	Procedure : Specification for Butterfly Valve	
	Department : Material Evaluation Technical Committee (METC)	
	Document No : PBA/VALVE/BUTTERFLY VALVE	Revision No : 01
	Classification : PUBLIC	Effective Date : 13 March 2019

1.0 Scope

This Material Specification details the minimum requirement for the design, manufacture, testing, inspection and supply of Butterfly Valve for Perbadanan Bekalan Air Pulau Pinang (hereinafter referred as PBAPP) to be used for transport and distribution of potable water.

2.0 Standards, Codes and Guidelines

All activities relating to this section of the specification shall comply with the following or approved equivalent standards. The following codes and standards, to the extent specified herein, form a part of this specification. The latest edition of these codes and standards shall govern the work.

BS EN 593 + A1	Industrial Valve - Metallic Butterfly Valve
BS EN 1563	Founding - Spheroidal graphite cast irons
BS EN 1503	Valves - Materials for bodies, bonnets and covers
BS EN 681	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Thermoplastic elastomers
MS 672	Rubber seals in water supply, drainage and sewerage pipelines
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water
ISO 8501	Preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness
BS EN 558	Industrial valve - Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems.
BS EN 1092	Flanges and their joints - circular flanges for pipes, valves, fittings and accessories, PN designated
ISO 5210	Industrial valves-Multi-turn valve actuator attachments

3.0 Technical Requirement


3.1 General

The butterfly valves shall be of the double-flanged short in accordance to **BS EN 593+A1**

3.2 Valve Size

Size of the valve shall be according to the PBAPP standard pipe sizes as shown in Table 1 below:

Table 1 — PBAPP standard Nominal Sizes of pipes

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Pipe Size (mm)	Pipe Size (in)
300	12
450	18
600	24
900	36
1200	48
1350	54

3.3 Valve Operation

3.3.1 PN Rating

The valve shall be of **PN16** rating unless otherwise stated by PBAPP.

3.3.2 Direction of Operation


Valve operating direction which to be delivered shall be as below:

- **Penang Island: The direction is anticlockwise closing (CTO)**
- **Seberang Perai: The direction is clockwise closing (CTC)**

4.0 Valve Material

Materials used for the manufacture of the butterfly valve shall conform to the following:

Part	Material
Body	Spheroidal graphite iron according to BS EN 1563, material number EN-JS 1030 Grade 420/12 or BS EN 1503
Shaft	Stainless Steel 316 in accordance to BS970: Part 4
Internal fastener	Fasteners such as bolts, nuts or pins that are used to fasten or secure any two or more parts from moving shall be of Stainless Steel 316 L
Disc	Spheroidal graphite in accordance to BS EN 1563
Retaining Plate for disc and Sleeve Seat	Stainless Steel 316
Sealing Ring	EPDM in accordance with MS 672 or BS EN 681
Coating	Fusion Bonded Epoxy Coating

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5.0 Valve Design

5.1 Off-set Disc

The butterfly valve design shall be of the double offset disc type. The elastomer sealing ring shall be placed at circumference of the disc or on the valve body. Technical details of how the elastomer sealing ring is secured to the disc must be clearly shown in the engineering drawing.

5.2 Operational Torque

Torque characteristics of the butterfly valve such as torque during valve travel, at fully closed and opening shall be supplied by the valve manufacturer.

The normal operating torque shall be designed to 60 Nm with the safety factor of at least 5 times of normal operating torque. This shall apply to all sizes of butterfly valve. Safety pin shall be designed to be failed at 4 times of normal operating torque or equivalent to 240 Nm.

5.3 Tight Shut-Off

Valves shall be designed for tight shut-off.

5.4 Flanges


Flanges shall be cast integral with the body.

5.5 Sleeve Seat for the Disc (Soft Seated Valve)

The part of the valve body that comes close or in contact with the elastomer sealing ring during travel to close or when in closed position shall be lined with stainless steel. This stainless steel liner shall be Stainless Steel Grade 316.

The width of this sleeve shall be sufficient to ensure that the elastomer sealing ring of the disc shall be protected from damage by incrustations of the internal walls of the valve (should this happen) during its travel between open and close positions.

The method of securing the sleeve to the valve body shall be stated by the manufacturer or clearly shown in the engineering drawings. The minimum thickness of the sleeve shall not be less than 500µm.

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5.6 Sealing Ring

The sealing ring on the disc shall be fastened to the disc or the internal side of the valve body such that it may be replaced when worn or damaged.

5.7 Flow Characteristics of Butterfly Valve

Flow characteristics of the butterfly valves test in accordance to Clause 4.2.3.1 and 4.2.3.2 of *BS EN 593 + A1* shall be submitted together with the tender.

5.8 Locking System to Disc

The disc shall be secured to the shaft by locking pins (<300mm) or key & corresponding keyway (>300mm). Locking pin is preferred not to pass through completely the whole disc. Should it pass through completely, locking systems shall be in-place to prevent the locking pins from being expelled by hydrostatic pressures when the valve is in closed position. The type of locking system shall be clearly shown on engineering shop floor drawings.

5.9 Corrosion Protection Coating

All metal surfaces of the butterfly valve body and disc both internal and external surfaces shall be coated with fusion bonded epoxy coating. The coating material shall comply with *BS 6920-1:2014*.

The thickness of the coating shall not less than 250µm when measured on any part of valve and the disc.

Metallic surface preparation prior to application of the coating shall conform to the requirement of ISO 8501-1:2007(E). Clause 4.2 of the standard on Blast Cleaning to SA 2½ standard classified 'very thorough blast - cleaning' shall be applicable.


Blasting to be done through grit blast to the roughness of between 2.0 G/S 76 to 3.0 G/S 76 using Keane - Tator Profile Comparator on Grit blast disc for comparison.

5.10 Face to face dimensions for flanges

Flanges for connection to the pipeline or other fittings shall be PN16 and conform to *BS EN 558:2017* or ISO 5752:1982 Table 1 Series 13.

Flange for actuator attachment shall comply with the following standards:

- a) ISO 5211/1:1977 for flange dimensions
- b) ISO 5211/2:1979 for flange and coupling performance characteristics
- c) ISO 5211/3:1977 for dimension of driving components

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5.11 Flange Standards

Valve flanges shall conform to BS EN 1092-2:1997, Table 9, Type 21 for all sizes of **PN16** rating.

5.12 Thrust Bearing

If the valve to be installed vertically, thrust bearing at the lower shaft shall be incorporated to avoid the gravity force.

6.0 Documentation and Drawings

Documentation and drawings as required in Clause 5.5, 5.7, 5.8 and 5.9 shall be submitted together with the tender.

7.0 Test Requirement

The butterfly valve shall apply to tight shut - off service application in accordance to prEN 122663 and shall comply with all test requirements as stipulated below:

- a) Shell strength test in accordance with prEN12266-3
- b) Shell tightness test in accordance with prEN12266-3
- c) Seat tightness test in accordance with prEN12266-3

The successful tender shall produce the test certificates upon delivery of the valves.


Apart from that, there shall be a complete opening and closing test in accordance to the same standard.

8.0 Marking Requirement

The following are the mandatory markings on the valve body and these markings shall be integral with the body:

- a) Nominal size — DN (size in mm)
- b) Pressure rating — PN16
- c) Body materials — SG
- d) Brand
- e) Arrow to indicate direction of flow
- f) Standard number — BS EN 593
- g) Material Number (eg: EN-JS 10)
- h) Cast Number I Melt Identification e.g. 11B02 for casting date 11 May 2012
- i) Year of manufacture
- j) Valve Serial Number
- k) Arrow indicating direction of opening or closing

Seat materials identification (i.e. EPDM) with proper colour code/number or marking must be clearly shown on the sealing materials.

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8.1 Opening Direction Indicator

The opening direction marking shall be clearly indicated at the top position of valve cap

9.0 Actuators

9.1 General

Valves shall be supplied with manual actuators.

The actuator shall be a manual mechanical gearbox mounted on the shaft of the valve and shall be of any of the following designs:

- a) Worm screw nut linkage type
- b) Step down gear type
- c) Sector gear type

The gear box shall be designed such that the direction of opening and closing is interchangeable.


The gear shall be grease pack and lubricated for life without repacking the grease.

Stops shall be provided for both the fully closed and fully open positions of the valve. Stop adjusting screws shall be incorporated for making field adjustments of the closed and open positions.

The gear box shall be designed in such a manner to enable the direction for the opening and closing to be interchangeable. Instruction manual on performing the change must be clearly shown.

9.2 Material for Actuator

Actuator Part	Material
Body	Spheroidal graphite iron according to BS EN 1563, material number EN-JS 1030 Grade 420/12 or BS EN 1503:Part 3
Gears	Cast steel, carbon steel or Ductile iron
Spindle	Stainless Steel 316 with Ductile Iron valve cap for valve key operation
Mounting Flange	Cast integral with actuator body and shall comply to <i>ISO 5211 : 2017</i> 300mm minimum F10 450mm minimum F14 600mm minimum F16 900mm minimum F25 1200mm minimum F30 1350mm minimum F30
Bolts and Nuts	High tensile strength steel Class 8.8 as according to <i>ISO 898-1:2013</i>

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Actuator Part	Material
Position Indicator	Bronze
Cover to position Indicator	Thick transparent material sufficient to withstand breakage in buried condition or Perspex

9.3 Torque

The torque requirements shall follow *ISO 5210:2017* Sizing of torques and thrust against the flange shall follow Table 1 of the standard. Values of bare shaft operating torque and the gearbox input torque must be given in clear calculations to verify the functionality and the sizing of the reduction ratio.

9.4 Water Tightness

The whole gearbox shall be designed to be watertight against ingress of ground water to IP68 rating *with 3 m minimum depth for 72 hours of the submerge test.*

9.5 Position Indicator

All valves shall be provided with a position indicator to show the position of the disc. The indicator shall be sealed from the external environment with an enclosed non-tempered and waterproof clear glass

9.6 Protective Coating

The actuator body shall be similarly protected as that provided in Clause 5.9 of this specification.

9.7 Safety Device to Protect Gear Damage from Excessive Torque

The gear box design shall be done incorporating a safety pin to snap and give way when excessive torque is applied before the gears are damaged.

Other than the safety pin design, alternatives such as clutch system or any mechanical system can be considered. The details must be shown.

A typical drawing of the gearbox design and its requirements is attached.

Markings: Marking on the gear box shall indicate:


Brand Name:

Gear ratio:

Materials used:

Max. Torque allowed:

No of turns:

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10.0 Packaging

The valve with actuator shall be packed using either metal or wood container as a protection from bad handling. The box shall be stuffed with soft material sufficient to prevent the unit from shaking inside. The external part shall be labeled with the following information:

- a) Goods : Butterfly Valve
- b) Customer : Perbadanan Bekalan Air Pulau Pinang Sdn. Bhd.
- c) Order No :
- d) Date of Shipment :
- e) Size :

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