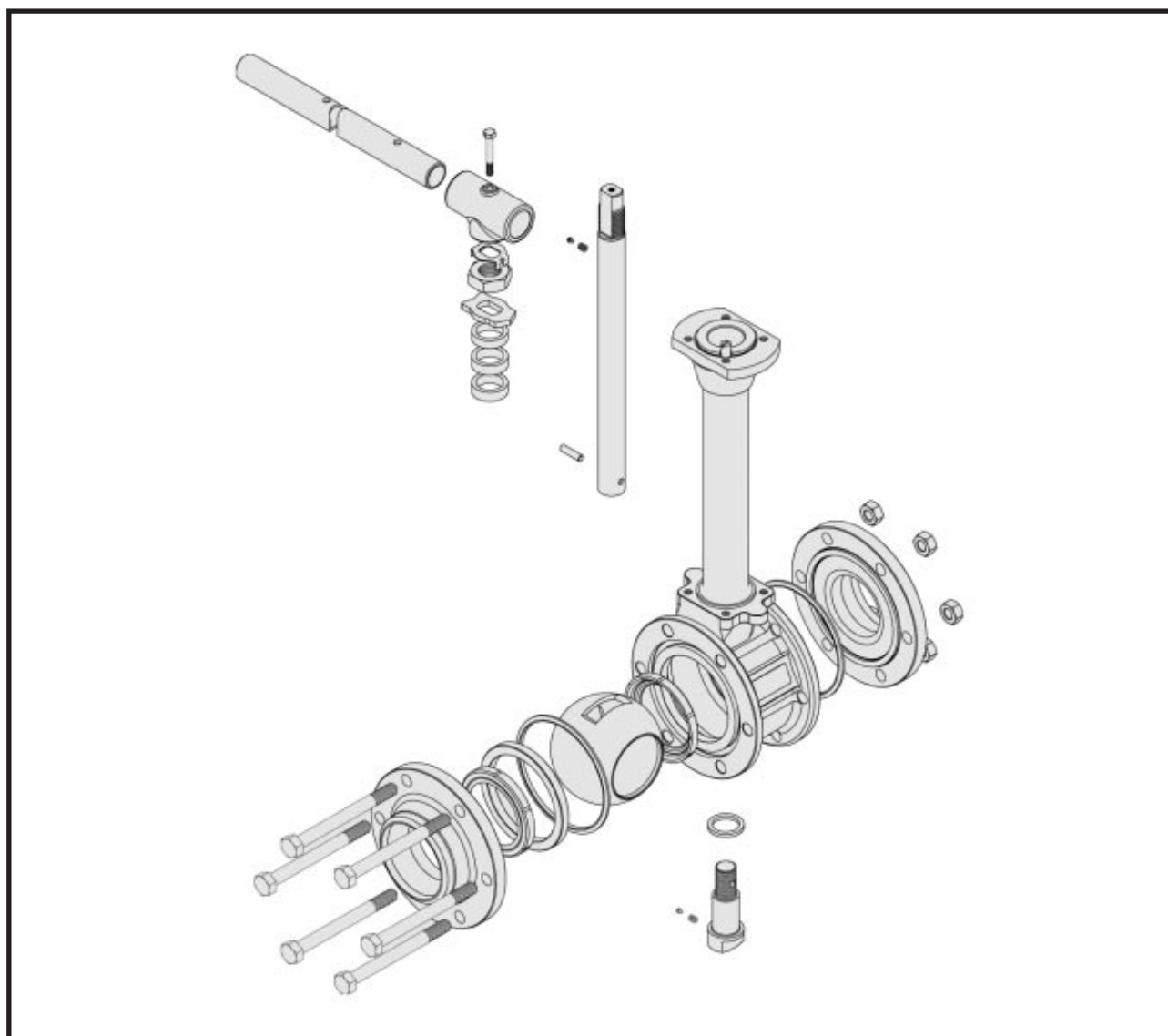
## Installation, Operating & Maintenance Instructions

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### Worcester Large 3-Piece Cryogenic Valves

C459 (65-200mm)

C599 (50-150mm)

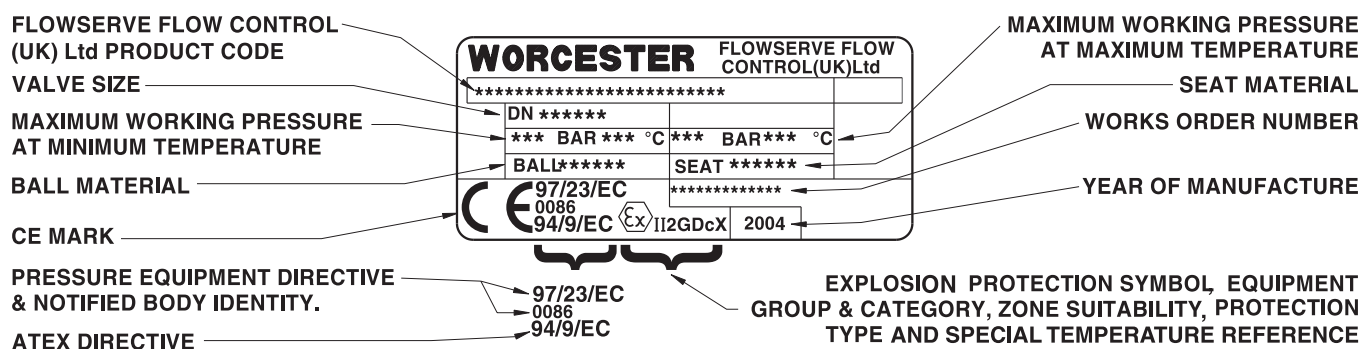


# 1 STORAGE AND PRESERVATION

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 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 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, for valve sizes DN32-DN50, the maximum/minimum allowable operating temperatures for the product are marked on the identification plate. Refer to the product brochure and/or Flowserve Flow Control (UK) Ltd. Technical Sales for allowable temperature limits for all other sizes).

**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 and connector.

### 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 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 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 (UK) Ltd. 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 (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

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

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.

Graphite seals should be handled with care due to their delicate nature.

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

# 5 INSTALLATION INSTRUCTIONS

## 5.1 GENERAL

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.

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 down stream. The valve stem axis must be within 45° of the vertical

## 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**.

## **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 for this purpose, are available from Flowserve Flow Control (UK) Ltd.

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 (UK) Ltd. can supply pneumatic and electric actuators to cover a wide range of operating torque requirements.

# **7 MAINTENANCE**

## **7.1 GENERAL**

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

With self wipe ball / seats, 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 (see Section 9 & 10).

## **7.3 STEM LEAKAGE**

Cryogenic and low temperature 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.), followed by the gland nut locking clip and retighten the gland nut to the recommended torque.

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 gland packing/s (see Section 9 & 10).

## **7.4 BODY / CONNECTOR JOINT LEAKAGE**

Check the body bolting is tightened to the recommended torque values and tighten if necessary. If leakage still occurs it will be necessary to remove the valve body 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

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. When rebuilding, cleanliness is essential for long valve life.

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. If the valve is altered in any way, without the consent of Flowserve Flow Control (UK) Ltd. then Flowserve Flow Control (UK) Ltd. will accept no responsibility.



## 9 REFURBISHMENT INSTRUCTIONS

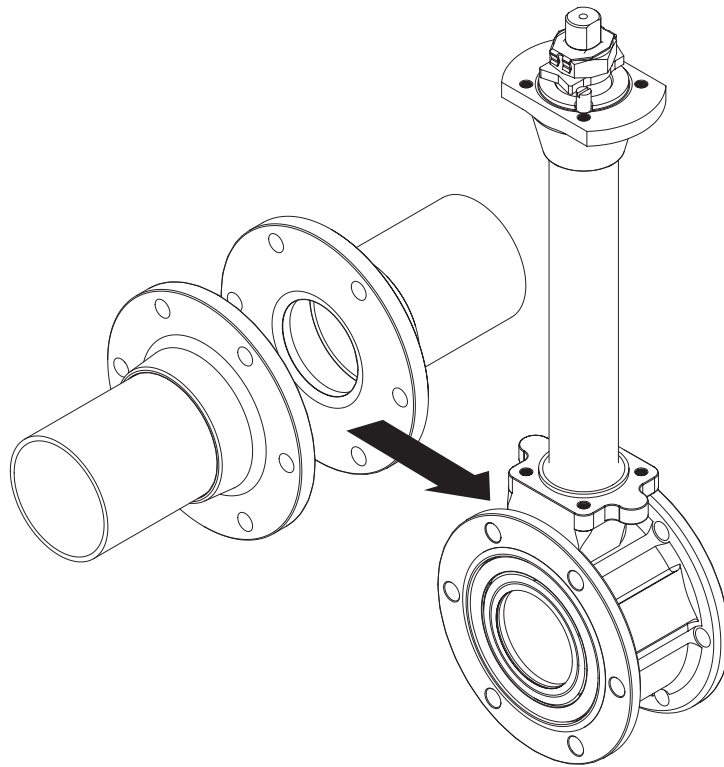
Prior to commencing any work on the valve or removing it from line, refer to the 'Health & Safety' Instructions.

**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.

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

### 9.1 DISMANTLING

- a) When removing the body assembly from the pipeline, ensure the ball is 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 end connectors
- b) Extract all of the body bolts, spring the end connectors apart slightly (to prevent the sealing faces from being damaged) and slide the body out from between the end connectors, as shown below.



## 9 REFURBISHMENT INSTRUCTIONS (cont.)

- c) Once the body is clear of the connectors, half close the ball, remove and discard the seats. Remove the seat-retaining ring. Complete the closing turn and the ball may be removed. This must be done with care, otherwise the ball may mark against the body.
- d) 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.
- e) Disassembly of the extended stem assembly:  
Remove the wrench assembly, followed by the locking clip, gland nut, stop plate and gland. Push the stem down into the valve body cavity and drive out the extension 'Drivelok' pin. The lower stem portion can now be unscrewed and removed from within the cavity and the top portion withdrawn through the top of the housing. Remove the remaining gland components and discard the gland packing and thrust seal. The two sections of the stem must be stored together and remain as a matched pair.
- f) All components not replaced by items in the repair kit should be thoroughly cleaned and stored in a secure area. All sealing surfaces on the body, connectors, ball and stem should be checked for corrosion, erosion and scratches. If any damage is found, or if there is any doubt over the suitability of the part, then it must be replaced.
- g) Cleaning of parts may be carried out using a suitable degreasing agent. Hard deposits can be removed using wire wool. Again, care should be taken not to damage any of the sealing surfaces.

## 9 REFURBISHMENT INSTRUCTIONS (cont.)

### 9.2 REBUILDING

- a) Before rebuilding, ensure the repair kit and/or components used are suitable for the valve requirement.
- b) Rebuilding: Fit the thrust seal to the lower stem portion and position into the stem bore through the valve cavity. Insert the upper stem portion through the top of the housing and screw the two sections together until the pin holes align, then refit the 'Drivelok' pin.
- c) To the top of the stem, fit the gland components, stop plate and gland nut.
- d) Using the wrench (or other means) to prevent the stem from turning, gradually tighten the gland nut and operate the stem several times until the stem operating torques figures specified in Section 10 are achieved. Over-tightening the gland nut will only reduce the life of the stem assembly.
- e) The gland nut 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
- f) Turn the stem to the closed position (wrench / stem flats across the pipeline).
- g) Insert the ball into position by sliding it onto the stem tang. The pressure relief hole must be on the upstream side of the valve relative to the flow direction arrow on the side of the valve. Turn the valve to the open position to stop the ball from falling out and from fouling the end connectors when the valve is placed back into the pipeline.
- h) The seat retaining ring, new seats and body seals can now be fitted.  
The application of a little suitable lubricant (such as mineral oil, a silicon based lubricant or clean grease such as petroleum jelly) to the seats and seals will help hold them in position and aid 'bedding-in' of the completed valve assembly. **NOTE:** ensure that the lubricant used is compatible with the pipeline media.
- i) 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.
- j) Centralise the body, replace the body bolts and tighten diagonally and evenly to the torque specified in Section 10.
- k) If practical, check for leak tightness and operating torque.

## 10 VALVE ASSEMBLY TORQUES

### 10.1 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.

<b>Valve Nominal Size</b>	<b>Recommended Torque (Nm)</b>	
	<b>C459</b>	<b>C599</b>
50mm (2")	-	77
65mm (2½")	77	117
80mm (3")	117	135
100mm (4")	135	220
150mm (6")	220	490
200mm (8")	490	-

### 10.2 GLAND NUT TORQUES

These figures are for tightening plain gland nuts, which are used in conjunction with gland nut locking clips. They are not to be used for tightening self-locking gland nuts.

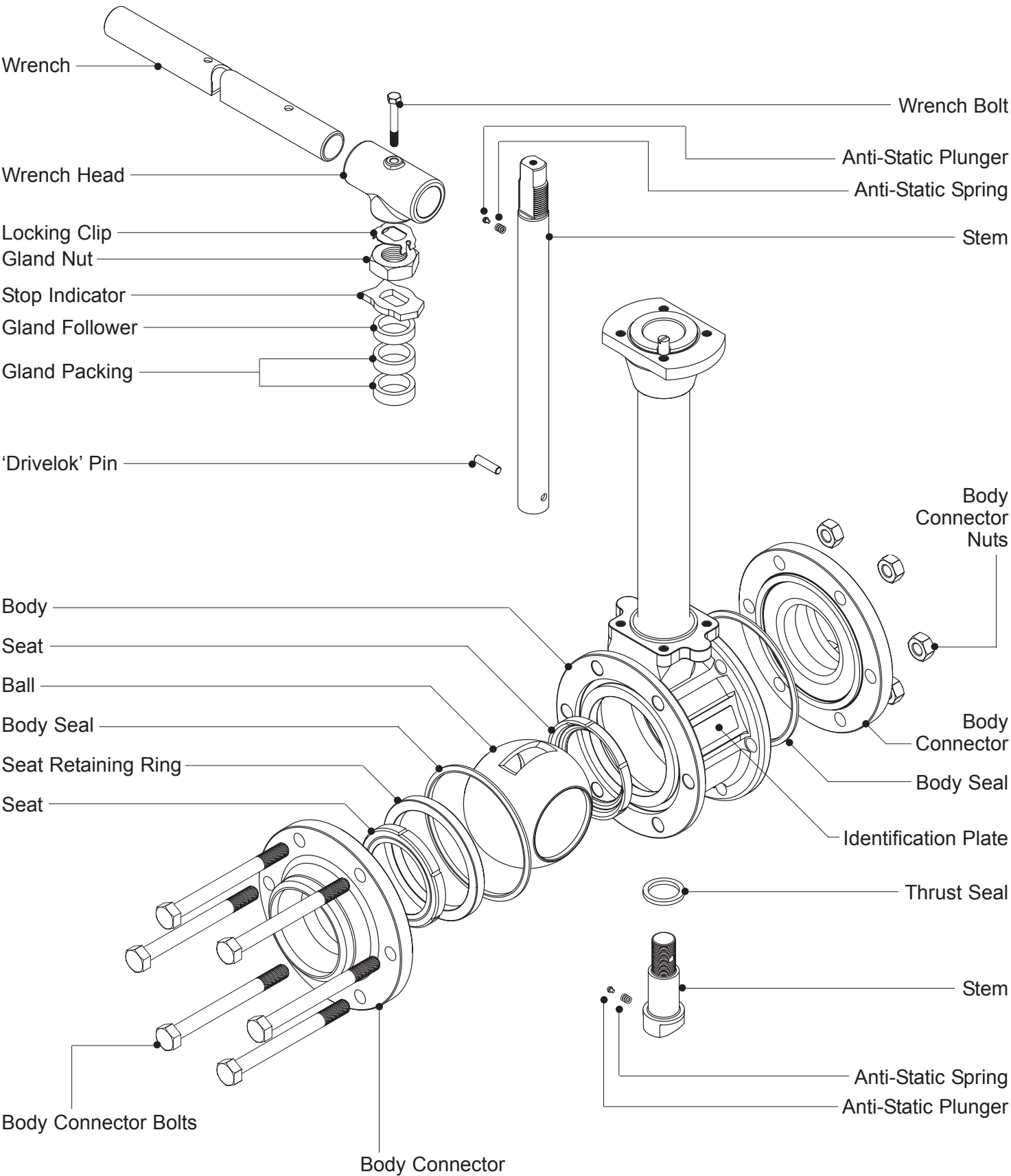
<b>Valve Nominal Size</b>	<b>Recommended Torque (Nm)</b>			
	<b>Graphite Seals</b>		<b>PTFE Seals</b>	
	<b>C459</b>	<b>C599</b>	<b>C459</b>	<b>C599</b>
50mm (2")	-	15 - 20	-	19 - 24
65mm (2½")	15 - 20	27 - 32	19 - 24	-
80mm (3")	27 - 32	35 - 40	-	-
100mm (4")	35 - 40	47 - 53	-	-
150mm (6")	47 - 53	63 - 68	-	-
200mm (8")	63 - 68	-	-	-

### 10.3 STEM ASSEMBLY TORQUES

The following figures are for guidance only. The torques quoted are those to operate the stem assembly before the ball and seats are fitted.

<b>Valve Nominal Size</b>	<b>Recommended Torque (Nm)</b>	
	<b>C459</b>	<b>C599</b>
50mm (2")	-	8 - 11
65mm (2½")	8 - 11	18 - 22
80mm (3")	18 - 22	20 - 26
100mm (4")	20 - 26	23 - 28
150mm (6")	23 - 28	29 - 35
200mm (8")	29 - 35	-

# SERIES C459/C599





**Flow Control Division**

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