



# PUB's Stipulation of Standards & Requirements for Water Fittings for Use in Potable Water Service Installations

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<b>Table no.</b>	<b>Types of water fittings</b>	<b>Remarks</b>
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7.17	Ductile Iron Check Valves (10 mm – 450 mm)	
7.18	Ductile Iron Globe Valves (DN10 – DN400)	Updated on 1 Mar 21
7.19	Ductile Iron Solenoid Valves	
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7.21	Air Valves	Added on 1 Mar 23
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8.3	Ductile Iron Flange Adaptor (with / without rubber expansion joints)	
8.4	Metallic and Non-Metallic Flexible Connecting Tubes (For hot and cold water)	
8.5	[Nil]	
8.6	Steel Flange Adaptor (with / without rubber expansion joints)	
8.7	Toilet Seat with Bidet	
8.8	Water Heaters (electric storage, electric instantaneous and gas instantaneous)	Updated on 15 Jun 23.

<b>Table no.</b>	<b>Types of water fittings</b>	<b>Remarks</b>
		Added on 1 Mar 23.
8.9	Gasketed Mechanical Couplings	Updated on 1 Jun 20
8.10	Rubber gaskets for use as elastomeric seals for joints in pipework – flange and socket spigot joints of ductile iron pipes and pipe fittings	Updated on 1 Jun 20
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9.1	Single Taps and Combination Taps	Updated on 1 Sep 22
9.2	Mechanical Mixers	Updated on 1 Sep 22
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9.5	Dual Flush Water Closets Flushing Cisterns	
9.6	Dual Flush Low Capacity Flushing Cisterns (LCFCs) – Flushing Test with Offset Pan Collars & Bend Connectors	Added on 1 Jul 22
9.7	Urinal flush valves	
9.8	Water closet flush valves with WC pan	Added on 22 Jun 21
9.9	Household appliances and commercial equipment <ul style="list-style-type: none"> <li>• clothes washing machines</li> <li>• household dishwasher</li> <li>• commercial washer extractors</li> <li>• commercial dishwashers</li> <li>• high pressure washers</li> </ul>	Added on 1 Jul 22
9.10	Showerheads	Added on 1 Mar 2023

### Document history of changes from 1 June 2023

Version date of PUB S&R	Effective Date	Table no.	Changes/description	Remarks
15 Jun 23	17 May 23	8.8	The Total Colony Count (TCC) from the bacteriological parameters.	Circular dated 17 May 23 - Updated test requirements for sale and supply of water heaters.

For more information on PUB's circulars, please refer to PUB's website under Fittings & Standards for Water Service and/or WELS at <https://www.pub.gov.sg/compliance/industry/circulars>.

## 1) Introduction

This document is to provide for suppliers, retailers and installers of water fittings such as:

- pipes
- pipe fittings
- valves
- taps/mixers
- urinal flush valves
- flush valves for water closets (WCs)
- dual-flush low capacity flushing cisterns (LCFCs)
- coating/lining materials in contact with potable water
- water storage tanks
- other products as stipulated by PUB from time to time

the standards and requirements stipulated by PUB for such water fittings to comply with before they can be offered for sale, displayed or advertised for use in potable water service installations.

Suppliers, retailers, manufacturers, importers, Professional Engineers, Licensed Plumbers and installers shall ensure that the water fittings comply with every requirement applicable to it as specified in the \*PUB S&R Standard.

The installation and use of the water fittings in potable water service installations shall conform to the Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.

All clauses in the Singapore Standard SS 636:2018 – Code of Practice for Water Services are deemed mandatory for the purposes of the PUB S&R Standard, except for the list of clauses listed in **Annex A** of the PUB S&R Standard which are deemed non-mandatory.

*Updated on  
1 June 2020*

“PUB S&R Standard” means the document known as “PUB’s Stipulation of Standards & Requirements for Water Fittings for Use in Potable Water Service Installations” published by the Board, as in force from time to time.

For flush valves and flushing cisterns, suppliers, retailers, manufacturers, importers, Professional Engineers, Licensed Plumbers and installers of such fittings shall ensure compliance with the requirements on backflow prevention and wastage of water as stipulated in the Public Utilities (Water Supply) Regulations and the Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.

### For enquiries

Water Fittings Section

Inspectorate Branch

Water Supply (Network) Department

PUB Waterhub

82 Toh Guan Road East #C3-01

Office Building

Singapore 608575

Telephone: 65172925 / 65172928 / 65172932 / 65172934 / 68852521 / 68056314 / 68056315

Fax: 68852442

E-mail: [pub\\_waterfittings@pub.gov.sg](mailto:pub_waterfittings@pub.gov.sg)

## 2 What is deemed as a compliant water fitting?

A water fitting shall be deemed to comply with the stipulated standards if it is tested as complying with such standards by a testing laboratory accredited by the Singapore Accreditation Council (SAC) or its Mutual Recognition Arrangement (MRA) partners. Separate approval from PUB for the water fitting is not required. However, fittings must be supported with valid, complete and full test reports. Test reports issued by a testing laboratory accredited by the SAC or its MRA partners must bear the SAC-SINGLAS logo or the logo of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC-MRA) respectively. This applies to testing done by the test labs or testing outsourced to other test labs. \*See note below.

Updated  
on 1 July  
19.

Suppliers, retailers and installers shall ensure that these test reports of all the water fittings which they offer for sale, advertise, display, sell or supply are properly kept and must be produced for verification upon request by PUB.

Please note that PUB will not accept any test report issued by a testing laboratory (notwithstanding that the testing laboratory is accredited by the SAC or its MRA partners) if the test report does not bear the SAC-SINGLAS logo or the logo of the ILAC-MRA partner. PUB continues to conduct checks and will take action against non-compliance.

### Non-Compliance of Water Fittings

It is an offence under the Public Utilities (Water Supply) Regulations to offer for sale, advertise, display, sell or supply or install non-compliant water fittings.

All water fittings which are installed by the Licensed Plumbers must comply with PUB's stipulated requirements and Standards and its use in water service installations conform to the Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.

PUB will conduct surveillance inspections and will not hesitate to take action against non-compliance. The penalty for the offence is a fine not exceeding \$10,000 or imprisonment for a term not exceeding 12 months or to both.



\*From 1 Aug 2019 (date of test report), a test lab who subcontracts the testing to accredited test labs must also issue the accredited test reports which bear SAC-SINGLAS logo or the logo of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC-MRA) respectively to the suppliers. Suppliers are advised to request a copy of the accredited test reports from their testing service providers to ensure compliance with PUB's stipulated standards and requirements. Existing test reports with no SAC and ILAC-MRA logo from test lab who subcontracts the testing prior 1 Aug 2019 (date of test report), can continue to be accepted by PUB, provided that the test(s) was/were conducted by an accredited test lab.

### 3 Review of Standards and Requirements

PUB reviews the standards and requirements stipulated for water fittings from time to time to allow for innovation and changes in technology and to ensure relevance.

The testing requirements stipulated by PUB address 3 Main Concerns below:

1. Water Wastage
2. Water Contamination
3. Reliability/Integrity/Durability

Water fittings that fail or break down during the tests in accordance with the relevant Standards and requirements that PUB stipulates means that they fail to address the concerns above.

If standards and requirements for a water fitting are not stipulated in this document, the supplier or retailer shall approach PUB to stipulate the necessary standards and requirements for compliance.

The water fitting / coating materials / lining materials in contact with potable water will be assessed based on, not limited to, its installation and use, its working principles, its materials, its working principles, etc. PUB has the rights to disallow its use or stipulate the standards and requirements as it deems fit for such water fittings to comply with, before it can be offered for sale, advertised, displayed, sold or supply.

Please note that when the standards and requirements have been stipulated for the water fitting you are enquiring for, it does not constitute as approval or clearance on the use of the water fitting for potable water service installations. Suppliers, retailers and installers shall ensure that the water fitting are tested for compliance with the standards and requirements stipulated by PUB before it can be offered for sale, advertised, displayed, sold or supply.

The following documents are to be provided to Water Fittings Section for assessment and evaluation:

- Type of product (e.g. pipes, pipe fittings, valves, coating/lining materials, etc.), brand, model, size (if any);
- Describe the working principle/specific use of the product with complete drawings/photos showing the internal parts of the mechanisms, materials, etc.;
- The manufacturer and country of origin of the product;
- For pipes/pipe fittings, provide full details of the materials, jointing method, etc.;
- For coating / lining materials in contact with potable water, please provide the materials
- International Standards (e.g. BS, BS EN, ISO, AS/NZS, etc.) that the product has been fully tested for compliance with. Full details of the test carried out on the product are also required.
- Any other information as and when requested by PUB.

If necessary, a sample of the product is to be furnished to Water Fittings Section for examination. Please note that all of the above documents/information shall be in English language.

Requests for stipulation of standards and requirements can be submitted to:

Water Fittings Section  
Inspectorate Branch  
Water Supply (Network) Department  
PUB  
40 Scotts Rd #15-01  
Environment Building  
Singapore 228231  
Telephone: 65172925 / 65172928 / 65172932 / 65172934 / 68852521 / 68056314 / 68056315  
E-mail: pub\_waterfittings@pub.gov.sg



<b>SS636 Clause No.</b>	<b>LIST OF NON-MANDATORY CLAUSES UNDER SS 636 : 2018 – CODE OF PRACTICE FOR WATER SERVICES</b>
<b>Section 6: Distribution</b>	
<b>6.1 Pipework</b>	
6.1.8	The data for determining the bore of a pipe are the maximum rate of discharge required, the length of the pipe, the head available for loss by friction in that length, and the roughness of the internal surface of the piping. Allowance shall be made for the head that is lost by friction in bends and fittings.
6.1.9	In designing and planning the layout of the pipework, due attention should be given to the maximum rate of discharge required, suitability of materials and ease of installation and subsequent maintenance, accessibility, protection against damage and corrosion, and avoidance of airlocks, noise transmission and unsightly arrangement.
6.1.10	To reduce frictional losses, the piping should be as smooth as possible internally. Methods of jointing should be such as to avoid internal roughness and projections at the joints whether of the jointing materials or otherwise.
6.1.11	Changes in diameter and in direction should preferably be gradual rather than abrupt to avoid undue loss of head. No bend or curve in piping should be made so as materially to diminish or alter the cross-section.
6.1.12	Underground piping should be laid at a depth where it is unlikely to be damaged by traffic loads and vibrations. Where piping has to be laid in any ground liable to subsidence then special consideration should be given to the type of piping to be used and the type of joint to be adopted in order to minimise risk of damage due to settlement. Where piping has to be laid across recently disturbed ground, continuous longitudinal support should be provided and not merely supporting piers at intervals.
<b>6.3 Mains</b>	
6.3.1	Mains connecting the Authority's water meter to individual buildings within the premises should be divided into sections by the provision of valves so that the water may be shut off for repairs.
<b>6.4 Services</b>	
6.4.6	As far as practicable, the underground service pipe should be laid at right angles to the mains and in approximately straight lines to facilitate location for repairs.
6.4.20	Water pipes shall not be laid at a depth more than 2 m below ground. Where unavoidable, due consideration should be given to the maintenance and repair of the pipe.
<b>Section 7: Storage</b>	
<b>7.1 General</b>	
7.2.1	The period during which consumption is to be met by storage should be decided after examination of the rate and regularity of the draw-off and the consequences of exhausting the storage and the need to prevent stagnation.
<b>7.2 Storage Capacity</b>	

<b>SS636 Clause No.</b>	<b>LIST OF NON-MANDATORY CLAUSES UNDER SS 636 : 2018 – CODE OF PRACTICE FOR WATER SERVICES</b>
7.2.2	The following considerations affect the capacity to be provided: (a) Number of consumers; (b) Type of building; (c) Pattern of water use; and (d) Number and types of fittings to be served. Each case should be judged on its own merits.
<b>7.3 Storage Tank</b>	
7.3.6	In feed tanks for a heating apparatus, provisions should be made for the expansion of the water by fixing a low water level in the tank. Where a ball valve is used, this requirement will necessitate the use of a drop-level arm.
7.3.7	Storage tanks may supply cold water to a hot water supply apparatus as well as to the cold water distributing pipe.
<b>Section 8: Fittings and appliances</b>	
<b>8.1 Water Efficiency</b>	
8.1.1	The actual rate of flow of water available for fittings and appliances depends on the water head available and the design of the water service.  Table 1 sets out the maximum allowable flow rates for fittings and appliances for which the design should provide. In designing, it is necessary to make some assumptions as to the number of fittings that may be called upon to discharge water simultaneously.
<b>Section 9: Work on Site</b>	
<b>9.4 Mainlaying</b>	
9.4.5	Where there is a gradient, pipelaying should preferably proceed in an uphill direction to facilitate joint making.
<b>9.5 Service pipes</b>	
9.5.1	Service pipes of less than 50 mm bore are usually connected to the mains by means of right-angled screw-down ferrules of non-ferrous metal. 25 mm and 20 mm ferrules should not be used in mains of less than 100 mm bore. The main is drilled and tapped and the ferrule screwed in. This may be done by a tapping-under-pressure machine that obviates any interference with the use of the main. Where necessary, saddle may also be used.
9.5.2	Service pipes may be connected to PVC or thin-walled steel mains using a ferrule screwed into a saddle or iron or steel, copper-alloy or plastics secured to the main by bolts or wedges. Ferrous metals should be suitably protected. A special tool is required for tapping PVC mains to prevent the formation of swarf.
<b>Section 10: Inspection, Testing and Maintenance</b>	
<b>10.4 Maintenance</b>	
10.4.1	10.4.1 Samples of water from various outlets should be examined periodically by a water analyst. A chemical examination is useful to show whether corrosion of the pipes and fittings is taking place. Bacterial pollution originating within the installation will be indicated by a bacteriological examination.

## **Clause 4 Stipulated Standards and Requirements for All Water Fittings & Appliances Including Those Listed in Annex B**

*Updated  
on 22  
Jun  
2021*

The material shall be supported with a complete, full and valid test report showing compliance with the stipulated standards. Partial/combined test reports are not acceptable, unless otherwise stated)

If standards, requirements or material grade for a water fitting are not stipulated in this document, the supplier, manufacturer or importer shall approach PUB to request for stipulations on the standards and requirements.

- a) All water fittings/appliances, unless otherwise stated, shall comply with the requirements in this clause, where applicable.
- b) All water fittings/appliances shall be legibly marked with the following information where applicable:
  - ii. Manufacturer's identification mark, brand name or logo either on body or plate
  - iii. Marking of the Standard e.g. BS EN 545 : 2010. (if the Standard so requires)
  - iv. Nominal size and direction of flow
  - v. Colour code for hot and cold water supply
- c) All non-metallic materials in contact with water shall comply with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. For non-metallic materials intended for use in hot water applications, the temperature used for the High Temperature Tests shall be the maximum temperature for which the non-metallic materials are designed for and declared/specified by the manufacturer. In the absence of any documented declaration of this maximum temperature by the manufacturer, the temperature used for the High Temperature Tests shall be the highest specified by the SS 375:2015 or BS 6920:2014. The non-metallic materials shall only be used in a potable water reticulation system with maximum water temperature not exceeding the temperature at which the non-metallic materials were tested and found complying with in the High Temperature Tests. See note 1.
- d) All metallic materials in contact with water shall be tested for compliance with AS/NZS 4020:2018 Appendix H on Extraction of Metals. The maximum allowable concentrations of metals listed in Table 2 shall not exceed the limits specified in AS/NZS 4020:2018.
- e) All copper alloy water fittings, except for exposed terminal fittings, shall comply with the following requirements:
  - i. The copper alloys that are acceptable for use in contact with potable water shall be of any grade which are listed in the "**Common Approach on Metallic Materials Part B: Positive List of Compositions**". The list can be downloaded from the Umweltbundesamt's website at <https://www.umweltbundesamt.de/en/topics/water/drinking-water/distributing-drinking-water/approval-harmonization-4ms-initiative#publication-of-common-approaches>. Please scan the QR code below to go to the above website.

*Clause  
4(d)  
updated  
on 1  
Mar 23.  
Clause  
4(e)  
updated  
on 1  
Mar 23.*



<https://go.gov.sg/6c6ccs>

- ii. The copper alloy shall be tested for compliance with the following test standards/methods:
  - 1) Chemical composition analysis;
  - 2) AS/NZS 4020:2018 Appendix H on Extraction of metals; and
  - 3) Dezincification resistant test (DZR) under ISO 6509-1:2014 and ISO 6509-2:2017, if applicable. Suppliers/manufacturers are advised to consult the accredited test laboratory on whether the DZR test is applicable for their copper alloy grade.

For more details on compliance requirements on Clauses 4(c) and 4(d), please also see PUB's Circulars of 1 Mar 2023 on "*New requirements for copper alloy fittings & phasing-out of certain copper alloy grades*" and "*Updated stipulated standards & requirements for metallic materials in contact with water*" which are downloadable from PUB's Fittings & Standards webpage at <https://www.pub.gov.sg/compliance/industry/circulars>

- f) All elastomeric seals for joints in pipework, pipelines, water fittings and valve seats for the flushing mechanism of the WC flushing cisterns shall also comply with SS 270:2015. See note 2.
- g) All other water fittings incorporated in the water fitting shall comply with the relevant Standards stipulated by PUB.
- h) All water fittings shall comply with the Standards stipulated by PUB and its use in water service installations shall conform to the Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.
- i) All water fittings shall also comply with all other relevant statutory requirements.
- j) Non-metallic seat washers shall also comply with BS 3457: 1973.

Note 1: Effective 1 Apr 2018. Water fittings tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375:2001 or BS 6920:2000 & Clause 8 of SS 375:Pt 1:2001.

Note 2: Effective 1 Apr 2018. Water fittings tested before 1 Apr 2018 may either comply with SS 270:2015 or SS 270:1996.

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**List of Water Fittings/Appliances**

**To be read in conjunction with Clause 4 above.**

- 1) Terminal and in-line electric water heaters (storage and instantaneous).

*Please also see PUB's circular of 30 Apr 2021 Reminder - Mandatory Requirements For Electric Water Heaters For Conveyance Of Potable Water - Storage Water Heaters & Instantaneous Water Heater downloadable from PUB's Fittings & Standards webpage at <https://www.pub.gov.sg/compliance/watersupplyservices/standards>.*

- 2) Water storage tank system\* (e.g. tank panels, booster pumps, pressure vessels, rubber bellows, rubber gaskets, ball float valves, internal cat ladders, internal reinforcement rods, internal screw/nuts, any other accessories in contact with potable water)

*\*Test reports of combined samples of metallic parts and combined samples of non-metallic parts are also acceptable.*

- 3) In-line water filters (i.e. installed before terminal fittings);
- 4) Water meters;
- 5) Coating and lining materials;
- 6) Elastomeric seals (e.g. rubber gaskets, O-rings, bellows, expansion joints, etc.);
- 7) Booster pumps and pressure vessels;
- 8) Jointing products such as, but not limited to, bolts and nuts, sealants, copper soldering rods, solvent cements, lubricants, priming liquids; and
- 9) Any other appliance/fittings used for the conveyance of piped water for human consumption (e.g. check valves, gate valves, flexible metal connecting tubes, angle valves, taps/mixers, Y-pattern strainers, etc.)

**Additional Notes to note: -**

- *The above list is non-exhaustive.*
- *Suppliers must also ensure that any other appliance/fittings used for the conveyance of piped water for human consumption be tested if that material is deemed to come into contact with potable water for human consumption.*

#### **Clause 4A - Installation Requirements Pertaining to Water Fittings**

*Added on  
22 Jun  
21*

1. Plastic pipes installed in areas exposed to sunlight
  - a) In the event that the plastic pipes need to be laid exposed to sunlight, the installers shall ensure that the pipes itself are adequately protected in order to prevent pipe degradation and potential impact on water quality (e.g. algae growth within the pipes). If left unprotected, the plastic pipes could deteriorate, resulting in water contamination and/or water leakages.
  - b) Professional Engineers and Licensed Plumbers are strongly advised to take immediate measures for your existing/ongoing projects (i.e. before submission of Certificate of Satisfactory Completion of Water Service Work - CSC) to ensure that the pipes are adequately protected by suitable means (e.g. painting over the surface of the pipe, provided with additional insulation, etc.).

For more information, please refer to PUB's Circular of 22 Jun 2021 "Reminder – Installation Of Plastic Pipes When Used In Areas Exposed To Sunlight" which is downloadable from PUB's website at <https://www.pub.gov.sg/compliance/industry/circulars> under Fittings & Standards for Water Service.

## **Clause 5 - Minor Water Service Installation (WSI) works without (prior) notification to PUB**

With effect from 1 Nov 2021, LPs are allowed to carry out selected minor WSI works without the need to submit (prior) notifications to PUB. However, it should be noted that **CSC (Certificate of Satisfactory Completion) shall still be submitted to PUB within 7 days** of the completion of the above WSI works. The selected minor WSI works are as follows:-

*Added  
on 1  
Oct  
2021*

- a. Adding new tap points whereby there is already an existing piping network in the premises.
- b. Laying new water pipes to draw hot water from an existing water storage heater.
- c. Re-routing existing water pipes due to obstructions such as washing machine, etc.
- d. Altering a water point for a washing machine or a dishwasher to the correct position of the appliance's inlet.
- e. Re-locating an existing water storage heater.

## STIPULATED STANDARDS AND REQUIREMENTS

### 5 Water Storage Tanks

#### FRP / GRP Sectional Water Storage Tank

Updated as at 7 Feb 19

5.1	Standards to comply with	Tests and requirements for FRP / GRP Sectional Water Storage Tank
	SS 245 : 2014	<p>Clause 4 - Construction            Clause 5 – Dimensions            Clause 6 - Service Requirements            Clause 7 - Composition of Panels            Clause 8 - Fabrication            Clause 8.1 - Flange of panels            Clause 8.2 - Bolts and nuts            Clause 8.3 - Sealing materials            Clause 8.4 - Supports for panels            Clause 9 - Components of FRP/GRP sectional water tanks            Clause 10 - Test requirements            10.1.1 - Appearance / Visual defects            10.1.2 - Performance of panels / Physical properties of panel            Annex B - Tensile Strength (MN/m<sup>2</sup>)            Annex C - Bending Strength (MN/m<sup>2</sup>)            Annex C - Elastic Modulus in Bend MN/m<sup>2</sup>)            Annex D - Glass Content (%)            Annex E - Barcol Hardness            Annex F - Water Absorption (%)            Clause 10.1.3 - Hydrostatic test.            Note : Every FRP/GRP panel including the drainage and bottom panels shall be tested for hydrostatic test if they are not identical (e.g. different in panel thickness, size, weight, design or material composition of panels, etc.). E.g. If every FRP/GRP panel for all the 4 tiers are not identical, every panel is required to undergo hydrostatic test in accordance with Clause 10.1.3.            Clause 10.1.4 - Effects of water            Clause 10.2.1 - Leakage test – Annex H            Clause 10.2.2 - Deflection test – Annex I            Clause 10.2.3 - Luminous transmittance test – Annex J            Clause 10.3 – All materials of tank and parts in including jointing sealants, sealing materials, bolts and nuts which come into contact with water to comply with SS 375 (for non-metallic) and AS/NZS 4020 App H (for metallic materials)            Clause 11 - Skid base            Clause 12 - Marking</p>
	<p><b>Other requirements:</b></p> <ol style="list-style-type: none"> <li>1) Suppliers/manufacturers shall declare in writing to the test laboratory the following:               <ol style="list-style-type: none"> <li>a) the brand and/or model of the water tank;</li> <li>b) the height of the water tank;</li> <li>c) the panel size, nominal thickness (with tolerance) and weight for every tier including the drainage and the bottom panel; and</li> <li>d) the design and composition of panels.</li> </ol> </li> <li>2) Additionally, product shall also comply with the stipulation standards and requirements in <b>Clause 4</b>, where applicable.</li> <li>3) Professional Engineers (PEs) shall ensure that the water service storage tanks are structurally sound with regard to hydrostatic, deflection and leakage, and shall also ensure that the water service installation (WSI) design works and the WSI works are done in compliance with the Public Utilities (Water Supply) Regulations, Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services and other statutory requirements.</li> </ol> <p>With effect from 1 Jun 2019 (date of test report), only FRP/GRP sectional water tested for compliance with SS 245:2014 and have also met other requirements stated in “Stipulation of Standards &amp; Requirements of Water Fittings for Use in Potable Water Service Installation” shall be allowed for supply and installation in potable water supply systems in Singapore.</p>	



5.1	Standards to comply with	Tests and requirements for FRP / GRP Sectional Water Storage Tank
	Any FRP/GRP sectional water tanks tested to comply with the older standard - SS 245:1995, will no longer be allowed for supply and installation in Singapore with effect from 1 Jun 2019 (date of test report).	

## FRP/GRP Integral Water Storage Tank

Updated as at 7 Feb 19

5.2	Standards to comply with	Tests for FRP/GRP Integral Water Storage Tank
	SS 245 : 2014	Please refer to item 5.1. All requirements shall apply, where applicable.
	<p><b>Other requirements:</b></p> <ol style="list-style-type: none"> <li>1) Suppliers/manufacturers shall declare in writing to the test laboratory the following: <ol style="list-style-type: none"> <li>a) the brand and/or model of the water tank;</li> <li>b) the height of the water tank;</li> <li>c) where applicable, the panel size, nominal thickness (with tolerance) and weight for every tier including the drainage and the bottom panel; and</li> <li>d) the design and composition of panels.</li> </ol> </li> <li>2) Additionally, product shall also comply with the stipulation standards and requirements in <b>Clause 4</b>, where applicable.</li> <li>3) Professional Engineers (PEs) shall ensure that the water service storage tanks are structurally sound with regard to hydrostatic, deflection and leakage, and shall also ensure that the water service installation (WSI) design works and the WSI works are done in compliance with the Public Utilities (Water Supply) Regulations, Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services and other statutory requirements.</li> </ol>	

## Stainless Steel Sectional Water Storage Tank (Minimum Grade 316)

5.3	Standards to comply with for stainless steel sectional water tanks	Requirements and test methods
i.	BS EN 10088 Part 2 : 2014  (for stainless steel panel material)	Clause 7.4.1 – Chemical composition Clause 7.4.2 – Tensile strength at room temperature (EN ISO 6892-1:2016) Clause 7.4.4 – Impact test (EN ISO 148-1:2016) Clause 7.4.5 – Hardness test (EN 6507-1:2005, EN ISO 6508-1:2016, or EN 6506-1:2014) Clause 7.4.6 – Resistance to intergranular corrosion test (EN ISO 3651-2: 1998) Clause 7.4.7 – Dimension test
ii.	<p><b>Additionally, the supply and installation of the stainless steel water tank shall also comply with the following:</b></p> <ol style="list-style-type: none"> <li>1) Stainless steel water tank material shall be of grade 316 or better. The water tank shall be in full stainless steel material including, but not limited to the tank body, drainage panel, bottom panel and tank roof cover shall be of stainless steel.</li> <li>2) Every stainless steel panel including, but not limited to, the tank body, drainage panel, bottom panel and tank roof cover shall be tested to the above standards, where applicable, if they are not identical (e.g. different in panel thickness, size, weight, design or material composition of panels, etc.).</li> <li>3) Suppliers are also required to ensure the traceability of the stainless steel water tanks they supply for potable water use, and are required to maintain and keep proper records of the distributors, retailers, sellers, plumbing companies and any other persons/companies and the batch identification of the stainless steel water tanks. As part of ensuring the traceability, suppliers who are submitting their</li> </ol>	

Updated  
on 21  
Nov 19

5.3	Standards to comply with for stainless steel sectional water tanks	Requirements and test methods
		<p>stainless steel water tank panels to accredited test laboratory for testing shall submit a written declaration to the accredited test laboratory on the following information /items:</p> <ul style="list-style-type: none"> <li>a) brand and/or model of the water tank;</li> <li>b) grade of stainless steel;</li> <li>c) manufacturer's name and country of origin;</li> <li>d) year of manufacture;</li> <li>e) clear and colour photographs of the stainless steel panel;</li> <li>f) panel size, nominal thickness (with tolerance) and weight for every tier including the drainage and the bottom panel, if applicable.</li> </ul> <p>All of the above information shall be included in the test reports.</p> <p>4) Additionally, the stainless steel water tank including, but not limited to its associated parts, components, bolts and nuts, joints, tie rods, ball floats, valves, elastomeric seals, rubber gaskets, etc. shall also comply with the prevailing standards and requirements, where applicable, which is published in PUB's website at <a href="http://www.pub.gov.sg">www.pub.gov.sg</a> under Fittings &amp; Standards Webpage.</p> <p>5) Professional Engineers (PEs) for the specific projects shall ensure the following:</p> <ul style="list-style-type: none"> <li>a) The water storage tanks are structurally sound with regards to hydrostatic, deflection and leakage, and shall also ensure that the water service installation (WSI) design works and the WSI works are done in compliance with the following: <ul style="list-style-type: none"> <li>i. Public Utilities Act;</li> <li>ii. Public Utilities (Water Supply) Regulations;</li> <li>iii. Singapore Standards SS 636:2018 – Code of Practice for Water Services; and</li> <li>iv. PUB's Stipulation of Standards &amp; Requirements for Water Fittings for Use in Potable Water Service Installations.</li> </ul> </li> <li>b) Besides using compliant water fittings, you are also expected to work closely with your suppliers/installers to ensure proper onsite construction /installation amongst others, to ensure that the water tank is fit and safe for use. This will require you to inspect the water tanks when supplied to site, as well as to inspect/supervise the onsite installation work, amongst others, before submitting the Certificate of Satisfactory Completion for the projects.</li> </ul> <p>6) Every stainless steel water tank supplied and installed shall be permanently and legibly marked as follows:</p> <ul style="list-style-type: none"> <li>1) Manufacturer's name;</li> <li>2) Manufacturer's serial number;</li> <li>3) Date of manufacture;</li> <li>4) Tank depth;</li> <li>5) Gross capacity in cubic metres of tonnage;</li> <li>6) Effective capacity in cubic metres of tonnage; and</li> <li>7) Application of water tank (i.e. potable or non-potable, etc.).</li> </ul> <p>Please also see PUB's Circular dated 21 Nov 19 - Updated Stipulated Standards for Stainless Steel Water Tank" which is downloadable from PUB's website at <a href="http://www.pub.gov.sg">www.pub.gov.sg</a>.</p>

## 6 Water Pipes and Pipe Fittings

### Acrylonitrile Butadiene Styrene (ABS) Pipes and Fittings

6.1	Standards to comply with	Tests for Acrylonitrile Butadiene Styrene (ABS) Pipes and Fittings
	AS 3518 Part 1 & Part 2 : 1988	Full compliance -Chemical composition for Nitrogen is not required
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Cement Lined Ductile Iron Pipes and Fittings

6.2	Standards to comply with	Tests for Cement Lined Ductile Iron Pipes and Fittings								
	BS EN 545:2010	<ul style="list-style-type: none"> <li>- Pipe Dimensions</li> <li>- Straightness of Pipes</li> <li>- Tensile Test</li> <li>- Brinell Hardness Test</li> <li>- Zinc Mass</li> <li>- Thickness of Paint Coatings</li> <li>- Thickness &amp; Surface Condition of Cement Mortar Lining</li> <li>- Compressive Strength of Cement Mortar Lining</li> <li>- Works Leak Tightness for Pipes &amp; Fittings</li> <li>- Leak Tightness of Flexible Joints to Positive Internal Hydrostatic Pressure</li> <li>- Leak Tightness of Flexible Joints to Negative Internal Pressure</li> <li>- Cyclic Internal Hydraulic Pressure</li> <li>- Leak Tightness and Mechanical Resistance of Flanged Joints</li> <li>- Leak Tightness and Mechanical Resistance of Pipe Saddles to Positive Internal Pressure</li> <li>- Leak Tightness and Mechanical Resistance of Pipe Saddles to Negative Internal Pressure</li> <li>- Microstructure</li> </ul>								
	BS EN 598:2007 <sup>++</sup>	<ul style="list-style-type: none"> <li>- Diametral Stiffness of Pipe test</li> <li>- Abrasion Resistance test</li> </ul>								
	<p><sup>++</sup>With effect from 1 Sep 2015, cement lining of ductile iron pipes and fittings complying with BS EN 545:2010 for the supply of potable water shall also comply with Diametral Stiffness of Pipe test and Abrasion Resistance test under BS EN 598:2007.</p> <p>With effect from 1 Sep 2015, only the following pipe sizes and Classes of cement lined DI pipes and fittings as listed in <b>Table</b> below shall be allowed for display, advertisement, sale, supply and installation in potable water service installations in Singapore.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Nominal Diameter (DN)</th> <th>Pipe Classes under BS EN 545:2010</th> </tr> </thead> <tbody> <tr> <td>≤150mm</td> <td>C100</td> </tr> <tr> <td>200 to 250mm</td> <td>C64 or C100</td> </tr> <tr> <td>300mm</td> <td>C50 or C64 or C100</td> </tr> </tbody> </table>		Nominal Diameter (DN)	Pipe Classes under BS EN 545:2010	≤150mm	C100	200 to 250mm	C64 or C100	300mm	C50 or C64 or C100
Nominal Diameter (DN)	Pipe Classes under BS EN 545:2010									
≤150mm	C100									
200 to 250mm	C64 or C100									
300mm	C50 or C64 or C100									
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.									

### Coatings and Linings for Ductile Iron (DI) Pipes and Pipe Fittings for Use in Water Service Installations

1. Where such coatings and linings are in contact with water, the coating/lining shall comply with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 as stipulated in Clause 4 of the PUB S&R.
2. From 1 December 2022, coatings and linings shall comply with the standards and requirements as stipulated in Table 6.2(a) as shown below.

6.2a	Types of coatings/linings	Stipulated standards and test requirements for coatings and linings for ductile iron (DI) pipes and pipe fittings for use in water service installations
1	External polyurethane coating for DI pipes	<b>BS EN 15189:2006</b> <ol style="list-style-type: none"> <li>1) Minimum thickness</li> <li>2) No porosity</li> <li>3) Hardness (Min. 70 shore D when tested in accordance with EN ISO 868)</li> <li>4) Adhesion</li> <li>5) Chemical Resistance</li> <li>6) Impact</li> <li>7) Elongation at break</li> <li>8) Specific coating resistance</li> <li>9) Indentation</li> </ol>
2	Internal polyurethane lining for DI pipes and fittings	<b>BS EN 15655-1:2018</b> <ol style="list-style-type: none"> <li>1) Chemical resistance (deionised water)</li> <li>2) Indirect impact strength</li> <li>3) Ovalisation resistance</li> <li>4) Elongation at break</li> <li>5) Specific lining resistance</li> <li>6) Ratio of lining resistance</li> <li>7) Lighting ageing resistance</li> </ol>
3	External polyethylene coating for DI pipes	<b>BS EN 14628-1:2020</b> <ol style="list-style-type: none"> <li>1) Peeling strength</li> <li>2) Impact strength</li> <li>3) Indentation resistance</li> <li>4) Elongation at break</li> <li>5) Specific coating resistance</li> <li>6) Ratio of resistance</li> <li>7) Heat ageing</li> <li>8) Light ageing</li> <li>9) Saponification of properties of adhesive</li> </ol>
4	External fusion bonded epoxy coating for DI fittings	<b>BS EN 14901-1:2014</b> Performance type tests <ol style="list-style-type: none"> <li>1) Clause 6.2 - Impact resistance</li> <li>2) Clause 6.3 - Indentation resistance</li> <li>3) Clause 6.4 - Non-porosity</li> <li>4) Clause 6.5 - Cross linkage</li> <li>5) Clause 6.6.2 - Resistance to thermal ageing in air</li> <li>6) Clause 6.6.3 - Resistance to thermal ageing in water</li> </ol>
5	Internal fusion bonded epoxy lining for DI pipes	<b>JIS G 5528:2014</b> <ol style="list-style-type: none"> <li>1) Clause 4 – Coating material</li> <li>2) Clause 5 – Coating</li> <li>3) Clause 6 – Quality of coating film on pipe</li> <li>4) Clause 7 – Testing on coating film of pipe</li> <li>5) Clause 8 – Inspection on coating film of pipe</li> <li>6) Clause 9 - Marking of coating</li> </ol>
6	Internal fusion bonded epoxy lining for DI fittings	<b>BS EN 14901-1:2014</b> <ol style="list-style-type: none"> <li>1) Technical requirements</li> <li>2) Performance type tests               <ol style="list-style-type: none"> <li>a) Clause 6.2 - Impact resistance</li> <li>b) Clause 6.3 - Indentation resistance</li> </ol> </li> </ol>

Clause 6.2a added on 1 Mar 23.

<b>6.2a</b>	<b>Types of coatings/linings</b>	<b>Stipulated standards and test requirements for coatings and linings for ductile iron (DI) pipes and pipe fittings for use in water service installations</b>
		c) Clause 6.4 - Non-porosity d) Clause 6.5 - Cross linkage e) Clause 6.6.2 - Resistance to thermal ageing in air f) Clause 6.6.3 - Resistance to thermal ageing in water

Clause 6.2a added on 1 Mar 23.

### Chlorinated Polyvinyl Chloride (PVC-C) Pipes and Fittings

<b>6.3</b>	<b>Standards to comply with</b>	<b>Tests for Chlorinated Polyvinyl Chloride (PVC-C) Pipes and Fittings</b>
	BS 7291 Part 1 : 1990 BS 7291 Part 4 : 1990	Full compliance
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Compression and Capillary Pipe Fittings

<b>6.4</b>	<b>Standards to comply with</b>	<b>Tests for Compression and Capillary Pipe Fittings</b>
	BS EN 1254-1:1998 (Fittings with ends for capillary soldering or capillary brazing)	- Leaktightness under internal hydrostatic pressure - Stress corrosion resistance test - Carbon content test - Carbon film test
	BS EN 1254-2:1998 (Fittings with compression ends)	- Leaktightness under internal hydrostatic pressure (Type A & B) - Resistance to pullout (Type A & B) - Leaktightness under internal hydrostatic pressure whilst subjected to bending (Type A only) - Stress corrosion resistance test
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Tubes

<b>6.5</b>	<b>Standards to comply with</b>	<b>Tests for Copper Tubes</b>
	BS EN 1057 : 2006	Full compliance: -Dimensions And Tolerances -Composition Analysis -Tensile Test -Vicker's Hardness Test -Carbon Content Test -Carbon Film Test -Bending Test -Drift Expanding Test -Flanging Test -Freedom From Defects Test -Hydrostatic Test
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper/Copper Alloy or Stainless Steel Mechanical Jointing End Connectors

6.6	Standards to comply with	Tests for Copper/Copper Alloy or Stainless Steel Mechanical Jointing End Connectors
	BS EN 1254-2:1998  AS 3688 : 2006	<ul style="list-style-type: none"> <li>-Leaktightness under internal hydrostatic pressure (for sizes 6 to 54mm)</li> <li>-Resistance to pullout (up to 28mm)</li> <li>-Leaktightness under internal hydrostatic pressure whilst subjected to bending</li> <li>-Stress corrosion resistance test</li> <li>-Determination of mean depth of dezincification</li> <li>-Strength of Joint Assembly (Pressure Cycling Test)</li> <li>-Resistance To Pull-Out Of Assembled Joints (for sizes above 28mm and up to 65mm)</li> <li>-Method Of Determining Compatibility Of Fittings With Pipe</li> </ul>
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Crosslinked Polyethylene (PE-X) Pipes and Fittings

6.7	Standards to comply with	Tests for Crosslinked Polyethylene (PE-X) Pipes and Fittings
	BS 7291 : Part 1 : 2010	<ul style="list-style-type: none"> <li>- Long-term hydrostatic strength of pipes</li> <li>- Hydrostatic pressure resistance of assembled pipes and fittings</li> <li>- Resistance to thermal cycling of assembled pipes and fittings</li> <li>- Resistance to cyclic pressure shock of assembled pipes and fittings</li> <li>- Opacity</li> <li>- Oxygen permeability</li> </ul>
	BS 7291 : Part 3 : 2010	<ul style="list-style-type: none"> <li>- Dimensions</li> <li>- Degree of cross-linking</li> <li>- Elongation</li> <li>- Short-term hydrostatic</li> <li>- Pressure resistance of pipe at 95°C</li> <li>- Short-term hydrostatic pressure resistance at 20°C of assembled fittings &amp; pipes</li> <li>- Resistance to pull-out of assembled joint</li> <li>- Resistance to vacuum</li> </ul>
	<p>PE-X pipes and joint fittings to be laid concealed and any leaks along such pipes and joint fittings shall be detectable using commonly available devices. The supplier of such pipes and fittings shall ensure after sales service in terms of provision of equipment and trained personnel for pipe location and leak detection.</p> <p>+ All PE-X pipes and fittings tested after 31 Aug 11 shall comply with BS 7291:Part 1:2010 and BS 7291:Part 3:2010. For PE-X and PE pipes and fittings tested before 1 Sep 11 may comply with either BS 7291:Part 1:2010 and BS 7291:Part 3:2010 or BS 7291:Part 1:2006 and BS 7291:Part 3:2006.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

Table 6.8 on Galvanised Iron / Malleable Iron Pipe Fittings with Plastic Core has been removed. From 1 Mar 2022, this water fitting is no longer allowed for supply and installation in Singapore.

### Glass Reinforced Plastics (GRP) Pipes and Fittings

6.9	Standards to comply with	Tests for Glass Reinforced Plastics (GRP) Pipes and Fittings
	BS EN 1796:2006+A1:2008	<p><u>For GRP pipes:</u></p> <ul style="list-style-type: none"> <li>- Dimensions &amp; tolerances</li> <li>- Initial specific ring stiffness</li> <li>- Long-term specific ring stiffness under wet condition</li> <li>- Initial resistance to failure in a deflected condition</li> <li>- Ultimate long-term resistance to failure in a deflected condition</li> <li>- Initial specific longitudinal tensile strength</li> <li>- Initial failure and design pressures for pressure pipes</li> <li>- Long term failure pressure</li> </ul> <p><u>For GRP fittings and joints:</u></p> <ul style="list-style-type: none"> <li>- Dimensions &amp; tolerances</li> <li>- Non-end-load-bearing flexible joints with elastomeric sealing rings</li> <li>- Initial leakage</li> <li>- Leak-tightness when subject to internal pressure following assembly</li> <li>- Leak-tightness when subject to negative pressure</li> <li>- Leak-tightness test when simultaneously subject to misalignment &amp; draw</li> <li>- Leak-tightness test when subject to positive cyclic pressure</li> <li>- Leak-tightness test when simultaneously subject to angular deflection &amp; draw</li> <li>- End-load-bearing flexible joints with elastomeric sealing rings</li> <li>- Initial leakage</li> <li>- Resistance to pressure including the end thrust - External pressure differential</li> <li>- Resistance to pressure including the end thrust - Misalignment with internal pressure</li> <li>- Resistance to pressure including the end thrust - Short duration resistance</li> <li>- Resistance to pressure including the end thrust - Resistance to bending for pipes</li> </ul> <p><u>Wrapped or cemented joints</u></p> <ul style="list-style-type: none"> <li>- Initial leakage</li> <li>- Resistance to pressure excluding the end thrust</li> <li>- Resistance to the joint to bending and pressure including end thrust (if applicable)</li> </ul> <p><u>Bolted flange joints</u></p> <ul style="list-style-type: none"> <li>- Initial leakage</li> <li>- Resistance to pressure excluding the end thrust</li> <li>- Resistance to pressure including the end thrust</li> <li>- Resistance of the joint to bending and pressure including end thrust</li> <li>- Torque resistance</li> </ul>
		<p>All GRP pipes &amp; fittings tested after 1 Mar 11 shall comply with BS EN 1796:2006+A1:2008. GRP pipes and fittings tested before 1 Mar 11 may comply with either BS 5480:1990 or BS EN 1796:2006+A1:2008.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>

### Light Gauge Stainless Steel Tubes (Minimum Grade 304)

6.10	Standards to comply with	Tests for Light Gauge Stainless Steel Tubes (Minimum Grade 304)
	BS EN 10312 : 2002	Visual Examination Dimensional Inspection Material Identification Drift Expanding Test Flattening Test Leak Tightness Test Tensile Test
	<p>All light gauge stainless steel tubes tested after 1 Jun 10 shall comply with BS EN 10312:2002. Light gauge stainless steel tubes tested before 1 Jun 10 may comply with either BS 4127:1994 or BS EN 10312:2002.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

Table 6.11 on Malleable Cast Iron Pipe Fittings with Plastic Core has been removed. From 1 Mar 2022, this water fitting is no longer allowed for supply and installation in Singapore.

### Multilayer Pipes of Polybutylene (PB), Polyethylene of Raised Temperature (PE-RT), Crosslinked Polyethylene (PE-X), Polypropylene (PP) and Chlorinated Poly(Vinyl Chloride) (PVC-C) and Their Associated Fittings

6.12	Standards to comply with	Tests for Multilayer Pipes of Polybutylene (PB), Polyethylene of Raised Temperature (PE-RT), Crosslinked Polyethylene (PE-X), Polypropylene (PP) and Chlorinated Poly(Vinyl Chloride) (PVC-C) and Their Associated Fittings
	BS EN ISO 21003-2:2008 + A1:2011 For pipes (with plastic inner layers)	<ul style="list-style-type: none"> <li>- Appearance</li> <li>- Opacity</li> <li>- Pipe dimensions</li> <li>- Pressure strength test</li> <li>- Thermal durability test</li> <li>- Strength of weld line</li> <li>- Delamination test</li> <li>- Oxygen permeability test</li> <li>- Physical and chemical properties</li> <li>- Marking</li> </ul>
	BS EN ISO 21003-3:2008 For fittings	<ul style="list-style-type: none"> <li>- Material properties</li> <li>- Thermal stability</li> <li>- Opacity</li> <li>- Appearance</li> <li>- Dimensions</li> <li>- Sealing element test</li> <li>- Visual inspection on the marking</li> </ul>
	BS EN ISO 21003-5:2008 For joints	<ul style="list-style-type: none"> <li>- Internal Pressure Test</li> <li>- Bending test</li> <li>- Pull out test</li> <li>- Thermal cyclic test</li> <li>- Pressure cyclic test</li> <li>- Leak tightness under vacuum</li> </ul>
	<p>Plastic pipes and joint fittings to be laid concealed and any leaks along such pipes and joint fittings shall be detectable using commonly available devices. The supplier of such pipes and fittings shall ensure after sales service in terms of provision of equipment and trained personnel for pipe location and leak detection.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Polybutylene (PB) Pipes and Fittings



6.13	Standards to comply with	Tests for Polybutylene (PB) Pipes and Fittings
	BS 7291 : Part 1 : 2010	<ul style="list-style-type: none"> <li>- Long-term hydrostatic strength of pipes</li> <li>- Hydrostatic pressure resistance of assembled pipes and fittings</li> <li>- Resistance to thermal cycling of assembled pipes and fittings</li> <li>- Resistance to cyclic pressure shock of assembled pipes and fittings</li> <li>- Opacity</li> <li>- Oxygen permeability</li> </ul>
	BS 7291 : Part 2 : 2010	<ul style="list-style-type: none"> <li>- Dimensions</li> <li>- Resistance to thermal ageing</li> <li>- Pigmentation</li> <li>- Elongation</li> <li>- Short-term hydrostatic pressure resistance of pipe at 95°C</li> <li>- Short-term hydrostatic pressure resistance at 20°C of assembled fittings &amp; pipes</li> <li>- Resistance to pull-out of assembled joint</li> <li>- Resistance to vacuum</li> </ul>
	<p>PB pipes and joint fittings to be laid concealed and any leaks along such pipes and joint fittings shall be detectable using commonly available devices. The supplier of such pipes and fittings shall ensure after sales service in terms of provision of equipment and trained personnel for pipe location and leak detection.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Polyethylene (PE) Pipes and Fittings

6.14	Standards to comply with	Tests for Polyethylene (PE) Pipes and Fittings
	BS EN 12201-1 : 2003 (General)	<ul style="list-style-type: none"> <li>- Materials</li> <li>- Tensile strength for butt fusion (in the form of pipe)</li> <li>- Slow crack growth (in the form of pipe)</li> </ul>
	BS EN 12201-2 : 2003 (Pipes)	<ul style="list-style-type: none"> <li>- Visual examination</li> <li>- Dimensions</li> <li>- Hydrostatic strength at 20°C</li> <li>- Hydrostatic strength at 80°C (165 hours)</li> <li>- Hydrostatic strength at 80°C (1000 hours)</li> <li>- Elongation at break</li> <li>- Melt mass-flow rate</li> <li>- Oxidation induction time</li> <li>- Markings</li> </ul>
	BS EN 12201-3 : 2003 (Fittings)	<ul style="list-style-type: none"> <li>- Visual examination</li> <li>- Dimensions</li> <li>- Hydrostatic strength at 20°C</li> <li>- Hydrostatic strength at 80°C (165 hours)</li> <li>- Hydrostatic strength at 80°C (1000 hours)</li> <li>- Melt mass-flow rate</li> <li>- Oxidation induction time</li> <li>- Cohesive resistance for electrofusion fittings</li> <li>- Tensile strength for butt fusion - spigoted fittings</li> <li>- Impact resistance of tapping tees</li> <li>- Markings</li> </ul>
	BS EN 12201-4 : 2003 (Valves) and	<ul style="list-style-type: none"> <li>- Visual examination</li> <li>- Dimensions</li> <li>- Hydrostatic strength at 20°C</li> <li>- Hydrostatic strength at 80°C (165 hours)</li> <li>- Hydrostatic strength at 80°C (1000 hours)</li> <li>- Leak tightness of seat and packing</li> <li>- Operating torque</li> </ul>

6.14	Standards to comply with	Tests for Polyethylene (PE) Pipes and Fittings
		<ul style="list-style-type: none"> <li>- Stop resistance</li> <li>- Resistance to bending between supports</li> <li>- Leak tightness under tensile load</li> <li>- Leak tightness under and after bending applied to the operating mechanism</li> <li>- Impact loading</li> <li>- Multiple test</li> <li>- Oxidation induction time</li> <li>- Melt mass-flow rate</li> <li>- Markings</li> </ul>
	BS 7291:Part1:2010	- Opacity
	<p>PE pipes and joint fittings to be laid concealed and any leaks along such pipes and joint fittings shall be detectable using commonly available devices. The supplier of such pipes and fittings shall ensure after sales service in terms of provision of equipment and trained personnel for pipe location and leak detection.</p> <p>+ All polyethylene (PE) pipes, fittings and valves tested after 1 Jan 2012 shall comply with BS EN 12201:2003. PE pipes and fittings tested before 1 Jan 2012 may comply with either BS EN 12201:2003 or BS 7291:2010 (from 1 Sep 2011) or BS 7291:2006 (before 1 Sep 2011).</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Polypropylene (PP) Pipes and Fittings

6.15	Standards to comply with.	Tests and requirements for Polypropylene (PP) Pipes and Fittings
	<p><b>ISO 15874-2:2013</b></p> <p>Plastics piping systems for hot and cold water installations — Polypropylene (PP) — Part 2: Pipes</p>	<ol style="list-style-type: none"> <li>1) Material</li> <li>2) General characteristics: <ul style="list-style-type: none"> <li>-Appearance</li> <li>-Opacity</li> </ul> </li> <li>3) Mechanical characteristics: <ul style="list-style-type: none"> <li>-Resistance to internal pressure</li> </ul> </li> <li>4) Physical and chemical characteristics: <ul style="list-style-type: none"> <li>-Longitudinal reversion test</li> <li>-Thermal stability by hydrostatic pressure test</li> <li>-Impact resistance test</li> <li>-Melt flow rate (compound)</li> <li>-Melt flow rate (pipe)</li> </ul> </li> <li>5) Performance requirements <p><i>“When pipes conforming to this part of ISO 15874 are jointed to each other or to components conforming to ISO 15874-3, the pipes and the joints shall conform to ISO 15874-5.”</i></p> </li> <li>6) Marking</li> </ol>
	<p><b>ISO 15874-3:2013</b></p> <p>Plastics piping systems for hot and cold water installations —</p>	<ol style="list-style-type: none"> <li>7) Material characteristics: <ul style="list-style-type: none"> <li>-Plastics fitting material</li> <li>-Metallic fitting material</li> </ul> </li> <li>8) Influence on water intended for human consumption. Please refer to PUB’s stipulated standards &amp; requirements for non-metallic and metallic materials in contact with water.</li> <li>9) General characteristics: <ul style="list-style-type: none"> <li>-Appearance</li> </ul> </li> </ol>

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6.15	Standards to comply with.	Tests and requirements for Polypropylene (PP) Pipes and Fittings
	Polypropylene (PP) — Part 3: Fittings	-Opacity  10) Geometrical characteristics: -Dimensions -Angles -Threads  11) Mechanical characteristics of plastics fittings 12) Physical and chemical characteristics of plastic components 13) Sealing elements 14) Performance requirements <i>"When fittings conforming to this part of ISO 15874 are jointed to pipes conforming to ISO 15874-2, the fitting and the joints shall conform to ISO 15874-5. Intended combinations of materials of pipes and fittings, e.g. PP-RCT pipes and PP-R fittings, shall be given in the manufacturers documentation."</i> 15) Marking
	<b>ISO 15874-5:2013</b>  Fitness for purpose of the system	<b>Performance of joint assemblies</b>  16) Internal pressure test 17) Bending test 18) Pull out test 19) Thermal cycling test 20) Pressure cycling test 21) Leak tightness under vacuum test
<p>Additional requirements to comply with:</p> <p>22) For Polypropylene (PP) pipes and joint fittings which are to be laid concealed, any leaks along such pipes and joint fittings shall be detectable using commonly available devices. The supplier of such pipes and fittings shall ensure after sales service in terms of provision of equipment and trained personnel for pipe location and leak detection.</p> <p>23) All materials and associated parts shall also comply with the prevailing stipulated standards and requirements in <u>Clause 4</u> of the PUB S&amp;R which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a> under Fittings &amp; Standards Webpage.</p> <p>24) Suppliers/manufacturers shall ensure the traceability of the specified size, types (e.g. PN rating, etc.) of PP pipes and fittings they supply for potable water use and are required to maintain and keep proper records of the distributors, retailers, sellers, plumbing companies and any other persons/companies and the batch identification of these pipes and fittings.</p> <p>Suppliers/manufacturers are strongly recommended to adopt the requirements/guidance on Type testing (including change in design, material, production methods, extension of product range, etc.) and Sampling as stipulated in ISO 15874-7:2018 <i>Plastics piping systems for hot and cold water installations — Polypropylene (PP) Part 7: Guidance for the assessment of conformity.</i></p> <p>Please also see PUB's Circular dated 1 Mar 2021 - "Updated PUB's Stipulated Standards &amp; Requirements for Polypropylene (PP) Pipes &amp; Fittings" which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p>		

### Stainless Steel Pipes (for seamless tubes)

6.16	Standards to comply with	Tests and requirements for Stainless Steel Pipes (for seamless tubes)
	BS EN 10216-5:2013  <i>Seamless steel tubes for pressure purposes – Technical delivery conditions Part 7- Stainless steel tubes</i>	1) Chemical composition – grade 304 or better 2) Material identification 3) Visual inspection 4) Dimension 5) Tensile test at room temperature 6) Flattening test, or Ring tensile test, or Drift expanding test, or Ring expanding test. 7) Leak tightness test 8) Impact test at room temperature 9) Intergranular corrosion test 10) Marking
	<p><b>Other requirements to comply with:</b></p> <p>11. Stainless steel pipe shall be of minimum grade 304 or better.</p> <p>12. The pipe shall also comply with the stipulation standards and requirements in <u>Clause 4</u>, where applicable, which can be found in the PUB S&amp;R downloadable from Fittings &amp; Standards webpage at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p> <p>13. Every pipe of different size and thickness (if applicable) for each brand and material grade shall be fully tested, unless otherwise supported with reference test reports of the same brand and manufacturer's declaration that the samples tested are made from same material grade, came from the same source, body design, manufactured and assembled-as the tested sample and reported in the reference test report.</p> <p>Please also see PUB's Circular dated 1 Mar 2021 - "Updated PUB's Stipulated Standards &amp; Requirements for Valves &amp; Stainless Steel Pipes" which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p>	

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### Stainless Steel Pipes (for longitudinally welded tubes)

6.17	Standards to comply with	Tests for Stainless Steel Pipes (for longitudinally welded tubes)
	BS EN 10217-7 : 2014  <i>Welded steel tubes for pressure purposes – Technical delivery conditions Part 7- Stainless steel tubes</i>	1) Chemical composition – grade 304 or better 2) Material identification 3) Visual inspection 4) Dimension 5) Tensile test at room temperature 6) Flattening test, or Ring tensile test, or Drift expanding test, or Ring expanding test, or Weld bend test. 7) Leak tightness test 8) Impact test at room temperature 9) Intergranular corrosion test 10) Marking
	<p><b>Other requirements to comply with:</b></p> <p>11) Stainless steel pipe shall be of minimum grade 304 or better.</p> <p>12) The pipe shall also comply with the stipulation standards and requirements in Clause 4 of the PUB S&amp;R, where applicable.</p> <p>13) Every pipe of different size and thickness (if applicable) for each brand and material grade shall be fully tested to PUB's stipulated standards, unless otherwise supported with reference test reports of the same brand and manufacturer's declaration that the samples tested are made from same</p>	

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6.17	Standards to comply with	Tests for Stainless Steel Pipes (for longitudinally welded tubes)
	<p>material grade, came from the same source, body design, manufactured and assembled-as the tested sample and reported in the reference test report.</p> <p>Please also see PUB's Circular dated 1 Mar 2021 - "Updated PUB's Stipulated Standards &amp; Requirements for Valves &amp; Stainless Steel Pipes" which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p>	

Updated on 1 Mar 21.

Table 6.18 on UPVC lined steel pipes has been removed. From 1 Mar 2022, this water fitting is no longer allowed for supply and installation in Singapore.

### UPVC Pipe Fittings

6.19	Standards to comply with	Tests for UPVC Pipe Fittings
	SS 174 : 1977	Full compliance
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### UPVC Pipes

6.20	Standards to comply with	Tests for UPVC Pipes
	SS 141 : 1976	Full compliance
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

## 7 Valves

## Anti-vacuum Valves

7.1	Standards to comply with	Tests for Anti-vacuum Valves
	BS EN 14451:2005	In accordance with the test sequence specified in BS EN 14451:2005: - Stage 1 Visual verification - Stage 2 Tightness - Stage 3 Flow rate/pressure loss - Stage 4 Bending moment, mechanical strength of body and leak tightness - Stage 5 Tightness - Stage 6 Endurance - Stage 7 Vacuum - Stage 8 Tightness
	<p>+With effect from 1 Oct 12, only anti-vacuum valves that have been tested to comply with BS EN 14451:2005 shall be allowed for display, advertisement, sale, supply and installation in potable water supply systems in Singapore. Anti-vacuum valves tested to comply with BS 6282:Part 2:1982 prior to 1 Oct 12 will continue to be allowed for display, advertisement, sale, supply and installation until 1 Oct 13.</p> <p>After 1 Oct 13, only anti-vacuum valves that have been tested to comply with BS EN 14451:2005 shall be allowed for display, advertisement, sale, supply and installation in potable water supply systems in Singapore.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

## Copper Alloy / Ductile Iron Float Operated Valves (Diaphragm type)

7.2	Standards to comply with	Tests for Copper Alloy / Ductile Iron Float Operated Valves (Diaphragm type)
	BS 1212 Part 2 : 1990	Only the following tests/specifications are required: - Constructions and Dimensions - Performance(Only tests for hydraulic pressure and shutoff, backnut distortion and backflow prevention)
	BS 1968 : 1953	Full compliance
	BS EN 1092 Part 2 : 1997	Only the following tests/specifications are required: - Mating dimensions - Flange thickness
	BS EN 545 : 2010	- Microstructural examination ( for DI material )
	<p>Ductile Iron valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375 : 2015 or BS 6920 : 2014 plus Clause 8 of SS 375 : Part 1 : 2015. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

## Copper Alloy / Ductile Iron Float Operated Valves (Piston type)

7.3	Standards to comply with	Tests for Copper Alloy / Ductile Iron Float Operated Valves (Piston type)
	BS 1212 Part 1 : 1990	- Construction and Dimensions - Performance
	BS 1968 : 1953	Full compliance
	BS EN 1092 Part 2 : 1997	- Mating dimensions - Flange thickness
	BS EN 545 : 2010	- Microstructural examination ( for DI material )

7.3	Standards to comply with	Tests for Copper Alloy / Ductile Iron Float Operated Valves (Piston type)
	Ductile Iron valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.	
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Alloy / Ductile Iron Water Pressure Reducing Valves

7.4	Standards to comply with	Tests for Copper Alloy / Ductile Iron Water Pressure Reducing Valves
	BS EN 1567 : 2000	<ul style="list-style-type: none"> <li>- Pressure strength and tightness of body</li> <li>- Tightness between inlet and outlet chamber</li> <li>- Set point range for adjustable/non adjustable valves</li> </ul>
	BS EN 545 : 2010	<ul style="list-style-type: none"> <li>- Microstructural examination ( for DI material )</li> </ul>
	<p>With effect from 1 Apr 2018, ductile Iron valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Copper Alloy and Stainless Steel Ball Valves (DN 8 to DN 100)

7.5	Standards to comply with	Tests for Copper Alloy and Stainless Steel Ball Valves (DN 8 to DN 100)
	BS EN 13828:2003	<ul style="list-style-type: none"> <li>-Operating Torque Test</li> <li>-Torque &amp; Bending Test</li> </ul> <p>Stops &amp; Spindle</p> <ul style="list-style-type: none"> <li>- Mechanical Resistance Test</li> </ul> <p>Hydraulic Tests</p> <ul style="list-style-type: none"> <li>- Leak Tightness Test</li> <li>- Hydraulic Strength</li> </ul> <p>-Endurance Test</p>
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Alloy Globe and Check Valves

7.6	Standards to comply with	Tests for Copper Alloy Globe and Check Valves
	BS 5154 : 1991	<ul style="list-style-type: none"> <li>- Dimensions and tolerances of body ends</li> <li>- Pressure testing</li> </ul>
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Alloy Gate Valves (DN8 to DN500)

7.7	Standards to comply with	Tests for Copper Alloy Gate Valves (DN8 to DN500)
	BS EN 12288 : 2010 <i>Industrial valves – copper alloy gate valves</i>	<ol style="list-style-type: none"> <li>1) Dimensions</li> <li>2) Pressure ratings</li> <li>3) Shell design strength</li> <li>4) Obturator design strength</li> <li>5) Shell tightness</li> <li>6) Seat tightness</li> <li>7) Flow characteristics</li> <li>8) Sizing the operating element</li> <li>9) Marking</li> </ol>
	<p>10) The valve and its associated parts, coatings, linings, etc. shall comply with the stipulation standards and requirements in <u>Clause 4</u>, where applicable, which can be found in the PUB S&amp;R downloadable from <u>Fittings &amp; Standards</u> webpage at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p> <p>11) Every valve of different size for each brand and model shall be fully tested, unless otherwise supported with reference test reports of the same brand and manufacturer's declaration that the samples tested are made from same material grade, came from the same source, body design, manufactured and assembled-as the tested sample and reported in the reference test report.</p>	

Updated on 1 Mar 2021.

### Copper Alloy Stop Valves

7.8	Standards to comply with	Tests for Copper Alloy Stop Valves
	BS EN 1213:2000	<p>Mechanical tests:</p> <ul style="list-style-type: none"> <li>- Clause 7.2.1 Torque test</li> <li>- Clause 7.2.2 Bending moment</li> </ul> <p>Hydraulic tests:</p> <ul style="list-style-type: none"> <li>- Clause 7.3.1 Leaktightness</li> <li>- Clause 7.3.2 Pressure resistance</li> <li>- Clause 7.3.3 Flow capacity</li> </ul> <p>Acoustic test:</p> <ul style="list-style-type: none"> <li>- Clause 7.4 Acoustic test</li> </ul> <p>Endurance test:</p> <ul style="list-style-type: none"> <li>- Clause 7.5 Endurance test</li> </ul>
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Alloy Solenoid Valves (DN8 to DN500)

7.9	Standards to comply with	Tests for Copper Alloy Solenoid Valves (DN8 to DN500)
	BS EN 12288 : 2010 <i>Industrial valves – copper alloy gate valves</i>	<ol style="list-style-type: none"> <li>1) Dimensions</li> <li>2) Pressure ratings</li> <li>3) Shell design strength</li> <li>4) Obturator design strength</li> <li>5) Shell tightness</li> <li>6) Seat tightness</li> <li>7) Flow characteristics</li> <li>8) Sizing the operating element</li> <li>9) Marking</li> </ol>

Updated on 1 Mar 2021.



	<p><b>Other requirements to comply with:</b></p> <p>11) The valve and its associated parts, coatings, linings, etc. shall comply with the stipulation standards and requirements in <u>Clause 4</u>, where applicable, which can be found in the PUB S&amp;R downloadable from <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">Fittings &amp; Standards webpage at https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p> <p>12) Every valve of different size for each brand and model and shall be fully tested, unless otherwise supported with reference test reports of the same brand and manufacturer's declaration that the samples tested are made from same material grade, came from the same source, body design, manufactured and assembled-as the tested sample and reported in the reference test report.</p> <p>Please also see PUB's Circular dated 1 Mar 2021 - "Updated PUB's Stipulated Standards &amp; Requirements for Valves &amp; Stainless Steel Pipes" which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a></p>
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### Stainless Steel Float-Operated Valve (Piston type) & Ball Float

From 1 July 2022, stainless steel float-operated valve and ball float shall comply with the standards and requirements as stipulated in Table 7.4 as shown below.

7.10	Standards to comply with.	Tests and Requirements for Stainless Steel Float Operated Valve (Piston type) & Ball Float
a	BS 1212: Part 1 : 1990  (Float-operated valve, piston type)	1) Constructions and Dimensions, if applicable. 2) Performance: a) Hydraulic pressure test b) Shut-off test c) Backnut distortion, if applicable d) Locknut distortion, if applicable e) Mechanical strength of levers, if applicable.
b	BS 1968 : 1953 (Ball float)	-Dimensions, if applicable. -Leakage test
c	BS EN 10088 Part 2 : 2014	Chemical composition for stainless steel material (minimum grade 304)
d	BS EN 1092 Part 2 : 1997 (for flanged ends)	-Mating dimensions, if applicable. -Flange thickness, if applicable.
e	Marking	Permanent and legible manufacturer's name or trademark on the body of the float valve and ball float.
f	The product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

*Added on  
1 Mar 23.*

### Stainless Steel Solenoid Valve (Threaded Ends)

From 1 July 2022, stainless steel solenoid valves (threaded ends) shall comply with the standards and requirements as stipulated in Table 7.11 as shown below.

7.11	Standards to comply with.	Tests requirements for stainless steel solenoid valve (threaded ends)
	BS EN 12288 : 2010	<ul style="list-style-type: none"> <li>• Dimensions (by manufacturer's declaration)</li> <li>• Pressure ratings (by manufacturer's declaration)</li> <li>• Shell design strength (by manufacturer's declaration)</li> <li>• Obturator design strength (by manufacturer's declaration)</li> <li>• Shell tightness</li> <li>• Seat tightness (no visually detectable leakage for the duration of the test for all DN sizes)</li> <li>• Marking, where applicable.</li> </ul>
	BS EN 10088 Part 2 : 2014	<ul style="list-style-type: none"> <li>• Chemical composition for stainless steel material (minimum grade 304)</li> </ul>

7.11	Standards to comply with.	Tests requirements for stainless steel solenoid valve (threaded ends)
	The product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Stainless Steel Solenoid Valve (Flanged Ends)

From 1 July 2022, stainless steel solenoid valves (flanged ends) shall comply with the standards and requirements as stipulated in Table 7.11 as shown below.

7.12	Standards to comply with.	Tests requirements for stainless steel solenoid valve (flanged ends)
	BS EN 12266-1:2012	<ul style="list-style-type: none"> <li>• Shell tightness</li> <li>• Seat tightness (no visually detectable leakage for the duration of the test for all DN sizes)</li> <li>• Obturator strength test</li> </ul>
	BS EN 10088 Part 2 : 2014	<ul style="list-style-type: none"> <li>• Chemical composition for stainless steel material (minimum grade 304)</li> </ul>
	BS EN 1092: Part 1:2018	<ul style="list-style-type: none"> <li>• Mating dimensions, if applicable.</li> <li>• Flange thickness, if applicable.</li> </ul>
	The product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Draw-off Taps and Stopvalves (Screw-down pattern)

7.13	Standards to comply with	Tests for Draw-off Taps and Stopvalves (Screw-down pattern)
	SS 75 Part 2 : 1978	<ul style="list-style-type: none"> <li>- Design &amp; construction</li> <li>- Hydraulic test</li> </ul>
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Ductile Iron Butterfly Valves

7.14	Standards to comply with	Tests for Ductile Iron Butterfly Valves
	BS EN 593 : 2004	<ul style="list-style-type: none"> <li>- Dimensions and tolerances</li> <li>- Pressure test</li> </ul>
	BS EN 545 : 2010	- Microstructural examination (for DI material )
	With effect from 1 Apr 2018, the valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of	

	<p>SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>
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### Ductile Iron Check Valves (10 mm - 1000 mm)

7.15	Standards to comply with	Tests for Ductile Iron Check Valves (10 mm - 1000 mm)
	BS 5153 : 1974	<ul style="list-style-type: none"> <li>- Body ends</li> <li>- Design and manufacture</li> <li>- Pressure testing</li> </ul>
	BS EN 545 : 2010	- Microstructural examination (for DI material)
	<p>With effect from 1 Apr 2018, the valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Ductile Iron Gate Valves

7.16	Standards to comply with	Tests for Ductile Iron Gate Valves
	BS 5163-1:2004	- Dimensions and tolerances
	BS 5163-2:2004	<ul style="list-style-type: none"> <li>- Stem caps materials &amp; dimensions</li> <li>- Stem caps : Resistance to operating loads</li> </ul>
	BS EN 1074-1 & 2:2000	<ul style="list-style-type: none"> <li>- Resistance to internal pressure of the shell &amp; all pressure containing components</li> <li>- Resistance of the obturator to differential pressure</li> <li>- Leaktightness to internal pressure</li> <li>- Leaktightness to external pressure</li> <li>- Leaktightness of gearbox to external pressure</li> <li>- Seat tightness at high differential pressure</li> <li>- Seat tightness at low differential pressure</li> <li>- Max Operating Torque for operation &amp; leak tightness</li> <li>- Hydraulic characteristics (Not applicable to full bore gate valves or clear way valves)</li> <li>- Resistance of valves to bending</li> <li>- Resistance of valves to operating loads</li> <li>- Endurance Test</li> </ul>
	BS EN 545:2010	- Microstructural Examination (for DI material)
	<p>With effect from 1 Apr 2018, the valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

### Ductile Iron Check Valves (10 mm - 450 mm)

7.17	Standards to comply with	Tests for Ductile Iron Check Valves (10 mm - 450 mm)
	BS 5152 : 1974	- Body ends - Design and manufacture - Pressure testing
	BS EN 545 : 2006	- Microstructural examination (for DI material )
<p>With effect from 1 Apr 2018, the valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>		

### Ductile Iron Globe Valves (DN10 – DN400)

7.18	Standards to comply with	Tests and requirements for Ductile Iron Globe Valves (DN10 – DN400)
	BS EN 13789 : 2010 <i>Industrial valves – cast iron globe valves</i>	<ol style="list-style-type: none"> <li>1) Dimensions</li> <li>2) Pressure ratings</li> <li>3) Shell design strength</li> <li>4) Flow characteristics</li> <li>5) Allowable differential pressure</li> <li>6) Seat tightness</li> <li>7) Sizing the operating element</li> <li>8) Flow characteristics</li> <li>9) Sizing the operating element</li> <li>10) Marking</li> <li>11) Microstructural examination of ductile iron</li> </ol>
<p><b>Other requirements to comply with:</b></p> <p>12) The valve and its associated parts, coatings, linings, etc. shall comply with the stipulation standards and requirements in <u>Clause 4</u>, where applicable, which can be found in the PUB S&amp;R downloadable from <u>Fittings &amp; Standards</u> webpage at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p> <p>13) Every valve of different size for each brand and model and shall be fully tested, unless otherwise supported with reference test reports of the same brand and manufacturer's declaration that the samples tested are made from same material grade, came from the same source, body design, manufactured and assembled-as the tested sample and reported in the reference test report.</p> <p>Please also see PUB's Circular dated 1 Mar 2021 - "Updated PUB's Stipulated Standards &amp; Requirements for Valves &amp; Stainless Steel Pipes" which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p>		

Updated on 1 Mar 2021.

### Ductile Iron Solenoid Valves

7.19	Standards to comply with	Tests for Ductile Iron Solenoid Valves
	BS 5163 : 1986	- Pressure testing
	BS EN 545 : 2010	- Microstructural examination (for DI material)
<p>With effect from 1 Apr 2018, the valves shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of</p>		

7.19	Standards to comply with	Tests for Ductile Iron Solenoid Valves
	SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.  In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

**Thermostatic Mixing Valves (up to 50mm)**

7.20	Standards to comply with	Tests for Thermostatic Mixing Valves (up to 50mm)
	BS EN 1111 : 1999 Or BS EN 1111 : 2017  And  AS 4032.1:2005  Or AS 4032.1:2005	<p><b><u>For sizes up to 22 mm</u></b></p> <ul style="list-style-type: none"> <li>i. Leakage tightness</li> <li>ii. Hydraulic operating characteristics             <ul style="list-style-type: none"> <li>a. Flow rate (using hot and cold water)</li> <li>b. The sensitivity (using hot and cold water)</li> <li>c. Safety with cold water failure</li> <li>d. Temperature stability:                 <ul style="list-style-type: none"> <li>i. with changing inlet pressure</li> <li>ii. with changing inlet temperature</li> <li>iii. Mechanical performance under pressure</li> <li>iv. Endurance characteristics</li> <li>v. Torsional resistance</li> </ul> </li> <li>vi. Electronic valves – power failure (if applicable)</li> </ul> </li> </ul> <p>Or</p> <ul style="list-style-type: none"> <li>1. Torque test</li> <li>2. Watertightness at ambient temperature</li> <li>3. Thermal shut-off</li> <li>4. Sensitivity of temperature adjustment</li> <li>5. Mixed water temperature overshoot on starting from ambient</li> <li>6. Temperature stability of mixed water</li> <li>7. Watertightness at operating temperature</li> <li>8. Endurance</li> <li>9. Electronic valves – Power failure (if applicable)</li> </ul>
	AS 4032.1:2005	<p><b><u>For sizes &gt; 22m to 50mm</u></b></p> <ul style="list-style-type: none"> <li>1.) Torque test</li> <li>2.) Watertightness at ambient temperature</li> <li>3.) Thermal shut-off</li> <li>4.) Sensitivity of temperature adjument</li> <li>5.) Mixed water temperature overshoot on starting from ambient</li> <li>6.) Temperature stability of mixed water</li> <li>7.) Watertightness at operating temperature</li> <li>8.) Endurance</li> <li>9.) Electronic valves – Power Failure (if applicable)</li> </ul>
	BS EN 248: 2002	Full compliance, if applicable.
	<p>With effect from 1 Apr 2020 (date of test report), only thermostatic mixing valves tested for compliance with BS EN 1111:2017 shall be allowed for display, advertisement, sale, supply and installation in potable water supply systems in Singapore. Between 1 April 2019 to 31 March 2020 (date of test report), thermostatic mixing valves which have been tested to BS EN 1111:1999 and BS EN 1111:2017 are acceptable.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>	

Updated  
on 1  
July 19

Updated  
on 1  
July 19

## Air Valves

Added on  
1 Mar 23.

7.21	Standard to comply with.	Subclause	Requirements and Tests for Air Valves
	BS EN 1074-4:2000	4.1 to 4.8	Design requirements
		4.10	Internal corrosion and ageing resistance
		4.11	External corrosion and ageing resistance
		5.1.1	Resistance to internal pressure of the shell and of all pressure containing components
		5.1.2	Resistance of the obturator to differential pressure
		5.1.4	Resistance of valves to operating loads
		5.2.1.1	Leaktightness of the shell and all pressure containing components to internal pressure
		5.2.1.2	Leaktightness of the shell and all pressure containing components to internal pressure
		5.2.2.1	Seat tightness at high pressure
		5.2.2.2	Seat tightness at low pressure
		5.2.3	Maximum operating torque (MOT)
		5.3.1	Airflow characteristics for air release function
		5.3.2	Airflow characteristics for air intake function
		5.3.3	Airflow characteristics for air venting function
		5.4	Resistance to disinfection products
		5.5.1	Endurance for air intake and/or air release function
5.5.2	Endurance for air venting function		
5.5.3	Long term unseating test		
	BS EN 10088 Part 2 : 2014 (for stainless steel air valves)	Chemical composition for stainless steel material (minimum grade 304)	
	BS EN 1092 Part 2 : 1997	<ul style="list-style-type: none"> <li>- Mating dimensions, where relevant.</li> <li>- Flange thickness, where relevant.</li> </ul>	
	Marking	-Permanent and legible manufacturer's name or trademark on the body of the product.	
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.		

## 8 Others

### Constant Flow Regulators

8.1	Standards to comply with	Tests for Constant Flow Regulators
	Nil	The flow rate shall be tested at a pressure of 50 kPa to 550 kPa at intervals of 50 kPa. Within the pressure range of 150 kPa and 550 kPa, the flow rate shall remain within $\pm 10\%$ of the specific rating of the CFR.
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Copper Alloy / Ductile Iron Y-Pattern Strainer

8.2	Standards to comply with	Tests for Copper Alloy / Ductile Iron Y-Pattern Strainer
	BS EN 1092 Part 2 : 1997	Only the following tests/specifications are required : - Mating dimensions - Flange thickness - Pressure / temperature rating
	BS EN 545 : 2010	Only the following test/specification is required : - Microstructural examination (for DI material)
	With effect from 1 Apr 2018, the ductile Iron strainers shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.	
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Ductile Iron Flange Adaptor (with / without rubber expansion joints)

8.3	Standards to comply with	Tests for Ductile Iron Flange Adaptor (with / without rubber expansion joints)
	BS EN 1092 Part 2 : 1997	Only the following tests/specifications are required : - Mating dimensions - Flange thickness - Pressure / temperature rating
	BS EN 545 : 2010	Only the following test/specification is required : - Microstructural examination (for DI material)
	With effect from 1 Apr 2018, the adaptors shall be coated with an appropriate non-corrodible or corrosion-resistant material complying with SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015. Valves tested before 1 Apr 2018 may comply with either SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 or SS 375 : 2001 or BS 6920 : 2000 and clause 8 of SS 375 : Part 1 : 2001. Only fusion bonded coating is allowed.	
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Metallic and Non-Metallic Flexible Connecting Tubes (For hot and cold water)

8.4	Standards to comply with	Tests for Metallic and Non-Metallic Flexible Connecting Tubes (For hot and cold water)
	AS/NZS 3499 : 1997	Full compliance
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

Table 8.5 WC flush valves has been deleted. Please refer to Table 9.8.

### Steel Flange Adaptor (with / without rubber expansion joints)

8.6	Standards* to comply with	Tests
	BS 4504 Part 3 : Sect 3.1 : 1989	Only the following tests/specifications are required : - Mating dimensions - Flange thickness - Materials - Pressure / temperature rating
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	

### Toilet Seat with Bidet

8.7	Standards* to comply with	Tests
	JIS A4422 : 2011	Clause 9.3.1 – Washing water temperature Clause 9.3.2 - Washing water quantity Clause 9.3.3 - Rear washing force Clause 9.4.1 - Warm air temperature Clause 9.4.2 - Warm air volume Clause 9.5 - Heated seat temperature Clause 9.6 - Pressure withstanding Clause 9.7 - Water hammer Clause 9.8 - Backflow prevention and vacuum breakers Clause 9.10 - Mechanical strength – seats, bowl covers, installation Clause 9.11 - Endurance – operations, seats, seats and bowl covers Clause 7.1 – Construction and general requirement Clause 7.2 -Water system Clause 7.3 - Electrical system
	In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.	



**Water Heaters:**

- A. Electric storage water heaters;**
- B. Electric instantaneous water heaters; and**
- C. Gas instantaneous water heaters.**

Added on  
1 Mar  
2023

From 1 June 2023, the above-mentioned water heaters shall comply with the following requirements before they can be supplied in Singapore:

- (a) The stipulated standards and requirements in Table 8.8 as shown below;

Or

- (b) Clause 4 of the PUB S&R, where applicable.

8.8	Tests and requirements for electric storage, electric instantaneous and gas instantaneous water heaters
	<p>1. The water heater as a whole unit with its associated parts/components for conveyance of water shall be tested in accordance with and comply with the following:</p> <ul style="list-style-type: none"><li>a) <b>AS/NZS 4020:2018 Appendix K</b> – Sample extraction procedure for use with water heating system. Accredited or non-accredited test report for Appendix K is acceptable provided that the test laboratory is accredited by Singapore Accreditation Council (SAC) to AS/NZS 4020:2018 Appendix H on Extraction of Metals, at point of testing.</li><li>b) The samples extracted in accordance with Appendix K shall then be tested in accordance with the following:<ul style="list-style-type: none"><li>i. <b>AS/NZS 4020:2018 Appendix H</b> – Extraction of metals (<u>for metallic materials in contact with water</u>). The maximum allowable concentrations of metals listed in Table 2 of AS/NZS 4020:2018 shall not exceed the limits specified by the World Health Organisation (WHO) Guidelines for Drinking Water Quality. From 1 September 2023, the maximum allowable concentrations of metals of new water heaters shall not exceed the limits specified in AS/NZS 4020:2018; and</li><li>ii. <b>Physical, bacteriological and chemical analysis.</b> The minimum parameters to be tested and the corresponding typical values <u>to comply with</u> are shown in Table which is published in PUB's website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/waterstoragetanks">https://www.pub.gov.sg/compliance/watersupplyservices/waterstoragetanks</a>. The Total Colony Count (TCC) is not required as a bacteriological parameter.</li></ul></li></ul> <p><b>Testing conditions and requirements:</b></p> <p>2. If supplier/manufacturer has a variant of models of different capacity under the same brand, a copy of the test report of the tested basic model plus manufacturer's declaration with company's letterhead that the brand, type, design and materials, parts and components are the same and they are produced or assembled at or from the same factory, <u>are acceptable as proof of compliance.</u></p> <p>3. All of the above tests and analyses on the parameters shall be carried out by an SAC-SINGLAS accredited test laboratory or the Mutual Recognition Arrangement (MRA) partners. Test reports must bear the SAC-SINGLAS mark or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement partner (ILAC-MRA) mark. All models shall be supported with complete accredited test reports and relevant copies manufacturer's declarations, as proof of compliance to PUB's requirements.</p> <p>4. Suppliers/manufacturers should work closely with the test laboratory and the Licensed Plumber (engaged by any party) on installation of the sample water heater unit for testing. The installation of water heaters shall also comply with all other relevant statutory requirements such as from the Energy Market Authority (EMA), safety from Enterprise Singapore, etc., where applicable.</p>

Upd  
on  
23.

8.8	<b>Tests and requirements for electric storage, electric instantaneous and gas instantaneous water heaters</b>
	<p>5. A copy of Bill of Materials (BOM) and diagram showing the surface area of parts and components in contact with water of the model shall be clearly reflected in the test report.</p> <p>6. In relation to <u>Clause 1 of the Annex</u>, the following requirements shall be adopted:</p> <ul style="list-style-type: none"> <li>a) The test water shall comply with the maximum allowable concentrations of metals listed in Table 2 of AS/NZS 4020:2018 and shall not exceed the limits specified by the World Health Organisation (WHO) Guidelines for Drinking Water Quality. This requirement is for test laboratory.</li> <li>b) The test unit shall be installed using water fittings (e.g. pipes, fittings, valves, etc.) that comply with PUB's stipulated standards so as not to influence any test results.</li> <li>c) The installation shall be done in accordance with the manufacturer's installations and all local applicable statutory and regulatory requirements.</li> <li>d) All plumbing works shall be carried out and supervised by Licensed Plumbers (LPs). The LPs shall make the necessary notifications to PUB (before start of work) and submit Certificate of Satisfactory Completion (CSC) upon completion of work. For more information on Licensed Plumbers, please refer to the following PUB's websites:- <ul style="list-style-type: none"> <li>➤ <a href="https://app.pub.gov.sg/searchlicensedplumber/Pages/SearchPlumbers.aspx">https://app.pub.gov.sg/searchlicensedplumber/Pages/SearchPlumbers.aspx</a></li> <li>➤ <a href="https://www.pub.gov.sg/compliance/plumbingworks/licensedplumbers">https://www.pub.gov.sg/compliance/plumbingworks/licensedplumbers</a>.</li> </ul> </li> <li>e) Licensed Plumbers (LPs) are advised to work closely with the water heater suppliers to ensure that the water heater test unit including its associated parts and water fittings are installed in accordance with SS 636:2018 Code of Practice for Water Services.</li> <li>f) For installation of electric instantaneous water heaters, a Licensed Plumber is not required.</li> </ul> <p><b>Other requirements/advisory:</b></p> <p>7. The associated standalone water fittings such as pipes, pipe fittings, check valve, pressure relief valve, etc. shall comply with the prevailing stipulated standards and requirements in the PUB S&amp;R other requirements which includes <u>Clause 4</u> of the PUB S&amp;R.</p> <p>8. The water heater shall also comply with all other relevant statutory requirements such as those on electricity from the Energy Market Authority (EMA), safety from Enterprise Singapore, City Energy, etc.</p> <p>9. The water heater and its installation and use shall also conform to the Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>9. To facilitate the installation of compliant water heaters, suppliers are strongly advised to show the complete and valid test reports (<i>for example, where applicable, results of non-metallic materials in contact with water (i.e. SS 375:2015), results of metallic materials in contact with water to AS/NZS 4020:2018 App H, results of testing of whole unit to AS/NZS 4020:2018 App K and App H and water quality tests (i.e. physical, bacteriological and chemical analyses), results of SS 270:2015, etc.</i>) and relevant manufacturer's declarations, OR provide a Letter of Undertaking to the Licensed Plumber that the water heater has been tested for compliance with PUB's requirements.</p>

## Gasketed mechanical couplings

With effect from 1 Dec 2020 (date of test report), only gasketed mechanical couplings for use in potable water service installations which have been tested to comply with the stipulated standards and requirements in the PUB S&R shall be allowed to be offered, displayed or advertised for supply for potable water service installations in Singapore.

Gasketed mechanical couplings which have been tested before 1 Dec 2020 (date of test report) to the stipulated standards and requirements in the PUB S&R, can be offered, displayed or advertised for supply for potable water service installations in Singapore.

8.9	Standards to comply with	Tests for gasketed mechanical couplings
	ASTM F1476 : 2013	a) Pneumatic proof test b) Vacuum proof test c) Hydrostatic proof test d) Flexibility proof test e) Hydrostatic burst test f) Rigidity proof test (if applicable) g) Bending moment proof test (if applicable) h) Bending moment ultimate test (if applicable)
i)	BS EN 10088 Part 2 : 2014	Chemical composition for stainless steel casing and fasteners (minimum grade 304)
j)	Additional requirements to comply with:  The couplings and its associated parts and materials shall also comply with the stipulation standards and requirements in Clause 4 of the PUB S&R which is downloadable from PUB's website at <a href="http://www.pub.gov.sg">www.pub.gov.sg</a> , where applicable.	
k)	Suppliers who are submitting their gasketed mechanical couplings to accredited test laboratory for testing shall submit an original copy of written declaration from the manufacturer to declare the types of pipes and materials that the couplings are designed to be used for, in potable water service installations.	
l)	Each coupling based on brand, model and size shall be tested. If the coupling is of the same brand, model and material, suppliers shall submit an original copy of the written declaration from the manufacturer to the accredited test laboratory to declare that the manufacturing process/treatment are the same and its parts, components and materials are from the same source for this group of couplings. Information of couplings in different sizes, if applicable, shall be clearly reflected in the test reports.	
<i>Please see PUB's circular dated 1 June 2020 (ref. WSN 92413/90/042020/COUPLING) which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/industry/circulars">https://www.pub.gov.sg/compliance/industry/circulars</a></i>		

Updated on 1 June 2020

**Gaskets for use as elastomeric seals for joints in pipework and pipeline  
- for flange joints and socket spigot joints of ductile iron pipes and pipe fittings**

Updated  
on 1 June  
2020

8.10	Standards to comply with	Tests and requirements for gaskets
(a)	SS 270 : 2015	<p>-All applicable requirements for seals of type WA (potable water)</p> <p>-Clause 7 Seals of type WA (potable water) The physical properties of type WA shall comply Table 5 of SS 270:2015.</p>
(b)	<p>SS 375:2015</p> <p>Or</p> <p>BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015.</p>	<p>Part 2.2.1 - Odour and flavour Part 2.3 - Appearance of water Part 2.4 - Growth of aquatic micro organisms Part 2.5 - The extraction of substances that may be of concern to public health (Cytotoxicity test) Part 2.6 - The extraction of metals</p> <p>Part 2.2.1 - Odour and flavour Part 2.3 - Appearance of water Part 2.4 - Growth of aquatic micro organisms Part 2.5 - The extraction of substances that may be of concern to public health (Cytotoxicity test) Part 2.6 - The extraction of metals</p> <p>The concentration of metals shall not exceed the maximum concentration levels as specified in Table 1 of SS 375 : Part 1 : 2015.</p>
<p>Additional requirements to comply with:</p> <p>Suppliers and manufacturers who are submitting their gaskets to accredited test laboratory for testing to SS 375:2015 or BS 6920:2014 plus Clause 8 of SS 375:Part 1:2015 <u>shall submit test samples in its finished form</u>. Hence, only gaskets which have been tested in its finished form and complied fully to the above-mentioned standards, shall be allowed to be offered, displayed or advertised for sale and supply for potable water use in Singapore.</p> <p>Each flange gasket based on brand, model, size and thickness is required to be tested. If the gasket brand and model come in different sizes, thickness or shapes, suppliers shall submit an original copy of the written declaration from the manufacturer to the accredited test laboratory to declare that the manufacturing process/treatment and materials are the same for this group of gaskets. Information of gaskets in different sizes, thickness or shapes, if applicable, shall be clearly reflected in the test reports.</p> <p>The requirements (c) and (d) shall apply to new batches of existing gaskets and new brands of gaskets onwards. Existing stocks of gaskets which are supported with existing complete set of accredited test reports can continue to be supplied until the stocks have depleted.</p> <p>Suppliers and manufacturers shall ensure the traceability of the gaskets they supply for potable water use and are required to maintain and keep proper records of the distributors, retailers, sellers, plumbing companies/contractors and any other persons/companies and the batch identification of the gaskets. As part of ensuring the traceability, suppliers who are submitting their gaskets to accredited test laboratory for testing shall submit a written declaration to the accredited test laboratory on the following information/items:</p> <ol style="list-style-type: none"> <li>i. Brand, size and model number (if any) of the rubber gasket;</li> <li>ii. Type of material e.g. EPDM, etc.;</li> <li>iii. Manufacturer's name and country of origin;</li> <li>iv. Year of manufacture; and</li> <li>v. Clear and colour photographs of front and back view of the rubber gasket showing the identification mark.</li> </ol> <p>All of the above information and clear and colour photographs of test samples of gasket shall be included in all test reports.</p>		

8.10	Standards to comply with	Tests and requirements for gaskets
	<p>Note: For quality assurance, suppliers, distributors, retailers and manufacturers are encouraged to send samples of the gaskets for batch testing to the above-mentioned standards, where necessary.</p> <p>Please see PUB's circulars dated 1 June 2020 (ref. WSN 92413/90/032020/GASKET &amp; WSN 92413/90/082019/GASKET) which is downloadable from PUB's website at <a href="https://www.pub.gov.sg/compliance/industry/circulars">https://www.pub.gov.sg/compliance/industry/circulars</a></p>	

Updated on 1 June 2020

## Private Water Meters for Use in Water Service Installations

(For sizes DN15, DN25, DN40, DN50, DN65, DN100, DN150, DN200 & DN300mm)

8.11	General requirements	Requirements and tests for private water meters for use in water service installations																																																												
1		<p>(a) Private water meter shall be tested to comply with the standards ISO 4064:2014 or OIML R49:2006 Standards or the respective latest edition of ISO Standards. The stipulated tests and requirements are as given in this document. The meters shall be tested by an SAC-accredited test laboratory or its Mutual Recognition Arrangement (MRA) partners.</p> <p>and</p> <p>(b) Private water meter shall also be supported with a Certificate of Conformity (CoC) issued by an SAC-accredited product certification or its Mutual Recognition Arrangement (MRA) partners.</p> <p>All documents such as test reports, certificates, etc. shall be in English version.</p>																																																												
2	<p>Meter accuracy</p> <p>Test method : Clause 7.4 of ISO 4064-2:2014</p> <p>The maximum permissible error in the flow range from the transitional flow rate (Q2) to the maximum flow rate (Q4) shall be <math>\pm 2\%</math>. The maximum permissible error in the flow range from the minimum flow rate (Q1) up to but excluding the transitional flow rate (Q2) shall be <math>\pm 5\%</math>.</p> <p>The minimum, transitional, nominal and maximum flow rates are shown in Table 1. The calibration/re-adjustment mechanism of the meters (except for the by-pass meter of compound meter) shall be housed internally.</p> <p>Table 1</p> <table border="1" data-bbox="293 1144 1439 1496"> <thead> <tr> <th>Size of meter (mm)</th> <th>Measuring range R=Q3/Q1</th> <th>Maximum flow rate (Q4) (Lit/hr)</th> <th>Nominal flow rate (Q3) (Lit/hr)</th> <th>Transitional flow rate (Q2) (Lit/hr)</th> <th>Minimum flow rate (Q1) (Lit/hr)</th> </tr> </thead> <tbody> <tr> <td>15 Single</td> <td>R160</td> <td>3125</td> <td>2500</td> <td>25</td> <td>15.6</td> </tr> <tr> <td>25 Single</td> <td>R160</td> <td>7,875</td> <td>6,300</td> <td>63</td> <td>39.4</td> </tr> <tr> <td>40 Single</td> <td>R80</td> <td>20,000</td> <td>16,000</td> <td>320</td> <td>200</td> </tr> <tr> <td>50 Single</td> <td>R250</td> <td>31,000</td> <td>25,000</td> <td>160</td> <td>100</td> </tr> <tr> <td>65 Single</td> <td>R50</td> <td>50,000</td> <td>40,000</td> <td>1280</td> <td>800</td> </tr> <tr> <td>100 Single</td> <td>R250</td> <td>125,000</td> <td>100,000</td> <td>640</td> <td>400</td> </tr> <tr> <td>150 Single</td> <td>R50</td> <td>313,000</td> <td>250,000</td> <td>8000</td> <td>5,000</td> </tr> <tr> <td>200 Single</td> <td>R50</td> <td>500,000</td> <td>400,000</td> <td>12,800</td> <td>8,000</td> </tr> <tr> <td>300 Single</td> <td>R50</td> <td>1,250,000</td> <td>1,000,000</td> <td>32,000</td> <td>20,000</td> </tr> </tbody> </table>	Size of meter (mm)	Measuring range R=Q3/Q1	Maximum flow rate (Q4) (Lit/hr)	Nominal flow rate (Q3) (Lit/hr)	Transitional flow rate (Q2) (Lit/hr)	Minimum flow rate (Q1) (Lit/hr)	15 Single	R160	3125	2500	25	15.6	25 Single	R160	7,875	6,300	63	39.4	40 Single	R80	20,000	16,000	320	200	50 Single	R250	31,000	25,000	160	100	65 Single	R50	50,000	40,000	1280	800	100 Single	R250	125,000	100,000	640	400	150 Single	R50	313,000	250,000	8000	5,000	200 Single	R50	500,000	400,000	12,800	8,000	300 Single	R50	1,250,000	1,000,000	32,000	20,000	
Size of meter (mm)	Measuring range R=Q3/Q1	Maximum flow rate (Q4) (Lit/hr)	Nominal flow rate (Q3) (Lit/hr)	Transitional flow rate (Q2) (Lit/hr)	Minimum flow rate (Q1) (Lit/hr)																																																									
15 Single	R160	3125	2500	25	15.6																																																									
25 Single	R160	7,875	6,300	63	39.4																																																									
40 Single	R80	20,000	16,000	320	200																																																									
50 Single	R250	31,000	25,000	160	100																																																									
65 Single	R50	50,000	40,000	1280	800																																																									
100 Single	R250	125,000	100,000	640	400																																																									
150 Single	R50	313,000	250,000	8000	5,000																																																									
200 Single	R50	500,000	400,000	12,800	8,000																																																									
300 Single	R50	1,250,000	1,000,000	32,000	20,000																																																									
3	<p>Pressure loss test</p>	<p>Clause 6.5 of ISO 4064-1:2014 - Test method : Clause 7.9 of ISO 4064-2:2014</p> <p>The pressure loss of water meters including its associated parts shall not be greater than 0.63 bar.</p>																																																												
4	<p>Static pressure test</p>	<p>Clause 7.3 of ISO 4064-2:2014</p> <p>The maximum admissible pressure (MAP) for the Meters shall be 16 bar. The water meter shall be capable of withstanding the following test pressures without leakage or damage:</p> <p>a) 1.6 times the maximum admissible pressure (MAP) applied for 15 min;</p> <p>and</p> <p>b) Twice the maximum admissible pressure (MAP) applied for 1 min.</p>																																																												

Added on 1 Mar 23.

8.11	General requirements	Requirements and tests for private water meters for use in water service installations																																										
5	Water pressure test	Clause 7.7 of ISO 4064-2:2014																																										
6	Static magnetic field test	<p>Clause 7.2.8 of ISO 4064-1:2014.</p> <p>The totalizer shall be housed in a shockproof synthetic polymer container and it shall be rotatable on site to all positions. The totalizer shall be incorporated with pulse output in the form of inductive type to facilitate accurate remote meter reading and communication. This feature shall be immune to magnetic interference or tampering. The encapsulated totalizer of the water meter shall comply with protection class IP68.</p> <p>Test may not be applicable for water meters with digital display.</p>																																										
7	Size, length and connection type	<p>The size of meter shall be determined by the internal diameter of inlet pipe to and outlet pipe from the meter.</p> <p>The total length of the meter body from flange to flange/connector-faces shall be as shown in Table 2.</p> <p>Table 2</p> <table border="1" data-bbox="592 831 1198 1290"> <thead> <tr> <th data-bbox="592 831 735 931">Nominal Diameter</th> <th data-bbox="735 831 935 931">Meter Length (mm)</th> <th data-bbox="935 831 1198 931">End Connection Type</th> </tr> <tr> <th data-bbox="592 931 735 943">mm</th> <th data-bbox="735 931 935 943">(± 1 mm)</th> <th data-bbox="935 931 1198 943"></th> </tr> </thead> <tbody> <tr><td data-bbox="592 943 735 965">15</td><td data-bbox="735 943 935 965">110</td><td data-bbox="935 943 1198 965">BSP threads</td></tr> <tr><td data-bbox="592 965 735 987">20</td><td data-bbox="735 965 935 987">110</td><td data-bbox="935 965 1198 987">BSP threads</td></tr> <tr><td data-bbox="592 987 735 1010">25</td><td data-bbox="735 987 935 1010">260</td><td data-bbox="935 987 1198 1010">BSP threads</td></tr> <tr><td data-bbox="592 1010 735 1032">32</td><td data-bbox="735 1010 935 1032">260</td><td data-bbox="935 1010 1198 1032">BSP threads</td></tr> <tr><td data-bbox="592 1032 735 1055">40</td><td data-bbox="735 1032 935 1055">300</td><td data-bbox="935 1032 1198 1055">BSP threads</td></tr> <tr><td data-bbox="592 1055 735 1077">50</td><td data-bbox="735 1055 935 1077">200</td><td data-bbox="935 1055 1198 1077">Flange type</td></tr> <tr><td data-bbox="592 1077 735 1099">65</td><td data-bbox="735 1077 935 1099">200</td><td data-bbox="935 1077 1198 1099">Flange type</td></tr> <tr><td data-bbox="592 1099 735 1122">80</td><td data-bbox="735 1099 935 1122">200</td><td data-bbox="935 1099 1198 1122">Flange type</td></tr> <tr><td data-bbox="592 1122 735 1144">100</td><td data-bbox="735 1122 935 1144">250</td><td data-bbox="935 1122 1198 1144">Flange type</td></tr> <tr><td data-bbox="592 1144 735 1167">125</td><td data-bbox="735 1144 935 1167">250</td><td data-bbox="935 1144 1198 1167">Flange type</td></tr> <tr><td data-bbox="592 1167 735 1189">150</td><td data-bbox="735 1167 935 1189">300</td><td data-bbox="935 1167 1198 1189">Flange type</td></tr> <tr><td data-bbox="592 1189 735 1211">200</td><td data-bbox="735 1189 935 1211">350</td><td data-bbox="935 1189 1198 1211">Flange type</td></tr> </tbody> </table>	Nominal Diameter	Meter Length (mm)	End Connection Type	mm	(± 1 mm)		15	110	BSP threads	20	110	BSP threads	25	260	BSP threads	32	260	BSP threads	40	300	BSP threads	50	200	Flange type	65	200	Flange type	80	200	Flange type	100	250	Flange type	125	250	Flange type	150	300	Flange type	200	350	Flange type
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8	Main casings	<p>For small water meters (DN15/20/25/32/40), the main casing shall be made of non-corrodible or corrosion-resistant material.</p> <p>For Dezincification-Resistant Brass (DZR) material, the DZR brass grades shall be those which are stipulated in Clause 4 of the PUB S&amp;R.</p> <p>For DN50 and larger water meters, preferred materials of main casing would be copper alloy or ductile iron. Ductile iron body shall be internally lined with fusion-bonded epoxy.</p> <p>All non-metallic materials in contact with water shall not have adverse effects on the quality of the water that it conveys.</p>																																										
9	Material and quality	<p>a) The materials shall be tested for compliance with the stipulated standards and requirements in Clause 4 of the PUB S&amp;R which is downloadable from PUB website at <a href="https://www.pub.gov.sg/compliance/watersupplyservices/standards">https://www.pub.gov.sg/compliance/watersupplyservices/standards</a>.</p> <p>b) All parts of the water meter in contact with the water flowing through it shall be manufactured from materials that are conventionally known to be non-toxic, non-contaminating and biologically inert. It shall be fit for drinking water application.</p>																																										
10	Mechanism integrity	<p>The water meters supplied shall be in-line which normally be worked in the direction indicated by an arrow on the meter body, that is, from inlet to outlet. However, the meters must be so designed to operate satisfactorily in the reverse direction, and all working parts liable to displacement or liable to be displaced for such reverse direction must be secured in such a manner that they will not become displaced.</p>																																										

8.11	General requirements	Requirements and tests for private water meters for use in water service installations						
		<p>The meters must be able to register accurately when installed in either a vertical position, or a horizontal position with the dial facing upwards.</p>						
11	Strainers	<p>The Licensed Plumber should ensure a strainer be installed, be it integral, removable, or as a dedicated strainer that is upstream from the water meter, if there are moving mechanical components.</p> <p>The strainers shall be made of suitable synthetic polymer, or stainless steel or other corrosion-resistant materials.</p>						
12	Meter register holder	<p>The meter registers shall be properly secured to meter body by mechanical means to ensure proper registration such as screw on or holder with steadfast fastener type.</p> <p>Materials used should be of adequate strength and durability to keep the registers secured over the meter's useful life of 15 years. Metallic alloys are preferred.</p> <p>If plastic materials are used, they must not break, fade, chalk, become brittle, loses strength or dimensional stability even after prolonged outdoor exposure, for instance such as under solar radiation (heat and ultraviolet), water and accidental impact during transport or operation.</p>						
13	Registers	<p>a) The register shall read in cubic metres (m<sup>3</sup>) and litres and shall be suitably protected with strong covers of suitable materials. The cubic metres and its multiples shall be indicated in black and sub-multiples of the cubic metre (litres) in red.</p> <p>b) Register shall be one of the following types (all other types will not be acceptable).</p> <table border="1" data-bbox="507 1048 1436 1249"> <thead> <tr> <th data-bbox="507 1048 1093 1106">Type 1 - Straight reading roller counter type</th> <th data-bbox="1093 1048 1436 1106">Maximum Indication of Initial Dial/Roller Wheel</th> </tr> </thead> <tbody> <tr> <td data-bbox="507 1106 1093 1164">a 4 or 5 black roller wheels and at least 3 red roller wheels</td> <td data-bbox="1093 1106 1436 1164">1.0 litre</td> </tr> <tr> <td data-bbox="507 1164 1093 1249">4 or 5 black roller wheels and 4 red roller wheels 0.1litre (Counter unit shall be able to pick up 0.1 litre/Pulse)</td> <td data-bbox="1093 1164 1436 1249">0.1 litre</td> </tr> </tbody> </table> <p>c) The actual or apparent height of the digits on the roller wheel must not be less than 4 mm readable at a 30-degree angle from the vertical. Cover lid for register window is not required. However, provision is to be made on the meter for fixing of cover lid, when required. The meter dial shall be in upright position, i.e. to be read at 90 degrees to the direction of flow. Meter with inclined dial face is not acceptable.</p> <p>d) For hybrid volumetric water meter with brass body and electronic register display, the register shall read in cubic metres (m<sup>3</sup>) and litres and shall be suitably protected with strong covers of suitable materials. The LCD display digits shall not be less than 4 mm in height and shall minimally be indicated in cubic metres up to the 10,000th place with 4 decimal places (i.e. 00000.0000 m<sup>3</sup>). The protection class of the electronic register shall be IP68.</p>	Type 1 - Straight reading roller counter type	Maximum Indication of Initial Dial/Roller Wheel	a 4 or 5 black roller wheels and at least 3 red roller wheels	1.0 litre	4 or 5 black roller wheels and 4 red roller wheels 0.1litre (Counter unit shall be able to pick up 0.1 litre/Pulse)	0.1 litre
Type 1 - Straight reading roller counter type	Maximum Indication of Initial Dial/Roller Wheel							
a 4 or 5 black roller wheels and at least 3 red roller wheels	1.0 litre							
4 or 5 black roller wheels and 4 red roller wheels 0.1litre (Counter unit shall be able to pick up 0.1 litre/Pulse)	0.1 litre							
14	Marking	<p>a) Each water meter shall be marked or embossed on the casing with the direction(s) of flow of water on both sides of the meter.</p> <p>b) Each water meter shall have a permanent and legible manufacturer's name or trademark on the body of the product.</p>						



# **PUB's Stipulated Standards & Requirements for Water Fittings covered under WELS**

## **PUB's Stipulated Standards and Requirements for Water Fittings covered under MWELS**

In addition to the test standards, all water fittings and appliances covered under the Mandatory WELS and Voluntary WELS shall also comply with the relevant requirements in the Public Utilities (Water Supply) Regulations and PUB's WELS Guidebook. For more information, please refer to PUB's WELS website at <https://www.pub.gov.sg/wels>.

All water fittings covered under the Mandatory WELS shall comply with the requirements in **Clause 4 of the PUB S&R**.

Any innovative design/features of WELS products (e.g. taps/mixers, dual-flush LCFCs, WC flush valves, urinal flush valves, etc.), which meet specific purposes is to be reviewed and cleared by PUB first with specific conditions applied on a case-by-case basis. Suppliers should approach PUB directly for our assessment first before sending for testing. Please submit your request to [pub\\_waterfittings@pub.gov.sg](mailto:pub_waterfittings@pub.gov.sg).

### **Taps and Mixers**

#### **Single Taps and Combination Taps**

1. All single tap and combination taps shall comply with the stipulated standards and requirements, the flow rates and flow durations in Table 9.1.
2. Self-closing delayed-action taps and sensor taps shall comply with the flow rates and flow durations as shown in Table 2.

**Table 1 – Test standards & requirements**

9.1	Standards to comply with	Tests and requirements for Single Taps and Combination Taps
a	BS EN 200 : 2008	Clause 8 - Leak-tightness Characteristics Clause 9 - Pressure Resistance Characteristics - Mechanical Performance Under Pressure Clause 11 - Mechanical Strength Characteristics - Torsion Test for Operating Mechanism Clause 12 - Mechanical Endurance Characteristics Clause 10 - Hydraulic Operating Characteristics –  a) Flow rates shall be measured at the following dynamic flow pressures: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 and 5.5 bars.  b) Maximum flow rates: <ul style="list-style-type: none"> <li>• Basin taps – 4 L/min</li> <li>• Shower taps – 7 L/min</li> <li>• Sink/bib taps – 6 litres/min</li> </ul>
b	BS EN 14506:2005	Vacuum test
c	SS 671:2021	For mechanical SCDATs, sensor SCDATs and sensor taps -All tests and requirements, where applicable.
d	-	Sensor taps and sensor SCDATs – the test for closure of device during power failure is required.
e	BS EN 248 : 2002	Clause 5.1 - Corrosion Resistance Test – Test with Neutral Saline Spray Clause 5.2 - Test for Coating Adherence – Test for Resistance to Thermal Shock

**Table 2 - Flow rates & flow durations for SCDATs**

Types of SCDATs	Maximum flow rate	Flow duration
Mechanical self-closing delayed-action taps	<ul style="list-style-type: none"> <li>Basin – 4 L/min</li> <li>Shower – 7 L/min</li> </ul>	<ul style="list-style-type: none"> <li>Basin – 5 to 7 sec</li> <li>Shower – 13 to 15 sec</li> </ul>
Sensor tap	<ul style="list-style-type: none"> <li>Basin taps – 4 L/min</li> <li>Shower taps – 7 L/min</li> <li>Sink taps – 6 litres/min</li> </ul>	<i>Suppliers should approach PUB for requirements and clearance first.</i>
Sensor self-closing delayed action taps	<ul style="list-style-type: none"> <li>Basin (public toilet) – 2 ± 0.2 L/min</li> <li>Shower (public toilet) – 7 L/min</li> </ul>	<ul style="list-style-type: none"> <li>Basin – 60 ± 5 sec</li> <li>Shower – 13 to 15 sec</li> </ul>

Added on  
1 Mar 23.

- Mechanical SCDAT : A tap which is activated by depressing its cap or by other means. The flow is automatically cut-off after a pre-set time. Examples are hand-pressed, pedal-operated, knee-operated and foot-operated. For types which are not listed here, suppliers should approach PUB for stipulation of standards and requirements.
- Sensor SCDAT : A tap in which the flow, when activated, is automatically cut-off after a pre-set period once the user's hands or body leave the sensing zone, whichever is earlier.
- For sensor SDAT basin taps in public toilets and food retail outlets where toilet facilities are provided, such SCDATs are taps in which the flow, when activated, shall automatically cut-off after a pre-set period or once the user's hands are moved away from beneath the tap, whichever is earlier.
- For information, please refer to PUB's Circulars at PUB's Fittings & Standards webpage at <https://www.pub.gov.sg/compliance/industry/circulars>.

### Mechanical Mixers

9.2	Standards to comply with	Tests for Mechanical Mixers
a	BS EN 817 : 2008	Clause 8 - Leaktightness Characteristics Clause 9 - Pressure Resistance Characteristics Clause 10 - Hydraulic Characteristics: <ol style="list-style-type: none"> <li>Determination of sensitivity</li> <li>Determination of flow rate:</li> <li>Flow rates shall be measured at the following dynamic flow pressures: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 and 5.5 bars.</li> <li>Maximum flow rates:                             <ul style="list-style-type: none"> <li>Basin taps – 4 L/min</li> <li>Shower taps – 7 L/min</li> <li>Sink/bib taps – 6 litres/min</li> </ul> </li> </ol> Clause 11 - Mechanical Strength Characteristics Clause 12 - Mechanical Endurance Characteristics
b	BS EN 14506:2005	Vacuum test
c	BS EN 248 : 2002	Clause 5.1 - Corrosion Resistance Test – Test with Neutral Saline Spray Clause 5.2 - Test for Coating Adherence – Test for Resistance to Thermal Shock

**Thermostatic Mixers (for dynamic pressure up to 5 bars)**

9.3	Standards to comply with	Tests for Thermostatic Mixers (for dynamic pressure up to 5 bars)
a	BS EN 1111 : 2017	Clause 9 - Leakage tightness Clause 10 - Hydraulic operating characteristics: <ul style="list-style-type: none"> <li>a. Flow rates (using hot and cold water) shall be measured at the following dynamic flow pressures: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 and 5.5 bars.</li> <li>b. Maximum flow rates:               <ul style="list-style-type: none"> <li>• Basin taps – 4 L/min</li> <li>• Shower taps – 7 L/min</li> <li>• Sink/bib taps – 6 litres/min</li> </ul> </li> <li>c. The sensitivity (using hot and cold water)</li> <li>d. Safety with cold water failure</li> <li>e. Temperature stability:               <ul style="list-style-type: none"> <li>i. with changing inlet pressure</li> <li>ii. with changing inlet temperature</li> </ul> </li> </ul> Clause 11 - Mechanical performance under pressure Clause 12 – Mechanical Endurance characteristics Clause 13 - Torsional resistance
b	AS 4032.1:2005	Electronic valves – power failure (if applicable)
c	BS EN 248 : 2002	Clause 5.1 - Corrosion Resistance Test – Test with Neutral Saline Spray Clause 5.2 - Test for Coating Adherence – Test for Resistance to Thermal Shock
With effect from 1 Apr 2020 (date of test report), only thermostatic mixing valves tested for compliance with BS EN 1111:2017 shall be allowed for display, advertisement, sale, supply and installation in potable water supply systems in Singapore. Between 1 April 2019 to 31 March 2020 (date of test report), thermostatic mixing valves which have been tested to BS EN 1111:1999 and BS EN 1111:2017 are acceptable.		

Table 9.4 on Thermostatic Mixers (for dynamic pressures up to 1 bar has been removed.

## Dual Flush Water Closets Flushing Cisterns

Any innovative design/features of dual-flush LCFCs e.g. additional operating mechanisms such as, not limited to, wave sensors, touch sensor, etc., which meet specific purposes is to be reviewed and cleared by PUB first with specific conditions applied on a case-by-case basis. Suppliers should approach PUB directly for our assessment first before sending for testing. Please submit your request to [pub\\_waterfittings@pub.gov.sg](mailto:pub_waterfittings@pub.gov.sg).

9.5	Standards to comply with	Tests for Dual Flush Water Closets Flushing Cisterns
a	<p>SS 574:Part 1:2012</p> <p style="text-align: center;">AND</p> <p>BS 1212 : Part 4: 1991 Section 3 and Section 4 (except Clauses 18, 19 and 20.1)</p>	<p>Clause 5.1 - Materials &amp; Design/Dimension (General)</p> <p>Clause 5.2.1 – Vitreous china cisterns (wall thickness and front thrust test)</p> <p>Clause 5.2.2 – Stainless steel cistern (wall thickness)</p> <p>Clause 5.2.3.3 – Colour fastness to light for Rubber compound and plastic cisterns (except conceal cistern)</p> <p>Clause 5.2.3.4 - Distortion Test for Rubber compound and plastic cisterns (except conceal cistern)</p> <p>Clause 5.2.3.5 – Shell thickness</p> <p>Clause 5.2.3.6 – Front thrust test (For exposed Rubber compound and plastic cisterns)</p> <p>Clause 5.2.3.7-Impact Test for Rubber compound and plastic cisterns (except conceal cistern)</p> <p>Clause 5.2.3.8 - Leakage Test for Rubber compound and plastic cisterns</p> <p>Clause 5.3 – Flushing device (including resistance to torque)</p> <p>Clause 5.4 – Volume of discharge per flush</p> <p>Clause 5.5 – Water line</p> <p>Clause 5.6 – Warning pipe connections</p> <p>Clause 5.7 – Water inlet connections</p> <p>Clause 5.8 – Water inlet valve</p> <p>Clause 5.9 – Outlet valve</p> <p>Clause 5.10 – Outlet connection</p> <p>Clause 5.11 – Flush pipe</p> <p>Clause 5.12 - Covers</p> <p>Clause 5.13 – Flush button design. Dimensions shall be reflected in the test report.</p> <p>Clause 6 – Construction.</p> <p>Clause 7.1 - Flushing Tests</p> <p>Clause 7.2 - Volume of Discharge per Flush (for full &amp; reduced flush)</p> <p>Clause 7.3 - Endurance Test (for full &amp; reduced flush)</p> <p>Clause 7.4 - WC Drainline Transportation Test (For cisterns with full flush volume of less than 3.5 litres/flush)</p> <p>Clause 7.5 – Backflow prevention test in accordance with BS 1212</p> <p>Clause 8 - Marking</p> <p>Clause 10 - General dimensional requirement</p> <p>Clause 11.1 - Inlet connection - general</p> <p>Clause 11.2 3 - Inlet connection - Bottom inlet connection</p> <p>Clause 12.1 - Backnuts - general</p> <p>Clause 12.2 - Backnuts - backnuts for use with side entry Cisterns</p> <p>Clause 12.3 - Backnuts - backnuts for use with bottom entry Cisterns</p> <p>Clause 13 - Float adjustment</p> <p>Clause 14 - Discharge arrangements</p> <p>Clause 15 - Inlet shank and backnuts</p> <p>Clause 16.1 - Static pressure - section 4</p> <p>Clause 16.2 - Shut-off pressure and lever</p> <p>Clause 16.3 - Dynamic pressure</p> <p>Clause 17 - Backflow</p> <p>Clause 20.2 - Float - impact</p>
b	<b>Water Closet Pans</b>	<p>Clause 4.3 – Flushing test</p> <p>Clause 4.4 – Load test for wall hung pan</p>

9.5	Standards to comply with	Tests for Dual Flush Water Closets Flushing Cisterns
	SS 574:Part 2:2012	Clause 4.5 - Trap seal depth determination and restoration test Clause 4.6 – WC drainline transportation test for WC which uses less than 3.5 litres of water for full flush.
c	<b>For Vitreous China WC Flushing Cisterns/Pans</b>  BS 3402:1969	Clause 3 – Application of glazing Clause 5 - Visual Examination Clause 6 - Water Absorption Clause 7 - Crazeing Test Clause 8 - Chemical Resistance Clause 9 - Resistance to Burning/Staining
d	<p>1) <u>Additional requirements for flushing test:</u></p> <p><b>For close-coupled or one-piece WC suite with S-type outlet WC pan</b></p> <p>For each model, flushing test shall be carried out on the following WC combination set-ups:</p> <ul style="list-style-type: none"> <li>• WC and straight pan collar; and</li> <li>• WC and 1-inch offset pan collar or</li> <li>• WC and straight pan collar; and</li> <li>• WC and 1½-inch offset pan collar or</li> <li>• WC and straight pan collar; and</li> <li>• WC and 2"-inch offset pan collar</li> </ul> <p>Supplier must inform the test lab which WC combination set-up they want to test.</p> <p>The straight pan collar, 1-inch, 1 ½-inch and 2-inch offset pan collars shall be provided by the test laboratory, as part of their test equipment. These sanitary fittings shall be those which have been tested to comply with Singapore Standard SS 213.</p> <p>A WC combination set-up which passed the flushing test with 2-inch offset pan collar need not be tested with 1-inch or 1 ½-inch offset pan collars.</p> <p><b>For close-coupled or one-piece WC suite with P-typed (horizontal) outlet WC pan</b></p> <p>The P-type (horizontal) outlet close-coupled WC or the one-piece WC suite shall be fixed with the P-type or P-S type bend connector.</p> <p>The close-coupled WC or one-piece WC suite set up shall then be fixed with a 1-inch, 1 ½-inch or 2-inch offset pan collar only.</p> <p>The bend connector shall be supplied by the manufacturer.</p> <p>The P-type, 1-inch, 1 ½-inch and 2-inch offset pan collars shall be provided by the test laboratory, as part of their test equipment. These sanitary fittings shall be those which have been tested to comply with Singapore Standard SS 213.</p> <p>A WC combination set-up which passed the flushing test with 2-inch offset pan collar need not be tested with 1-inch or 1 ½-inch offset pan collars. Supplier must inform the test lab which offset pan collar size they want to test.</p> <p>2) <u>Additional requirements for independent WC flushing cistern and pan</u></p> <p>For independent WC flushing cistern and pan, the height set-up between the cistern outlet and the centreline of the discharge into the pan for testing purpose shall not exceed 80mm. This maximum set-up distance is not applicable for flushing cistern with permanently integrated flush pipe of predetermined fixed length that does not allow any adjustment or change. However, <u>the set-up distance for testing purpose shall be clearly reflected in the test reports and the product manual such that the installer is aware of the limitation.</u> Under no circumstances shall this set-up testing distance be reduced when the cistern is installed for use.</p>	

## PUB's Stipulated Requirements for Urinal Flush Valves

9.7	Standards to comply with - Requirements for Urinal Flush Valves
a	<p>For flush valves, suppliers, retailers and installers shall have to ensure compliance with the requirements on backflow prevention and conservation of water as stipulated in the Public Utilities (Water supply) Regulations and the Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>Every flush valve serving a urinal shall be such a design and be and remain so arranged as to give a single flush of not less than 0.5* litres and not more than 1.0 litres (notwithstanding that the operating member continues to be held actuated).</p> <p>There shall be no pre-flush, flushing at fixed time intervals or multiple flushing features.</p> <p>Urinals in public toilets shall be fitted with automatic flushing devices. The automatic flushing devices shall be activated by sensors and equipped with manual over-ride feature. The manual over-ride feature shall comply with the following requirements:</p> <p>a. The manual over-ride feature shall allow manual activation of flushing in the event of malfunction or breakdown of the sensor or sensing unit. In the event of a power supply failure, the sensor and the manual over-ride may not function.</p> <p>b. When manual over-ride is activated, the flushing shall take place immediately and the sensor flushing shall be overridden to prevent double flushing i.e. the over-ride shall over-ride all sensor operation even when the sensor has been activated and the sensor shall not activate another flush after the user leaves the sensing area.</p> <p>c. The manual over-ride button shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users.</p> <p>d. The volume of water discharged per flush by manual over-ride shall continue to be 0.5* - 1.0 litres for urinals (notwithstanding that the operating member continues to be held actuated).</p> <p>Every flush valve shall be fitted with an adequate device or so constructed to prevent the backflow of water and shall be of such a design so as not to cause wastage of water.</p> <p>Flush valve shall be incorporated with check valves that comply with BS 5154 and vacuum breakers that comply with American Society of Sanitary Engineering Standard No.1001. Alternatively, flush valves shall derive water from separate storage tank which is not connected in any way with all other fittings supplying basins, sinks, heater, etc.</p> <p>All water fittings incorporated in the flush valve shall comply with the relevant Standards stipulated by PUB.</p> <p>Flush valves shall not be used in residential dwelling units.</p> <p>For sensor operated flush valves, the sensor shall comply with the requirements given in Appendix A.</p> <p>The flush valve shall be tested to meet the requirements of the relevant tests given in Appendices B to C and shall be supported with test reports from a testing laboratory:</p> <p>Please note that PUB does not enquire into the effective performance of the flush valve. Compliance with the requirements and Standards stipulated by PUB does not constitute an endorsement or recommendation of the flush valve for its proposed use. The onus is on the manufacturer/supplier to ensure that flush valve performs according to specifications and effectively for its proposed use.</p> <p>For the tests and supply of waterless urinals, suppliers shall contact the Water Reclamation (Network) Department at 67313256 or 67313245 for further assistance.</p> <p>*Urinal flush valve with flush volume below 0.5 litre may be used if its Manufacturer ensures that it is designed to perform effectively with such flush volume. In addition, such urinals shall be tested to comply with the Dye Test specified in</p> <p>a) Clause 8.5 of ASME A112.19.2 - 2008/CSA B45.1-08; or b) Clause 8.5 of ASME A112.19.2 - 2013/CSA B45.1-13.</p> <p><b>APPENDIX A</b></p>

9.7	Standards to comply with - Requirements for Urinal Flush Valves
	<p><b>REQUIREMENTS FOR SENSORS OF FLUSHING DEVICES</b></p> <p>1) Each sensor unit shall only operate one flushing device for a sanitary appliance. The sensor unit when installed shall not be affected by the operation of adjacent sensor unit.</p> <p>2) The sensor unit's stable sensing area shall be adjusted for an activating distance</p> <p>Of 600mm for a urinal.</p> <p>3) The sensor units shall be designed to being operation only after a person approaches the unit and remain within the sensing zone for a duration exceeding 5 sec.</p> <p>4) The sensor units shall be designed to flush after each usage with minimal time delay (eg. immediate for urinal flush valve) and without multiple flushing or any flushing at fixed time intervals. There shall also be no pre-flush.</p> <p>5) Sensor shall only activated flushing devices after usage and such flushing devices shall be capable of delivering the stipulated volume per 0.5* - 1.0 litres for each bowl (urinal) required for flushing (solenoid valve shall be provided with flow regulator for adjustment of volume of discharge).</p> <p>6) Urinal sensor flush valves installed in public toilets shall be provided with manual over-ride feature to allow manual activation of flushing in the event of malfunction or breakdown of the sensor or sensing unit. In the event of a power supply failure, the sensor and the manual over-ride may not function. The manual over-ride shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users. When manual over-ride flushing is activated, the flushing shall take place immediately and the sensor flushing shall be overridden to prevent double flushing i.e. the over-ride feature shall override all sensor operation even when the sensor has been activated and the sensor shall not activated another flush after the user leaves the sensing area. The volume of water discharge per flush by manual over-ride shall continue to be 0.5* - 1.0 litres for urinals, notwithstanding that the operating member continues to be held actuated.</p> <p>7) The sensor units shall be designed to permit easy adjustment of volumes and flow rates on the flushing devices.</p> <p>8) All sensor devices shall be firmly installed on the wall fronting the appliance. Sensor devices may be installed at ceiling levels if the above requirements and the limitation on sensing distance can be complied with.</p> <p>9) Agents are required to ensure proper adjustment of sensor-operated flush valves, in particular, the sensing distance and timing for activation of sensor and flushing prior to delivery to site.</p> <p>10) Agents shall also ensure proper installation and adjustment of the sensor-operated flush valves at site to prevent multiple flushing.</p> <p>Note:  *Urinal flush valve with flush volume below 0.5 litre may be used if its Manufacturer ensures that it is designed to perform effectively with such flush volume. In addition, such urinals shall be tested to comply with the Dye Test specified in</p> <p>c) Clause 8.5 of ASME A112.19.2 - 2008/CSA B45.1-08;  or  d) Clause 8.5 of ASME A112.19.2 - 2013/CSA B45.1-13.</p> <p><b>APPENDIX B</b></p> <p><b>TESTING OF SENSOR DEVICE FOR URINAL FLUSH VALVE</b>  <b>PART I - TESTING OF SENSOR DEVICE FOR URINAL FLUSH VALVE</b></p> <p><b>(1) ENDURANCE TEST FOR SENSOR DEVICE FOR URINAL FLUSH VALVE</b></p> <p>1 This test shall be the first test to carried out on the sensor operated flush valve  2 The sensor operated flush valve shall be initially set to give a volume of discharge of <math>1.0 \pm 0.5</math> litres at flow dynamic pressure of <math>3.0 \pm 0.5</math> bars. The sensor operated flush valve is then subjected to 75,000 cycles of test.</p>



9.7	Standards to comply with - Requirements for Urinal Flush Valves
	<p>3 The sensing distance, time delay before activation of sensor, time delay for activation of flush, average volume of discharge and average discharge time for three consecutive flushes shall be recorded at the start of the test and after each 25,000 cycles.</p> <p>4 After each 25,000 cycles, the change in volume of discharge shall not exceed 10% of the volume of discharge at the start of the test and any reduction in the volume of discharge shall not result in a volume of discharge falling below 0.5 litres.</p> <p>5 The sensor operated flush valve shall be capable of continuous operation without sticking, chattering or leaking and shall have no change in the following viz:</p> <p>(a) Sensing distance Requirement: 600±100mm</p> <p>(b) Time delay before activation of sensor Requirement: The sensor device shall be design operation only after a person approaches the unit within sensing distance of 600±100mm and remains within the sensing area for a duration exceeding 5 seconds.</p> <p>(c) Time delay for activation of flush Requirement: The sensor device shall be designed to flush only immediately or less than 5 seconds after the person leave the sensing area.</p> <p><b>(2) DETERMINATION OF SENSING DISTANCE AND TIME DELAYS</b></p> <p>(a) Sensing distance Requirement: 600±100mm</p> <p>Condition: 150mm x 150mm white paper shall be used for determination of sensing distance.</p> <p>(b) Time delay before activation of sensor Requirement: The sensor device shall be design operation only after a person approaches the unit within sensing distance of 600±100mm and remains within the sensing area for a duration exceeding 5 seconds.</p> <p>(c) Time delay for activation of flush</p> <p>Requirement: The sensor device shall be designed to flush only immediately or less than 5 seconds after the person leave the sensing area.</p> <p><b>(3) PRE-FLUSH/FLUSHING AT FIXED TIME INTERVAL/MULTIPLE FLUSHING FOR FLUSH VALVE</b></p> <p>The sensor device for flush valve shall have no pre-flush, flushing at fixed time intervals or multiple flushing features.</p> <p><b>(4) MANUAL OVER-RIDE FEATURE FOR URINAL FLUSH VALVE (WHERE APPLICABLE)</b></p> <p>If the sensor device for a urinal flush valve is equipped with a manual over-ride feature, it shall comply with the following:</p> <p>(a) When manual over-ride flushing is activated, the flushing shall take place immediately and the sensor flushing shall be overridden to prevent double flushing i.e. the over-ride feature shall over-ride all sensor operation even when the sensor has been activated and the sensor shall not activate another flush after the user leaves the sensing area.</p> <p>(b) The manual over-ride button shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users.</p> <p>(c) When the manual over-ride feature is activated, the urinal flush valve shall delivery a volume of discharge of not more than 1.0 litres and not less than 0.5* litres per flush at each of the following dynamic pressures: 0.7, 1.0, 1.5, 2.0 and 3.0 bars with the operating member continued to be held activated.</p> <p><b>APPENDIX B</b></p> <p><b>TESTING OF SENSOR DEVICE FOR URINAL FLUSH VALVE</b></p> <p><b>PART II - TESTING OF URINAL FLUSH VALVE</b></p>

9.7	Standards to comply with - Requirements for Urinal Flush Valves
	<p><b>(1) ENDURANCE TEST</b></p> <p>This shall be the first test to be carried out on the flush valve. The flush valve shall be initially set to give a volume of discharge of 1.0 ±0.5 litres at flow dynamic pressure of 3.0 ±0.5 bars. The flush valve is then subjected to 75,000 cycles of test.</p> <p>The average volume of discharge for three consecutive flushes shall be recorded at the start of the test and after 25,000 cycles.</p> <p>After each 25,000 cycles, the change in volume of discharge shall not exceed 10% of the volume of discharge at the start of the test and any reduction in the volume of discharge shall not result in a volume of discharge falling below 0.5* litres.</p> <p>The flush valve shall be capable of continuous operation without sticking, chattering or leaking.</p> <p><b>(2) HYDRAULIC TEST</b></p> <p>Test A: Hydraulic test on flush valve body With the outlet of the flush valve plugged, a hydraulic pressure of 20 bars is applied through the inlet for 60 seconds. There shall be no sign of leakage or permanent distortion of any component of the flush valve.</p> <p>Test B: Hydraulic test on stop valve (for flush valve with built-in stop valve only) The inlet of the stop valve is connected to a hydraulic pressure system with the seat of the stop valve in closed position. A hydraulic pressure of 20 bar is applied for 60 seconds. The stop valve is inspected for leakage and other defects.</p> <p>Test C: Hydraulic test on check valve (for flush valve with built-in check valve only) Hydrostatic pressure test on check valve body and seat shall be carried out in accordance with BS 5154:1991 specifications. There shall be no visible leakage or permanent distortion of any component of the check valve during tests.</p> <p><b>(3) EFFECTIVENESS OF VACUUM BREAKER TEST</b> (for flush valve with built-on vacuum breaker only)</p> <p>The flush valve is installed as in the volume of discharge test and the lower end of the flush is submerged in water such that the distance from the bottom of the vacuum breaker to the water level is 150mm.</p> <p>With the valve seat slightly opened (by inserting a 2mm diameter wire) and actuating member held in operating position, the flush valve inlet (without a check valve/stop valve fixed) is connected to a vacuum line and the test is conducted in following order:</p> <p>(a) A constant vacuum of 635mm mercury is applied for a period of 30 seconds. (b) Intermittent vacuum of 50, 125, 380, 635 mm of mercury are applied. Each application is for 5 seconds on and 5 seconds shut. (c) First a slowly increasing vacuum is applied at a uniform rate from 50 mm to 635 mm mercury. Next, a slowly decreasing vacuum is applied at a uniform rate from 635mm to 0 mm mercury.</p> <p>In tests (a) to (c), if the water rise in the flush pipe exceeds 76mm, the vacuum breaker is deemed to have failed the test.</p> <p><b>(4) VOLUME OF DISCHARGE TEST</b></p> <p>(a) A flush pipe of 300 mm length is to be secured to the outlet of flush valve. The internal diameter of the flush pipe shall be at least 13mm. (b) With the flush valve connected to a water supply system, a pressure gauge and a control valve are fitted at the inlet of the flush valve.</p>

9.7	Standards to comply with - Requirements for Urinal Flush Valves
	<p>(c) The flow regulator is to be set at maximum. Before commencing the actual test, the flush valve is subjected to a series of trail runs and the dynamic pressure is adjusted to 0.7 bars.</p> <p>(d) The operating member is actuated and the water discharge from the flush pipe is collected until the flow of water ceases (for manual over-ride, the operating member shall continue to be held actuated until the flow of water ceases). Record the volume of water collected.</p> <p>(e) With the flow regulator adjusted to the maximum setting, repeat the above procedure at each of the following dynamic pressure: 1.0, 1.5, 2.0 and 3.0 bars.</p> <p>(f) When tested in accordance with the procedure above, the discharge volume per flush shall not be more than 1.0 litres and less than 0.5* litres.</p> <p>Note:</p> <p>Supplier, retailers and installers of flush valves shall have to ensure compliance with the requirements on backflow prevention and wastage of water as stipulated in Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>PUB does not enquire into the effective performance of the flush valve and compliance with the above testing requirements does not attest to the effective performance of the flush valve. The responsibility of ensuring the effective performance of flush valve lies with the manufacturer and supplier of the flush valve.</p> <p>*Urinal flush valve with flush volume below 0.5 litre may be used if its Manufacturer ensures that it is designed to perform effectively with such flush volume. In addition, such urinals shall be tested to comply with the Dye Test specified in</p> <ul style="list-style-type: none"> <li>a) Clause 8.5 of ASME A112.19.2 - 2008/CSA B45.1-08;</li> <li>or</li> <li>b) Clause 8.5 of ASME A112.19.2 - 2013/CSA B45.1-13.</li> </ul> <p><b>APPENDIX C</b></p> <p><b>TESTING OF MANUAL OPERATED URINAL FLUSH VALVE</b></p> <p><b>(1) ENDURANCE TEST</b></p> <p>1 This test shall be the first test to be carried out on the flush valve.</p> <p>2 The flush valve shall be initially set to give a volume of discharge of <math>1.0 \pm 0.5</math> litres at flow dynamic of <math>3.0 \pm 0.5</math>bars. The flush valve is then subjected to 75,000 cycles of test.</p> <p>3 The average volume of discharge for three consecutive flushes shall be recorded at the start of the test and after each 25,000 cycles.</p> <p>4 After each 25,000 cycles, the change in volume of discharge shall not exceed 10% of the volume of discharge at the start of the test and any reduction in volume of discharge shall not result in a volume of discharge falling below 0.5* litres.</p> <p>5 The flush valve shall be capable of continuous operation without sticking, chattering or leaking.</p> <p><b>(2) HYDRAULIC TEST</b></p> <p>Test A: Hydraulic test on flush valve body With the outlet of flush valve plugged, a hydraulic pressure of 20 bars is applied through the inlet for 60 seconds. There shall be no sign of leakage or permanent distortion of any component of the flush valve.</p> <p>Test B: Hydraulic test on stop valve (for flush valve with built-in stop valve only) The inlet of the stop valve is connected to hydraulic pressure system with the seat of the stop valve in closed position. A hydraulic pressure of 20 bars is applied for 60 seconds. The stop valve is inspected for leakage and other defects.</p> <p>Test C:</p>

9.7	Standards to comply with - Requirements for Urinal Flush Valves
	<p>Hydraulic test on check valve (for flush valve with built-in check valve only)  Hydrostatic pressure test on check valve body and seat shall be carried out in accordance with BS 5154:1991 specifications. There shall be no visible leakage or permanent distortion of any component of the check valve during the tests.</p> <p><b>(3) EFFECTIVENESS OF VACUUM BREAKER TEST</b>  (For flush valve with built-on vacuum breaker only)</p> <p>1 The flush valve is installed as in volume of discharge test and the lower end of the flush pipe is submerged in water such that the distance from the bottom of the vacuum breaker to the water level is 150 mm.</p> <p>2 With the valve seat slightly opened (by inserting a 2 mm diameter wire) and the actuating member held in operating position, the flush valve inlet (without a check valve/stop valve fixed) is connected to a vacuum line and the test is conducted in the following order:</p> <p>(a) A constant vacuum of 635 mm mercury is applied for a period of 30 seconds.  (b) Intermittent vacuum of 50, 125, 255, 380, 635 mm of mercury are applied. Each application is for 5 seconds on and 5 seconds shut.</p> <p>(c) First a slowly increasing vacuum is applied at a uniform rate 50m to 635 mm mercury. Next, a slowly decreasing vacuum is applied at a uniform rate from 635 mm to 0 mm mercury.</p> <p>In tests (a) to (c), if the water rises in the flush pipe exceeds 76 mm, vacuum breaker is deemed to have failed the test.</p> <p><b>(4) VOLUME OF DISCHARGE TEST</b></p> <p>1 A flush pipe of 300 mm length to be secured to the outlet of the valve. The internal diameter of the flush pipe shall be at least 13mm.</p> <p>2 With the flush valve connected to a water supply system, a pressure gauge and a control valve are fitted at the inlet of the flush valve.</p> <p>3 The flow regulator is to be set at maximum. Before commencing the actual test, the flush valve is subjected to a series of trial runs and the dynamic pressure is adjusted to 0.7 bars.</p> <p>4 The operating member is actuated and held actuated and the water discharge from the flush pipe is collected until the flow of water ceases (the operating member shall continue to be held actuated until the flow of water ceases). Record the volume of water collected.</p> <p>5 With the flow regulator adjusted to the maximum setting, repeat the above procedure at each of the following dynamic pressures: 1.0, 1.5, 2.0 and 3.0 bars.</p> <p>6 When tested in accordance with the procedure described above, the discharge volume per flush shall not be more than 1.0 litres and less than 0.5* litres.</p> <p>Note:  Supplier, retailers and installers of flush valves shall have to ensure compliance with the requirements on backflow prevention and wastage of water as stipulated in Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>PUB does not enquire into the effective performance of the flush valve and compliance with the above testing requirements does not attest to the effective performance of the flush valve. The responsibility of ensuring the effective performance of flush valve lies with the manufacturer and supplier of the flush valve.</p> <p>*Urinal flush valve with flush volume below 0.5 litre may be used if its Manufacturer ensures that it is designed to perform effectively with such flush volume. In addition, such urinals shall be tested to comply with the Dye Test specified in</p> <p>a) Clause 8.5 of ASME A112.19.2 - 2008/CSA B45.1-08;  or  b) Clause 8.5 of ASME A112.19.2 - 2013/CSA B45.1-13.</p> <p>In addition, product shall also comply with the stipulation standards and requirements in Clause 4, where applicable.</p>

<b>9.7</b>	<b>Standards to comply with - Requirements for Urinal Flush Valves</b>

## PUB Stipulated Standards & Requirements for Flush Valves for Water Closet (WC) Pan

With effect from 1 Jan 2022, only flush valves for WCs that are labelled under MWELS can be offered-for-sale, displayed, and advertised for sale or supply in Singapore.

*Added  
on 22  
Jun 21.*

With effect from 1 Jan 2022, all flush valves for WCs being offered-for-sale, displayed, advertised for sale or supply in Singapore:

- a) shall have a flush volume of not more than 4.0 litres per flush; and
- b) shall be of minimum 2-tick or more water efficiency rating under the MWELS.

For more information, please refer to PUB's WELS website at [www.pub.gov.sg/wels](http://www.pub.gov.sg/wels) and PUB's Circulars at PUB's Fittings & Standards webpage at <https://www.pub.gov.sg/compliance/industry/circulars>.

Please note that PUB does not enquire into the effective performance of the flush valve and compliance with the above testing requirements does not attest to the effective performance of the flush valve. The responsibility of ensuring the effective performance of flush valve lies with the manufacturer and supplier of the flush valves.

9.8	Standards to comply with - Requirements WC flush for valves
	<p>For flush valves, suppliers, retailers and installers shall have to ensure compliance with the requirements on backflow prevention and conservation of water as stipulated in the Public Utilities (Water supply) Regulations and the Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>Every flush valve serving a water-closet pan shall be such a design and be and remain so arranged as to give a single flush of not more than 4.0 litres (notwithstanding that the operating member continues to be held actuated). The water closet pan to be used with flush valves shall be of a design suitable for use with the flush valve of up to 4.0 litres maximum capacity and shall conform to the functional requirements and tests in Singapore Standard 574 : Part 2 : 2012.</p> <p>There shall be no pre-flush, flushing at fixed time intervals or multiple flushing features.</p> <p>Water closets in public toilets shall be fitted with automatic flushing devices. The automatic flushing devices shall be activated by sensors and equipped with manual over-ride cum by-pass features. The manual over-ride cum by-pass feature shall comply with the following requirements:</p> <ol style="list-style-type: none"> <li>a. The manual over-ride cum by-pass feature shall allow manual activation of flushing in the event of malfunction/breakdown of the sensor or sensing unit or failure of power supply. In the event of a power supply failure, the sensor and the manual over-ride may not function, however the manual by-pass shall continue to be functional.</li> <li>b. When manual over-ride or by-pass flushing is activated, the flushing shall take place immediately and the sensor flushing shall be overridden to prevent double flushing i.e. the over-ride and by-pass feature shall over-ride all sensor operation even when the sensor has been activated and the sensor shall not activate another flush after the user leaves the sensing area.</li> <li>c. The manual over-ride / by-pass button/s shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users</li> <li>d. The volumes of water discharged per flush by manual over-ride and by by-pass shall continue to be not more than <u>4.0 litres</u> for water closets (notwithstanding that the operating member continues to be held actuated).</li> </ol> <p>Every flush valve shall be fitted with an adequate device or so constructed to prevent the backflow of water and shall be of such a design so as not to cause wastage of water.</p> <p>Flush valve shall be incorporated with check valves that comply with BS 5154 and vacuum breakers that comply with American Society of Sanitary Engineering Standard No.1001. Alternatively, flush valves shall derive water from separate storage tank which is not connected in any way with all other fittings supplying basins, sinks, heater, etc.</p> <p>All water fittings incorporated in the flush valve shall comply with the relevant Standards stipulated by PUB.</p> <p>Flush valves shall not be used in residential dwelling units.</p>

9.8	<b>Standards to comply with - Requirements WC flush for valves</b>
	<p>For replacement of existing water closet flush valves of flushing cisterns, it must be ensured that the existing water closet pans used are compatible with the reduced flush (where applicable) from the newly installed flush valves so as not to affect the flushing efficiency. If not compatible, the existing water closet pans shall be replaced with compatible ones.</p> <p>For sensor operated flush valves, the sensor shall comply with the requirements give in <b>Appendix A</b>.</p> <p>The WC flush valve shall be tested to meet the requirements of the relevant tests given in <b>Appendices B to E</b> and shall be supported with test reports from an accredited testing laboratory:</p> <p>Please note that PUB does not enquire into the effective performance of the flush valve. Compliance with the requirements and Standards stipulated by PUB does not constitute an endorsement or recommendation of the flush valve for its proposed use. The onus is on the manufacturer/supplier to ensure that flush valve performs according to specifications and effectively for its proposed use.</p> <p style="text-align: center;"><b>APPENDIX A</b></p> <p style="text-align: center;"><b>REQUIREMENTS FOR SENSORS OF FLUSHING DEVICES</b></p> <ol style="list-style-type: none"> <li>1) Each sensor unit shall only operate one flushing device for a sanitary appliance. The sensor unit when installed shall not be affected by the operation of adjacent sensor unit.</li> <li>2) The sensor unit's stable sensing area shall be adjusted for an activating distance as follows:       <ol style="list-style-type: none"> <li>a) 900mm for water closet; and</li> <li>b) 600mm for urinal</li> </ol> </li> <li>3) The sensor units shall be designed to being operation only after a person approaches the unit and remain within the sensing zone for a duration exceeding 5 sec.</li> <li>4) The sensor units shall be designed to flush after each usage with minimal time delay (eg. min 5 sec for WC flush valve and immediate for urinal flush valve) and without multiple flushing or any flushing at fixed time intervals. There shall also be no pre-flush.</li> <li>5) Sensor shall only activated flushing devices after usage and such flushing devices shall be capable of delivering the stipulated volume per flush (not more than <u>4.0 litres</u> for WC) required for flushing (solenoid valve shall be provide with flow regulator for adjustment of volume of discharge).</li> <li>6) WC sensor flush valves installed in public toilets shall be provided with manual over-ride cum by-pass feature to allow manual activation of the flushing in the event of malfunction/breakdown of the sensor or sensing unit or failure of power supply. In the event of a power supply failure, the sensor and the manual over-ride may not function, however the manual by-pass shall continue to be functional. The manual over-ride/ by-pass button/s shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users. When manual over-ride or by-pass flushing is activated, the flushing shall take place immediately and the sensor flushing shall be overridden to prevent double flushing i.e. the over-ride and by-pass feature shall over-ride all sensor operation even when the sensor has been activated and the sensor shall not activate another flush after the user leaves the sensing area. The volumes of water discharge per flush by manual over-ride and by by-pass shall continue to be not more than <u>4.0 litres</u> for water closets, notwithstanding that the operating member continues to be held actuated.</li> <li>7) The sensor units shall be designed to permit easy adjustment of volumes and flow rates on the flushing devices.</li> <li>8) All sensor devices shall be firmly installed on the wall fronting the appliance. Sensor devices may be installed at ceiling levels if the above requirements and the limitation on sensing distance can be complied with.</li> <li>9) Agents are required to ensure proper adjustment of sensor-operated flush valves, in particular, the sensing distance and timing for activation of sensor and flushing prior to delivery to site.</li> <li>10) Agents shall also ensure proper installation and adjustment of the sensor-operated flush valves at site to prevent multiple flushing.</li> </ol>

## APPENDIX B

## TESTING OF SENSOR OPERATED 4.0 LITRES WATER CLOSET FLUSH VALVE

## PART I - TESTING OF SENSOR DEVICE FOR WATER CLOSET VALVE

## 1. ENDURANCE TEST FOR SENSOR DEVICE FOR WATER CLOSET FLUSH VALVE

- i. This test shall be the first test to be carried out on the sensor operated flush valve.
- ii. The sensor operated flush valve shall be initially set to give a volume of discharge of not more than 4.0 litres at flow dynamic pressure of  $3.0 \pm 0.5$  bars. The sensor operated flush valve is then subjected to 75,000 cycles of test.
- iii. The sensing distance, time delay before activation of sensor, time delay for activation of flush, average volume of discharge and average discharge time for three consecutive flushes shall be recorded at start of test and after each 25,000 cycles.
- iv. After each 25,000 cycles, the change in volume of discharge shall not exceed 10% of the volume of discharge at start of the test and any reduction in the volume of discharge shall not result in a volume of discharge falling below 3.5 litres.
- v. The sensor operated flush valve shall be capable of continuous operation without sticking, chattering or leaking and shall have no change in the following viz:

## (a) Sensing distance

Requirement: 800 to 900 mm

## (b) Time delay before activation of sensor

Requirement: The sensor device shall be designed to begin operation only after a person approaches the unit within the sensing distance of 800 to 900 mm and remains within the sensing area for a duration exceeding 5 seconds.

## (c) Time delay for activation of flush

Requirement: The sensor device shall be designed to flush only after 5 to 10 seconds after the person leaves the sensing area.

## APPENDIX C

## 1. DETERMINATION OF SENSING DISTANCE AND TIME DELAYS



9.8	Standards to comply with - Requirements WC flush for valves
	<p><b>(a) Sensing distance</b></p> <p>Requirement 800 to 900 mm ent</p> <p>Condition: 150 mm x 150 mm white paper shall be used for determination of sensing distance.</p> <p><b>(b) Time delay before activation of sensor</b></p> <p>Requirement The sensor device shall be designed to being operation only after a person ent approaches the unit within the sensing distance of 800 to 900 mm and remain within the sensing area for a duration exceeding 5 seconds.</p> <p><b>(c) Time delay for activation of flush</b></p> <p>Requirement The sensor device shall be designed to flush only after 5 to 10 seconds after ent the person leaves the sensing area.</p> <p><b>2. PRE-FLUSH/FLUSHING AT FIXED TIME INTERVALS/MULTIPLE FLUSHING FOR WATER CLOSET FLUSH VALVE</b></p> <p>The sensor device for flush valve shall have no pre-flush, flushing at fixed time intervals or multiple flushing features.</p> <p><b>3. MANUAL OVER-RIDE OR BY-PASS FEATURE FOR WATER CLOSET FLUSH VALVE (WHERE APPLICABLE)</b></p> <p>If the sensor device for the WC flush valve is equipped with a manual over-ride or by-pass feature, it shall comply with the following:</p> <p>(a) When manual over-ride or by-pass flushing is activated, the flushing shall take place immediately and sensor flushing shall be overridden to prevent double flushing i.e. the over-ride or by-pass feature shall over-ride all sensor operation even when the sensor has been activated and the sensor shall not activate another flush after the user leaves the sensing area.</p> <p>(b) The manual over-ride or by-pass button shall not be placed in a conspicuous position such that it would encourage unnecessary activation by users.</p> <p>(c) When the manual over-ride or by-pass feature is activated, the WC flush valve shall deliver a volume of discharge of not more than <u>4.0 litres</u> at each of the following dynamic pressure: 1.0, 1.5, 2.0 and 3.0 bars with the operating member continue to be held actuated.</p> <p style="text-align: center;"><b>APPENDIX D</b></p>

9.8	Standards to comply with - Requirements WC flush for valves
	<p style="text-align: center;"><b>TESTING OF SENSOR OPERATED <u>4.0 LITRE</u> WATER CLOSET FLUSH VALVE</b></p> <p><b>PART II - TESTING OF WATER CLOSET FLUSH VALVE</b></p> <p><b>1. ENDURANCE TEST</b></p> <p>This test shall be the first test to be carried out on the flush valve.</p> <p>The flush valve shall be initially set to give a volume of discharge of not more than <u>4.0 litres</u> at flow dynamic pressure of <math>3.0 \pm 0.5</math> bars. The flush valve is then subjected to 100,000 cycles of test.</p> <p>The average volume of discharge and average discharge time for three consecutive flushes shall be recorded at the start of the test and after each 25,000 cycles.</p> <p>After each 25,000 cycle, the change in volume of discharge shall not exceed 10% of the volume of discharge at the start of the test and any reduction in the volume of discharge shall not result in a volume of discharge falling below 3.5 litres.</p> <p>The flush valve shall be capable of continuous operation without sticking, chattering or leaking.</p> <p><b>2. HYDRAULIC TEST</b></p> <p><b>Test A: Hydraulic test on flush valve body</b></p> <p>With the outlet of the flush valve plugged, a hydraulic pressure of 20 bars is applied through the inlet for 60 seconds. There shall be no sign leakage or permanent distortion of any component of the flush valve.</p> <p><b>Test B: Hydraulic test on stop valve (for flush valve with built-in stop valve only)</b></p> <p>The inlet of the stop valve is connected to a hydraulic pressure system with the seat of the stop valve in closed position. A hydraulic pressure of 20 bars is applied for 60 seconds. The stop valve is inspected for leakage and other defects.</p> <p><b>Test C: Hydraulic test on check valve (for flush valve with built-in check valve only)</b></p> <p>Hydrostatic pressure test on check valve body and seat shall be carried out in accordance with BS 5154: 1991 specifications. There shall be no visible leakage or permanent distortion of any component of the check valve during the tests.</p> <p style="text-align: center;"><b>APPENDIX D</b></p> <p><b>1. EFFECTIVENESS OF VACUUM BREAKER TEST</b> (For flush valve with built-on vacuum breaker only)</p> <p>The flush valve is installed as in the volume of discharge test and the lower end of the flush pipe is submerged in water such that the distance from the bottom of the vacuum breaker to water level is 150mm.</p> <p>With the valve seat slightly opened (by inserting a 2mm diameter wire) and the actuating member held in operating position, the flush valve inlet (without a check valve/ stop valve fixed) is connected to a vacuum line and the test is conducted in the following order:</p> <ol style="list-style-type: none"> <li>i. A constant vacuum of 635 mm mercury is applied for a period of 30 seconds.</li> <li>ii. Intermittent vacuum of 50, 125, 255, 380, 635 mm of mercury are applied. Each application is for 5 seconds on and 5 seconds shut.</li> <li>iii. First a slowly increasing vacuum is applied at a uniform rate from 50mm to 635mm mercury. Next, a slowly decreasing vacuum is applied at a uniform rate from 635mm to 0 mm mercury.</li> </ol> <p>In test i to iii, if the water rise in the flush pipe exceeds 76mm, the vacuum breaker is deemed to have failed the test.</p> <p><b>2. VOLUME OF DISCHARGE TEST</b></p>

- i. A flush pipe of 300mm length is to be secured to the outlet of the flush valve. The internal diameter of the flush pipe shall be at least 25mm.
- ii. With the flush valve connected to water supply system, a pressure gauge and a control valve are fitted at the inlet of the flush valve.
- iii. The flow regulator is to be set at maximum. Before commencing the actual test, the flush valve is subjected to a series of trail runs and the dynamic pressure is adjusted to 1.0 bar.
- iv. The operating member is actuated and the water discharged from the flush pipe is collected until the flow of water cease (for manual over-ride and by-pass, the operating member shall continue to be held actuated until the flow of water ceases). A stop watch is started as soon as water emerges from the flush pipe and stopped when the flow of water ceases. Record the volume of water collected and discharge time.
- v. With the flow regulator adjusted to the maximum setting, repeat the above procedure at each of the following dynamic pressures: 1.5, 2.0 and 3.0 bars.
- vi. When tested in accordance with the procedure described above, the discharge volume per flush shall not be more than 4.0 litres and the rate of discharge shall not be less than 1.2 litres per second. Conduct this test 3 times for each pressure and record the average volume of discharge.
- vii. When tested in accordance with the procedure described above, the flush valve shall discharge at a rate not less than 1.2 litres per second or shall be capable of discharging at some slower rate provide that a satisfactory flush can be delivery to the WC pan. The flush valve shall be deemed to be capable of delivering satisfactory flush only when it complies with the flushing test requirement as given in (5). Notwithstanding the rate of discharge from the flush valve, the flush valve must still be tested to comply with the flushing test requirements in (5).

### 3. FLUSHING TEST

The flush valve shall be coupled with a water closet pan and to be tested for flushing efficiency.

The flush valve to be tested complete with a water closet pan and all its fittings shall be connected in accordance with the manufacturer's instructions to a water closet (WC) pan with a minimum 25 mm internal diameter flush pipe. The height of the flush pipe measuring from the bottom of the vacuum breaker to the rim of the WC pan shall be 700mm for oriental WC pan and 300mm for other pedestal WC pan. The complete suit shall then be placed on a firm flat horizontal surface with the pan outlet discharge freely into air with no obstruction within a distance of 150mm of the pan outlet measured in the direction of the axis of the outlet.

With the flush valve connected to a water supply system, a pressure gauge and a control valve are fitted at inlet of flush valve for adjusting the water supply pressure.

#### APPENDIX E

Flushing tests as prescribed in Annex G of SS 574 : Part 1 : 2012 shall be carried out for each of the appliances. The type of tests are as follows:

Type of Test	Method	Results
Paper test	12 separate sheets of loosely crumpled soft tissue (twin-ply, sheet area between 14,000mm <sup>2</sup> & 16,000mm <sup>2</sup> ) and flush within 20 secs	The trap shall be cleared completely four time out of five in each test.
Towel test	A piece of towel (360 x 340 mm) and flush within 20 secs	
Ball test	A ball of non-absorbent material, relative density = 1.075 to 1.080, dia=43 ±0.5mm	

Sawdust test

Sprinkle 20g of fine dry sawdust on the inside of the pan between normal water level and the flushing rim

The unflushed area between the water surface and the underside of the rim shall not exceed 5,000 mm<sup>2</sup>.

The flushing test shall be carried out for each of the following dynamic water supply pressure 1.0, 1.5 and 3.0 bars.

**Additional requirements:**

Supplier, retailers and installers of flush valves shall have to ensure compliance with the requirements on backflow prevention and wastage of water as stipulated in Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.

The water closet flush valve shall be used in conjunction with a water closet pan complying with SS 574 : Part 2 : 2012.

The flush valve shall be supplied and installed as a whole complete unit (i.e. coupled with the water closet pan and its associated fittings to which it is tested with, certified and labelled under MWELS. For more information, please refer to WELS Guidebook which is downloadable from PUB's WELS website at <https://www.pub.gov.sg/wels>.

Flush valve with WC pan with volume of discharge of lower than 3.5 litres per full flush (i.e. <3.5 litres) when tested at 1.5, 2.0 and 3.0 bars, is recommended to be tested for WC drainline transportation test as stipulated in Clause 7.4 of SS 574:Part 1:2012.

PUB does not enquire into the effective performance of the flush valve and compliance with the above testing requirements does not attest to the effective performance of the flush valve. The responsibility of ensuring the effective performance of flush valve lies with the manufacturer, supplier and installer of the flush valve.

The flush valve and its associated fittings shall also comply with the stipulation standards and requirements in Clause 4 of the PUB S&R, where applicable.

## APPENDIX E

### TESTING OF MANUAL OPERATED 4.0-LITRE WATER CLOSET FLUSH VALVE

#### 1. ENDURANCE TEST

This test shall be first test to be carried out on the flush valve.

The flush valve shall be initially set to give a volume of discharge of not more than 4.0 litres at flow dynamic pressure of 3.0 ± 0.5 bars. The flush valve is then subjected to 100,000 cycles of test.

The average volume of discharge and average discharge time for three consecutive flushes shall be recorded at the start of the test and after each 25,000 cycles.

After each 25,000 cycle, the change in volume of discharge shall not exceed 10% of the volume of discharge at the start of the test and any reduction in the volume of discharge shall not result in a volume of discharge falling below 3.5 litres.

The flush valve shall be capable of continuous operation sticking, chattering or leaking.

#### 2. HYDRAULIC TEST

##### Test A: Hydraulic test on flush valve body

With the outlet of the flush valve plugged, a hydraulic pressure of 20 bars is applied through the inlet for 60 seconds. There shall be no sign leakage or permanent distortion of any component of the flush valve.

##### Test B: Hydraulic test on stop valve (for flush valve with built-in stop valve only)

9.8	Standards to comply with - Requirements WC flush for valves
	<p>The inlet of the stop valve is connected to a hydraulic pressure system with the seat of the stop valve in closed position. A hydraulic pressure of 20 bars is applied for 60 seconds. The stop valve is inspected for leakage and other defects.</p> <p><b>Test C: Hydraulic test on check valve (for flush valve with built-in check valve only)</b></p> <p>Hydrostatic pressure test on check valve body and seat shall be carried out in accordance with BS 5154: 1991 specifications. There shall be no visible leakage or permanent distortion of any component of the check valve during the tests.</p> <p><b>3. EFFECTIVENESS OF VACUUM BREAKER TEST</b> (for flush valve with built-on vacuum breaker only)</p> <p>The flush valve is installed as in the volume of discharge test and the lower end of the flush pipe is submerged in water such that the distance from the bottom of the vacuum breaker to water level is 150mm.</p> <p>With the valve seat slightly opened (by inserting a 2 mm diameter wire) and the actuating member held in operating position, the flush valve inlet (without a check valve/stop valve fixed) is connected to a vacuum line and the test is conducted in the following order:</p> <ol style="list-style-type: none"> <li>i. A constant vacuum of 635 mm mercury is applied for a period of 30 seconds.</li> <li>ii. Intermittent vacuum of 50, 125, 255, 380, 635 mm of mercury are applied. Each application is for 5 seconds on and 5 seconds shut.</li> <li>iii. First a slowly increasing vacuum is applied at a uniform rate from 50mm to 635mm mercury. Next, a slowly decreasing vacuum is applied at a uniform rate from 635mm to 0 mm mercury.</li> </ol> <p>In test i to iii, if the water rise in the flush pipe exceeds 76mm, the vacuum breaker is deemed to have failed the test.</p> <p><b>4. VOLUME OF DISCHARGE TEST</b></p> <p>A flush pipe of 300mm length is to be secured to the outlet of the flush valve. The internal diameter of the flush pipe shall be at least 25mm.</p> <p>With the flush valve connected to water supply system, a pressure gauge and a control valve are fitted at the inlet of the flush valve.</p> <p>The flow regulator is to be set at maximum. Before commencing the actual test, the flush valve is subjected to a series of trial runs and the dynamic pressure is adjusted to 1.0 bar.</p> <p>The operating member is actuated and held actuated and the water discharge from the flush pipe is collected until the flow of water ceases (the operating member shall continue to be held actuated until the flow of water ceases). A stop watch is started as soon as water emerges from the flush pipe and stopped when the flow of water ceases. Records the volume of water collected and discharge time.</p> <p>With the flow regulator adjusted to the maximum setting, repeat the above procedure at each of the following dynamic pressures: 1.5, 2.0 and 3.0 bars.</p> <p>When tested in accordance with the procedure described above, the discharge volume per flush shall not be more than <u>4.0 litres</u> and the rate of discharge shall not be less than 1.2 litres per second. Conduct this test 3 times for each pressure and record the average volume of discharge.</p> <p>When tested in accordance with the procedure described above, the flush valve shall discharge at a rate not less than 1.2 litres per second or shall be capable of discharging at some slower rate provide that a satisfactory flush can be delivery to the WC pan. The flush valve shall be deemed to be capable of delivering satisfactory flush only when it complies with the flushing test requirement as given in (5). Notwithstanding the rate of discharge from the flush valve, the flush valve must still be tested to comply with the flushing test requirements in (5).</p> <p><b>5. FLUSHING TEST</b></p> <p>The flush valve is to be tested for flushing efficiency.</p>

**9.8 Standards to comply with - Requirements WC flush for valves**

The flush valve to be tested complete with all its fittings shall be connected in accordance with the manufacturer's instructions to a WC pan with a minimum 25 mm internal diameter flush pipe. The height of the flush pipe measuring from the bottom of the vacuum breaker to the rim of the WC pan shall be 700mm for oriental WC pan and 300mm for other pedestal WC pan. The complete suit shall then be placed on a firm flat horizontal surface with the WC pan outlet discharge freely into air with no obstruction within a distance of 150mm of the pan outlet measured in the direction of the axis of the outlet.

With the flush valve connected to a water supply system, a pressure gauge and a control valve are fitted at the inlet of the flush valve for adjusting the water supply pressure.

Flushing tests as prescribed in Annex G of SS 574 : Part 1 : 2012 shall be carried out for each of the appliances. The type of tests are as follows:

Type of Test	Method	Results
Paper test	12 separate sheets of loosely crumpled soft tissue (twin-ply, sheet area between 14,000mm <sup>2</sup> & 16,000mm <sup>2</sup> ) and flush within 20 secs	The trap shall be cleared completely four time out of five in each test.
Towel test	A piece of towel (360 x 340 mm) and flush within 20 secs	
Ball test	A ball of non-absorbent material, relative density = 1.075 to 1.080, dia= 43 ±0.5mm	
Sawdust test	Sprinkle 20g of fine dry sawdust on the inside of the pan between normal water level and the flushing rim	The unflushed area between the water surface and the underside of the rim shall not exceed 5,000 mm <sup>2</sup> .

The flushing test shall be carried out for each of the following dynamic water supply pressure 1.0, 1.5 and 3.0 bars.

**TEST REQUIREMENTS FOR REDUCED FLUSH FOR WC FLUSH VALVES WITH MANUALLY-OPERATED DUAL-FLUSH MODE**

The following tests shall also be carried out:

- a) **Endurance test for reduced flush** – When tested in accordance with **Appendix E** of PUB's requirements for WC flush valves, the dual flush WC flush valve shall be capable of continuous operation without sticking, chattering or leaking. After each 25,000 cycles, the change in volume of discharge for the reduced flush shall not exceed 3 litres or 10% of the discharge at the start of the test, whichever lower.
- b) **Volume of discharge per reduced flush** – When tested in accordance with the procedure as described in **Appendix E** of PUB's requirements for WC flush valves, the dual flush WC flush valve shall discharge a volume as specified by the manufacturer but not more than 3.0 litres.
- c) **Dilution test for reduced-flush** – With the set up in accordance with the Flushing Test described in **Appendix E** of PUB's requirements for WC flush valves, when tested in accordance with the procedure as described in the Procedure for Dilution Test for the Reduced Flush of the Dual Flush Low Capacity Flushing Cistern, there shall be no visible traces of colouring matter in the water trap of the WC pan.
- d) **Paper Discharge Test** – With the set up in accordance with the Flushing Test described in **Appendix E** of PUB's requirements for WC flush valves, when tested in accordance with the procedure as described in the Appendix of the requirements for the Reduced-Flush for the Dual Flush Low Capacity Flushing Cistern, the WC pan shall discharge from the outlet spigot of the pan all of the paper in at least two (2) out of the three (3) tests.

9.8	Standards to comply with - Requirements WC flush for valves
	<p>e) <b>Flush Buttons design</b> – The buttons for activation of Full-Flush and Reduced-Flush shall be clearly and properly designed/labelled so that they are clearly and easily distinguishable by all users.</p> <p><u>Additional requirements:</u>  Supplier, retailers and installers of flush valves shall have to ensure compliance with the requirements on backflow prevention and wastage of water as stipulated in Public Utilities (Water Supply) Regulations and Singapore Standard SS 636:2018 (formerly CP48:2005) – Code of Practice for Water Services.</p> <p>The water closet flush valve shall be used in conjunction with a water closet pan complying with SS 574 : Part 2 : 2012.</p> <p>The flush valve shall be supplied and installed as a whole complete unit (i.e. coupled with the water closet pan and its associated fittings to which it is tested with, certified and labelled under MWELS. For more information, please refer to WELS Guidebook which is downloadable from PUB's WELS website at <a href="https://www.pub.gov.sg/wels">https://www.pub.gov.sg/wels</a>.</p> <p>Flush valve with WC pan with volume of discharge of lower than 3.5 litres per full flush (i.e. &lt;3.5 litres) when tested at 1.5, 2.0 and 3.0 bars, <u>is recommended</u> to be tested for WC drainline transportation test as stipulated in Clause 7.4 of SS 574:Part 1:2012.</p> <p>PUB does not enquire into the effective performance of the flush valve and compliance with the above testing requirements does not attest to the effective performance of the flush valve. The responsibility of ensuring the effective performance of flush valve lies with the manufacturer, supplier and installer of the flush valve.</p> <p>All the WC flush valves submitted for test after 1 August 2008 shall be subjected to the requirement of 100,000 cycles in the Endurance Tests.</p> <p>The flush valve and its associated fittings shall also comply with the stipulation standards and requirements in Clause 4 of the PUB S&amp;R, where applicable.</p>

## Testing and determining water consumption for selected household appliances and commercial equipment

9.9	Types of appliance/ equipment	Type	Test method or standard	Determination of water consumption & water efficiency requirement
1	Clothes washing machine	-	<p>Clause 8.6 of IEC 60456 Edition 5.0 (2010-02);</p> <p>or</p> <p>Clause 11 of BS EN 60456 (2005)</p> <p>relating to measurement of water consumption.</p>	<p>The water consumption for a clothes washing machine is to be measured using the wash programme or other associated settings recommended in the manufacturer's product literature for a normally soiled load at rated load capacity, and the following are not required as a test condition:</p> <p>(a) the use of a reference clothes washing machine for normalisation of base load items;</p> <p>(b) the parallel operation of a reference clothes washing machine with the tested clothes washing machine;</p> <p>(c) the use of a specific inlet water temperature, water hardness, water pressure, ambient temperature or humidity;</p> <p>(d) the use of stain test strips;</p> <p>(e) the use of detergent.</p> <p>Every clothes washing machine intended for household use must be of such a design as to use <b>not more than 12 litres of water per kilogram</b> of wash load for the washing programme recommended by the manufacturer for a normally soiled load at the rated capacity of the washing machine.</p>
2	Household dishwashers	-	<p>Clause 8.2 of BS EN 50242: 2016 / BS EN 60436: 2016;</p> <p>or</p> <p>Clause 8.2 of IEC 60436: 2015</p> <p>relating to measurement of water consumption.</p>	<p>The water consumption is to be measured using the wash programme or other associated settings recommended in the manufacturer's product literature for <u>normally soiled tableware</u> at rated dishwasher capacity, and the following are <u>not required</u> as a test condition:</p> <p>(a) the use of a reference dishwasher for normalisation of base load items;</p> <p>(b) the parallel operation of a reference dishwasher with the tested dishwasher;</p> <p>(c) the use of a specific inlet water temperature, water hardness, water pressure, ambient temperature or humidity;</p> <p>(d) the use of soiling agents;</p> <p>(e) the use of detergent, rinse agent or salt;</p>



9.9	Types of appliance/ equipment	Type	Test method or standard	Determination of water consumption & water efficiency requirement
				<p>(f) the use of an electric supply at a specific voltage;</p> <p>(g) the use of regeneration operations; and</p> <p>(h) the preparation and application of soiling agents.</p> <p>Every dishwasher intended for household use must be of such a design as to use <b>not more than 1.5 litres of water per place setting</b> for normally soiled tableware at rated dishwasher capacity.</p>
3	Washer extractor intended for commercial use	Front load Top load	<p>Clause 9.1 and 9.2 of BS EN 17116-4:2019 relating to measurement of water consumption.</p> <p>The water consumption is determined in accordance with paragraph 1A.</p>	<p>1A. The water consumption for a washer extractor is to be measured using the wash programme or other associated settings recommended in the manufacturer's product literature for a <u>nominal load</u> at rated load capacity, and the following are <u>not required</u> as a test condition:</p> <p>(a) the use of a reference washer extractor;</p> <p>(b) the use of specific:</p> <ol style="list-style-type: none"> <li>1. Ambient temperature &amp; humidity</li> <li>2. Fresh water properties – hardness</li> <li>3. Fresh water temperature</li> <li>4. Water pressure</li> <li>5. Energy supply</li> <li>6. Electricity supply</li> <li>7. Compressed air supply</li> <li>8. Steam supply</li> <li>9. Condition of the machine</li> </ol> <p>(c) the use of stain and soil monitors, wash process control sheets and rinse performance fabrics;</p> <p>(d) the use of detergent; and</p> <p>(e) determination of wash performance.</p> <p>1B. Washer extractor intended for commercial use (front load and top load) must be of such a design as to use <b>not more than 8.0 litres of water per kilogram</b>.</p>

9.9	Types of appliance/ equipment	Type	Test method or standard	Determination of water consumption & water efficiency requirement
4	Dishwasher intended for commercial use	<ul style="list-style-type: none"> <li>•Undercounter</li> <li>•Hood</li> </ul>	<p>Clause 7 of IEC 63136:2019 relating to measurement of water consumption.</p> <p>The water consumption is determined in accordance with paragraph 2A.</p>	<p>2A. The water consumption for a commercial dishwasher is to be measured using the wash programme as specified in Clause 5.4 of IEC 63136:2019, and the following are <u>not required</u> as a test condition:</p> <ul style="list-style-type: none"> <li>(a) cleaning and resoiling performance test;</li> <li>(b) the use of: <ul style="list-style-type: none"> <li>(i) conditioning of the machine under test and sequence of test procedures;</li> <li>(ii) electricity supply at a specific voltage;</li> <li>(iii) specific ambient conditions;</li> <li>(iv) specific water supply temperature, hardness &amp; pressure;</li> <li>(v) detergent;</li> <li>(vi) rinse aid;</li> <li>(vii) temperature measurement.</li> </ul> </li> </ul> <p>2B. Dishwasher intended for commercial use (undercounter and hood) must be of such a design as to use <b>not more than 2.4 litres of water per rack.</b></p>
5	High Pressure Washer	For general cleaning only	The test method for determining the flow rate set out in paragraph 3A	<p>3A. The flow rate for a high pressure washer (HPW) is to be measured with the following test method and test parameters:</p> <ul style="list-style-type: none"> <li>(i) Water supply with delivery flow of not less than 20 litres per minute at 3 bars from a bib tap;</li> <li>(ii) HPW is connected to a stable power supply (230±10V and 50Hz) with an ammeter</li> </ul> <p>The bib tap must be fully opened after connected securely via a 5/8" inlet hose to the HPW. Connect the flow meter and pressure gauge to the outlet hose of the HPW and adjust the pressure setting of HPW to maximum. Measure and record the flow rate, pressure and current reading.</p> <p>3B. High pressure washer intended for general cleaning must be of such a design as to use <b>not more than 11.0 litres of water per minute.</b></p>

## Showerheads

From 1 Apr 2020, it is recommended that all new and existing 3-tick showerheads under VWELS to be tested for Spray Force test and Spray Coverage test under AS 3662:2013. See Remarks in Table 5 and Annex 1c.

9.10	Test standard	Test method
	AS 3662 : 2013	<p>Clause 5.1 – Flow rate test. The flow rate test shall be measured in accordance with <b>Appendix B</b> of the standard but at the following dynamic flow pressures: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0 and 5.5 bars. The flow rate shall be determined in accordance with the requirements in PUB’s WELS Guidebook.</p> <p>Clause 5.4.1 – App H Spray Force test Clause 5.4.2 – App I Spray Coverage test.</p>