

WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION M-02-01

VALVES

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VALVES

1. GENERAL

This specification covers the requirements for gate valves, butterfly valves and reflux valves.

All valves, with the exception of reflux valves, shall be provided with suitable gearboxes of self-locking design, if necessary, to enable the valve to be opened / closed against the specified maximum unbalanced pressure by one person only, including the emergency manual operation of an electrical valve. For manual operation, the effort required to operate the valve against maximum unbalanced pressure shall not exceed 25 kgf at rim of handwheel or 125 Nm at cap.

Where specified in the Particular Specification, a headstock with extension spindle shall be provided for operation of the gate valve or butterfly valve. For valves with vertical handwheel spindle, the rim of the handwheel shall be approximately 0.9 m above floor level. For valves with horizontal handwheel spindle, the height of the handwheel spindle axis shall be approximately 1 m above floor level. Gate position indicator showing both open and close position shall be provided with the extension spindle arrangement.

For cast iron valves, all internal and external bare surfaces shall be coated with epoxy coating in accordance with Clause 4.1.2.3 of BS EN 593. Unless otherwise specified in the Particular Specification, the coating shall be suitable for use in potable water to meet the full requirements of BS 6920 with minimum thickness as specified below:

	Electrostatically Fusion Powder Coated Epoxy (μ m)	Airless Sprayed Application (μ m)
Flat and Pressurised Parts	250	400
Convex Outer Edges	150	300

2. GATE VALVES

Gate valves shall be constructed in accordance with BS 5163-1 and BS 5163-2 with flanged ends and inside screw stems for non-rising stem type. The valves shall also comply with BS EN 1074-1 and BS EN 1074-2 and the flange ends shall be faced and drilled to BS EN 1092-1 and BS EN 1092-2 unless otherwise specified in the Particular Specification. To ensure smooth operation, the valves shall be fitted with body guides and gate shoes.

Depending on the types of applications and the nominal bore of the valves, gate valves shall be constructed of the following or other equivalent or superior materials according to the types as specified in the Particular Specification :

Item	Materials of Construction			
	Fresh Water & Raw Water Applications		Sea Water Application	
	Resilient Seated	Metal Seated -With copper alloy faced	Resilient Seated	Metal Seated -With all stainless steel
Body, Bonnet and Stuffing Box	Spheroidal Graphite Cast Iron to BS EN 1563	Spheroidal Graphite Cast Iron to BS EN 1563	Spheroidal Graphite Cast Iron to BS EN 1563	Stainless Steel 1.4401 to BS EN 10088-1:2005
Stem	Stainless Steel 1.4057 to BS EN 10088-1	Stainless Steel 1.4057 to BS EN 10088-1	Stainless Steel 1.4401 to BS EN 10088-1	Stainless Steel 1.4401 to BS EN 10088-1
Wedge type obturator	Spheroidal Graphite Cast Iron to BS EN 1563 with natural rubber (EPDM, NBR or equivalent material) complied with BS EN 681-1 Type WA and satisfied with the requirements stated in BS 6920 Parts 1 and 2 for use in potable water quality. The full rubber lining should be vulcanized and bonded to the valve body.	Spheroidal Graphite Cast Iron to BS EN 1563	Spheroidal Graphite Cast Iron to BS EN 1563 with natural rubber (EPDM, NBR or equivalent material). The full rubber lining should be vulcanized and bonded to the valve body.	Stainless Steel 1.4401 to BS EN 10088-1
Facing materials fitted onto the wedge shoes and body guides	Resilient Material such as polyamide or equivalent material with low friction coefficient and high wear-resistance.	Copper alloy to BS EN 1982 Grade CC333G	Resilient Material such as polyamide or equivalent material with low friction coefficient and high wear-resistance.	Not Applicable
Stem nut	Copper alloy to BS EN 1982 Grade CC333G	Copper alloy to BS EN 1982 Grade CC333G	Copper alloy to BS EN 1982 Grade CC333G	Stainless Steel 1.4401 to BS EN 10088-1 or Copper alloy to BS EN 1982 CC333G
Bolt	Stainless Steel A2	Stainless Steel A2	Stainless Steel A4	Stainless Steel A4

The resilient material shall comply with BS EN 681-1 Type WA of hardness to Category “70” and shall be of good resistance to chlorinated sea water. In addition, the material shall also be suitable for use in potable water to the full requirements of BS 6920, and shall have a nominal thickness of minimum 4mm on the seating areas, and minimum 1.5mm on the other non-seating areas.

Gate valves of nominal size 300 mm and larger shall be provided with supporting feet.

Means of operation of gate valves shall be either manually or electrically as specified in the Particular Specification. The valves shall be closed by turning the stem in a clockwise direction. Valve position indicator shall be provided and fitted in such a position that it can be legibly be viewed by the person operating the valve.

For manually operated gate valves, each valve shall be supplied with a stem cap secured to the valve stem by a stainless steel hexagon headed setscrew or a handwheel as specified in the Particular Specification. The stem cap or handwheel shall be marked with an arrow to indicate the clockwise closing direction of the valve.

Stem caps shall be designed to be the first component of the valve to break under both of the following situations: -

- (a) a gradually increasing closing torque is applied to the top end of the stem cap when the valve is in a fully open position; and
- (b) a gradually increasing opening torque is applied to the top end of the stem cap when the valve is in a fully closed position.

An easily replaceable shear device, as an alternative, to prevent the stem or other valve components from damage when the valve is applied with an excessive torque may be considered at the discretion of the Engineer. Design and details of such shear device, if proposed by the valve manufacturer, shall be submitted to the Engineer for agreement. This device shall be replaceable with the valve under pressure.

Notwithstanding the above requirement, all parts of the valve including the stem cap or the shear device shall comply with the minimum strength torque requirements as specified in Table B.1, Annex B of BS EN 1074-2:2000 and Clause 4.3 of BS 5163-2:2004.

Test requirements for each stem cap in its delivery state shall conform to Clause 4.3 of BS 5163-2:2004 and test certificates shall be submitted to the Engineer for acceptance.

Report of appropriate testing issued by an approved independent laboratory to demonstrate the compliance with the above requirements shall be submitted to the Engineer for acceptance.

For electrically operated gate valves, the electric actuator fitted onto the valves shall comply with the Water Supplies Department Standard Specification E-51-02 - Electric Actuator for Valve and Penstock. A handwheel shall be provided for manual operation of the valve in case of power failure. For safety, the handwheel operation shall be

independent of the motor drive and gear, i.e. the motor operation shall not cause the handwheel to rotate, and the operation of the handwheel shall not cause the motor to rotate.

3. **BUTTERFLY VALVES**

Butterfly valves shall be constructed in accordance with BS EN 593. The valves shall also comply with BS EN 1074-1 and BS EN 1074-2.

Butterfly valves shall be of double flanged type with flange ends faced and drilled to BS EN 1092-2. The face-to-face dimensions of the butterfly valves shall comply with BS EN 558 Table 4, Basic Series 13 for pressure rating of PN 25 and below, and Basic Series 14 for PN 40 unless otherwise specified in the Particular Specification.

Butterfly valves shall be designed for continuous operation of flow in either direction at any intermediate disk angles between fully opened and fully closed positions. The disk and seat shall be designed and profiled in such a way that it can reduce operating torque, provide tight shut-off and ensure long service life. The disk shaft sealing shall be of replaceable 'O' rings and cup-seal design. The shaft seals and bearings shall be free from external lubrication.

Supporting feet shall be provided for butterfly valves of nominal size 600 mm and above.

Butterfly valves shall be constructed of the following or other equivalent or superior materials according to its application as specified in the Particular Specification :

Item	Material	
	<u>Fresh Water & Raw Water Applications</u>	<u>Sea Water Application</u>
Body	Spheroidal Graphite Cast Iron to BS EN 1563. All wetted area shall be lined with rubber liner made from natural rubber, (EPDM, NBR or equivalent material) complied with BS EN 681-1 Type WA and satisfied with the requirements stated in BS 6920 Parts 1 and 2 for use in potable water quality. The full rubber lining should be vulcanized and bonded to the valve body.	Spheroidal Graphite Cast Iron to BS EN 1563 Spheroidal Graphite Cast Iron to BS EN 1563 Spheroidal Graphite Cast Iron to BS EN 1563. All wetted area shall be lined with rubber liner made from natural rubber, EPDM, NBR or with equivalent abrasion and resistance to chlorinated sea water. The full rubber lining should be vulcanized and bonded to the valve body.

Disk	Spheroidal Graphite Cast Iron to BS EN 1563	Stainless Steel 1.4401 to BS EN 10088-1 or Copper alloy to BS EN 1982 Grade CC333G
Shaft	Stainless Steel 1.4057 to BS EN 10088-1	Stainless Steel 1.4401 to BS EN 10088-1
Rings bolted onto body or disk for seating or clamping purposes (If applicable)	Stainless Steel 1.4401 to BS EN 10088-1	Stainless Steel 1.4401 to BS EN 10088-1
Resilient Seal (Not applicable to metal to metal seat)	Seal complied with BS EN 681-1 Type WA and satisfied with the requirements stated in BS 6920 Parts 1 and 2 for use in potable water quality.	Seal such as PTFE, EPDM or NBR Liner or other type of material with equivalent abrasion and resistance to chlorinated sea water.
Internal Fastenings	Corrosion-resistant and compatible materials i.e. Stainless Steel 1.4401 to BS EN 10088-1 or better.	

For valves of nominal bore larger than 250mm, butterfly valves shall be suitable for use with the disk shaft horizontal and provided with a handwheel for manual operation. The handwheel shall close the valve when turned in the clockwise direction and shall be marked clearly with the words “OPEN” and “CLOSE”, with arrows to indicate the direction of operation. Valve position indicator shall be provided and fitted in such a position that it can be legibly be viewed by the person operating the valve.

For electrically operated butterfly valves, the electric actuator fitted onto the valves shall comply with the Water Supplies Department Standard Specification E-51-02 - Electric Actuator for Valve and Penstock. A handwheel shall be provided for manual operation of the valve in case of power failure. For safety, the handwheel operation shall be independent of the motor drive and gear, i.e. the motor operation shall not cause the handwheel to rotate, and the operation of the handwheel shall not cause the motor to rotate.

4. **REFLUX VALVES**

Unless otherwise specified in the Particular Specification, reflux valves shall be of wafer type or double flanged type that are suitable for mounting in between flanges of raised face and drilling to BS EN 1092:1 and BS EN 1092:2. The reflux valves shall be designed to effectively resist slam and water hammer.

The following designs of reflux valves are acceptable :

- (i) spring operated double flap type supported by a vertical hinge;
- (ii) spring operated nozzle type with annulus shaped waterways; and

- (iii) single or multi disk recoil type reflux valve.

Reflux valve with counter weights or springs fitted externally to the valve will not be accepted unless otherwise specified in the Particular Specification.

Suppliers shall provide a “head loss” curve and a dynamic characteristic curve for the same size of the valve to be offered. Reflux valves shall be selected in accordance with the required dynamic response characteristic and other requirements as specified in the Particular Specification.

The reflux valve shall be constructed of the following or suitable superior materials :

Item	Material	
	<u>Fresh Water & Raw Water Applications</u>	<u>Sea Water Application</u>
<u>1.For Double Flap Type</u>		
Body	Spheroidal Graphite Cast Iron to BS EN 1563	Stainless Steel 1.4401 to BS EN 10088-1 or Copper alloy to BS EN 1982, designation CC333G.
Flap	Spheroidal Graphite Cast Iron to BS EN 1563	Stainless Steel 1.4401 to BS EN 10088-1 or Copper alloy to BS EN 1982, designation CC333G.
Seal	Seal complied with BS EN 681-1 Type WA and satisfied with the requirements stated in BS 6920 Parts 1 and 2 for use in potable water quality specified.	Seal, such as PTFE, RTFE, EPDM, etc. or with equivalent abrasion and resistance to chlorinated sea water.
Stop Pin, Hinge Pin, Spring and Pin Retainers	Stainless Steel 1.4401 to BS EN 10088-1	

<u>2.For Nozzle Type</u>		
Body	Spheroidal Graphite Cast Iron to BS EN 1563	Spheroidal Graphite Cast Iron to BS EN 1563. All wetted area shall be lined with material such as natural rubber, EPDM, NBR or with equivalent abrasion and resistance to chlorinated sea water.
Seat Ring and Disk Ring	Stainless Steel 1.4401 to BS EN 10088-1	

Flow Diffusers (inner and outer)	Stainless Steel 1.4401 to BS EN 10088-1	
Guides	Stainless Steel 1.4401 to BS EN 10088-1	
3. For Recoil Type		
Body and Door	Spheroidal Graphite Cast Iron to BS EN 1563	Spheroidal Graphite Cast Iron to BS EN 1563. All wetted area shall be lined with material such as natural rubber, EPDM, NBR or with equivalent abrasion and resistance to chlorinated sea water.
Seats and Faces	Stainless Steel 1.4401 to BS EN 10088-1	
Disk Hinge Pin	Stainless Steel 1.4401 to BS EN 10088-1	

5. VALVE TESTS

Valves shall be tested in accordance with BS EN 1074-1, BS EN 1074-2 for gate and butterfly valves, BS EN 1074-3 for reflux valves, and BS EN 12266-1&2 as appropriated for a duration of not less than 10 minutes.

The valves shall be leak-tight with no visually detectable leakage for the duration of the test under an internal water pressure equal to 1.5 times the PN rating. The seat of valves in the fully closed position shall be leak-tight with no visually detectable leakage for the duration of the test under a differential water pressure equal to 1.1 times the PN rating. All valve seats shall be tested on both sides, but for reflux valves, the test pressure shall only be applied in the direction tending to close the obturator.

For butterfly valves with metal to metal seals, a low leakage rate of not more than the figures given in the following table is acceptable in the valve seat tests :

Maximum permissible seat test leakage rates for metal to metal seals of butterfly valves	
DN 1200 and below	above DN 1200
0.1 mm ³ /s x DN	as specified in the Particular Specification

Suppliers may be requested to submit certificates of origin and test for the materials used in the construction of the valves and their component parts.

6. VALVE MARKING

Valve bodies shall be marked or on a plate of durable material securely fixed to the body of the valve with screws or bolts with the following information :

- (a) Name of manufacturer
- (b) Nominal pressure (PN)
- (c) Nominal size (DN)
- (d) Sealing material, e.g. RES for resilient seated valves
- (e) Direction of flow for reflux valves
- (f) The allowable differential pressure (Δp)
- (g) The weight of the valve in kg.

7. INFORMATION TO BE PROVIDED IN THE PARTICULAR SPECIFICATION

The following information shall be provided in the Particular Specification for requirements other than this Standard Specification.

Clause in this Standard Specification	Specified requirement to be quoted in the Particular Specification
Paragraph 1 General	State whether a headstock with extension spindle shall be provided for operation of the gate valve or butterfly valve.
	State whether the coating shall be suitable for use in potable water to meet the full requirements of BS 6920 and the minimum thickness of the coating.
Paragraph 2 Gate Valve	Specify the details of flange ends.
	Specify the materials for the gate valves.
	Specify the means of operation of gate valve (manual or electrical).
	Specify the need for a stem cap for manually operated gate valve.
Paragraph 3 Butterfly Valve	Specify the face-to-face dimensions of the butterfly valves.
	Specify the materials for butterfly valves.
Paragraph 4 Reflux Valve	Specify the type of connection of the reflux valves.
	Specify whether counter weights or springs fitted externally to the valve are required.
	Specify any additional requirements other than the required dynamic response characteristic for reflux valve.

- End of Specification -