WATER SUPPLIES DEPARTMENT

STANDARD SPECIFICATION M-02-01

VALVES

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CONTENTS

VALVES

M-02-01
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VALVES

1. GENERAL

This specification covers the requirements for gate valve, butterfly valve and reflux valve intended for installation in waterworks installations including pumping stations, water treatment works and service reservoirs or as specified otherwise.

All valves, with the exception of reflux valve, 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 a motorized valve. For manual operation, the effort required to operate the valve against maximum unbalanced pressure shall not exceed 250 N at the rim of handwheel or 125 Nm at the valve key.

Where specified in the Particular Specification, a headstock with an extension spindle shall be provided for operation of the gate valve or butterfly valve. For valve with vertical handwheel spindle, the rim of the handwheel shall be approximately 0.9 m above floor level. For valve with horizontal handwheel spindle, the height of the handwheel spindle axis shall be approximately 1 m above floor level.

For cast iron valve, all internal and external bare surfaces shall be coated with epoxy coating complied with Section 4 and 5 of WIS 4-52-01. The coating for fresh water, raw water and recycled water[1] applications shall be suitable for use in potable water and capable of meeting the full requirements of BS 6920. The minimum thickness of the coating shall be as specified below:

	Fusion Bonded Epoxy (μm)
Flat and Pressurised Parts	250
Convex Outer Edges	150

Quality control tests on the coating applied to the valves shall be in accordance with Clause 13 of WIS 4-52-01 and include the following as a minimum requirement.

- Visual Inspection
- Thickness test
- Holiday detection
- Impact resistance test
- Adhesion test
- Cure test

[1] The recycled water comprises reclaimed water (from the processing of treated sewage effluent (TSE) from sewage treatment works), treated grey water (from the treatment of used water collected from baths, wash basins, kitchen sinks or similar fitments) and harvested rainwater (treated water converted from rainwater not collected through the raw water systems of the WSD).

The valve manufacturer may be requested to submit quality control or type test certificate on the coating applied to the valves for scrutiny or, if specified in the Particular Specification, conduct the quality control tests in the presence of an Independent Inspection Body.

2. GATE VALVE

Gate valve shall be of non-rising stem design with flanged ends constructed in accordance with BS 5163-1 or BS 5163-2. 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, valves of DN 350 mm and above shall be fitted with channel guides and gate shoes.

Depending on the types of applications and the valve seat arrangement as specified in the Particular Specification, gate valve shall be constructed of the following or other equivalent or superior materials:

Item	**Materials of Construction**			
	Fresh Water, Raw Water and Recycled Water Applications		**Salt water Application (unless otherwise specified in the Particular Specification, metal seated valve of stainless steel construction shall be offered)**	
	Resilient Seated with rubber-coated wedge	**Metal Seated**	**Resilient Seated with rubber-coated wedge**	**Metal Seated (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
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	Spheroidal Graphite Cast Iron to BS EN 1563 fully vulcanized with EPDM, NBR or other equivalent material (Note 1). No ferrous part of the wedge shall be exposed.	Spheroidal Graphite Cast Iron to BS EN 1563.	Spheroidal Graphite Cast Iron to BS EN 1563 fully vulcanized with EPDM, NBR or other type of material with equivalent abrasion and resistance to chlorinated salt water. No ferrous part of the wedge shall be exposed.	Stainless Steel 1.4401 to BS EN 10088-1

Item	Materials of Construction			
	Fresh Water, Raw Water and Recycled Water Applications		**Salt water Application (unless otherwise specified in the Particular Specification, metal seated valve of stainless steel construction shall be offered)**	
	Resilient Seated with rubber-coated wedge	**Metal Seated**	**Resilient Seated with rubber-coated wedge**	**Metal Seated (all stainless steel)**
Wedge Seat Rings	Not applicable	Aluminium Bronze to BS EN 1982 CC331G / CC333G	Not applicable	Not applicable
Body Seat Rings	Not applicable	Aluminium Bronze to BS EN 1982 CC331G / CC333G	Not applicable	Not applicable
Gate / Wedge Shoes	Engineering plastic material such as polyamide or equivalent with low friction coefficient and high wear-resistance	Aluminium Bronze to BS EN 1982 Grade CC331G / CC333G	Engineering plastic material such as polyamide or equivalent with low friction coefficient and high wear-resistance	Not applicable
Channel Guides / Body Guides	Same as body material	Aluminium Bronze to BS EN 1982 Grade CC331G / CC333G	Same as body material	Not applicable
Stem nut	Aluminium Bronze to BS EN 1982 Grade CC331G/CC333G		Aluminium Bronze to BS EN 1982 CC333G	
Bolt	Stainless Steel to BS EN ISO 3506-1 Grade A2		Stainless Steel to BS EN ISO 3506-1 Grade A4	

Note 1 : The materials shall comply with BS EN 681-1 Type WA and the requirements stated in BS 6920 Parts 1 and 2 for use in potable water.

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

Means of operation of gate valve shall be either manual or motorized as specified in the Particular Specification.

For manually operated gate valve, it shall be supplied with a hand wheel or stem cap for T-key operation as specified in the Particular Specification marked with arrow indicating

closure of valve in a clockwise direction. The stem cap shall be replaceable and secured to the valve stem or gearbox spindle by a stainless steel socket head bolt. For valves operated with gearbox, valve position indicator shall be provided and fitted in such a position that it can be clearly viewed by the operator.

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For electrically operated gate valves, the electric actuator fitted onto the valves shall comply with Water Supplies Department Standard Specification E-51-02 - Electric Actuator for Valve and Penstock. A hand wheel shall be provided for manual operation of the valve in case of power failure and shall close the valve when turned in the clockwise direction. For safety reason, the hand wheel operation shall be independent of the motor drive and gear, i.e. the motor operation shall not cause the hand wheel to rotate or vice versa.

Stem Cap

For key-operated gate valves, stem caps shall be designed to be the first component of the valve to break under both of the following operation conditions: -

(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 stainless steel shear device of steel designation 1.4301 or 1.4401 to BS EN 10088-1, as an alternative, to protect the stem or other valve components from damage due to excessive torque applied may be accepted subject to the approval of the Engineer or acceptance of the *Project Manager*. The device shall be replaceable with the valve under pressure.

Tests shall be conducted to verify compliance of the requirements by adopting the procedures as described in the Annex A of BS EN 1074-2. When so tested, the valve stem cap or shear device shall fail between 0.8 and 1.0 of the nominal minimum strength torque (mST) of the size of valve concerned.

For stem caps or shear devices fitted to gearboxes on valves, their strength rating shall be reduced by the ratio of the respective gearbox to ensure that the torque applied to the stem through the gearbox shall not exceed the mST of the respective size of the valves.

Notwithstanding the above requirement, all parts of the valve excluding the stem cap or the shear device shall comply with the mST requirements as specified in Table B.1, Annex B of BS EN 1074-2:2000. The valve shall be tested in bare stem state without gearbox or stem cap fitted.

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/*Project Manager* 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/

Project Manager for reference.

3. BUTTERFLY VALVE

Butterfly valve shall be constructed in accordance with BS EN 593, and 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 valve shall comply with BS EN 558:2022 Table 7, 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 valve 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 bi-directional 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 valve of nominal size 600 mm and above.

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

Item	**Materials of Construction**	
	Fresh Water, Raw Water and Recycled Water Applications	**Salt water Application**
Body	Spheroidal Graphite Cast Iron to BS EN 1563. All wetted area shall be lined with rubber liner made from 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. All wetted area shall be lined with rubber liner made from EPDM, NBR or with equivalent abrasion and resistance to chlorinated salt 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 Aluminium Bronze 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

Item	Materials of Construction	
	Fresh Water, Raw Water and Recycled Water Applications	**Salt water Application**
Rings bolted onto body or disk for seating or clamping purposes (If applicable)	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982 Grade CC331G/CC333G	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982 Grade CC333G
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 salt water.
Internal Fastenings (if applicable)	Corrosion-resistant and compatible materials i.e. Stainless Steel 1.4401 to BS EN 10088-1 or better.	

For valve of nominal size larger than 250mm, it shall be suitable for use with the disk shaft in horizontal position 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 viewed by the person operating the valve.

For electrically operated butterfly valve, the electric actuator fitted onto the valve 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 or vice versa.

4. REFLUX VALVE

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

The following designs of reflux valve 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	**Materials of Construction**	
	Fresh Water, Raw Water and Recycled Water Applications	**Salt water Application**
Double Flap Type		
Body	Spheroidal Graphite Cast Iron to BS EN 1563	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982, designation CC333G.
Flap	Stainless Steel 1.4401 to BS EN 10088-1	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze 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.	Seal, such as PTFE, RTFE, EPDM, etc. or with equivalent abrasion and resistance to chlorinated salt water.
Stop Pin, Hinge Pin, Spring and Pin Retainers	Stainless Steel 1.4401 to BS EN 10088-1	
Nozzle Type		
Body	Spheroidal Graphite Cast Iron to BS EN 1563	Not Applicable
Seat Ring and Disk Ring	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982 Grade CC331G/CC333G	

Flow Diffusers (inner and outer)	Stainless Steel 1.4401 to BS EN 10088-1	
Guides	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982 Grade CC331G/CC333G	
Recoil Type		
Body and Door	Spheroidal Graphite Cast Iron to BS EN 1563	Not Applicable
Seats and Faces	Stainless Steel 1.4401 to BS EN 10088-1 or Aluminium Bronze to BS EN 1982 Grade CC331G/CC333G	
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 and BS EN 1074-2 for gate valve and butterfly valve, BS EN 1074-3 for reflux valve, and also BS EN 12266-1&2 as appropriate.

The valve body 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 valve seat 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 in both directions except reflux valves for which the test pressure shall only be applied to the obturator in the flow direction of the valve.

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

Maximum allowable seat leakage rate For metal to metal seat of valve	
DN 1200 and below	above DN 1200
$0.01 mm^3/s$ x DN (In accordance with BS EN 12266-1 Table A.5 - Rate B)	As specified in the Particular Specification

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

The valves in contact with fresh water shall comply with the Clause 2.10 of the Water Supplies Department Standard Specification **EM-00-03**. For leachability of metal test according to AS/NZS4020:2018 (Appendix H), the scaling factor for valves as specified below shall be applied.

Metallic Product	Scaling Factor
Gate valve	0.01
Butterfly valve	0.05
Non-return/Check valve	0.01 for DN=>100 0.05 for DN<100

6. VALVE MARKING

Valve body shall be marked or securely fixed with a plate of durable material by 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) Allowable differential pressure (△p)

(g) Weight of the valve in kg.

7. INFORMATION TO BE PROVIDED IN THE PARTICULAR SPECIFICATION

The following information, if required, shall be provided in the Particular Specification in addition to this Standard Specification.

Section of this Standard Specification	Requirement(s) to be specified in the Particular Specification
Section 1 General	● Necessity of headstock with an extension spindle for operation of the gate valve or butterfly valve. ● Any coating tests to be witnessed by IIB.
Section 2 Gate Valve	● Operation of the valve (i.e. manual or motorized) ● Valve seat arrangement (i.e. resilient or metal seated) ● Pressure rating of the valve ● Maximum unbalance pressure across the valve ● Valve stroke time (applicable with motorized valve) ● Any alternative flange drillings details ● Any alternative use of resilient seated gate valve with rubber-coated wedge in place of stainless steel gate valve for salt water application ● Provision of hand wheel or T-key operated stem cap (applicable with manually operated valve) ● Provision of valve position indicator, if required, for valve operated with hand wheel directly mounted on valve stem
Section 3 Butterfly Valve	● Operation of the valve (manual or motorized) ● Pressure rating of the valve ● Maximum unbalance pressure across the valve ● Valve stroke time (applicable with motorized valve) ● Any alternative flange drilling details
Section 4 Reflux Valve	● Pressure rating of the valve ● Mounting method of the valves (e.g. wafer type or flanged type) ● Any acceptance of valve fitted externally with counter weights, damper or springs. ● Dynamic response of the valve, if required, in terms of system deceleration dv/dt (m/s^2) and maximum allowable reverse flow velocity V_R (m/s).
Section 5 Valve Tests	● Maximum allowable seat leakage rate for metal seated butterfly valves of size above DN 1200.

8. INFORMATION REQUIRED IN THE MATERIAL SUBMISSION BY THE CONTRACTOR

The following information shall be provided in the material submission for material approval/ acceptance by the Engineer or *Project Manager*.

Item	Description	Details
1.	Technical Schedule	Location
		Size
		Media (Fresh water, raw water, recycled water or salt water)
		Operation (Manual or Motorized)
		Manufacturer
		Country of Origin
		Application Standard
		Model No. / Type
		Seat
		Shaft/ Stem arrangement
		Headstock
		Cap/Hand Wheel/ Actuated
		Maximum Unbalance Pressure Across
		PN Rating
		Flange Drilling
		Test Pressure for Body and Seat
		Materials and Coating
		Production Test
		Maximum seating/ unseating torque required at maximum unbalance pressure , at valve gear box input spindle
		No. of turns required at gearbox input shaft for a complete stoke (Full open to full close
		Weight of Valve
		Gearboxes of self-locking
		Actuator (refer to E-51-02)
		Actuator sizing (refer to E-51-02)
2	Compliance with Standard Specification M-02-01	
3	Compliance with Particular Specification	
4	Valve Catalogue	Outline and sectional drawing of the valve, indicating the general dimensions, components and materials
		Job reference
5	Certificates	Certificate of Compliance and Origin
		Water Regulations Approval Scheme (WRAS) certificate
		Type test certificate for the leachability test of valves

- End of Specification -