PAPER NO. RC 10/2015

Memorandum for the Review Committee on Quality Assurance Issues Relating to Fresh Water Supply of Public Housing Estates of the Hong Kong Housing Authority

Design and Specifications for Fresh Water Supply System in Housing Authority's Public Housing Developments

PURPOSE

This paper informs Members about the Design and Specifications in pre-contract stage in the context of fresh water supply system in the Housing Authority (HA)'s public housing developments in pre-contract stage.

BACKGROUND

2. **Papers No. RC 6/2015** and **RC7/2015** inform Members about the major processes shown in a Flow Chart of various stages, and the outline quality assurance of fresh water supply system through Design and Specifications for Fresh Water Supply System in the HA's Public Housing Developments respectively, to facilitate Members' understanding of the existing mechanism as described in **Paper No. RC 3/2015**, and to enable them to make informed decisions. This paper covers the design process and specifications on plumbing installation, submission of plumbing proposal to Water Supplies Department (WSD) and WSD's approval process in pre-contract stage corresponding to **Step 2 to 4 of the Flow Chart** in **Annex 1 of Paper No. RC 6/2015**.

STEP 2 - DESIGN PROCESS IN PRE-CONTRACT STAGE

3. Plumbing design for buildings comprises both up-feed and down-feed system. The design process covers the following areas –

Up-feed System

(a) Master water meter room;
(b) Underground water supply pipe;
(c) Water meter chamber;
(d) Fresh water up-feed pump room;
(e) Up-feed water pipe;
(f) Twin roof water tanks;

Down-feed System

(g) Down-feed water pipe;
(h) Fresh water booster pump for top 5 to 6 floors;
(i) Pressure reducing valves on intermittent floors;
(j) Water meter cupboards at each floor;
(k) Fresh water pipe in corridors; and
(l) Plumbing installation in domestic flats (bathroom and kitchen).

4. The complete system is designed in accordance with the requirements stipulated in the Waterworks Regulations (Cap 102A), WSD's handbooks and guidelines. In order to ensure consistency in compliance with these requirements, HD promulgates in-house design guidelines through -

(a) Building Services Technical Guide on water pump and water services installation; and

(b) Technical Guide to Public Housing Developments for water services installation. On top of statutory requirements, HD has over the years developed initiatives, such as -

(i) Construct twin water tank for securing non-stop water supply to residents and minimizing water wastage due to cleansing of water tank;

(ii) Adopt light duty pump of smaller capacity for noise reduction;

(iii) Adopt pump of more energy efficient performance; and

(iv) Use variable speed drive booster pump for lower noise and minimize size of pressure vessel.

Details of the Design Process of the Fresh Water Supply System are set out in **Annex 1**.

STEP 2 - SPECIFICATIONS ON PLUMBING INSTALLATION IN PRE-CONTRACT STAGE

5. We exercise quality control on water supply systems in public housing estates through specifications and testing. The latest edition of the HA's Specification Library 2014[1] was promulgated in 2014 vide **Paper No. BC 91/2014; QH 6/2014** being "Promulgation of Housing Authority Specification Library 2014 Edition" attached as **Annex 6** to **Paper No. RC 7/2015** issued earlier on. First review of the Specification Library 2014 is in progress through collection of feedback from Housing Department project teams, stakeholders and users. The reviewing process is anticipated to be completed in end of 2015.

6. There are two Sections in the Specifications for the Plumbing Installation, namely, PLU1 – Water Supply, and PLU2 – Sanitary Appliances. The structure of the Specifications generally comprises four aspects, namely, (I) General Description, (II) Materials, (III) Workmanship, and (IV) Testing. Specifications for "Water Pump Installation" are applicable to Nominated Sub-contractor for Fire Service and Water Pump Installation to assure quality along the water supply chain.

I. General Description

7. In PLU1, the scope of the works in the context of fresh water supply system includes the complete plumbing installation all shown in the drawings approved by Water Supplies Department (WSD). The plumbing installation shall comply with the statutory requirements together with any revisions and amendments made thereto. The following Ordinance, Regulations and Standards are particularly relevant –

1 Specification Library 2004, 2008, 2012 are earlier versions. Reviews are conducted in a continuous basis with incorporation of latest guidelines and requirements.

(a) The Waterworks Ordinance (Chapter 102) and Waterworks Regulations (Chapter 102A);

(b) Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings and Circular Letters issued by the Water Authority; and

(c) Relevant sections of appropriate international standards on materials and workmanship

8. In PLU2, the Registered Contractor shall submit samples of the specified sanitary fittings for approval.

II. Materials

9. HD duly incorporates all critical criteria for compliance in the HA's Specification Library. The HA, being a procuring entity governed by the Agreement on Government Procurement of the World Trade Organisation, adopts performance based specifications that must be non-discriminatory. As such, no brand names or origin of materials shall be specified. Specifications for "Plumbing and Sanitary Fittings" (PLU1) and "Sanitary Appliances" (PLU2) 2014 Edition are attached as **Annex 4** to Paper No. **RC 3/2015** issued earlier on.

10. The specifications cover all pipes, fittings and joints. In selecting materials, we consider a number of factors, including construction techniques, availability of the material in the market, as well as compliance with the international standards stipulated in the Waterworks Ordinance (WO) and Regulations. Galvanized Iron (GI) pipes were used in fresh water plumbing systems of early public housing estates. In the mid-1990s, lined GI pipes were introduced owing to its anti-rust property. However, this material was uncommon in the retail market and difficult to purchase in small quantities. Tenants would use copper pipes instead of lined GI pipes for alterations inside flats. From 2002 onwards, contractors were allowed to use either lined GI or copper pipes. Currently, copper or stainless steel pipes are adopted for fresh water plumbing systems in public housing estates. However, as stainless steel pipes are still uncommon in the retail market, even if stainless steel pipes are used for the plumbing system, copper pipes would still be used inside flats[2] to facilitate alteration by tenants.

2 Only one pilot project has stainless steel water pipes inside flats.

11. All plumbing materials specified by HA comply with the relevant international standards as required under the WO and Regulations. They shall fulfil HA's specification requirements and one of the followings as required by WSD for all pipes, draw-off taps, stop valves, gate valves, ball valves and combination fittings -

(a) Category A - Bearing the British Standard Institution Kitemark;

(b) Category B - Accepted by the Water Supply (Water Fittings) Regulations, United Kingdom (formerly known as the Water Byelaws);

(c) Category C - Accepted by the Water Authority in writing (to quote WSD reference number);

(d) Category D - Bearing the Water Authority Stamping

12. Apart from complying with the statutory requirements and relevant international standards, all pipes and fittings shall –

(a) conform to the Specification. Alternative materials cannot be used without the approval of the Housing Department Chief Architect who serves the role of Authorised Person, Contract Manager (CM) and Design Manager;

(b) where applicable, be approved by the Water Authority for the intended application. The Registered Contractor shall submit test reports/certificates for pipes, elbows and equal tees issued by laboratories for verification of compliance with the Specifications for CM's approval;

(c) be of standard products. On-site fabricated and locally manufactured pipes and fittings are prohibited;

(d) be suitable for the required working and test pressures and temperatures of the fluid carried;

(e) be capable of withstanding system working pressure and maximum static pressure that may arise upon failure of the associated pressure reducing devices; and

(f) be taken with all necessary precautions to avoid surface damage or contamination during shipping, handling, storage and prefabrication; and

(g) be provided with protective wrapping, including the pipe ends.

13. Pursuant to Specification Clause PLU1.M120 and PLU1.M160 for copper pipes and fittings, the Registered Contractor shall use soldering alloys for copper and copper alloy capillary fittings in compliance with BS EN 1254-1, Table 6 Sections II & III and only use lead-free category solders (Page No. PLU/10 of **Annex 4 of Paper No. RC 3/2015** refers) -

(a) Copper Pipes (Specification Clause no. PLU1.M120)

(i) Seamless drawn copper tubes manufactured to BS EN 1057; provide pipe markings in accordance with tube manufacturing standard BS EN 1057;

(ii) Copper pipes for cold water supply inside domestic flats: completed with factory applied plain polyethylene sheath to BS 3412. Copper pipes for cold water supply at external areas / common areas shall be bare and without paint finishes; and

(iii) Copper pipes for hot water supply inside and outside domestic flats: completed with factory applied castellated polyethylene sheath comply with BS 3412 and suitable for use up to 80°C.

(b) Soldering Alloys for Copper and Copper Alloy Capillary Fittings (Specification Clause no. PLU1.M160)

(i) Comply with BS EN 1254-1, Table 6 Section II & III;

(ii) Use of integral solder fittings is permitted provided they comply with BS EN 1254-1;

(iii) Use only lead-free category solders; and

(iv) Use only a non-corrosive type of flux that is recommended by the solder alloy manufacturer.

14. Pursuant to Specification Clause PLU2.M510.7, the Registered Contractor shall use chromium plated brass deck mounted kitchen sink mixer consisting of flexible hose assembly with stainless steel wire braiding and submit a sample of the proposed mixer together with catalogue, brand name/ model name, job reference, name, address and contact person of local supplier and manufacturer, and above all, the approval letter issued by Water Supplies Department for the proposed mixer, for CM's approval (Pages No. PLU/65 and PLU/69 at **Annex 4 of Paper No. RC 3/2015** refers).

15. For fresh water up-feed pump room and booster pump room, ductile iron pipe with flange joints are adopted to facilitate periodic maintenance works. Also, equipment connections are either in the form of flange or screw joints.

16. Major materials and equipment involved in the fresh water supply system include pipes & fittings, solder wire and flux, mixers, flexible hose, tap, stop cock and valves, pressure dial gauge, strainer, pumps, pressure switch and flange gasket etc. Different extents of lead content are permissible according to the international standards governing various components of equipment such as pumps and valves in the water supply chain. A summary table listing the specifications for major plumbing materials is attached in **Annex 2**.

III. Workmanship

17. Pursuant to Specification Clauses PLU1.W010.7 and PLU1.W020.7 at Page No. PLU/27 of **Annex 4 of Paper No. RC 3/2015**, all pipes and fittings shall be stored properly in accordance with the manufacturer's instructions and cleaned before erection to remove all scales, burrs, furs, sand and slag etc. The Registered Contractor shall maintain cleanliness throughout erection by covering the exposed ends of the pipework.

18. For jointing copper pipework by soldering, pursuant to Specification Clause PLU1.W260.7 at Page No. PLU/30 of **Annex 4 of Paper No. RC 3/2015,** the Registered Contractor shall -

(i) remove copper oxide and dirt from pipe spigot and fitting socket prior to the application of soldering flux;

(ii) apply flux sparsely and remove excess flux prior to heating; and

(iii) clean pipe joints with a damp cloth on completion to remove flux residues.

19. Upon completion of the plumbing installation, pursuant to Specification Clause PLU1.W910.7 at Page No. PLU/35 of **Annex 4 of Paper No. RC 3/2015,** the Registered Contractor shall clean out the sump tank at ground floor, roof tank, water mains of inside service, sterilize the systems to the satisfaction of the Water Authority (WA) before they are put into operation, and arrange the Waterworks Chemists of the WA to collect samples for bacteriological and chemical analysis.

20. The HA has incorporated the latest additional water sample testing requirements, published under WSD's Circular Letter No. 1/2015 on 13 July 2015[3], in all HA building contracts.

21. **On top of compliance with the statutory requirements,** HD incorporated the assessment criteria for water quality survey under Building Environmental Assessment Method (BEAM) Plus version 1.2 in the 2012 version of specifications where water samples as described in ISO5667 be taken at all the farthest points of use in the distribution system from the storage tank, and also include sampling for each water supply tank used in the building. All the water samples have to meet the requirements in the WSD Guidelines.

22. To address the risk of Legionnaires' disease, since 2012, HD has also required the water supply system of newly completed public housing estates to be disinfected with chlorinated water with a concentration of 50mg/L for two hours. After disinfection, the chlorinated water is drained away and the water supply system is flushed with fresh water.

IV. Testing

23. Upon completion of the plumbing installation, pursuant to Specification Clause PLU1.T020.7 at Page No. PLU/41 of **Annex 4 of Paper No. RC 3/2015,** the Registered Contractor shall submit detailed procedures and a programme for testing and commissioning for the CM's approval. After approval, the Registered Contractor shall carry out complete performance tests for all equipment and systems installed which include water pressure test, water quality test by HOKLAS accredited laboratory or the HA's recognised

3 The four new test parameters and acceptance criteria required under this Circular Letter are: lead (≤10μg/L), cadmium (≤3μg/L), chromium (≤50μg/L) and nickel (≤70μg/L).

laboratory, according to the water quality requirements specified in the Water Authority's Quality Water Recognition Scheme for Buildings, commissioning/adjustment of the system like correct pressure reducing valve pressure range to ensure performance, and submit tests reports for HD's approval. Similarly, testing and commissioning have to be carried out for the pump room installations in accordance with Specification FWP14.1 during construction and upon completion which include water pressure test, and complete performance tests of water pump systems with necessary adjustments to ensure proper performance. After tenants intake, a continuous recording of water pump operation status for 3 days is taken to monitor and confirm proper performance of water pump system.

STEP 3 – Submission of Plumbing Proposal

24. Following the HA Building Committee's approval of the Scheme Design and Project Budget of the public housing project and Independent Checking Unit's approval of the general building plans, HD prepares plumbing proposal for WSD's approval with submission documents including the following –

(a) Scheduled commencement and completion dates of building works;

(b) Project data of building blocks (i.e. number of storeys and flats, and information of non-domestic premises);

(c) Site location plan, site layout plan, proposed connection points for water supplies, location of master water meter room, proposed plumbing layout plans, vertical plumbing line diagrams, elevations and preliminary utility services layout, estimation of water consumption etc.; and

(d) Form **WWO132 Part 1** : Application for Certificate regarding Water Supply Availability

25. Upon submission of plumbing proposal, HD also submits a Form **WWO542** (Application for Water Supply/Request for Works to be carried out by the Water Authority) including the schedules of water meter to WSD.

STEP 4 – Approval Process of Plumbing Proposal

26. After vetting and finding the submission documents being in order, WSD would approve the plumbing proposal and issue reply to HD with the following –

(a) Acceptance of vertical plumbing line diagrams and layout plans for water supplies;

(b) No objection in principle to providing a connection for fire services;

(c) The anticipated completion date of main laying work; and

(d) Location and size of water connection, master meters, Schedules of water meters to be provided, Provisions of direct water supplies for specific premises, Provisions of water supplies for other project specific water-related item etc.;

27. WSD would also issue the following confirming availability of Water Supply and Supply Water Heads -

(e) Form **WWO1004** (Certificate regarding Water Supply Availability) certifying that water supply can be made available to the premises;

(f) No objection in principle to providing a connection for fire services;

(g) The approximate minimum water pressure and the size of location of fresh water supply; and

(h) The location and top level of reservoir providing the fresh water supply.

IMPROVEMENT MEASURES

28. The HA's specifications for quality assurance of fresh water supply system are comparable to that adopted by other government bureau and departments, including Architectural Services Department (ArchSD). A summary of comparison for specifications adopted by HD and ArchSD is

attached at **Annex 3**. We will continue to review and update our specifications through benchmarking with peers and incorporate in HA's specifications as appropriate. We are actively exploring the incorporation of specifications to require more active involvement of the Licensed Plumber in site supervision and reporting.

29. HD will continue to thoroughly investigate the issue of lead in fresh water plumbing systems. HA is implementing the short, medium and long term improvement measures as listed in **Paper No. RC 6/2015**, and will align the plumbing system design, specifications and other relevant requirements with the recommendations, if any, of the Task Force on Excessive Lead Content in Drinking Water led by WSD to prevent recurrence of the issue.

INFORMATION

30. This paper is for Members' information.

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Annex 1

Design Process of Fresh Water Supply System

Item	System/Installation	HA's Design Process	WSD's Requirements
1	Master water meter room	● To follow WSD's requirements. ● ***Building Services Technical Guide DBSG-305, Para. 12, 13 and 18.*** To select pipe and fitting materials based on types of application (e.g. fresh or flush water, working pressure, etc.).	● ***Handbook on Plumbing Installation for Buildings, Para. 5.3(a)(ii)***. For development with more than 1 detached village type building, master meter requirement shall be applied if the total length of underground and concealed pipes exceeds 15m. ● ***Handbook on Plumbing Installation for Buildings, Para. 5.3.*** A master meter room to house the master meter and its by-pass arrangement should be provided as close to and within the boundary lot as possible. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.4(k)***. For check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.
2	Underground water supply pipe	● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To select pipe and fitting materials based on types of application.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations **(Appendix A),** in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.9.*** Tee-branch valves shall be provided for all underground water pipes. ● ***Handbook on Plumbing Installation for Buildings, Para. 6.1.6.1.*** For carriageway a minimum cover of 1000mm is usually

Item	System/Installation	HA's Design Process	WSD's Requirements
			required.
3	Water meter chamber	● To follow WSD's requirements. ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To select pipe and fitting materials based on types of application.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations **(Appendix A),** in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.2.*** All pipework before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.4.*** No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.4(k).*** For check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.
4	Fresh water upfeed pump room	● ***To adopt night duty pump of smaller capacity for noise reduction***. ● ***To adopt pump of more energy efficient***	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations

Item	System/Installation	HA's Design Process	WSD's Requirements
		performance. ● ***Building Services Technical Guide, DBSG-305 Para. 1, 3 and 5.*** To calculate total storage capacity of sump tank. ● ***Building Services Technical Guide, DBSG-305 Para. 6, 7 and 8.*** To determine pump flow rate based on Plumbing Engineering Services Design Guide together with WSD's requirements. ● ***Building Services Technical Guide, DBSG-305 Para. 9 and 10.*** To determine pump head. ● ***Building Services Technical Guide, DBSG-305 Para. 12, 13, 14 and 18.*** To select pipe and fitting materials based on types of application. ● ***Building Services Technical Guide, DBSG-305 Para. 11.*** To size water pipe based on flow velocity and friction loss.	**(Appendix A)**, in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Handbook on Plumbing Installation for Buildings, Para. 8.2.*** Where a sump-and-pump system is used, it shall be provided with a duplicate pumpset. The pumping capacity of the pumps shall not be less than the designed out-flow rate of the storage tank being supplied. ● ***Handbook on Plumbing Installation for Buildings, Para. 8.2.*** Consideration should be given to minimise noise nuisance to adjacent consumers when choosing a pump system.
5	Upfeed water pipe	● ***Building Services Technical Guide, DBSG-305 Para. 12, 13 and 18.*** To select pipe and fitting materials based on types of application. ● ***Building Services Technical Guide, DBSG-305 Para. 11.*** To size water pipe based on flow velocity and friction loss.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations **(Appendix A)**, in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.6.*** No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction.
6	Roof fresh water tank	● ***Technical Guide to Public Housing Developments, DCG-D-502 Para. 1(b). To adopt twin water tanks for avoiding disturbance to***	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.17.*** The total volume of the roof storage tank and sump tank shall be on the basis of 135 litres

Item	System/Installation	HA's Design Process	WSD's Requirements
		resident and minimizing water wastage due to cleansing of water tank. ● ***Building Services Technical Guide, DBSG-305 Para. 1, 3 and 5.*** To calculate total storage capacity of water tank.	for each of the first 10 flats and 90 litres thereafter for each additional flat. The proportion of capacity of sump tank to roof tank shall be in the order of 1:3 or as advised by the Water Authority. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.1.*** Each cistern shall be fitted with an automatic control switch and a stop valve for temporary isolation purpose. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.1.*** The ball valve or control switch shall shut off the supply when the water level is 25mm below the invert of the overflow pipe or the warning pipe. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.1.*** The invert of the inlet pipe or the face of the outlet nose of the ball valve shall be not less than 25mm above the top of the overflow pipe. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.1.*** All overflow and warning pipes of potable water storage cisterns shall be constructed of non-metallic pipe materials. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.2.*** Full way gate valves shall be provided on all the outlets of every cistern and provision shall be made for a drain-off pipe to enable the cistern to be emptied. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.2.*** The drain-off pipe shall be properly plugged or adequate means shall be provided to prevent any unauthorized operation of the control valve at drain-off pipe. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.3.*** Every storage cistern shall be

Item	System/Installation	HA's Design Process	WSD's Requirements
			provided with an overflow pipe which shall discharge overflowed water to a conspicuous position in a communal area easily visible and accessible by the occupants. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.3.*** The overflow pipe shall be at least one commercial size larger than the inlet pipe and shall in no case be less than 25 mm in diameter. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.3.*** No part of the overflow pipe shall be submerged inside the storage cistern. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.3.*** A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.4.*** The warning pipe shall be installed at a level below the overflow pipe and shall be extended to outside of the building periphery for roof cistern or outside the pump room for sump cistern. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.8.*** All outlet pipes from the storage cistern should, whenever possible, be positioned at the opposite side to the inlet supply pipe. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 4.12.*** The invert of an outlet pipe from a water storage tank with capacity less than 5000 litres shall be at least 30 mm above the bottom of the tank; this distance shall be increased to 100 mm if the storage tank capacity is 5000 litres or more.
7	Downfeed water pipe	● ***Building Services Technical Guide, DBSG-305***	● ***Hong Kong Waterworks Standard Requirements for Plumbing***

Item	System/Installation	HA's Design Process	WSD's Requirements
		Para. 12, and 18. To select pipe and fitting materials based on types of application. ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To size water pipe based on flow velocity and friction loss.	***Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations **(Appendix A),** in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.6.*** No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction.
8	Fresh water booster pump room	● ***To adopt pump of more energy efficient performance.*** ● ***To use variable speed drive booster pump for lower noise and minimizing size of pressure vessel.*** ● ***Building Services Technical Guide, DBSG-305 Para. 6, 7 and 8.*** To determine pump flow rate based on Plumbing Engineering Services Design Guide together with WSD's requirements. ● ***Building Services Technical Guide, DBSG-305 Para. 9 and 10.*** To determine pump head. ● ***Building Services Technical Guide, DBSG-305 Para. 12, 13 and 18.*** To select pipe and fitting materials based on types of application ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To size water pipe based on flow velocity and friction loss.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations **(Appendix A),** in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride.
9	Pressure reducing valve (PRV)	● ***Building Services Technical Guide, DBSG-305 Para. 35.*** To adopt two sets of fixed ratio type Pressure Reducing Valve (duty and standby).	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.18(a).*** A bypass arrangement be incorporated with the provision of a second pressure reducing

Item	System/Installation	HA's Design Process	WSD's Requirements
			valve to enable isolation of any defective pressure reducing valve for repair and replacement when necessary; ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.18(b).*** A pressure indicator be provided for pressure monitoring; ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.18(c).*** The associated pipes and fittings be able to withstand the maximum static pressure that may arise upon failure of the pressure reducing valve.
10	Water meter cupboard	● ***Technical Guide to Public Housing Developments, DCG-D-607 Para. 1.*** To follow WSD's requirements. ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To select pipe and fitting materials based on types of application.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.4.*** No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.4(b).*** The clear depth measured from the outside face shall not be more than 800mm ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.5.*** For meters arranged in groups, meter position shall not be lower than 300 mm or higher than 1500 mm above the floor level. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.15.*** A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position at each meter position on the inlet side of the meter. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.16A.*** The minimum

Item	System/Installation	HA's Design Process	WSD's Requirements
			longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.
11	Corridor water pipe	● ***Technical Guide to Public Housing Developments, DCG-D-502 Para. 1(f) and Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To select pipe and fitting materials based on types of application. ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To size water pipe based on flow velocity and friction loss.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations (**Appendix A**), in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.6.*** No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction.
12	Domestic flat	● ***Technical Guide to Public Housing Developments, DCG-D-502 Para. 1(e).*** All pipes are exposed to facilitate maintenance. ● ***Technical Guide to Public Housing Developments, DCG-D-502 Para. 1(f) and Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To select pipe and fitting materials based on types of application. ● ***Building Services Technical Guide, DBSG-305 Para. 12 and 18.*** To size water pipe based on flow velocity and friction loss.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 10.2.*** Pipes and fittings shall conform to Part 1 of Schedule 2 of the Waterworks Regulations (**Appendix A**), in which Para. 1 indicates that pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. ● ***Cap 102A Waterworks Regulations, Schedule 2, Part 1, Para. 2.*** No pipe shall be less than 20 mm diameter, except that a branch pipe may be 15 mm diameter if the pipe run is short and the pipe supplies only one draw-off point. ● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 1.6.*** No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction.

Item	System/Installation	HA's Design Process	WSD's Requirements
13	Sanitary fittings	***Building Services Technical Guide, DBSG-305 Para. 16 and 17.*** ● Working pressure at cold water taps is in the range of 0.5 – 5 bar. ● Minimum water pressure at the cold water inlet of towngas water heater is 1.7 bar. ● Bath/shower mixer at 7 l/min. water flow rate – 0.25 bar. ● Shower hose and shower head at 7 l/min. water flow rate – 0.75 bar.	● ***Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings, Para. 5.7.*** If mixing valves, water blenders or combination fittings are to be used, the cold water supply to these fixtures shall be drawn from the same source as is supplying the hot water apparatus in order to provide a balanced pressure and to obviate the risk of scalding should the supply at the source fail or be restricted for any reason. ● ***Cap 102A Waterworks Regulations, Schedule 2, Part 4, Para. 7.*** Pipes used for conveying hot water shall be of galvanized steel, copper, or of some corrosion-resisting alloy. ● ***Cap 102A Waterworks Regulations, Schedule 2, Part 4, Para. 5.*** No tap used for the purpose of drawing hot water shall be fixed at a distance (measured along the axis of the pipe by which the tap is supplied) from a water heater or hot water cistern, cylinder or tank, or from a flow and return system, not greater than the distance appropriate to the largest internal diameter of any part of the said pipe as shown in the table**,** which is applicable for all pipe materials.

Note

HA's initiatives on top of statutory requirements are highlighted in ***Green***.

List of Appendices

Appendix A - Part 1 of Schedule 2 of the Waterworks Regulations (Cap 102A)
Appendix B - Handbook on Plumbing Installation for Buildings
Appendix C - Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings
Appendix D - Part 4 of Schedule 2 of the Waterworks Regulations (Cap 102A)
Appendix E - Building Services Technical Guide DBSG-305
Appendix F - Technical Guide to Public Housing Developments DCG-D-502
Appendix G - Technical Guide to Public Housing Developments DCG-D-607

Schedule 2 of the Waterworks Regulations (Cap 102A)

Part 1

Pipes and Fittings

1. (1) Pipes on a fresh water fire service shall be made of cast iron, steel or copper.
   (2) Pipes and fittings on a salt water fire service shall be made of such material as the Water Authority, in consultation with the Director of Fire Services, thinks fit.
   (3) Pipes on a fresh water inside service shall be made of cast iron, unplasticized P.V.C., polybutylene, steel, copper, polyethylene, crosslinked polyethylene or chlorinated polyvinyl chloride. (L.N. 673 of 1994)
   (4) Pipes on a salt water inside service shall be made of cast iron or unplasticized P.V.C. (L.N. 320 of 1992)

2. No pipe shall be less than 20 mm diameter, except that a branch pipe may be 15 mm diameter if the pipe run is short and the pipe supplies only one draw-off point.

3. No bend or curve shall be made in any pipe so as to diminish the waterway or alter the internal diameter of the pipe in any part.

4. Changes of direction for a pipe of less than 40 mm diameter shall be effected by slow bends and no elbows shall be used.

5. (a) Cast iron pipes shall comply with BS 4622 for grey iron pipe and with BS 4772 for ductile iron pipe, except that they may incorporate a mechanical or automatic joint of approved design.
   (b) Cast iron pipes to BS 4622 and ductile iron pipes to BS 4772 shall be of a class appropriate to the duty required.

6. (Repealed L.N. 320 of 1992)

7. Cast iron fittings for use with cast iron pipes shall comply with BS 4622 for grey iron fittings and with BS 4772 for ductile iron fittings, except that they may incorporate a mechanical joint of approved design. Fittings shall be of a class appropriate to the duty required. (L.N. 320 of 1992)

8. (Repealed L.N. 252 of 1977)

9. Steel pipes shall-
   (a) be galvanized;
   (b) comply with BS 1387 for 'Medium' tubes and tubulars; and
   (c) if on a fresh water inside service, be lined with internal unplasticized polyvinyl chloride or polyethylene lining approved by the Water Authority. (L.N. 673 of 1994)

10. Malleable cast iron fittings for use with steel pipes shall be galvanized and shall comply with BS 143 and 1256 for malleable cast iron and cast copper alloy pipe fittings. (L.N. 320 of 1992)

11. Wrought fittings of iron or steel for use with steel pipes shall be galvanized and shall comply with BS 1740, Part 1 for wrought iron pipe fittings. (L.N. 320 of 1992)

12. Unplasticized P.V.C. pipes and fittings shall comply with BS 3505 for Class 'D' tubes or equivalent.

13. Copper pipes incorporating screw joints shall comply with BS 2871, Part 2, for copper tubes (heavy gauge) for general purposes and screw thereof shall comply with BS 61, for screw threads for copper tubes.

14. (Repealed L.N. 320 of 1992)

15. Cast copper alloy fittings, for copper pipes screwed in accordance with Table 1 of BS 61, shall comply with the relevant requirements of BS 143 and 1256 for malleable cast iron and cast copper alloy pipe fittings. (L.N. 320 of 1992)

16. Copper pipes to be jointed with compression fittings or capillary fittings or by bronze or autogenous welding shall comply with BS 2871, Part 1.

17. Capillary fittings or compression fittings shall comply with BS 864, Parts 2 for capillary and compression fittings of copper and copper alloy and compression fittings for pipes laid under the ground shall be Type B. (L.N. 320 of 1992)

18. Polybutylene pipes and fittings shall comply with BS 7291 Parts 1 and 2. (L.N. 673 of 1994)

19. Polyethylene pipes shall comply with BS 6730 and BS 6572. (L.N. 673 of 1994)

20. Crosslinked polyethylene pipes and fittings shall comply with BS 7291 Parts 1 and 3. (L.N. 673 of 1994)

21. Chlorinated polyvinyl chloride pipes and fittings shall comply with BS 7291 Parts 1 and 4. (L.N. 673 of 1994)
(L.N. 252 of 1977)

Appendix B

Handbook on
Plumbing Installation for Buildings

W **Water Supplies Department**

Handbook on Plumbing Installation for Buildings

Contents

List of Figures

Preface

Water Supplies Department issued several booklets on the requirements, policies and practices of plumbing installations. They are:

(a) Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings;
(b) Water Supplies Department Circular Letters issued to Licensed Plumbers and Authorized Persons;
(c) General Information on the Use of Different Types of Pipe Materials as Inside Service in Buildings;
(d) Installation Notes of Different Types of Corrosion Resistant Pipe Materials as Inside Service in Buildings; and
(e) A Guide to the Preparation of Plumbing Proposals.

With an aim to providing more comprehensive information in a user-friendly manner to the practitioners for submission of plumbing proposals for new building developments to the Water Authority, this **Handbook on Plumbing Installation for Buildings** summarises the current Hong Kong waterworks requirements in respect of policies, procedures and practices that the practitioners are expected to observe. This book is therefore intended to serve as a handy reference for those concerned.

The contents of this book are based on the following references:-

(a) the Waterworks Ordinance (Cap 102) and the Waterworks Regulations (Cap 102 Subsidiary Legislation);
(b) The Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings; and
(c) Water Supplies Department Circular Letters issued to Licensed Plumbers and Authorized Persons.

In all circumstances, it is the responsibility of the applicants to ensure that the plumbing proposals comply with the prevailing waterworks requirements. It is therefore important for the readers of this book to refer to the original text of these documents for the latest information on new or modified requirements from the Water Authority before they submit plumbing proposals. In case there is any discrepancy between the references and this book, the references should take precedence.

For information and procedures on how to apply for water supply applications, you are advised to visit the WSD's website at http://www.wsd.gov.hk/

Your suggestions and comments on this book are welcome. Please send them to:-

Chief Engineer/Customer Services
Water Supplies Department
Immigration Tower, 7 Gloucester Road, Hong Kong

1. General

1.1 Definitions

The definitions used in this booklet are as follows:-

Agent	A person who is approved under Section 7 of Waterworks Ordinance as an agent of a communal service.
Authorized Person	An Authorized Person registered under the Buildings Ordinance.
Communal Service	That part of a fire service or inside service which is used in common by more than one consumer in the same premises.
Connexion to the Main	The pipe between the main and the control valve which is nearest to the main and which regulates the flow of a supply from the main into a fire service or inside service, such control valve and all fittings between such control valve and the main.
Consumer	A person who is approved under Section 7 of Waterworks Ordinance as a consumer of a fire service or inside service.
Direct Supply System	A plumbing system which conveys water directly from the government water mains to the point of usage without any transit water storage tanks.
Fire Service	The pipes and fittings in premises, and any pipes and fittings between the premises and a connexion to the main, which are used or are intended to be used for a supply solely for the purposes of fire fighting.
Fitting	Any apparatus, cistern, cock, equipment, machinery, material, tank, tap and valve; and any appliance or device other than a meter, which is installed or used in a fire service or inside service.
Indirect Supply System	A plumbing system which conveys water from the government water mains to the point of usage through a transit water storage tank.
Inside Service	The pipes and fittings in premises, and any pipes and fittings between the premises and a connexion to the main (other than the pipes and fittings forming part of a fire service) which are used or are intended to be used for the purposes of a supply.
Licensed Plumber	A person licensed under the Waterworks Ordinance to construct, install, maintain, alter, repair or remove fire services or inside services.
Main	Main includes a connexion to the main and any pipe owned by the Government and maintained by the Water Authority for the purposes of a supply.

Meter	An appliance or device owned by the Government and maintained by the Water Authority for the purpose of measuring water consumption.
Premises	Any building or structure or any part thereof and any place in which there is a fire service, inside service or any part of the waterwork; or in which a fire service or inside service is intended to be constructed or installed.
Water Authority	The Director of Water Supplies
Waterworks	Any property occupied, used or maintained by the Water Authority for the purpose of water supply, including all water gathering grounds.

1.2 Abbreviations

Abbreviations used in this booklet are as follows:-

BS	British Standards
FSD	Fire Services Department
GI	Galvanized Steel
HKWSR	Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings
LP	Licensed Plumber
PB	Polybutylene
PE	Polyethylene
PVC-C	Chlorinated Polyvinyl Chloride
PVC-U	Unplasticised Polyvinyl Chloride
TMF	Temporary Mains Fresh Water for Flushing
VPLD	Vertical Plumbing Line Diagram(s)
WSD	Water Supplies Department
WW	Waterworks
WWReg	Waterworks Regulations

1.3 Commonly Used Waterworks Pipes and Fittings

The functions of some commonly used waterworks pipes and fittings are described below:-

Fitting	Function
Anti-vacuum Valve	a valve in a water service that opens to admit air if the pressure within the water service falls below atmospheric pressure.
Ball Valve	a valve that controls the entry of water into a storage cistern or flushing cistern, closing off the supply when the water level in the cistern has reached a predetermined level. It is sometimes called a ball cock or float-operated valve.
Boiler	an enclosed vessel in which water is heated by the direct application of heat
Butterfly Valve	a valve in which a disc is rotated about a diametric axis of a cylinder to vary the aperture. It is used where space is limited or more sophisticated control is required.
Calorifer	a storage vessel, not open to the atmosphere, in which a supply of water is heated. The vessel contains an element, such as a coil of pipe, through which is passed a supply of hot water or steam, in such a way that the two supplies do not mix, heat being transferred through the walls of the element.
Expansion Vessel	a closed vessel for accommodating the thermal expansion of water in a pressurized hot water heating system
Float Switch	a device incorporating a float that operates a switch in response to changes in the level of a liquid.
Gate Valve	a valve that provides a straight-through passage for the flow of fluid and in which the passage can be closed by a gate. It is used where the water pressure is low and on distribution pipework from a storage cistern. This valve is sometimes referred to as a fullway gate valve because when it is fully open, there is no restriction of flow through the valve.
Loose Jumper Type Stopcock	a screwdown pattern valve with horizontal inlet and outlet connections. It incorporates a loose jumper valve permitting flow in one direction only. It is used for isolating the supply of water in a high pressure pipeline. In case the supply main is shut off and drained down for any reason, the ‘non-return’ action of the loose valve plate will stop any backflow from the service pipe.

Non-return Valve	a valve that prevents reversal of flow in the pipe of a water supply by means of the check mechanism, the valve being opened by the flow of water and closed by the action of the check mechanism when the flow ceases, or by back pressure. It is also known as check valve.
Pressure Reducing Valve	a valve that reduces the pressure of a fluid immediately downstream of its position in a pipeline to a preselected value or by a predetermined ratio.
Pressure Relief Valve	A self-acting valve that automatically opens to prevent a predetermined safe pressure being exceeded.
Temperature Relief Valve	A self-acting valve that automatically opens to prevent a predetermined safe temperature being exceeded.

2. Responsibilities of Water Authority and Consumers/Agents

2.1 Divisions of Responsibilities

The division of responsibilities for Water Authority, consumer/agent on the maintenance of water supply systems are as follows (Fig 1 & Fig 2):-

Area of Responsibility	Maintained by
Connexion to the main	Water Authority
Water meter	Water Authority (the Consumer/Agent is however responsible for the safe custody of the meter serving his/her premises.)
Communal inside/fire service within the building/lot boundary	Agent
Non-communal inside/fire service within the building/lot boundary	Consumer

2.2 Obligations of Consumers/Agents

The obligations of a consumer/agent under the Waterworks Ordinance are as follows:-

OBLIGATIONS	
Consumer	Agent
(i) proper maintenance of the inside services within his/her premises. (ii) safe custody of the water meter for his/her premises. If the meter is stolen or damaged (not as a result of fair wear and tear), he/she must pay for its replacement or costs of repairs. (iii) payment of a deposit and all charges in respect of the supply to the premises.	(i) proper maintenance of the communal services within the premises. (ii) safe custody of the water meter for the communal services. If the meter is stolen or damaged (not as a result of fair wear and tear), the Agent must pay for its replacement or costs of repairs. (iii) payment of a deposit and all charges in respect of the supply to the communal service.

The liability of a consumer/agent in respect of a supply will continue, until another consumer/agent is approved by the Water Authority in his/her place or an undertaking given under Section 7 of Waterworks Ordinance is cancelled by the Water Authority.

2.3 General Principles for Installing Plumbing Works

The followings are the general principles for installing plumbing works:-

(a) all water fittings and pipework shall comply with the relevant Waterworks Regulations;
(b) all plumbing works shall be carried out in accordance with the Hong Kong Waterworks Requirements;
(c) all plumbing works shall be carried out by a licensed plumber.

As far as practicable, it is advised that the communal service should not be run through the individual premises because access to the fire service and/or communal service for routine inspection, maintenance and repair of the communal service may be restricted and obstructed by individual premises.

3. Submissions of Plumbing Proposals

3.1 General

Plumbing installation that receives water supply from the Waterworks has to comply with the Waterworks requirements under the provision of the Waterworks Ordinance/Regulations, Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings (HKWSR), and Water Supplies Department Circular Letters issued to Licensed Plumbers and Authorized Persons. Approval from the Water Authority is required in order to construct, install, alter or remove a plumbing installation.

Plumbing installation that is not to receive water supply from the Waterworks does not need the approval of the Water Authority. However, it is advisable for the plumbing installation to follow the Waterworks requirements such that when a supply from the Waterworks becomes necessary, the modification of the plumbing installation to comply with the Waterworks requirements will be minimized.

3.1.1 Minimum Residual Pressure

The Water Authority maintained a minimum residual pressure of 30-metre head in most ***existing*** fresh water supply zones except at their extremities. To tie in with various national standards and international practice, the Water Authority has decided to lower the minimum residual pressure to 20-metre head, except at the extremities of supply zones for new developments in new or existing supply zones or re-developments in existing supply zones, for plumbing proposals first submitted to the Water Authority on or after 1 April 2008.

3.1.2 Application for Water Supply for two- storey Warehouse through One Stop Centre (OSC)

Applicant may apply for water supply for 2-storey warehouse through the OSC operated under the Efficiency Unit (EU) of Chief Secretary for Administration's Office with effect from 1 December 2008. The OSC is an option in addition to the existing channels of application. It aims to streamline the application process by setting a centralized office for receiving submissions of building plans and related applications (including technical audit for water supply connection works) and coordinating joint inspections for two-storey warehouses. For applicants who would like to join the service, the scope of works must satisfy the criteria specified by the EU. For details, please refer to the EU's website at http://www.eu.gov.hk/english/osc/osc.html.

3.1.3 Household-Scale Solar Water Heater System for Village House

The Electrical and Mechanical Services Department (EMSD) provides general guidelines for the intending purchasers, owners and installers of household-scale solar water heating system to be installed at village houses. The guidelines helps the above people to understand the installation requirements and application procedures associated with the installation, operation and maintenance of the aforesaid solar water heating system. For details, please refer to the EMSD's website at
http://www.emsd.gov.hk/emsd/e_download/pee/Guidance_Notes-solar_water_heating_system.pdf

3.2 Submissions

3.2.1 Plumbing Works

The applicant should obtain from the Water Authority such information as are relevant to the design of the plumbing installation and submit the plumbing proposal to the Water Authority for approval. The Water Authority will as far as practical provide the information to the applicant such as location and size of connection points, water pressures, single or double-end fed supply.

WSD pledges to vet submissions of plumbing proposals for new building developments in 20 clear working days. Sometimes it may take a longer time for the applicant to clarify on points not clearly mentioned in the proposal. Therefore, it is advisable for the applicant to submit the plumbing proposal to the Water Authority for approval early in order not to delay the plumbing works. **No plumbing work shall commence before the plumbing proposal has been approved by the Water Authority.** It is important for the applicant to bear in mind the need to accommodate all the inside service and fire service, which include water storage tanks, break pressure tanks, meter rooms etc. together with the associated access, in the layout and structural design of the development.

3.2.2 Replumbing Works

Prior to carrying out replumbing works within private buildings, approval from the Water Authority must be sought. Failing this is in contravention of Section 14 of the Waterworks Ordinance and the offenders are liable to prosecution.
The Water Authority would like to replace the old meters of the buildings in conjunction with the replumbing works. For better co-ordination of work, it is considered more appropriate to have the meter replacement works to be carried out by the same licensed

plumber engaged in the replumbing works. In our approval to the application for replumbing works, the licensed plumber will be invited to carry out the meter replacement works and our District staff will inform the licensed plumber of the detailed arrangement.

3.3 Plumbing Proposals

Applicants should submit Application Forms WWO 542 together with plumbing proposals.

The plumbing proposal shall include:-

(i) a list of the documents submitted to the Water Authority.

(ii) a block plan in a scale of 1:1000 showing the location and boundary of the development. The locations should be marked with datum level.

(iii) a plan showing the alignment and size of the proposed connection pipes from the main to the development.

(iv) a plan showing the proposed alignment and size of the internal underground water pipes to be laid in the development.

(v) vertical plumbing line diagrams and water pipe alignment plans.

(vi) a schedule containing the following items:-

- (a) number of flats/units in each block of the building.
- (b) the address of each premises in the building that requires individually metered water supply.
- (c) number of draw-off points and sanitary fittings in each/unit.
- (d) estimated daily consumption for all trade purposes.

(vii) a drawing showing the arrangements of water meters in meter rooms/boxes and the fittings at the meter positions.

(viii) the relevant standards of the pipe materials to be used in the application.

(ix) capacities of the water storage tanks to be installed such as roof storage tanks and the water consumption of domestic appliances such as water heaters. Catalogues of such equipment and appliances etc. shall also be attached.

(x) any other information as may be required by the Water Authority.

3.4 Format

One set of the plumbing proposals is required. All drawings shall be:-

(a) identified by drawing numbers and drawing titles;

(b) folded to a plan size not exceeding the A4 size (i.e. 297 mm by 210 mm) and in such a way to display the drawing numbers and drawing titles.

For revised drawings, details of all the amendments shall be listed as notes to the drawings and the amendments shall also be highlighted or coloured in the drawings for easy

identification. The submission, whether approved or not, will not be returned to the applicant. Once approved, no details in the submission shall be altered without the written approval of the Water Authority.

4. Licensed Plumbers

4.1 General

4.1.1 Category of Grades

A licensed plumber (LP) is categorised into two grades:-

Grade I	for the construction, installation, maintenance, alteration, repair or removal of a fire service or inside service of any type
*Grade II **	for the maintenance and repair of a fire service or inside service; and for the installation, maintenance, repair or removal of water appliances

** No new Grade II plumbers' licence will be issued after 1 October 1993.*

4.1.2 Application for New Water Supply - Response Time

The Water Authority has provided target response time for completing the key activities in respect of the application for new water supply. To further step up the service to the public and the practitioners, the Water Authority has, from time to time, reviewed the target response time to look for improvements. (Please see http://www.wsd.gov.hk/en/about_us/performance_pledge/index.htm for updated details)
In case an application is not processed within the target response time or the applicant wants to discuss the way in which an application has been handled, the applicant can contact the supervisory staff of WSD's Regional Office to which the application has been submitted. The list of case officers and business facilitation officers can be obtained from webpage http://www.wsd.gov.hk/filemanager/en/share/pdf/list_case_officers.pdf

If the case still cannot be resolved, the applicant can bring up the matter to WSD's headquarters (refer to the Preface of this handbook for address) in writing.

4.1.3 Excavation Permit Fee Under the Land Ordinance (Miscellaneous Provision) (Amendment Ordinance 2003)

The Land (Miscellaneous Provision) (Amendment) Ordinance 2003 gazetted on 23 May 2003 was taken effect on 1 April 2004. Under the Ordinance, a fee is payable in respect of all excavation permits applied on or after 1 April 2004 for excavation in unleased land which is either a street maintained by the Highways Department or other than any street maintained by the Highways Department.

To recover the cost, the Water Authority will issue an additional and separate demand note on the estimated excavation permit fees to applicants irrespective of the approval dates of their plumbing proposals if the excavation permit is applied on or after 1 April 2004 for any part of their concerned water supply connection work. This demand note is subject to

adjustment according to the actual final excavation permit fees incurred for the work.

4.1.4 Awareness of Anti-corruption Laws

Licensed Plumber should always be aware of the anti-corruption laws and avoid to contravene them during their course of works. For details, please refer to the website of Independent Commission Against Corruption at http://www.icac.org.hk/ .

4.2 Commencement of Work

Provided that all pipes and fittings intended to be installed are approved by the Water Authority, the licensed plumber, who is employed by the applicant, should submit details of the plumbing proposals on Parts I and II of WWO 46 - "Notice/Application for Constructing, Installing, Altering or Removing an Inside or Fire Service" to notify the Water Authority of the details and commencement date of plumbing works. For the application of water supply for the food business (restaurant) premises, the Annex i.e. the material list may be submitted at a later stage but at least 7 working days before the submission of Part IV of WWO 46 requesting WSD for inspection of the completed plumbing works.

If any of the pipes and fittings used/to be used have not yet been approved by the Water Authority, prior approval must be obtained from the Water Authority before the commencement of plumbing work.

4.3 Interim Inspections and Final Inspections

No pipe or fitting forming part of a fire service or an inside service shall be used or covered up until it has been inspected and approved by the Water Authority. Hence, it is advisable, whenever practicable, to arrange for inspection by the Water Authority prior to concreting on any pipework to be embedded in structural elements or concealing any pipework by architectural features which cannot be easily removed for inspection and maintenance of the pipework after their installation; and in any event all underground plumbing works must be so inspected before it is backfilled or covered up. Moreover, the pipework arrangement should be so designed to minimize concealed pipework as far as possible.

The concealed inside service and fire service (not including underground pipeworks) will be inspected at random by the Water Authority. These random inspections will either be initiated by the licensed plumber or by the Water Authority. In either case, 3 working days' advance notice should be given to the other party in order to arrange a suitable time for conducting such random inspections.

Provided that due regard have been given to ensure compliance with Waterworks requirements and the approved plumbing details, the requirement of random inspection for concealed pipework is exempted for government projects administered by full-time resident government site staff.

4.4 Completion of Work

The licensed plumber should report completion of work on Part IV of WWO 46 within 7 working days after completion of the plumbing works to inform the Water Authority to arrange for final inspection. Water supply will only be effected after the inside service / fire service has been checked in order.

4.5 Works of a Minor Nature

No fire service or inside service shall be constructed, installed, maintained, altered, repaired or removed by a person other than a licensed plumber or a public officer authorized by the Water Authority, except for alteration or repairs to a fire service or inside service which are, in the opinion of the Water Authority, of a [1]minor nature or the rewashering of a tap.

Minor alterations and repairs to inside services without dismantling and reinstallation of the water meter within a domestic premises may be exempted as follows:-

(i) Replacement of defective piping, taps, stopcocks, gate valves, ball valves and work of a similar nature.
(ii) Repairs to leaking pipes or fittings and minor alterations to pipework.
(iii) Extensions within the same premises to supply a single additional tap, fitting or appliance, provided that the fitting or appliance does not require the installation of a storage tank.

Minor alterations and repairs to inside services shall conform to waterworks requirement in respect of quality of workmanship and material.

However, as most alterations, addition and extension to the existing plumbing installation can cause a change in the flow conditions in one way or another, it is in the interest of the consumer/agent that in case of doubt to notify the Water Authority of their intention, who will give an appropriate advice as necessary.

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[1] Works of a minor nature are works which can be completed without the involvement of specialised trade skill and those which do not change the general arrangement of the plumbing installation already approved by the Water Authority, or affect the flow conditions of the plumbing system thus causing possible supply problems.

5. Metering

5.1 General

Metering is required to measure water consumed for billing purposes. Meter position shall be provided by the LP (employed by the applicant) for meter installation while water meters will be provided by the Water Authority. Water meters may be installed either by the Water Authority or the licensed plumber.

The size and location of the water meter will be determined by the Water Authority. For domestic supply, a meter size of 15mm is usually recommended. For trade and industrial supply, the meter size is determined based on the actual water consumption.

However, a check meter position and/or a waste detection chamber shall be provided at the inlet pipe to the communal service for consumption check and waste detection purposes. The check meter position and/or a waste detection chamber shall be close to the lot boundary or close to the point of connection from the internal distribution mains whichever is applicable.

5.2 Meter Position

The meter position for a 15 mm diameter meter shall be constructed to include 20 mm x 15 mm bushes at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between (refer to Fig 3). The tube shall be hollow with conspicuous holes drilled through the body. A long screw connector shall be provided immediately after the bush at the delivery side. The meter position for meter of all sizes shall also be similarly provided with corresponding fittings of appropriate sizes. The length of the distance piece should be as follows (refer to Fig 4):-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

If a section of copper pipe is used either before or after a water meter position, the section of copper pipe between the water meter position and the first pipe clamp should be jointed by screwed joints.

When the applicant submits the vertical plumbing line diagrams (VPLD), he/she will also be required to submit the layout and elevation plans of the meter rooms/boxes with dimensions, including the width and height of the entrances (door openings in case of meter boxes) for the Water Authority's approval. All water meters, including vacant meter positions and check meter positions, shall be arranged in groups and housed in meter rooms or meter boxes.

The meter rooms/boxes shall be used solely for housing water meters to protect them against exposure to weather, falling objects and other undue external interferences. They shall not be used as store rooms/boxes, etc. No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. Unless otherwise accepted by the Water Authority, a typical meter room/box shall comply with the following requirements:

(a) for meter rooms, the minimum distance between the outward face of the meter group and the wall/door opening directly opposite the meter group shall be 1000mm and there shall be no obstacles in between. Besides, if the door to the meter room is to be opened at an inward position and it is at the opposite side of the meter group, the minimum perpendicular distance between the outward face of the meter group and the door (the point on the door that is nearest to the meter group) when it is fully opened shall be 600mm;

(b) the clear width and height of the door entrance to the meter room shall not be less than 800 mm and 2000 mm respectively. The arrangement of the meter position(s) and the door opening of the meter box shall be arranged in such a manner that staff of the Water Authority would not be required to lean inwards to take meter readings or carry out maintenance works. For meter boxes, the clear depth measured from the outside face shall not be more than 800mm;

(c) when the meter room is occupied for taking meter readings and/or maintenance of water meters, the illumination shall not be less than 120 lux at meter positions and the mechanical ventilation shall not be less than 6 air-changes per hour;

(d) an entrance located at communal area for safe, free, and uninterruped access to the meter room/box shall be provided;

(e) provision of adequate drainage inside the meter room and the meter box positioned at floor level shall be made;

(f) the door(s) to the meter room/box shall not be equipped with any self-closing device. The lock of the door to the meter room shall be located at a level between 0.9m and 1.1m above the finished floor level. The door to the meter room shall be equipped with handle to facilitate door opening. The door handle shall be either in the form of long cylindrical or spherical shape to facilitate handling. Covered or flat sectioned handles shall not be used;

(g) the outside of the door(s) to the meter room/box shall be clearly marked「水錶」,"Water Meters" in both Chinese and English of font size not less than 28 pt for easy identification;

(h) If there are more than one water meter room/box inside a building block, master-key locks shall be used at all meter rooms/boxes and a duplicate master key for the Water Authority or his/her staff's sole use shall be kept at the management office. In case there are more than 300 water meters or 30 meter rooms/boxes, two duplicate master keys shall be kept for the sole use of the Water Authority.

(i) for high-rise building blocks, water meters shall be installed in meter rooms/boxes. For low-rise buildings with fenced-off area, water meters shall be installed in meter room(s)/box(es) located at the boundary and shall be accessible from the public area;

(j) meter rooms/boxes inside market/commercial complex shall be positioned in areas with clear access and with no risk of being obstructed by hawkers, etc.

Upon completion of the water meter installation inside a meter room/box, the LP shall install a permanent display board at the wall/door inside the meter room/box showing the location and elevation of the meter positions. The top of the board shall not be higher than 1500 mm above the floor level and the bottom of the board shall not be lower than 500 mm for an individual meter above the floor level. This display board shall be constructed of durable plastic or corrosion-resistant plate engraved with words and diagrams in black on light colour background. The wordings should be of font size not less than 18 pt. Details of this display board shall be submitted by the applicant as part of the VPLD for the Water Authority's approval. This requirement can be waived for small meter boxes accommodating 3 meters or less.

Within two weeks after completion of the water meter installation, the LP shall submit as-built plans of the meter arrangements, the completed Meter Installation Table (MIT) and Part IV of the Form WWO 46 where amongst others the LP undertakes the correctness of the meter positions. The applicant/developer and the Authorised Person shall also countersign in Part IV of the Form WWO 46 to indicate their satisfaction of the correctness of the meter positions.

For meters arranged in groups, no meter position shall be lower than 300 mm nor higher than 1500 mm above the floor level. This requirement is also applicable for water meters installed inside meter boxes. For Housing Department estates where corridor meter arrangement is chosen and accepted, individual meter positions shall be at a suitable height not less than 750 mm but not more than 1500 mm above the floor level.

The meter position of a building supply to a construction site shall be provided within a

meter room or meter box located at the hoarding recess area so that reading and maintenance of the meter can be carried out outside the construction site. Safe, free and uninterrupted access to the meter room/box should be provided and maintained at all time. The door of the meter room or meter box shall be made of chicken-wire or provided with see-through glass panel. Details of the meter room or meter box are subject to the approval of the Water Authority.

For a meter installed in a landscape area, it should be installed above ground level with a clear working headroom not less then 2m. A safe pedestrian access to the meter position should be provided.

When the meters are sited at roof level, fullway gate valves shall be fitted before meter positions. For connections up to and including 40 mm diameter, a loose jumper type stopcock shall be provided and placed with spindle in the vertical position at each meter position on the inlet side of the meter where the meter is not sited at roof level and where the pressure is considered adequate. For connections larger than 40 mm diameter, a fullway gate valve shall be provided before the meter position and a non-return or check valve fitted on the delivery side as close as possible to the meter position.

The following practice should be adopted in plumbing work design for meter positions:-

(a) the fittings at the meter position should facilitate easy installation and removal of the water meter without the need to work on other pipes;

(b) the pipework at the meter position should be securely fixed to support the weight of the water meter and to resist any torsion, bending and tension during the installation and removal of the water meter.

5.3 Master Meter

The Water Authority had implemented the master metering policy after 31 December 2005. The purpose of introducing master metering is to detect water leakage and unlawful taking of water before meters. A master meter room to house the master meter and its by-pass arrangement should be provided as close to and within the boundary lot as possible. The details of implementation of the policy are as follows:

(a) (i) For all new developments, except single detached village type buildings and single block buildings, plumbing designers shall be required to provide master meter room with master meter position(s) in the plumbing, submit undertaking Form WWO 542 for the consumership(s) of master meter(s) and arrange licensed plumber to install master meter(s). These requirements shall apply to all plumbing proposals first submitted to the Water Authority after 31 December 2005.

(ii) For development with more than 1 detached village type building, master meter

requirement shall be applied if the total length of underground and concealed pipes exceeds 15m.

(iii) For developments not required to install master meters, fire service shall be connected from the main outside the lot boundary. Also, check meter positions shall be provided in fresh water and TMF inside service and fire service.

(b) The water supply connection arrangement for fresh water supply, fire service supply and Temporary Mains-water for Flushing (TMF) supply will be as shown in the Fig. 27 and 28.

(c) The master meter will substitute current requirement of check meter positions in all fresh water and TMF inside service and fire service. There will be 1 master meter installed in each set of connection points at the lot or building boundary. Twin or dual main connections are regarded as one set of connection points.

(d) Downstream of the master meter,

(i) <u>for fresh water supply</u>
all individual domestic premises, water usage points or group of water usage points shall be metered with separate meters.

(ii) <u>for fire service</u>
there shall be no other meter.

(iii) <u>for TMF supply</u>
there shall be 1 communal TMF meter to each individual block of buildings.

(e) To ensure accuracy of master meter, the plumbing designer shall provide two lengths of straight pipe, one upstream and one downstream of the master meter. The length upstream and downstream should not be less than 10 times the nominal diameter of the master meter and 5 times respectively.

(f) To facilitate replacement of master meter(s), a 100mm diameter by-pass arrangement should be provided for future maintenance of water supply during meter replacement. (refer to Fig. 28 and Fig. 30).

(g) To facilitate installation, inspection, reading, service, and replacement of master meter(s), the plumbing designer shall house master meter(s) and associated by-pass(es) in meter room(s) preferably with at-grade access where feasible. Please refer to Fig. 29-33 which indicate the design considerations for the at-grade master meter room.

(h) (i) If the watermain is to be laid underneath internal roads which is scheduled to be handed over to government within 5 years after completion, master meters should

be installed for each separate connection group for the buildings/podia at their respective boundaries.

(ii) If the handing over is scheduled longer than 5 years after completion, the said master meter positions mentioned in (h)(i) are still required but temporarily bridged over by short pieces. On top of this, master meters are also required at the estate's boundary (refer to Fig. 34)

(i) Fire service supply needs to be unaffected by potable supply interruption as far as practicable. Also, the metering characteristics of both supplies are different. Therefore, fire service needs to be separate from the potable supply right at the lot boundary. A typical configuration of master meter is shown in the Figs. 27 and 28.

5.4 Check Meter

For check meter of 100 diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	**50**	**80**	**100**
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (Distance A (mm) as shown in Fig.35)	310	310	380	400

The minimum longitudinal working clearance between both ends of meter flanges of the check meter position and a wall or any obstruction should be 200 mm.

6. Inside Service

6.1 Fresh Water Supply

The treated fresh water provided by the WSD complies fully with the drinking water standard according to the guidelines of the World Health Organization. However, in order to ensure that consumers can enjoy good quality of water at the taps, building owners have to maintain their plumbing systems properly as well. To encourage the building owners to do this, the WSD launched the "Fresh Water Plumbing Quality Maintenance Recognition Scheme" in 2002. Since 1 January 2008, the Scheme has been renamed as "Quality Water Recognition Scheme for Buildings". Please contact WSD's Customer Telephone Enquiry Centre at tel. no. 2824 5000 or visit the website at http://www.wsd.gov.hk for more details of the Scheme.

6.1.1 Metering Requirement

All fresh water supplies to inside service shall be metered. All domestic supplies and concessionary supplies shall be separately metered. For different usages of concessionary supplies, please see Section 6.1.10.

6.1.2 Pipe Materials

Pipes and fittings shall conform to Part I of Schedule 2 of the Waterworks Regulations. The Water Authority may approve other pipe materials for use in water supplies from time to time.

The following table summaries the different pipe materials that are commonly used in water supply systems:

Pipe Material	Fresh Water Inside Service		Salt Water Inside Service	Fire Service		Standards
	Cold Water	Hot Water		Fresh Water	Salt Water	
cast iron	✓	✓	✓ (with internal cement lining)	✓	✓	BS 4622
copper	✓	✓	×	✓	×	BS EN 1057
ductile iron	✓	✓	✓ (with internal cement lining)	✓	✓	BS EN 545
GI with PVC-C	✓	✓	×	✓	✓	BS 1387 &

lining						internal lining of an approved type
GI with PVC-U/ PE lining	✓	×	×	×	×	BS 1387 & internal lining of an approved type
polybutylene (PB)	✓	✓	×	×	×	BS 7291
polyethylene (PE)	✓	×	×	×	×	BS EN 12201 (below ground)
	✓	×	×	×	×	BS 6730 (above ground)
chlorinated polyvinyl chloride (PVC-C)	✓	✓	×	×	×	BS 7291
unplasticized polyvinyl chloride (PVC-U)	✓	×	✓	×	×	BS 3505 Class D or above
crosslinked polyethylene (PE-X)	✓	✓	×	×	×	BS 7291
stainless steel	✓	✓	×	✓	×	BS EN 10312

✓: suitable for use when the relevant standards are complied with

×: not suitable for use in general

The use of unlined GI pipes and fittings as fresh water inside service in new buildings and upon renewal of the plumbing installations in existing buildings is prohibited. However, this requirement does not apply to pipes and fittings installed prior to 23 December 1995 nor to minor repairs to such plumbing works.

For PB and PE pipes, the applicants should refer to the relevant approval letters and/or governing standards to determine the gradings of pipe to be installed.

The Water Authority may also accept pipes and fittings of other standards equivalent to the British Standards.

6.1.3 Guidelines on Cleansing and Disinfection of Fresh Water Inside Service

Under the provision of Waterworks Regulation 7, a consumer or the agent shall be responsible for keeping an inside service clean. To this end, the consumer or agent

concerned shall clean and disinfect a newly installed fresh water inside service before it is given a supply from the Water Supplies Department. Besides, after repair or maintenance of fresh water inside service, if there is a possibility that extraneous materials can get into the inside service, the inside service shall be cleaned and disinfected before water supply is resumed. The guidelines below on how to clean and disinfect the fresh water inside service are set out for general reference:-

(A) Newly Installed Fresh Water Inside Service

The newly installed fresh water inside service shall be cleaned and disinfected to the satisfaction of the Water Authority in accordance with the following procedures.

(I) Newly Installed Underground Fresh Water Mains

(1) Remove all extraneous materials inside the water mains. Fill the fresh water mains slowly with water and carry out the required water pressure testing. If the result of the test is satisfactory, clean the fresh water mains internally and flush them with potable water. For fresh water mains of sizes less than 600 mm in diameter, swab to remove the dirt and materials inadvertently left in the water mains and flush them with potable water.

(2) Fill the water mains completely with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the water mains are filled up with water, the free chlorine in the water will be at least 30 ppm. Keep the water mains under disinfection for at least 24 hours. After disinfection, flush the water mains thoroughly with potable water.

(3) Arrange with the Water Authority to collect samples at representative sampling point(s) as agreed by the Water Authority for bacteriological and chemical analysis. The test parameters and the related acceptance criteria are listed in Appendix A3.

Any contamination in underground mains may lead to pollution of the government supply. To ensure quality control and minimize the risk of pollution to the government supply, the Water Authority will carry out sampling and analysis for this part of inside service.

The contact persons of the Water Authority for such arrangements are:-

Areas	Contact Person	Telephone No.
Hong Kong & Outlying Islands	Waterworks Chemist/Treatment (1)	2891 9276
Kowloon and New Territories East	Waterworks Chemist/Treatment (2)	2691 7689
New Territories West	Waterworks Chemist/Treatment (3)	2450 6121

The Water Authority will inform the Licensed Plumber concerned of the result of analysis. If the results are satisfactory, the fresh water mains can be put into operation. If not, the above disinfection and testing procedures shall be carried out again.

(4) To avoid possible contamination, the fresh water mains concerned shall be put into operation within 7 days from the successful disinfection. In this respect, Licensed Plumbers are advised to allow sufficient time for the Waterworks Chemists to carry out sampling and analysis and to avoid arranging disinfection immediately before long public holidays.

(II) Newly Installed Fresh Water Inside Service other than Those covered in (A)(I) above

(1) Flush the inside service concerned thoroughly with potable water.

(2) After flushing, follow one of the three procedures stated below to disinfect the inside service concerned.

Methods Using Chlorine as a disinfectant

(i) Fill the inside service concerned with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the inside service is filled up with water, the free chlorine in the water will be at least 30 ppm. After keeping the inside service under disinfection for at least 24 hours, the inside service shall be immediately drained and thoroughly flushed with potable water.

or

(ii) Fill the inside service concerned with chlorinated water at an initial concentration of 50 ppm for a contact period of one hour. If the free residual chlorine measured at the end of the contact period is less than 30 ppm, the disinfection process shall be repeated. After successful disinfection, the inside service shall be immediately drained and thoroughly flushed with potable water.

or

Methods Using Disinfectants other than Chlorine

(iii) Fill the inside service concerned with the disinfectant solution other than chlorine at the initial concentration and for the contact time specified by the manufacturer of the disinfectant. If the residual of the disinfectant at the end of the contact time is less than the manufacturer's recommendation, the disinfection procedure shall be repeated. After successful disinfection, the inside service shall be immediately drained and thoroughly flushed with potable water. Flushing shall continue in accordance with the disinfectant manufacturer's instructions/recommendations or until there is no evidence of the disinfectant chemical being present, or it is at a level that is no higher than that present in the potable water supplied.

[Note : The applicant is requested to submit to the Water Authority at least one month before disinfection is carried out the type(s) and details of the proposed non-chlorine based disinfectant. The Water Authority will advise the applicant of any additional test parameters and related acceptance criteria for water samples (i.e. other than those stated in Paragraph (3) below) within two weeks upon receipt of the details.]

(3) After disinfection, arrange with either the Water Authority or an accredited laboratory[2] to collect samples at representative sampling point(s) as agreed by the Water Authority for bacteriological and chemical analysis. The test parameters and the related acceptance criteria are listed in Appendix A3 (Note: See Note of Paragraph (2)(iii) above also if non-chlorine based disinfectant is used).

If the results are satisfactory, the fresh water inside service can be put into operation. If not, the above disinfection and testing procedures shall be carried out again.

The contact persons of the Water Authority for such arrangements are:-

Areas	**Contact Person**	**Telephone No.**
Hong Kong & Outlying Islands	Waterworks Chemist/Treatment (1)	2891 9276
Kowloon and New Territories East	Waterworks Chemist/Treatment (2)	2691 7689
New Territories West	Waterworks Chemist/Treatment (3)	2450 6121

If the sampling and analysis is carried out by the Water Authority, the Water Authority will inform the Licensed Plumber concerned of the result of analysis. If an accredited laboratory is arranged to carry out the sampling and analysis, the

[2] The accredited laboratory shall be accredited for all the individual parameters listed in Appendix A3.

result of analysis shall be submitted to the Water Authority.

(4) To avoid possible contamination, the fresh water inside service concerned shall be put into operation within 7 days from the successful disinfection. In this respect, Licensed Plumbers are advised to allow sufficient time for the Waterworks Chemists or the accredited laboratory to carry out sampling and analysis and to avoid arranging disinfection immediately before long public holidays.

(B) Repair or Maintenance of Fresh Water Inside Service

(I) Repair or Maintenance of Underground Fresh Water Mains

(1) Keep the excavation surfaces of trench clear from the pipe body and remove all extraneous materials in the fresh water mains. If the trench is flooded, pump water out of the trench.

(2) Clean the internal surface of the exposed pipe ends and the replacement pipe with a solution of chloride of lime. The concentration of free chlorine in the solution shall be at least 30 ppm.

(3) Fill the section of the water mains that has been shut down for repair or maintenance with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the water mains are completely filled with water, the free chlorine in the water will be at least 30 ppm. Fill the water mains with water and isolate them when filling is completed. Keep the water mains under disinfection for at least 30 minutes. After disinfection, flush the water mains thoroughly with potable water through a fire hydrant, washout or, if no such facilities are available, through a submain temporarily put out of service.

(II) Repair or Maintenance of Fresh Water Inside Service other than Those covered in (B)(I) above

After completion of repair or maintenance works, fill the concerned inside service that has been shut down for repair or maintenance with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the inside service is completely filled with water, the free chlorine in the water will be at least 30 ppm. Isolate the inside service when filling is completed and keep the inside service under disinfection for at least 30 minutes. After disinfection, flush the inside service thoroughly with potable water.

(C) Proper Operation of Inside Service

Stagnant water provides a favourable breeding environment for bacteria. To minimize the possibility of bacteria growth after putting an inside service into operation, water outlets which are infrequently used or are connected to stagnant water supply pipeworks shall be flushed at full flow for a minimum period of one minute at least on a weekly basis and before use.

6.1.4 Application for Approval of Water Supply Pipes and Fittings

The acceptance letters or no-objection letters for pipes and fittings are issued against the products irrespective of the supplier or suppliers' agents. For a change in the supplier or supplier's agent for a product by the same manufacturer, it is not necessary to make a re-submission.

6.1.4.1 Approval/No Objection Letter for Water Supply Pipes

All thermoplastic pipes for conveyance of potable water are required to be tested to BS 6920 on the suitability of their use in contact with water with regard to their effect on the quality of water. The Water Authority will issue a “no-objection” letter for thermoplastic pipes in compliance with BS 6920.

6.1.4.2 Approval/No Objection Letter for Water Fittings

Water fittings accepted by the Water Authority for installation in inside services should be under one of the following categories:-

(a) Fittings marked in accordance with the appropriate British Standard and bearing the registered certification trade mark of the British Standard Institution (the BS Kitemark);
(b) Fittings accepted and certified by the Water Research Centre of the United Kingdom for compliance with the requirements of the Water Supply (Water Fittings) Regulations / Water Byelaws in the United Kingdom;
(c) Fittings approved by the Water Authority as suitable for use locally in conformity with the Waterworks Ordinance and Regulations.

All fittings to be installed in the water supply plumbing system must fall within one of the above categories in respect of their types and origin as approved by the Water Authority and conform to the waterworks requirements.

To obtain approval of waterwork fittings from the Water Authority, the applicant is required to produce certification from the British Standard Institution, the United Kingdom Water Research Centre or testing agents approved by the Water Authority to the effect that the fittings comply with the requirements of the Waterworks Regulations.

Under Category (c) of compliance of water supply fittings, the Water Authority issues acceptance letters for draw-off taps, stop valves, gate valves, ball valves, mixing valves and combination fittings. To apply for approval of water fittings, the applicant is required to submit a test report (original or certified true copy) together with 6 copies of the catalogue of the fittings under a covering letter to the Water Authority. No application form is required. The list of approved testing agencies is available in the WSD's website at http://www.wsd.gov.hk

6.15 Supply Modes

Water supply to premises can be effected in one of two ways:-

(i) **direct supply system**, where it is feasible to supply water by gravity from the mains (refer to Fig 5).
(ii) **indirect supply system**, where it is necessary for the water supplied to the inside service in highrise buildings be boosted in some ways like a sump and pump system or a hydro pneumatic pump system which is usually provided to the topmost floors after a roof storage tank. (refer to Fig 6).

6.1.6 Plumbing Arrangements

6.1.6.1 General

All plumbing works before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. Provision shall be made for checking leakage from any plumbing work laid underground.

If the connection is not laid in an exposed manner at the lot boundary, then it shall be laid underground with an adequate cover. For carriageway a minimum cover of 1000mm is usually required. Watermains located in Industrial Area or beneath footpaths/verges/cycle tracks whenever there is a possibility of vehicles parking or running on them should be laid with the same cover as those under carriageways. All underground plumbing works will be inspected by the Water Authority before it is backfilled or covered up.

6.1.6.2 Direct Supply System

The meters shall be sited at convenient locations in communal area.

6.1.6.3 Indirect Supply System

The meters shall be sited at roof level or at other convenient locations.

6.1.7 Domestic Appliances

6.1.7.1 Use of Water Purifiers / Filters

Water purifiers / filters shall not be used without the permission in writing of the Water Authority. As the treated municipal water supply to the whole territory of Hong Kong conforms chemically and bacteriologically to the Guideline Standards for Drinking Water of the World Health Organisation and is monitored closely by extensive sampling at treatment works, distribution networks and consumers' taps. the Water Authority does not normally approve nor recommend the installation of water filters in domestic premises because they can give rise to health hazards if they are not properly maintained.

Domestic water purifiers / filters must not be connected directly to the mains supply because of the possibility of contamination. They may be installed in an indirect supply system via the storage tank where there is no possibility of contamination of the mains supply, or of the supply to other premises, e.g. in a communal inside service a separate storage tank would be necessary.

As contaminated water in the filter can backflow to communal water supply system or upstream, the Water Authority does not recommend the installation of any water filter. When there is installation of any domestic filter or water filter incorporated in water using apparatuses (such as drinking fountain etc.), precautionary measures should be taken to ensure proper backflow prevention incorporated or installed where appropriate. The Water Authority does not require any test results of the filters before installation, i.e. "general acceptance" is not required and will not be given.

Despite the above, customers should carry out proper maintenance of water tanks and pipes in their buildings so as to maintain the water quality and to reduce the possibility of pollution arising from the use of water filters. Regular maintenance of domestic water filters is also equally important.

6.1.7.2 Use of Washing Machines / Dish-washing Machines

Where there is no possibility of back siphonage resulting in contamination of the water supply, washing machines / dish-washing machines may be connected directly to the mains. Washing machines / dish-washing machines with submerged inlets must not be connected directly to the mains and should be supplied with water via a storage tank. A ventilation

valve and reflux preventer shall be installed at the supply inlet at a level above the top edge of the washing machine / dish-washing machine.

6.1.8 Construction Supply

Provided that the construction site is within easy reach of the Waterworks distribution system, metered supply may be given for construction purposes.

For individual construction sites, metered water supply may either be tapped directly from the mains or from a fire hydrant. In cases of boring works for site investigation and location of sites are not confined to one particular area or the limit of the works area makes it technically impracticable for the installation of building supply meters, the applicant may apply for a meter adaptor to draw a supply from any fire hydrant near to the works area.

6.1.9 Supply to Temporary Structures and Modified/Converted Structures

6.1.9.1 Temporary Structure

Application for water supply to temporary structures will be considered regardless of the land status or the structural status of the premises concerned. Supply may be given provided it is technically feasible and Waterworks requirements are met.

6.1.9.2 Modified/Converted Structure

These include converted garages, sub-divided dwelling units, and structures where the nature of usage has changed(e.g. residential, commercial, industrial). Applications for metered water supply can be considered and approved with a statement which dissociates the approval from the legal status of the structure if it is technically feasible and Waterworks requirements are met.

6.1.9.3 Legal Implication of Providing Metered Water Supply

In all cases, the provision of metered water supply by the Water Authority will **not** confer any legal implication on the structural status of the premises nor carry any effect of precluding action being taken in respect of the structure by another authority.

6.1.10 Supply for Cooling / Air-conditioning / Humidification Purposes

Water supply shall not be used for any heating, cooling or humidification purposes except with the approval of the Water Authority. Uses of mains (fresh or salt) water may be given for cooling / air-conditioning / humidification purposes to meet the following requirements:

(a) closed circuit cooling systems for any purpose where operational losses are negligible and no water is rejected to waste;

(b) cooling systems involving no loss through evaporation and where all the water is re-used after cooling for an industrial process; (The normal trade requirement must not be less than that required for air-conditioning/cooling purposes at peak load);
(c) evaporative cooling systems essential to an industrial process, whether this be for cooling or for air-conditioning purposes and provided that system losses arise from evaporative only;
(d) evaporative cooling/air-conditioning/humidification systems for essential purposes other than industrial processes provided that system losses arise from evaporation only;
(e) humidification essential to an industrial process(e.g. the spraying of a fine mist in textile weaving plants).

The use of mains water in evaporative type plants for essential purposes other than industrial process is limited to those cases where the cooling / air-conditioning / humidification system is absolutely necessary. An example of such case is the use of mains water for the evaporative type air-conditioning system to serve those areas in hospitals, such as the operating theatres, intensive care units, mortuary etc., where air-conditioning is essential for operation requirement. Other examples are the provision of evaporative type cooling system for cold storage purpose or laboratory testing; and air-conditioning / humidification system for major computer facilities, art gallery or testing laboratory. The type of evaporative plant used should be of an enclosed design from which wastage of water by splashing is prevented.

In order to promote the use of more energy efficient air-conditioning systems in Hong Kong, a pilot scheme for the application to use fresh water for non-domestic air-conditioning in selected areas (i.e. evaporative cooling tower in the air-conditioning system) was commenced in June 2000. The pilot scheme is converted to the standing scheme on 1 June 2008. For more updated information, please refer to EMSD's website http://www.emsd.gov.hk/

Please contact the staff of EMSD or the Water Authority for details about the exact locations of the latest selected areas and the requirements for approving applications for water supply to water-cooled air-conditioning systems under the scheme.

6.1.11 Concessionary Usage of Mains Water

Approval to use government water supply for the purposes listed below can normally be given on concessionary basis when the territory is on full supply, subject to adequacy of the local water supply and distribution system. Such approval will be withdrawn if in the opinion of the Water Authority the supply situation requires it.

The concessionary usages are as follows:-

(i) initial filling of swimming pools and paddling pools and subsequent annual refilling

and make-up purposes, provided that the water is fully re-circulated.

(ii) initial filling of model boat pools and subsequently refilling once in every two months in summer and once in every three months in winter.

(iii) initial filling of fountains and water features and subsequent make-up purposes, provided that the water is fully re-circulated.

(iv) initial filling of artificial lakes in public recreation areas and subsequent make-up purposes.

(v) watering flower-gardens at public housing estates, Home Ownership Schemes, Private Sector Participation Schemes, schools, institutes, community service centres, large private developments, amenity areas alongside highways, and gardens maintained by government departments, including traffic islands and sitting out areas, where the aggregate area of the flower beds is not less than 30 m^2.

(a) point supply: the layout of the supply points should be such that each point will serve an area within the sweep of a 20 m-long hose, and the number of supply points shall be kept to a minimum.

(b) 'drip feed' irrigation system: where the aggregate area of flower beds exceeds 30 m^2, one connection point should normally be given. Additional connection point may be given only when physical barrier exists preventing extension of the drip feed irrigation system and the distance of two successive connection points exceeds 40 m. This category of concessionary usage must be supplied off tank.

(vi) watering plant nurseries.

(vii) irrigating large landscaped areas in new towns. This category of concessionary usage must be supplied off tank.

(viii) watering large area of grass in sports fields such as tennis courts, bowling greens, cricket pitches and football pitches. Supply may be permitted only if there is no practical alternative.

(ix) internal cleansing in buildings such as washing down floors and staircases, refuse chutes and lifts in large blocks of flats and offices; for essential floor cleansing in factories, hawker bazaars, markets, abattoirs and public latrines; and for washing down buses, railway rolling stocks, aircraft, cargo containers and government refuse vehicles, bins and handcarts; for car-washing in garages and car-parks. This category of concessionary usage must be supplied off tank.

(x) operation of mechanical washing vehicles such as mechanical street-cleaners belonging to government departments.

(xi) cleansing for the purpose of air pollution control in respect of smoke or gas emitted from plants or equipment provided that water loss is due to evaporation only. This category of concessionary usage must be supplied off tank.

(xii) dust suppression essential to an industrial process either from an operation standpoint or on grounds of air pollution control. Recycling of water is required unless it is demonstrated to be impracticable. This category of concessionary usage

must be supplied off tank.

The purpose of having some of the concessionary supplies to be supplied off tank is to prevent contamination of the supply source through back siphonage. Similar provisions should also be considered for other categories. For concessionary supplies under (v)(a),(vi),(vii) & (viii), where the installation takes the form of supply standpipe and that a hose will only be connected to the draw-off point when water is drawn, an anti-vacuum valve and a non-return valve may be installed at the draw-off point in lieu of a water storage tank for preventing back siphonage because the potential hazard of water contamination is relatively low. However, every draw-off tap that is freely accessible by the general public should be kept under lock and key.

Installation of water points for internal cleansing of open yards and for other miscellaneous domestic purposes in private houses of bungalow type or the like can be permitted as part of the domestic supply. This will not be taken as a concessionary supply.
Wheel-washing for lorries in construction and reclamation sites is categorised as construction supply. This use is permitted provided the water is fully re-circulated.

6.1.12 Hot Water Systems

6.1.12.1 Non-centralized Hot Water System

Type of Water Heater	Requirement for Direct Connection (without storage tank) to Supply Pipe
Non-pressure type heaters (Fig 7), Cistern type water heaters (Fig 8), Instantaneous water heaters (Fig 9)	the factory test pressure of the heater is in excess of 1.5 times the maximum static pressure at the water mains supply point
Unvented electric thermal storage water Heaters (Fig 10)	HKWSR Clause 5.11 and with safety devices complying with Electrical Products (Safety) Regulation
Pressure type thermal storage heaters Other than unvented heaters (Fig 11)	storage tank is required in all cases with a vented pipe.

A loose jumper type valve shall be fitted on the inlet of the water heater if a non-return valve is not incorporated in such water heater, but this requirement does not apply to an electric water heater of the thermal storage type satisfying HKWSR Clause 5.11.

HKWSR Clause 5.11

Every system incorporating an unvented electric water heater of the thermal storage

type shall be provided with:-
(a) a supply pipe that branches off from the feed pipe at a point above the top of the water heater, or some other device to prevent the water from draining down from the water heater if there is a failure at the source of water supply;
(b) an anti-vacuum valve complying with BS EN 13959 or some other device to prevent heated water from being syphoned back to the supply pipe; and
(c) a vessel to accommodate the expansion of heated water where that expansion is constrained by a non-return valve or some other device, incorporated at the inlet of the water heater.

Pressure type thermal storage heaters other than unvented electric thermal storage water heaters shall be supplied from a separate mains water storage cistern, no matter what the pressure at inlet point should be, except these are installed in flats supplied through the indirect or sump and pump system. They shall be provided with a vent or an expansion pipe taken from its highest point and discharge in the atmosphere above the storage cistern at sufficient height to prevent a constant outflow of hot water therefrom.

When the factory test pressure of the heater is less than 1½ times the maximum static water pressure at the mains water supply point then, for premises on direct supply, a separate mains water storage cistern of 45 litres capacity shall be provided for each flat to supply the hot water apparatus.

For flats supplied from the roof storage cistern (of an indirect or sump and pump system), no separate storage for hot water apparatus will be required but the supply to the apparatus shall be by a separate down feed supplying the apparatus only unless the flats on the indirect system are supplied through an oversized down feed pipe, for which case the pipe supplying the hot water apparatus shall be branched from the down feed at a point above the top of the apparatus.

Some heaters, such as gas geysers and instantaneous type electric water heaters, may require a minimum pressure and flow for their proper functioning. When these heaters are to be installed, their suitability shall be checked against the available pressure and flow, especially for the uppermost floors served by the direct system or the indirect system.

If mixing valves, water blenders or combination fittings are to be used, the cold water supply to these fixtures shall be drawn from the same source that supplies the hot water apparatus in order to provide a balanced pressure and to obviate the risk of scalding should the supply at the source fail or be restricted for any reason.

The Electricity (Wiring) Regulations require that installation of unvented electric thermal

storage type water heaters shall be carried out by a Grade R registered electrical worker. The safety devices of unvented storage type electric water heaters are under the control of the Electric Products (Safety) Regulations administered by the Electrical and Mechanical Services Department.

For the installation of unvented electric thermal storage type water heaters, the drain pipe provided for the relief valves shall be installed in such a manner that the water released from the valves shall be discharged to a safe and visible location.

The Water Authority may consider acceptance of plumbing installation and a supply to be given without heaters installed on the following conditions:-

(a) If VPLD indicates that heaters will not be installed but plumbing details are shown to provide supply points for heaters, a written undertaking must be obtained from the architect/developer with full description of the type of heaters intended to be installed in future so that VPLD should be checked and approved to comply with Waterworks requirements for the installation of the particular heaters.
(b) If heaters are shown on VPLD but cannot be installed in place ready for final inspection, an advance written undertaking should be obtained from the architect/developer giving a prescribed date for the heaters to be installed.
(c) A warning plate should be secured in a proper and conspicuous place as near to the heater position as possible and etched with the following instruction in both English and Chinese:

"Only [*type of water heater*] water heaters should be installed.
Prior approval must be obtained from the Water Authority."
"只准安裝[熱水器種類]熱水器，並須先向水務監督申請"

The Water Authority shall carry out re-inspections to the premises 6 months after the installation of meters to check if the correct type of heaters have been installed.

6.1.12.2 Centralized Hot Water System

All centralised hot water systems utilising a boiler and cylinder (direct system) (Fig 12), or calorifier (indirect system) (Fig 13), shall be provided with a vent or an expansion pipe taken from the highest point of the cylinder or calorifier, or if a secondary circulation system, from the highest point of such system. In either case the vent or expansion pipe shall discharge to the atmosphere above the storage cistern at sufficient height to prevent a constant outflow of hot water therefrom. Under no circumstances shall safety valves, air valves or relief valves be used as a substitute or replacement for a vent or expansion pipe nor should any control valve be installed on the vent or expansion pipe between the highest point of the cylinder or

calorifier, and the free end of such pipe.

When a centralised hot water system of the boiler/cylinder or calorifier type is installed, in addition to the vent pipe as required above, a safety valve or pressure relief valve shall be provided to the boiler or to the primary flow pipe as close to the boiler as possible. Such valve shall be set to discharge when the pressure in the boiler exceeds 35 kPa above that of the static pressure of the system.

The cold feed pipe to the boiler/cylinder or calorifer shall not be used for other purpose. If mixing valves, water blenders or combination fittings are to be used, the cold water supply to these fixtures shall be drawn by a separate down feed from the same water storage cistern supplying the hot water system. This outlet shall be slightly lower than the feed to the hot water system in order to provide a balanced pressure and obviate the risk of scalding should the mains supply fail or be restricted.

A screwed plug with a removable key shall be provided at the lower part of the system for the purpose of draining down or emptying the system. No stop valve shall be installed in the primary flow or return pipes except when a vent pipe is connected to the boiler and such installation shall only be made under skilled supervision.

No tap or other means of drawing off water (other than a screwed plug with a removable key for emptying the system for cleansing and repair) shall be connected to any part of the hot water system below the top of the hot water cylinder in such a way that the level of water in the cylinder can be lowered. In a hot water system comprising more than one storage cylinder at different levels, this requirement should apply to the lowest cylinder.

The hot water taps shall be fixed at a distance from a hot water apparatus or from a flow and return system not greater than 12m for pipes up to and including 20 mm diameter, 8m for pipes up to 25mm diameter, and 3m for pipes above 25 mm diameter.

To avoid waste of water when repairs are being effected, a stop valve shall be fitted on the cold feed pipe at the outlet from the storage cistern. If the storage cylinder is installed at a lower floor, and additional stop valve shall be fitted near the inlet to the cylinder. Such stop valve as provided shall have loose keys or hand-wheels which shall be kept in a safe place to prevent unauthorized interference.

6.2 Flushing Supply

Flushing supply may be obtained from the government supply system or from other sources. For inside service using government water supply for flushing, it should comply with the

Waterworks requirements. The inside service for flushing water supplied from privately owned wells, nullah intakes, stream intakes or other water source need not comply with the Waterworks requirements. If it is foreseen that flushing supply from government supply system is likely to be required, the flushing system should comply with the Waterworks requirements in order to minimise the modification work required at a later stage.

6.2.1 Metering Requirement

All flushing water supply systems shall be kept separate from water supply systems. A water meter shall be installed at each flushing system receiving a temporary mains fresh water (TMF) supply. TMF flushing supply is normally given to the entire building through a communal meter. Individual units with independent flushing supply systems will involve a very complicated plumbing arrangement which is both expensive and technically difficult because of the need to comply with the off-tank supply requirement. Hence, application for flushing supply should be submitted by a representative of the building and application for individual units is not entertained.

Salt water flushing supply is also subject to the bulk application but it is not metered. However, a meter position shall be provided for consumption check and waste detection purposes. It shall be close to the lot boundary or close to the point of connection from the internal distribution mains whichever is applicable.

6.2.2 Pipe Materials

Pipes and fittings shall conform to Schedule 2 of the Waterworks Regulations. The Water Authority may approve other pipe materials for use in salt water inside service from time to time.

Pipes on a salt water inside service shall be made of salt water resistant materials, e.g. ductile iron, cast iron, unplasticized polyvinyl chloride, vitreous earthware and gunmetal etc.

6.2.3 Plumbing Arrangements

6.2.3.1 General

A separate water storage tank shall be provided for flushing purpose. Every water closet, latrine shall be provided with a flushing cistern which shall have an overflow terminating in a conspicuous position.

For existing buildings for which permission is given to use government water supply in lieu of private supply for flushing purpose, any existing unsuitable flushing apparatus shall be

replaced with proper apparatus within a reasonable period before a government supply is given.

It is the requirement under Buildings Ordinance that all new buildings shall be provided with a system of plumbing for the supply of water for flushing purposes and every part of such system of plumbing (including the storage tank) shall be constructed of material that is suitable for use with salt water.

6.2.3.2 Salt Water Supply

Salt water supply to premises can be effected in two different ways (Fig 14). These are:-

(i) Direct Supply to a Roof Storage Tank

This system is used when the mains supply pressure is adequate. The storage tank is used to guard against contamination, accidental interruption of supply and to even out peak demands.

(ii) Sump and Pump System

This system is used when the mains pressure is insufficient to effect a direct supply to the roof tank. In this system, salt water is supplied from the mains to a sump tank from which it is pumped to a high level storage tank whence it gravitates to the draw-off points. Direct boosting from salt water mains is not permitted.

6.2.3.3 Temporary Mains Fresh Water for Flushing (TMF)

Mains fresh water may be given for flushing only in cases where the Water Authority is satisfied that there is no suitable alternative. Such flushing supply should be given on a temporary basis and shall revert to salt water supply when this becomes available.

When salt water becomes available in areas containing premises using fresh water as a temporary alternative, the Water Authority will inform the consumers that permission to use fresh water will be withdrawn in 3 months' time and salt water will be provided in lieu. Consumers will also be informed of the estimated cost of the salt water connection.

In the case of a TMF supply to be provided as the alternative source to augment an existing non-government supply, the water storage tank shall be constructed in accordance with Fig 15 (Drawing No W1543/5B).

6.2.3.4 Flushing Devices

Flushing devices can be classified broadly into 2 main types viz. the valveless syphonic type and the valve type. The current Waterworks Regulations require that flushing cisterns shall be of the valveless syphonic type capable of giving a flush between 7.5 and 15 litres. The

practice of accepting only valveless syphonic type cisterns is mainly to prevent leakage of water into the toilet bowl, as in the past, the water-tightness of most valve type flushing devices was often a problem. However, a disadvantage of valveless syphonic type cisterns is that they require a comparatively larger volume of water to generate the necessary flushing effect and a cistern volume of 7.5 litres is seen as the practically minimum requirement. With the improvement in design and material, valve type flushing devices have become more reliable in their performance. A major advantage of valve type flushing devices is that they can give instantaneous flushing even with a relatively smaller volume of flushing water. This helps reduce water required for flushing. Valve type flushing mechanism also permits the design of "dual-flush" cisterns in which the volume of water to be discharged from the cistern can be selected by choosing either a "full-flush" or a "half-flush" depending on need. This allows further reduction in flushing water requirement.

Therefore, by means of the WSD Circular Letter No. 4/2000 of 31 October 2000, the Water Authority relaxes the waterworks requirements in respect of the flushing mechanism and minimum flushing volume, as follows:-

(a) the use of valve type flushing devices (mechanical or sensor type with single flush or dual flush) in addition to valveless syphonic type flushing apparatuses; and

(b) the use of flushing devices which are capable to give a single flushing volume of less than 7.5 litres.

An essential requirement on the relaxation on the use of valve type flushing devices is that the design flushing volume should be compatible with the bowl to ensure effective clearance of waste by a single flush. For the use of flushing valves, a good management system ensuring frequent inspection and cleaning of filters is required. Normally, only public toilet with good management will be considered for the use. In case the flushing valve with a built-in strainer in place of a filter is adopted, the designer must ensure that the strainer can be readily inspected and cleaned. Otherwise, the installation of a filter readily accessible for inspection and cleaning is suggested.

The Water Authority will proceed to amend the Waterworks Regulations for the above changes. The proposed amendments to the Waterworks Regulations shall not apply to existing flushing apparatuses (including valve type flushing cisterns without the approval of the Water Authority) installed before the commencement of the new Regulations. No person shall be required to alter or renew any such flushing apparatuses by virtue of the amendments unless such flushing apparatuses are in the opinion of the Water Authority so defective or in such condition as to cause waste. In case the existing flushing apparatuses are found

defective or leaking, consumers are allowed to either repair the defective flushing apparatuses or replace them by the approved type flushing apparatuses.

6.2.3.5 Identification of Internal Fresh and Salt Water Mains within Large Developments

To avoid connecting the internal fresh water pipe to salt water pipe by mistakes, the following guidelines shall be closely observed:-

(a) when designing the plumbing proposals of large developments with internal fresh and flushing water mains to be laid at the same location, different pipe materials and/or different sizing for the fresh and flushing water mains should be used so that each of the two pipes systems can be easily identified and distinguished from the other on site.

(b) before connecting newly completed pipes to internal fresh or flushing watermains under supply, utmost care should be exercised in identifying and distinguishing each of the two pipe systems. The identification can be done by following step by step a planned operation procedure and test methods such as chemical tests. It is also important that any newly laid pipework should not be put into use before it has been inspected and approved by the Water Authority.

These good practices should also be applied to other similar types of multi-system pipeworks such as those with a private sea water cooling system.

7. Fire Service

The Director of Fire Services is responsible for approving proposals for installations of or alterations to fire services. The fire service in a building such as the choice of the fire-fighting system and its capacity must satisfy the requirements of the Fire Services Department (FSD). Only the plumbing system of the fire service is subject to the requirements of the Water Authority.

For installations which are to be connected to government mains, the method of supply and the materials used must be subject to the approval of the Water Authority and their installation should comply with the Waterworks requirements. The fire service should be designed to guard against contamination, waste and misuse.

7.1 Metering Requirement

As no charge is imposed on the consumption of water used for fire fighting and hence no chargeable meter will be installed for the fire service. However, check meter positions shall be provided for consumption check and waste detection purposes. It is also to remind that use of water from fire service for purposes other than fire fighting is prohibited.

The check meter position shall be close to the lot boundary or close to the point of connection from the internal distribution mains whichever is applicable. A fullway gate valve and a non-return valve have to be installed on the fire service as close as possible to the government water supply connection.

7.2 Pipe Materials

Pipes and fittings shall conform to Schedule 2 of the Waterworks Regulations. The Water Authority may approve other pipe materials for use in fire service from time to time.

Pipes on a fresh water fire service shall be made of cast iron, ductile iron, galvanized wrought iron, galvanized steel or copper of approved standards. Consideration can be given for the use of wrought iron pipe and black steel pipe without being galvanized, upon application, for a fresh water fire service after a positive air break (i.e. fire service tank or sump tank). Pipes and fittings on a salt water fire service shall be cast iron, ductile iron and fittings capable of withstanding the corrosive effect of salt water.

7.3 Supply Types and Arrangements

7.3.1 General

Fire service supply may be from a fresh water or salt water source and it must be from an independent connection. The fire service must be entirely independent of other water supply arrangements within the building or development concerned. A salt water installation may be "primed" with fresh water to inhibit corrosion etc. Such priming arrangements must be approved by the Water Authority prior to installation.

All pipeworks before check meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. Provision shall be made for checking leakage from any pipeworks laid underground. If the connection is not laid in an exposed manner at the lot boundary, then it shall be laid underground with an adequate cover. For carriageway a minimum cover of 1000mm is usually required. Watermains beneath footpaths/verges/cycle tracks should be laid with the same cover as those under carriageways.

The followings are some commonly used types of fire service systems:-

7.3.2 Sprinkler / Drencher System

Sprinkler system (Fig 16) is an automatic system which comes into operation at a predetermined temperature. It is designed to:

(i) detect a fire;
(ii) give an alarm;
(iii) attack and contain an outbreak of fire until the arrival of the Fire Services.

Drencher system is a system of pipes designed to operate either automatically or manually and provide a curtain of water over buildings which constitute a particular dangerous fire hazard e.g. tanks containing highly imflammable liquids.

A dual connection from the Government unrestricted supply ring main shall be provided for a fire service sprinkler / drencher system situated in the recognised Waterworks unrestricted industrial supply zone. Twin connections, one from an unrestricted supply main and one from a distribution main, will be provided for a fire service sprinkler / drencher system situated outside the recognised unrestricted industrial supply zone, where practicable.

Where it is not practical to connect the fire service sprinkler / drencher system to an unrestricted supply main, FSD may require the provision of fire service tank to serve as secondary source for the fire service installation. Dependent uponFSD's requirements, a single or dual connection can be given to serve the fire service tank of secondary source.

No part of any fire service sprinkler / drencher system supplied from the Government mains shall be used for supplying any other services including other fire services including other fire service installations, e.g. hose reels, except that a common suction tank can be used for both sprinkler and hose reel systems. Any exemption from this requirement should have the endorsement of the Director of Fire Services.

Where direct connections to a sprinkler / drencher system are to be from the government mains, an additional butterfly valve, without stop screw and lock nut on handle and strapped in open position, shall be installed at a point on the supply pipe before the fire service inlet and as close as possible to the control valves of the connections.

Application for improvised sprinkler systems (Fig. 17) should be first submitted to the FSD for endorsement before it is submitted to the Water Authority for processing.

7.3.3 Hydrant/Hose Reel System (Fig. 18)

This system ensures that an immediate supply of water is available to any floor of a multi-storey building. Supply must not be fed directly from the government mains and the outlet should be housed in a glass-fronted cabinet secured under lock and key. The glass panel shall be of a frangible type and shall not exceed 1.5 mm in thickness, and that it shall be of such size and design so as not to cause any undue obstruction to the free use of the hose reel. Furthermore, a metal or plastic striker shall be provided in the vicinity of the cabinet for the purpose of breaking the glass panel in case of emergency.

Common tank arrangements for fire-fighting and flushing or other purposes are not acceptable when a government supply is involved. Where a building is to be provided with a non-government flushing supply and where it is proposed to feed the fire service from that supply, the applicant is advised to install an independent fire service system if it is envisaged that the fire service system may require to be connected to the government main at a later stage.

7.3.4 Street Fire Hydrant System (Fig. 19 & Fig. 20)

A street fire hydrant system serves as the secondary water supply for firemen during fire fighting operation. The system consists of standard pedestal type street fire hydrants installed along emergency vehicular access to a building.

7.3.5 Fire Service Ring Mains

Where in large industrial complexes a fire service ring main is required this should be

connected to an unrestricted supply main, if practical. In cases where this is not practical a "dual" connection from the government ring main should be provided.

Fire service ring mains shall not be connected to or used for supplying any other service, except with the approval of the Water Authority.

7.3.6 Fire Service Installations for the New Territories Exempted Houses (NTEH)

FSD Circular letter No. 4/2006 has provided three sets of guidelines on specifications, installation and maintenance of fire service installations and equipment for the new fire safety requirements for NTEH applications. For details, please refer to the FSD's website at http://www.hkfsd.gov.hk/home/eng/source/circular/2006_04.pdf.

7.3.7 Installation of Sprinkler System for Specified Commercial Buildings (SCB) / Prescribed Commercial Premises (PCP) under the Fire Safety (Commercial Premises) Ordinance Cap. 502 and Composite Buildings under the Fire Safety (Buildings) Ordinance Cap. 572

In line with the FSD's requirement to improve the fire service system of SCB, PCP and non-domestic portion of composite building with total floor areas exceeding 230m^2, the following three options are acceptable to the FSD:

(a) addition of a new sprinkler system with water supplies in accordance with the requirements stipulated in para. 5.24 and para. 5.28 of the FSD's Code of Practice for "Minimum Fire Service Installations and Equipment (revision 1994)";
(b) addition of an improvised sprinkler system with its supply drawing from an existing FH/HR tank;
(c) addition of an improvised sprinkler system with direct connection to government mains.

For applications to install the improvised sprinkler systems stated in (b) & (c) above, the endorsement and referral from the FSD are required before any input is made by WSD's District staff to process such applications. The FSD in thus the first stop in processing such applications.

For SCB, PCP and non-domestic portion of composite building with total floor areas exceeding 230m^2, the provision of an automatic sprinkler system has been included as one of the requirements under the Fire Safety (Commercial Premises) Ordinance and Fire Safety (Buildings) Ordinance. For those existing buildings/premises without such a provision, the 3 options above are acceptable for the provision of a sprinkler system. Installation of an improvised sprinkler system is often required due to structural and spatial constraints of the

existing buildings.

8. Storage Cisterns ,Water Pumps and other Miscellaneous

8.1 Storage Cisterns (or Water Tanks)

Storage cisterns may be made of fibre glass, reinforced concrete or other materials approved by the Water Authority. Reinforced concrete is the most common material used. Prior approval by the Water Authority must be sought when fibre glass tank is to be used. Fibreglass storage cistern for potable water shall be of an approved type or certified to contain no toxic materials and suitable for storage of potable water.

A water storage cistern shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply. In the case of a pumped supply to a single cistern, the cistern shall be fitted with an automatic control switch and without any stop valve. In the case of a pumped supply to twin cisterns, each cistern shall be fitted with an automatic control switch and a stop valve for temporary isolation purpose. The ball valve or control switch shall shut off the supply when the water level is 25 mm below the invert of the overflow pipe or the warning pipe if there exists one. The invert of the inlet pipe or the face of the outlet nose of the ball valve shall be not less than 25 mm above the top of the overflow pipe. All overflow and warning pipes of potable water storage cisterns shall be constructed of non-metallic pipe materials. The invert of an outlet pipe from a water storage cistern with capacity less than 5,000 litres shall be at least 30 mm above the bottom of the cistern; this distance shall be increased to 100 mm if the capacity is 5,000 litres or more. The outlet pipe of every water storage cistern shall be provided with fullway gate valve. Provision shall be made for a drain-off pipe to enable the cistern to be emptied. The drain-off pipe shall be properly plugged or adequate means shall be provided to prevent any unauthorized operation of the control valve at drain-off pipe.

An overflow pipe shall be provided which shall discharge overflow water to a conspicuous position in a communal area easily visible and accessible by the occupants. The overflow pipe shall be at least one commercial size larger than the inlet pipe and shall in no case be less than 25 mm in diameter. No part of the overflow pipe shall be submerged inside the storage cistern. A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern. A warning pipe may be installed in addition to an overflow pipe. Except that a warning pipe can be of any size not less than 25 mm in diameter, it shall comply with all other requirements of an overflow pipe. The warning pipe shall be installed at a level below the overflow pipe and shall be extended to outside of the building periphery for roof cistern or outside the pump room for sump cistern.

Double sealed covers with locking devices so constructed as to prevent the ingress of surface water shall be provided for all storage cisterns other than cisterns for flushing and

fire-fighting purposes. Storage cisterns shall be so positioned that they are free from obstruction and readily accessible via safe access for cleansing and to facilitate repairs. It shall be located so as to minimise the risk of contamination of the stored water.

When the storage cistern for potable water is to be placed adjoining to a storage cistern for non-potable water, a physical break shall be provided between the two cisterns, i.e. walls and slabs of the two cisterns must be separated while tie beams linking the cisterns for structural requirements are acceptable. The tie beams shall be constructed in such a manner that cross contamination of two cisterns via the tie beams is not possible.

All outlet pipes from the storage cistern should, whenever possible, be positioned at the opposite side to the inlet supply pipe to prevent stagnation of water.

Structural design of the cistern and its supports should be subject to the requirements of the Building Authority.

8.1.1 Cleaning of Storage Cisterns

Potable water storage cisterns should be cleaned regularly at least once every three months, or more frequently if necessary, in order to prevent the accumulation of dirt and rust which may lead to discoloured water and chokage of water meter. To facilitate cleaning of water storage cisterns, all internal surface of floors, walls (to full height) and soffits (except the cistern openings) of potable water storage cisterns should be lined with a white non-toxic smooth finish such as ceramic tiles. A notice plate/board should be provided to record the dates of cleaning of the water cisterns. The notice plate/board together with the cleaning dates records should be securely fixed at a conspicuous location easily accessible and visible by the residents and the building management staff.

The following steps outline the general procedures for cleaning of the potable water storage cisterns in buildings:

<u>Preparation Stage</u>

i) the management office shall notify the affected occupants the date and time of cleaning, duration of supply interruption and expected supply resumption time at conspicuous location easily visible by the occupants.

<u>Cleaning Stage</u>

i) close the outlet valve of the cistern.
ii) empty the cistern through the washout pipe.
iii) thoroughly scrub and clean the cistern with fresh water.
iv) drain away the water.

v) scrub out the cistern thoroughly with a solution of chloride of lime or bleaching power containing not less than 50 parts of chlorine in one million parts of water.
vi) rinse the cistern thoroughly with fresh water.
vii) refill the cistern with fresh water.
viii) the cistern is ready for use after the outlet valve is open.

8.1.2 Size of Storage Cisterns

The storage capacities of water tanks must be approved by the Water Authority. The proportion of capacity of sump tank to roof tank shall be in the order of 1:3 or as advised by the Water Authority.
In general the storage capacities are recommended as follows:-
(i) Flushing Supply

Salt Water	minimum 1/2 day consumption
TMF	45 litres per flushing apparatus, minimum 250 litres

(ii) Domestic Water Supply
Sump and pump system

Up to 10 flats	135 litres/flat Total storage including sump tank
> 10 flats	90 litres for each additional flat

(iii) Trade/Commercial Water Supply

For industrial buildings, the entire internal service shall be supplied from storage tanks with separated outlets/downpipes feeding independent systems to serve separately the industrial and processing purposes and the other general and ablution appliances. These independent systems shall not be interconnected. The recommended capacity of storage tanks for industrial use is one-day demand.

For office buildings, theatres and other places of entertainment the provision of storage tanks will not be obligatory, and if storage is to be provided, this shall not exceed the capacity determined by the Water Authority.

8.2 Water Pumps

Where a sump-and-pump system is used, it shall be provided with a duplicate pumpset. The pumping capacity of the pumps shall not be less than the designed out-flow rate of the

storage tank being supplied.

All pipework connections to and from pumps should be adequately supported and anchored against thrust to avoid stress on pump casings and to ensure proper alignment. Consideration should be given to minimise noise nuisance to adjacent consumers when choosing a pump system.

8.3 Valves and Taps

Valve materials should conform to Part II of Schedule 2 of the Waterworks Regulations. Individual stop valves shall be provided at all draw-off points or at a series of draw-off points if situated close together.

8.3.1 Use of Pressure Reducing Valves (Fig. 21)

No part in the internal pipeworks shall be subject to excessive high pressure. In case of excessive high pressure, the provision of break pressure tanks at a suitable level of the internal supply system would be a positive and reliable means to reduce the water pressure. Alternately, pressure reducing valves may be provided in lieu of break pressure tank. Application for the installation of pressure reducing valve should be submitted to the Water Authority for approval on the basis of the merits of each individual case.

Whenever a pressure reducing valve is installed, a bypass arrangement shall be incorporated with the provision of a second pressure reducing valve, except for fire service installations, to enable isolation of any defective pressure reducing valve for repair and replacement when necessary. A pressure indicator shall be provided for pressure monitoring and the associated pipes and fittings shall be able to withstand the maximum pressure that may arise upon the failure of the pressure reducing valve.

8.3.2 Tee-branch Valve

A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(i) for all underground water pipes.
(ii) if the main pipe is a communal inside service.
(iii) in a flushing system if the main pipe serves more than one domestic unit or commercial floor.

8.3.3 Hot Water Mixing Valves

Installation of hot water mixing valves may be approved provided that both the cold and hot

water are drawn from the same source, i.e. both hot and cold water supplied from a common storage cistern, or under direct mains pressure.

8.3.4 Taps

When infra-red sensor operated automatic taps are used as inside services, a stop cock or gate valve must be installed at the upstream of each fitting for manual isolation of water supply.

Self-closing taps, of non-concussive type and of approved pattern, shall be used for the public or communal lavatory basins except for those in private clubs in which the use of screw-down tap is permissible.

8.4 Earthing

The metal work of an inside service shall not be used as an earth electrode. The use of non-metallic pipes or fittings should not have had any effect on the earthing arrangement of the building. However, for some old buildings metallic water pipes might have been used to form part of the earthing arrangement. Under such circumstances, whenever an electrical insulation is to be introduced in the inside service, the applicant or his/her licensed plumber is advised to consult the registered electrician to confirm that the earthing arrangement in the premises/building is acceptable. If the earthing arrangement becomes substandard, then actions should be taken to comply with the Electricity (Wiring) Regulations.

8.5 Separate Metering in Existing Premises

The inside service shall be constructed from each flat to the existing common meter positions. The existing sump-and-pump system, if any, shall be provided with a standby pumpset unless this proves to be impracticable.

In an occupied building, a temporary by-pass arrangement as close to the delivery side of the meter as possible shall be provided to maintain water supply to various units of accommodation when plumbing work is being carried out on separate meter conversion. The temporary arrangement shall be such that the consumption is still measured by the bulk meter. This by-pass arrangement must be removed immediately after the new separate meters are fixed. The bulk meter shall also be removed if no longer required.

8.6 Authorizing Private Developers/Authorized Persons to Undertake Water Supply Connection Works

Developers and Authorized Persons are encouraged to employ approved contractors to carry out all or any of the following works:-

(a) connection to the public drainage;
(b) provision of water supply connection;
(c) construction of run-in and repair of damaged footpaths.

This will improve developer's control of their development programmes. As reflected from a survey with Authorized Persons, the issue of Occupation Permits under this arrangement could be advanced by up to three months.

The unified form HBP1 "Application for Technical Audit of Run-in or Damaged Footways/Drainage/Water Supply Connection Works Carried Out by a Member of the Public" and the Practitioner's Guidelines on the scheme can be downloaded from the website http://www.devb-wb.gov.hk/.

9. Maintenance

The common problems in the internal water supply systems are water quality complaints, weak supply pressure and seepage / leakage of water. The main causes of these problems are usually due to corroded pipes and/or uncleaned storage cisterns, choked pipes and/or unauthorized alternation of inside service, and leaking pipe or pipe burst respectively. In this respect, the management office or the agent is recommended to :-

(i) thoroughly clean every fresh water storage cistern and scrub with a solution of chloride of lime or bleaching powder at least once every three months;

(ii) to conduct regular checks to the plumbing system to ensure that it conforms to the approved conditions;

(iii) to rectify any corroded pipes and irregularities immediately.

No system can be guaranteed forever but its service life can be greatly improved by proper maintenance and identifying initial signs of defects before they have a chance of further propagation.

Regular maintenance of the internal water supply system will not only help ensure that the plumbing system performs as it is intended but also minimize the cost of repair work required to rectify the damage to the plumbing system. A typical maintenance schedule is shown below for reference:-

Component	Action
Meters	Take meter reading and check water consumption for early signs of leakage Check the meter in correct working order
meter and valve chamber rooms	Ensure ease of opening to access doors/covers Clean out as necessary
Pipework	Check supports and inspect for loose-fittings Check for soundness of pipework Inspect for signs of corrosion and leakage Disconnect any unused pipes and fittings connected to the service installations
Pumps	Check operation of pumps in order and ensure noise levels to be minimal

Pressure reducing valves	Check the pressure at the upstream and downstream of valve within acceptable limits
Storage cisterns	Clean the potable water storage cisterns under a proper cleaning procedure once every three months, or more frequently if necessary ensure no cross connection between water storage tanks of different natures look for signs of leakage or overflow check for stagnant water, e.g. dust on surface of water check conditions of cistern supports confirm operation of overflow and warning pipes ensure the cover is of double sealed type, under lock and effective in preventing ingress of water

Appendix A1: Checklist for Vetting Plumbing Proposals

Points to Consider	Criteria
A <u>Potable & Flushing Supplies</u>	
A1 Government Supply Mains :	
(i) available water pressure	- Pressure being adequate with regard to the elevation of the premises.
(ii) capacity of supply system	- Capacity of the system being adequate.
(iii) location	- Suitable Government supply main nearest to the premises.
(iv) size	- Adequate to supply the premises.
A2 Connection Pipe :	
(i) location	- Nearest to the suitable Government supply main.
(ii) size	- Adequate to supply all proposed plumbing installations. - Minimum size of 40 mm dia. for flushing supply. - (HKWSR 8.8 & 8.15)
(iii) alignment	- All pipework before meter positions shall be exposed or laid in a proper service duct. (HKWSR 1.2, 7.3 & 8.8)
A3 Water Meter/Check Meter Position :	
(i) location	- The siting of a meter shall be determined by the Water Authority. - Meters shall be arranged in groups and sited at convenient locations in communal area and housed in meter rooms/boxes. - Meters on indirect supply systems shall be sited at roof level or at other convenient locations and housed in meter rooms/boxes. - Check meter positions will be required at the connections to the common inside service and to the sump tank. - Salt water supply will not be metered, but a meter position shall be provided. - Proper drainage, lighting and flood prevention facilities should be provided at the meter room. (WWReg 27, HKWSR 1.4, 1.5, 1.11, 1.12, 1.16, 7.7, 7.10, 8.9 & 8.16)

Points to Consider	Criteria
(ii) size	- Size of water meter should be adequate to meet the estimated consumption.
(iii) no. required	- All domestic units shall be separately metered. (HKWSR 1.1)
(iv) type of metered supply	- Water supplies are classified into domestic, construction, shipping and trade purposes. - (WWReg 2)
(v) arrangement	- A standard meter position should be provided with bushes or reducers at both sides of the meter position and with a distance piece of hollow tube with conspicuous holes drilled through the body placed in between. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. - Meters shall be arranged in groups and sited at convenient locations in communal area and housed in meter rooms/boxes. (HKWSR 1.3, 1.4, 1.5, 1.12, & 7.7)
(vi) fittings	- PVC-U fittings shall be used at meter position if PVC-U materials are used as inside service. - Brass fittings shall be used at meter position if copper, lined galvanized steel or thermal plastic materials are used inside service. (HKWSR 10.3)
A4 Water Storage Cisterns :	
(i) location	- Every cistern shall be located so as to minimize the risk of contamination of the stored water. (WWReg Sch 2 Pt III Para 4 & 9, HKWSR 4.6, 4.7 & 4.10)
(ii) storage capacity	- For domestic buildings, the total volume of the roof storage tank and sump tank shall be on the basis of 135 litres for each of the first 10 flats and 90 litres thereafter for each additional flat. The proportion of capacity of sump tank to

Points to Consider	Criteria
	roof tank shall be in the order of 1:3 or as advised by the Water Authority. - For industrial use, the permissible capacity of storage tank is one day demand. - For temporary mains fresh water flushing, the capacity of the water storage tank shall be limited to 45 litres per flushing apparatus with a minimum of 250 litres. - For salt water flushing supply, there is no limit to the storage capacity but a storage of no less than half a day's consumption is recommended. (HKWSR 1.17, 3.12, 7.1, 8.13 & 8.18)
(iii) material	- Every cistern shall be constructed of concrete, galvanized steel or other approved material. - Fibeglass storage cisterns for potable water shall be of an approved type. - All flushing water tanks must be of salt water resistant materials. (WWReg Sch 2 Pt III Para 2 & 3, HKWSR 4.11 & 8.19)
(iv) associated fittings	- Cisterns shall be fitted with a ball valve controlled inlet in the case of a gravity supply or with an automatic control switch in the case of a pumped supply. - An overflow pipe of one commercial size larger than the inlet pipe, and in no case less than 25 mm diameter, shall be fitted to each cistern and shall be extended to terminate in a conspicuous position in a communal area easily visible and accessible by the occupants. - A stop valve shall be provided on the outlet of every cistern and provision shall be made for a drain off pipe to enable the cistern to be emptied. - Safe access shall be provided to all cisterns by means of a secure permanent ladder or readily available portable ladder. - A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern. - Double sealed covers with locking devices shall be provided for all storage

Points to Consider	Criteria
	cisterns other than cisterns for flushing and fire-fighting purposes. (WWReg Sch 2 Pt III Para. 5, 6, 7 & 10, HKWSR 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 & 4.8)
A5 Water Pumps :	
(i) pumping capacity	- Not less than the designed outflow rate of the storage cistern being supplied.
(ii) provision of standby pump	- A standby pumpset shall be provided. (HKWSR 3.3)
A6 Pipings :	
(i) material	- Pipes on a fresh water inside service shall be made of cast iron, ductile iron, PVC-U, polybutylene, steel or copper or any approved material. - Pipes on a salt water inside service shall be made of cast iron, PVC-U, vitreous earthenware, gunmetal, or any other approved materials. (WWReg Sch 2 Pt I Para 1(3), 1(4), 5, 9, 12, 13 & 16, HKWSR 1.8, 2.8, 3.10, 7.14, 8.19 & 10.2)
(ii) size	- Depends on the no. and types of fittings served. - No pipe shall be less than 20 mm diameter, except that a branch pipe may be 15 mm diameter if the pipe run is short and the pipe supplies only one draw-off point. (WWReg Sch 2 Pt I Para 2)
(iii) routing/alignment	- All pipework before meter positions shall be exposed or laid in proper service duct. (HKWSR 1.2, 2.2, 3.1, 7.3 & 8.8) - The pipings which solely serve a particular flat/unit should not run through other flats/units as far as practicable.
A7 Control Valves :	
(i) size	- Depends on the size of the pipings.
(ii) type	- A loose jumper type stopcock shall be provided and placed with spindle in the vertical position before the meter

Points to Consider	Criteria
	position. - Fullway gate valves shall be fitted before meter positions when the meters are sited at roof level. - Cisterns shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply. Fullway gate valve should be provided on the outlets of every cistern. - Spring taps, of non-concussive type and of approved pattern, shall be used for public or communal lavatory basins. - For connections larger than 40 mm diameter, a gate valve shall be provided before the meter position and a non-return or check valve fitted on the delivery side as close as possible to the meter. (HKWSR 1.10, 1.14, 1.15, 2.4, 3.4, 4.1, 4.2, 7.5, 7.8, 7.9, 7.11, 8.11, 8.12 & 8.17)
(iii) location	- Individual stop valves shall be provided at all draw-off points or at a series of draw-off points if situated close together. (HKWSR 1.7 & 7.13) - Boundary valves shall be provided at the connection points as close to the lot boundary as possible. (HKWSR 1.11, 1.16, 3.7, 7.10, 8.16 & 9.5) - A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided : ● for all underground water pipes; ● if the main pipe is a communal inside service; ● in a flushing system if the main pipe serves more than one domestic unit or commercial floor. (HKWSR 1.9, 2.10, 3.13, 5.13, 6.15, 7.16 & 8.7)
A8 Hot Water System : (i) type of water heater	- The following types of water heaters may, with the written permission of the

Points to Consider	Criteria
	Water Authority, be connected direct to a main : ● non-pressure type water heaters where no restriction of flow can be effected beyond the inlet control valve; ● cistern type water heaters; ● instantaneous water heaters where the guaranteed test pressure of the water heater is at least 1½ times the static head available at the water heater; ● electric water heaters of the thermal storage type; ● having a guaranteed test pressure at least 1½ times the static head available at the water heater; and ● not being provided with an individual expansion pipe but complying with WWReg Sch 2 Pt IV Para 11 (WWReg Sch 2 Pt IV Para 1(2)(a)(b)(c) & (d))
(ii) compliance with WWReg/ HKWSR	- Should refer to WWReg Sch 2 Pt IV & HKWSR Chapter 5 & 6 for details.
A9 Cooling/Air-Conditioning System :	
(i) purpose	- Approvals for the use of mains water (fresh or salt) may be given to meet the following requirements : ● closed circuit cooling systems for any purpose where operational losses are negligible and no water is rejected to waste; ● cooling systems involving no loss through evaporation and where all the water is re-used after cooling for an industrial process; ● evaporative cooling systems essential to an industrial process, whether this be for cooling or for air-conditioning purposes and provided that system losses arise from evaporation only; ● evaporative cooling/air conditioning/humidification system for essential purposes other than industrial processes provided that system losses arise from evaporation

Points to Consider	Criteria
	only; ● humidification essential to an industrial process.
(ii) type	- use of mains water for cooling/air-conditioning and humidification purposes within the first 2 categories above. - use of mains water for cooling/air-conditioning and humidification purposes within the last 3 categories above; the applicant must demonstrate that the type of evaporate plant proposed is of an enclosed design from which wastage of water by splashing is prevented.
(iii) estimated consumption	- Demand can be met by the Distribution Supply System.
(iv) any alternative private source	- The applicant must prove that the demand cannot be effectively met by alternative means (e.g. air cooling, private source or a sea water supply is impractical)
A10 Typical Schematic Plumbing Diagram for food business (restaurant)/kitchen	- kitchen equipment connected to the potable supply are divided into the following categories:
(i) provision of off-tank	Cat 1 – direct supply by tapping over without connecting to water pipe (except water heater)
(ii) kitchen equipment to be submitted for approval	Cat 2(a) – off-tank supply with submerged inlet and for drinking purpose. Cat 2(b) – off-tank supply with submerged inlet but NOT for drinking purpose Cat 3 – off-tank supply to hydro-vent system
	- Separate water tanks are used for different categories of kitchen equipment to avoid backward and cross contamination of water

Points to Consider	Criteria
	- refer to the typical schematic plumbing diagram at Fig. 36 for further details and kitchen equipment required to be submitted to WSD for approval
B <u>Fire Service Supply</u>	
B1 Government Supply Mains :	
(i) available water pressure	- Pressure being adequate with regard to the elevation of the premises.
(ii) location	- Suitable Government supply main nearest to the premises.
(iii) size	- Not less than the size of the connection required.
(iv) unrestricted/restricted supply	- information may be given to the applicant upon request.
(v) single end/double ends feed	- information may be given to the applicant upon request.
B2 Connection Pipes :	
(i) location	- Nearest to the suitable Government supply main.
(ii) size	- Size required by applicant not greater than that of the available Government supply main.
(iii) alignment	- The fire service connection should be located close to the lot boundary or close to the point of connection from internal distribution main whichever is applicable. All pipe work before the check meter position shall be exposed or laid in a proper service duct. (HKWSR 9.5)
B3 Check Meter Position :	
(i) location	- A check meter position should be located so as to free from flood and obstruction and should be located close to the lot boundary and connection to Waterworks main or close to the point of connection from internal distribution main whichever is applicable. (HKWSR 9.5)
(ii) size	- Depends on size of piping.

Points to Consider	Criteria
B4 Water Storage Cisterns :	
(i) location	- Storage cisterns shall be so positioned that they are free from obstruction and readily accessible via safe access. (WWReg Sch 2 Pt III Para 4(a) & 9, HKWSR 4.6)
(ii) material	- Every cistern shall be constructed of concrete, galvanized steel or other approved material. (WWReg Sch 2 Pt III Para 2 & 3)
(iii) associated fittings	- Cisterns shall be fitted with a ball valve controlled inlet in case of a gravity supply or with an automatic control switch in the case of a pumped supply. - An overflow pipe of one commercial size larger than the inlet pipe, and in no case less than 25 mm diameter, shall be fitted to each cistern and shall be extended to terminate in a conspicuous position in a communal area easily visible and accessible by the occupants. A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern. - A stop valve shall be provided on the outlet of every cistern and provision shall be made for a drain-pipe to enable the cistern to be emptied. - Safe access shall be provided to all cisterns by means of a secure permanent ladder or readily available portable ladder. (WWReg Sch 2 Pt III Para 5, 6, 7 & 10, HKWSR 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 & 4.8)
(i) materials	- Piping on a fresh water fire service shall be made of cast iron, wrought iron, steel, copper, ductile iron. - Cast iron, ductile iron and fittings capable of withstanding the corrosive effect of salt water must be used in a salt water fire service. (WWReg Sch 2 Pt I Para 1(1), HKWSR 9.3 & 9.4)
(ii) routing/alignment	- An independent connection shall be provided from the Government water

Points to Consider	Criteria
	main for the fire service installation. - All pipe work before the check meter position shall be exposed or laid in a proper service duct to facilitate inspection and/or repairs. (HKWSR 9.5)
B6 Control Valves : (i) type	- Cisterns shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply. - Fullway gate valves shall be provided on all the outlets of every cistern and provision shall be made for a drain-off pipe to enable the cistern to be emptied. - A fullway gate valve and a non-return valve have to be installed on the fire service as close to the Government water supply connection as possible. - Where direct connections to sprinkler/drencher system are to be from Government mains, an additional butterfly valve, shall be installed at a point on the supply pipe before the fire service inlet and as close as possible to the control valves of the connections. (HKWSR 4.1, 4.2, 9.6 & 9.10)
(ii) size	- Depends on size of piping.
(iii) location	- As close to the Government water supply connection as possible. When direct connections to sprinkler/drencher system are to be from Government mains, an additional butterfly valve, shall be installed at a point on the supply pipe before the fire service inlet and as close as possible to the control valves of the connections. - Tee-branch valves shall be provided for all underground water pipes. (HKWSR 9.6, 9.7 & 9.10)
B7 Compliance	

Points to Consider	Criteria
(i) arrangement	- Independent of other water supply arrangements. A salt water installation may be primed with fresh water. - Fire service ring mains. (HKWSR 9.1, 9.2, 9.11, 9.12, 9.15 & 9.16)
(ii) type	- Sprinkler/Drencher System. - Hydrant/hose Reel System. (HKWSR 9.8 - 9.14)

Appendix A2: Common Mistakes by Practitioners

Plumbing systems shall be designed, constructed, operated and maintained to prevent contamination, wastage and misuse of mains water. Plumbing arrangement shall be so designed as to minimize concealed piping as far as possible, and all pipes and fittings shall be properly supported.

The followings are some common mistakes found in the plumbing submissions.

A) Common Mistakes for Meter/Check Meter Positions (Fig 22)		
		WSD Requirement
①	The check meter positions are not located close to the lot boundary and connection to the Government mains.	HKWSR 1.11 & 1.16
②	Size of potable and flushing supply connections is not indicated.	
③	A loose jumper type valve in lieu of a fullway gate valve is fixed at the inlet side of the salt water flushing supply check meter position. A non-return valve has not been fitted on the delivery side as close as possible to the check meter position.	HKWSR 8.17
④	Detailed drawing with dimensions showing the arrangement of meter position in meter box/cabinet and the fitting at the meter position is not given, e.g. a clear side distance from the centre of meter position on the delivery side to the internal wall of the meter cabinet/room should be indicated and the vertical distance space between each meter position should be indicated.	
⑤	The meters are housed in a multi-function room used for other purpose, e.g. fire service.	HKWSR 1.4
⑥	No proper floor drain is provided in the meter room.	HKWSR 1.4
⑦	The meter positions in the meter room are arranged in groups with front-row and back-row making meter reading and maintenance difficult.	
⑧	Meter sizes are not indicated. The premises that the meters are serving to are not specified.	
B) Common Mistakes for Inside Service (Fig 23)		
①	Types of water heaters to be used are not indicated. Catalogues of water heaters are not submitted.	

②	Sizes of supply pipes are not specified.	
③	Stop valve is not provided to the supply pipe serving the series of draw-off points.	HKWSR 1.7
④	The hot-water draw-off point is not at the left hand side according to the conventional practice.	
⑤	A receptacle, e.g. a sink is not indicated at the draw-off point.	
C) Common Mistakes for Sump and Pump System (Fig 24)		
①	Details of the storage tank, e.g. storage capacity, materials of the tank and the silencer pipe in the storage tank are not specified.	
②	A fullway gate valve is not provided on the drain-off pipe.	HKWSR 4.2
③	Details of overflow pipe, e.g. size, alignment are not indicated.	HKWSR 4.3
④	The overflow pipe was submerged inside the storage cistern and sited above the inlet.	HKWSR 4.3
⑤	Fullway gate valves have not been provided to the outlet of the storage cistern. The outlet was not positioned at the opposite side to the inlet supply pipe. Size of outlet pipe was not shown.	HKWSR 4.2 & 4.8
⑥	Pump rate and head are not specified.	
⑦	Cistern is not fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply. Size of inlet pipe was not shown.	HKWSR 4.1
D) Common Mistakes for Watering Flower Beds Plumbing System (Fig 25)		
①	Detailed dimensions showing the arrangement of the water meter in a meter box and the fittings at the meter position are not shown.	
②	No check meter position is provided. The check meter position is not located close to the lot boundary and connection to the Government mains.	HKWSR 1.11
③	Tee-branch valves are not provided at the branch pipe serving a series of supply points.	HKWSR 1.9
④	A stop valve is not installed on each vertical supply standpipe.	HKWSR 1.7

⑤	The total aggregate planting area and the estimated daily consumption are not given. The flower beds are not highlighted on the layout plan for easy identification.	
⑥	The orientation of the site is not indicated.	
⑦	Meter position is not indicated on the layout plan.	
⑧	Sizes of supply pipes is not specified.	
⑨	The layout plan is not drawn to scale.	
E) Common Mistakes for Fire Service (Fig 26)		
①	A fullway gate valve and a non-return valve are not installed on the fire service close to the government water supply connection.	HKWSR 9.6
②	Size of check meter is not indicated. Detailed drawing showing the arrangement of check meter position is not given.	
③	No additional butterfly valve is provided for the direct fed sprinkler system.	HKWSR 9.10
④	The check meter is housed inside a pump room, not in a designated meter room.	
⑤	The overflow pipe is not discharged to a conspicuous position outside the pump room.	HKWSR 4.3
⑥	A tee-branch valve is not provided to the underground water pipes to facilitate maintenance and repair.	HKWSR 1.9
⑦	Individual stop valve is not provided for the street fire hydrant.	
⑧	No typical installation details for the street fire hydrant is given.	
⑨	No fullway gate valve is provided to the supply pipe of each hose reel.	
⑩	The fire hose reel outlets is not housed in glass-fronted cabinets secured under lock and key.	HKWSR 9.14

Appendix A3: Test Parameters and Acceptance Criteria

The test parameters shall include but not limited to the following:-

Test parameter	Acceptance Criteria
Turbidity (NTU)	≤ 3.0
Colour (HU)	≤ 5
pH at 25^{o}C	6.5-9.2
Free residual Chlorine (mg/L)	＞0 and ≤ 1.5
Conductivity at 25^{o}C (μS/cm)	≤ 300
Total coliforms (cfu/100mL)	0
E.coli (cfu/100mL)	0
Heterotrophic Plate Count (cfu/mL)	≤ 20

Additional parameters may be tested if there is any sign of suspected contamination.

Appendix C

Hong Kong Waterworks
Standard Requirements for
Plumbing Installation in Buildings

Hong Kong Waterworks Standard Requirements For Plumbing Installation in Buildings

Revision History

Revision	Date	Clauses Amended	Description
1.WSD circular Letter No. 3/96	9 Feb 1996	9.11	Clause amended to require endorsement from the Director of Fire Services for exemption.
2. WSD Circular Letter No. 2/98	4 Sep 1998	4.1	Clause amended to require non-metallic overflow / warning pipes for portable water storage cisterns.
		4.4	Clause amended to require warning pipe to be installed at a level below the overflow pipe and extended to outside of the building periphery for roof cistern or outside pump room for sump cistern.
		4.7	Clause amended to require a physical break between two adjoining cisterns for potable and non-potable water.
		4.9	Clause amended to require notice plate / board to record the dates of cleaning water cisterns.
		4.13	Clause amended to require internal surfaces of floors, walls and soffits of potable water storage cisterns to be lined with a white non-toxic smooth finish.
		9.14	Clause amended to require provision of metal / plastic strikers for fire hose reel outlets.

Revision	Date	Clauses Amended	Description
3. WSD Circular Letter No.3/98	17 Dec 1998	1.9A	Requirement of cleansing supply at car park added.
		1.9B	Requirement of meter position at construction site added.
		7.17	Requirement of cleansing supply at car park added.
		7.18	Requirement of meter position at construction site added.
		10.2(c)	"BS 2871" is replaced by "BS EN 1057".
4. WSD Circular Letter No. 7/99	30 Nov 1999	4.5	Requirement for storage cistern covers amended.
		5.10	The safety requirements for unvented electric thermal storage water heaters followed the Electrical Products(Safety) Regulation (Cap. 406 sub. leg.).
		9.14	Clause amended to require sticker / plate carrying warning message for fire hose reel outlets.
5. WSD Circular Letter No. 1/2000	7 Jun 2000	1.6 2.7 3.9	Clauses amended to reject water pipes embedded within loading bearing structural elements.
6. WSD Circular Letter No. 1/2002	22 Feb 2002	8.2 8.2A to 8.2D 8.3 8.4	Requirements for valve type flushing devices added.

Revision	Date	Clauses Amended	Description
7. WSD Circular Letter No. 2/2003	14 Feb 2003	1.3A 2.5A 3.5A 7.4A	Requirement of section of copper pipe between the water meter position and the first pipe clamp using screw joints added.
8. WSD Circular Letter No. 4/2003	21May 2003	1.4, 2.3, 3.2 & 7.7 1.4A, 2.3A & 3.2A 1.4B, 2.3B & 3.2B 1.5, 2.6 & 3.6 1.9B & 7.18 1.9C	Requirement of detail layout and elevation plan of the meter room/box added. Requirement of permanent display board added. Requirement of submission of as-built added Requirement of position of meter arranged in group amended. Requirement of meter position of a building supply to a construction site amended. Requirement of meter position for installation in a landscape area added.

Revision	Date	Clauses Amended	Description
9 WSD Circular Letter No. 2/2007	20 June 2007	1.4(k) 2.3(k) 3.2(k) 7.7(k) 8.9A 9.5A	Requirement of straight length at upstream and downstream of check meter position added.
		1.11A 1.16A 2.11 3.14 7.10 8.9B 9.5B	Requirement of working clearance at check meter position added.
10 WSD Circular Letter No. 4/2007	26 Oct 2007	4.1	Clause amended to incorporate the requirement for twin cisterns
11 WSD Circular Letter No. 2/2010	24 Sept 2010	1.4(a) 2.3(a) 3.2(a) 7.7(a)	Requirement for meter room amended
		1.4(f) 2.3(f) 3.2(f) 7.7(f)	Requirement for door of meter room amended

Foreword

Section 14(3) of the Waterworks Ordinance (Chapter 102) empowers the Water Authority to prescribe the manner of construction or installation and the nature, size and quality of the pipes and fittings of an inside service or fire service for water supplies. All plumbing proposals for inside service and fire service are therefore subject to the approval of the Water Authority.

The Hong Kong Waterworks Standard Requirements is a set of normal requirements which are applicable to the installation of inside service and fire service in addition to the requirements that are set out in Schedule 2 of the Waterworks Regulations (Chapter 102) or modified under Regulation 25(1).

Where necessary, additional requirements may also be imposed on individual application for water supply depending on the nature and type of the plumbing installations.

Table of Contents

Chapter 1 : Fresh Water Supply to Domestic Buildings [New Buildings]

1.1 All domestic units shall be separately metered.

1.2 All pipework before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. Provision should be made for checking leakage from any pipework laid underground.

1.3 Normally, a 15 mm diameter meter will be installed. Provision for this should be made as follows: 20 mm x 15 mm bushes, or reducers, at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between. The tube shall be hollow with conspicuous holes drilled through the body. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. The meter position for meter of all sizes shall also be similarly provided with corresponding fittings of appropriate sizes. The length of the distance piece should be as follows:-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

1.3A For a section of copper pipe is used either before or after a water meter position, that section of copper pipe between the water meter position and the first pipe clamp should be jointed by screwed joints.

1.4 When the applicant submits the vertical plumbing line diagrams (VPLD), he/she will also be required to submit the layout and elevation plans of the meter rooms/boxes with dimensions, including the width and height of the entrances (door openings in case of meter boxes) for the Water Authority's approval. All water meters, including vacant meter positions and check meter positions, shall be arranged in groups and housed in meter rooms or meter boxes. The meter rooms/boxes shall be used solely for housing water meters to protect them against exposure to weather, falling objects and other undue external interferences. They shall not be used as store rooms/boxes, etc. No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. Unless otherwise accepted by the Water Authority, a typical meter room/box shall comply with the following requirements:

(a) for meter rooms, the minimum distance between the outward face of the meter group and the wall/door opening directly opposite

the meter group shall be 1000mm and there shall be no obstacles in between. Besides, if the door to the meter room is to be opened at an inward position and it is at the opposite side of the meter group, the minimum perpendicular distance between the outward face of the meter group and the door (the point on the door that is nearest to the meter group) when it is fully opened shall be 600mm;

(b) the clear width and height of the door entrance to the meter room shall not be less than 800 mm and 2000 mm respectively. The arrangement of the meter position(s) and the door opening of the meter box shall be arranged in such a manner that staff of the Water Authority would not be required to lean inwards to take meter readings or carry out maintenance works. For meter boxes, the clear depth measured from the outside face shall not be more than 800mm;

(c) when the meter room is occupied for taking meter readings and/or maintenance of water meters, the illumination shall not be less than 120 lux at meter positions and the mechanical ventilation shall not be less than 6 air-changes per hour;

(d) an entrance located at communal area for safe, free, and uninterruped access to the meter room/box shall be provided;

(e) provision of adequate drainage inside the meter room and the meter box positioned at floor level shall be made;

(f) the door(s) to the meter room/box shall not be equipped with any self-closing device. The lock of the door to the meter room shall be located at a level between 0.9m and 1.1m above the finished floor level. The door to the meter room shall be equipped with handle to facilitate door opening. The door handle shall be either in the form of long cylindrical or spherical shape to facilitate handling. Covered or flat sectioned handles shall not be used;

(g) the outside of the door(s) to the meter room/box shall be clearly marked「水錶」,"Water Meters" in both Chinese and English of font size not less than 28 pt for easy identification;

(h) if there are more than one water meter room/box inside a building block, master-key locks shall be used at all meter rooms/boxes and a duplicate master key for the Water Authority or his/her

staff's sole use shall be kept at the management office. In case there are more than 300 water meters or 30 meter rooms/boxes, two duplicate master keys shall be kept for the sole use of the Water Authority.

(i) for high-rise building blocks, water meters shall be installed in meter rooms/boxes. For low-rise buildings with fenced-off area, water meters shall be installed in meter room(s)/box(es) located at the boundary and shall be accessible from the public area

(j) meter rooms/boxes inside market/commercial complex shall be positioned in areas with clear access and with no risk of being obstructed by hawkers, etc.

(k) for check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

1.4A Upon completion of the water meter installation inside a meter room/box, the Licensed Plumber (LP) shall install a permanent display board at the wall/door inside the meter room/box showing the location and elevation of the meter positions. The top of the board shall not be higher than 1500 mm above the floor level and the bottom of the board shall not be lower than 500 mm for an individual meter above the floor level. This display board shall be constructed of durable plastic or corrosion-resistant plate engraved with words and diagrams in black on light colour background. The wordings should be of font size not less than 18 pt. Details of this display board shall be submitted by the applicant as part of the VPLD for the Water Authority's approval. This requirement can be waived for small meter boxes accommodating 3 meters or less.

1.4B Within two weeks after completion of the water meter installation, the LP shall submit as-built plans of the meter arrangements, the completed Meter Installation Table (MIT) and Part IV of the Form WWO 46 where amongst others the LP undertakes the correctness of the meter positions. The applicant/developer and the Authorised Person shall also countersign in Part IV of the Form WWO 46 to indicate their satisfaction of the correctness of the meter positions.

1.5 For meters arranged in groups, no meter position shall be lower than 300 mm nor higher than 1500 mm above the floor level. This requirement is also applicable for water meters installed inside meter boxes. For Housing Department estates

where corridor meter arrangement is chosen and accepted, individual meter positions shall be at a suitable height not less than 750 mm but not more than 1500 mm above the floor level.

1.6 All water pipes which come into direct contact with concrete shall be protected with suitable material. No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction. You are required to state explicitly in the submitted plumbing drawings that no water pipe will be embedded in load bearing structural elements. In this regard, vertical water pipes piercing through structural slabs and transfer plates; and horizontal water pipes piercing through beams, columns and structural walls may be permitted when such water pipes are protected by sleeving or other suitable means. It is advisable, whenever practicable, to arrange for inspection by the Water Authority prior to concreting on any pipework to be embedded in any structural elements or concealing any pipework by architectural features which cannot be easily removed for inspection and maintenance of the pipework after their installation. Moreover, in any event all underground pipework must be so inspected before it is backfilled or covered up.

1.7 Individual stop valves shall be provided at all draw-off points or at a series of draw-off points if situated close together.

1.8 Cast iron, ductile iron, unplasticized polyvinyl chloride (uPVC), lined galvanized steel or copper pipes of approved grades will be used for a fresh water inside service. All uPVC pipes must be properly supported and shielded from direct sunrays and must be painted with white acrylic paint when exposed. The type, make and duty of all pipe materials and water supply fittings to be used must be fully detailed on the Form WWO 46 "Application for constructing, installing, altering or removing an inside or fire service".

1.9 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service.

1.9A Sufficient cleansing taps shall be provided at car parks of a building for car/floor washing. The cleansing supply at the car park shall be given from a fresh water cistern with a separate meter unless it is a part of the cleansing supply system of the building.

1.9B The meter position of a building supply to a construction site shall be provided within a meter room or meter box located at the hoarding recess area so that reading and maintenance of the meter can be carried out outside the construction

site. Safe, free and uninterrupted access to the meter room/box should be provided and maintained at all time. The door of the meter room or meter box shall be made of chicken-wire or provided with see-through glass panel. Details of the meter room or meter box are subject to the approval of the Water Authority.

1.9C For a meter installed in a landscape area, it should be installed above ground level with a clear working headroom not less then 2m. A safe pedestrian access to the meter position should be provided.

For Direct Supply

1.10 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position at each meter position on the inlet side of the meter.

1.11 The connection to the common inside service will not be metered but a meter position shall be provided for the insertion of a check meter for checking and waste detection purposes. This meter position should be so located as to be free from flood and obstruction for ease of meter reading and maintenance at all times, and it should be located close to the lot boundary and connection to the Government mains.

1.11A The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

For Indirect Supply

1.12 Meters on indirect supply systems shall be sited at roof level or at other convenient locations.

1.13 A sump and pump system including a sump tank and a roof storage tank shall be fitted before meter positions when the meters are sited at roof level.

1.14 Fullway gate valves shall be fitted before meter positions when the meters are sited at roof level.

1.15 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position at each meter position on the inlet side of the meter where the meter is not sited at roof level and where the pressure is considered adequate.

1.16 The connection to the sump tank will not be metered but a meter position shall be provided for the insertion of a check meter for checking and waste detection purposes. This meter position should be so located as to be free from flood and obstruction for ease of meter reading and maintenance at all times, and it should be located close to the lot boundary and connection to the Government mains or close to the point of connection from internal distribution mains whichever is applicable.

1.16A The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

1.17 The total volume of the roof storage tank and sump tank shall be on the basis of 135 litres for each of the first 10 flats and 90 litres thereafter for each additional flat. The proportion of capacity of sump tank to roof tank shall be in the order of 1:3 or as advised by the Water Authority.

1.18 No draw-off point in the inside services shall be subject to excessive high pressure. In case of excessive high pressure, a break pressure tank or cistern shall be provided at a suitable level to reduce the water pressure. If this is not practicable, the installation of pressure reducing valves can be pursued with the following requirements:-

(a) a bypass arrangement be incorporated with the provision of a second pressure reducing valve to enable isolation of any defective pressure reducing valve for repair and replacement when necessary;

(b) a pressure indicator be provided for pressure monitoring;

(c) the associated pipes and fittings be able to withstand the maximum static pressure that may arise upon failure of the pressure reducing valve.

Chapter 2 : Separate Metering of Existing Properties on Direct Supply of Fresh Water

2.1 The inside service shall be constructed from each flat to the existing common meter connection or in such other locations as determined by the Water Authority.

2.2 All pipework before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs.

2.3 When the applicant submits the vertical plumbing line diagrams (VPLD), he/she will also be required to submit the layout and elevation plans of the meter rooms/boxes with dimensions, including the width and height of the entrances (door openings in case of meter boxes) for the Water Authority's approval. All water meters, including vacant meter positions and check meter positions, shall be arranged in groups and housed in meter rooms or meter boxes. The meter rooms/boxes shall be used solely for housing water meters to protect them against exposure to weather, falling objects and other undue external interferences. They shall not be used as store rooms/boxes, etc. No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. Unless otherwise accepted by the Water Authority, a typical meter room/box shall comply with the following requirements:

(a) for meter rooms, the minimum distance between the outward face of the meter group and the wall/door opening directly opposite the meter group shall be 1000mm and there shall be no obstacles in between. Besides, if the door to the meter room is to be opened at an inward position and it is at the opposite side of the meter group, the minimum perpendicular distance between the outward face of the meter group and the door (the point on the door that is nearest to the meter group) when it is fully opened shall be 600mm;

(b) the clear width and height of the door entrance to the meter room shall not be less than 800 mm and 2000 mm respectively. The arrangement of the meter position(s) and the door opening of the meter box shall be arranged in such a manner that staff of the Water Authority would not be required to lean inwards to take meter readings or carry out maintenance works. For meter boxes,

the clear depth measured from the outside face shall not be more than 800mm;

(c) when the meter room is occupied for taking meter readings and/or maintenance of water meters, the illumination shall not be less than 120 lux at meter positions and the mechanical ventilation shall not be less than 6 air-changes per hour;

(d) an entrance located at communal area for safe, free, and uninterruped access to the meter room/box shall be provided;

(e) provision of adequate drainage inside the meter room and the meter box positioned at floor level shall be made;

(f) the door(s) to the meter room/box shall not be equipped with any self-closing device. The lock of the door to the meter room shall be located at a level between 0.9m and 1.1m above the finished floor level. The door to the meter room shall be equipped with handle to facilitate door opening. The door handle shall be either in the form of long cylindrical or spherical shape to facilitate handling. Covered or flat sectioned handles shall not be used;

(g) the outside of the door(s) to the meter room/box shall be clearly marked「水錶」,"Water Meters" in both Chinese and English of font size not less than 28 pt for easy identification;

(h) if there are more than one water meter room/box inside a building block, master-key locks shall be used at all meter rooms/boxes and a duplicate master key for the Water Authority or his/her staff's sole use shall be kept at the management office. In case there are more than 300 water meters or 30 meter rooms/boxes, two duplicate master keys shall be kept for the sole use of the Water Authority.

(i) for high-rise building blocks, water meters shall be installed in meter rooms/boxes. For low-rise buildings with fenced-off area, water meters shall be installed in meter room(s)/box(es) located at the boundary and shall be accessible from the public area;

(j) meter rooms/boxes inside market/commercial complex shall be positioned in areas with clear access and with no risk of being obstructed by hawkers, etc.

(k) for check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

2.3A Upon completion of the water meter installation inside a meter room/box, the Licensed Plumber (LP) shall install a permanent display board at the wall/door inside the meter room/box showing the location and elevation of the meter positions. The top of the board shall not be higher than 1500 mm above the floor level and the bottom of the board shall not be lower than 500 mm for an individual meter above the floor level. This display board shall be constructed of durable plastic or corrosion-resistant plate engraved with words and diagrams in black on light colour background. The wordings should be of font size not less than 18 pt. Details of this display board shall be submitted by the applicant as part of the VPLD for the Water Authority's approval. This requirement can be waived for small meter boxes accommodating 3 meters or less.

2.3B Within two weeks after completion of the water meter installation, the LP shall submit as-built plans of the meter arrangements, the completed Meter Installation Table (MIT) and Part IV of the Form WWO 46 where amongst others the LP undertakes the correctness of the meter positions. The applicant/developer and the Authorised Person shall also countersign in Part IV of the Form WWO 46 to indicate their satisfaction of the correctness of the meter positions.

2.4 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position at each meter position on the inlet side of the meter.

2.5 The meter position for 15 mm diameter meter shall be constructed to include 20 mm x 15 mm bushes, or reducers, at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between. The tube shall be hollow with conspicuous holes drilled through the body. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. The meter position for meter of all sizes shall also be similarly provided with corresponding fittings of appropriate sizes. The length of the distance piece should be as follows:-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

2.5A For a section of copper pipe is used either before or after a water meter position, that section of copper pipe between the water meter position and the first pipe clamp should be jointed by screwed joints.

2.6 For meters arranged in groups, no meter position shall be lower than 300 mm nor higher than 1500 mm above the floor level. This requirement is also applicable for water meters installed inside meter boxes. For Housing Department estates where corridor meter arrangement is chosen and accepted, individual meter positions shall be at a suitable height not less than 750 mm but not more than 1500 mm above the floor level.

2.7 All water pipes which come into direct contact with concrete shall be protected with suitable material. No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction. You are required to state explicitly in the submitted plumbing drawings that no water pipe will be embedded in load bearing structural elements. In this regard, vertical water pipes piercing through structural slabs and transfer plates; and horizontal water pipes piercing through beams, columns and structural walls may be permitted when such water pipes are protected by sleeving or other suitable means. It is advisable, whenever practicable, to arrange for inspection by the Water Authority prior to concreting on any pipework to be embedded in any structural elements or concealing any pipework by architectural features which cannot be easily removed for inspection and maintenance of the pipework after their installation. Moreover, in any event all underground pipework must be so inspected before it is backfilled or covered up.

2.8 Cast iron, ductile iron, unplasticized polyvinyl chloride (uPVC), lined galvanized steel or copper pipes of approved grades will be used for a fresh water inside service. All uPVC pipes must be properly supported and shielded from direct sun rays and must be painted with white acrylic paint when exposed. The type, make and duty of all pipe materials and water supply fittings to be used must be fully detailed on the Form WWO 46 "Application for constructing, installing, altering or removing an inside or fire service" when submitted.

2.9 In an occupied building, a temporary bypass arrangement as close to the delivery side of the meter as possible shall be provided to maintain water supply to various units of accommodation when plumbing work is being carried out on separate meter conversion. The temporary arrangement should be such that the consumption is still measured by the bulk meter. This bypass arrangement must be removed immediately after the new separate meters are fixed. The bulk meter should also be removed if no longer required.

2.10 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service

2.11 The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

Chapter 3 : Separate Metering of Existing Properties on Indirect Supply of Fresh Water

3.1 All pipework before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. Approved provision should be made for checking leakage from any pipework laid underground.

3.2 When the applicant submits the vertical plumbing line diagrams (VPLD), he/she will also be required to submit the layout and elevation plans of the meter rooms/boxes with dimensions, including the width and height of the entrances (door openings in case of meter boxes) for the Water Authority's approval. All water meters, including vacant meter positions and check meter positions, shall be arranged in groups and housed in meter rooms or meter boxes. The meter rooms/boxes shall be used solely for housing water meters to protect them against exposure to weather, falling objects and other undue external interferences. They shall not be used as store rooms/boxes, etc. No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. Unless otherwise accepted by the Water Authority, a typical meter room/box shall comply with the following requirements:

(a) for meter rooms, the minimum distance between the outward face of the meter group and the wall/door opening directly opposite the meter group shall be 1000mm and there shall be no obstacles in between. Besides, if the door to the meter room is to be opened at an inward position and it is at the opposite side of the meter group, the minimum perpendicular distance between the outward face of the meter group and the door (the point on the door that is nearest to the meter group) when it is fully opened shall be 600mm;

(b) the clear width and height of the door entrance to the meter room shall not be less than 800 mm and 2000 mm respectively. The arrangement of the meter position(s) and the door opening of the meter box shall be arranged in such a manner that staff of the Water Authority would not be required to lean inwards to take meter readings or carry out maintenance works. For meter boxes, the clear depth measured from the outside face shall not be more than 800mm;

(c) when the meter room is occupied for taking meter readings and/or maintenance of water meters, the illumination shall not be less than 120 lux at meter positions and the mechanical ventilation shall not be less than 6 air-changes per hour;

(d) an entrance located at communal area for safe, free, and uninterruped access to the meter room/box shall be provided;

(e) provision of adequate drainage inside the meter room and the meter box positioned at floor level shall be made;

(f) the door(s) to the meter room/box shall not be equipped with any self-closing device. The lock of the door to the meter room shall be located at a level between 0.9m and 1.1m above the finished floor level. The door to the meter room shall be equipped with handle to facilitate door opening. The door handle shall be either in the form of long cylindrical or spherical shape to facilitate handling. Covered or flat sectioned handles shall not be used;

(g) the outside of the door(s) to the meter room/box shall be clearly marked「水錶」,"Water Meters" in both Chinese and English of font size not less than 28 pt for easy identification;

(h) if there are more than one water meter room/box inside a building block, master-key locks shall be used at all meter rooms/boxes and a duplicate master key for the Water Authority or his/her staff's sole use shall be kept at the management office. In case there are more than 300 water meters or 30 meter rooms/boxes, two duplicate master keys shall be kept for the sole use of the Water Authority.

(i) for high-rise building blocks, water meters shall be installed in meter rooms/boxes. For low-rise buildings with fenced-off area, water meters shall be installed in meter room(s)/box(es) located at the boundary and shall be accessible from the public area;

(j) meter rooms/boxes inside market/commercial complex shall be positioned in areas with clear access and with no risk of being obstructed by hawkers, etc.

(k) for check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a

straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

3.2A Upon completion of the water meter installation inside a meter room/box, the Licensed Plumber (LP) shall install a permanent display board at the wall/door inside the meter room/box showing the location and elevation of the meter positions. The top of the board shall not be higher than 1500 mm above the floor level and the bottom of the board shall not be lower than 500 mm for an individual meter above the floor level. This display board shall be constructed of durable plastic or corrosion-resistant plate engraved with words and diagrams in black on light colour background. The wordings should be of font size not less than 18 pt. Details of this display board shall be submitted by the applicant as part of the VPLD for the Water Authority's approval. This requirement can be waived for small meter boxes accommodating 3 meters or less.

3.2B Within two weeks after completion of the water meter installation, the LP shall submit as-built plans of the meter arrangements, the completed Meter Installation Table (MIT) and Part IV of the Form WWO 46 where amongst others the LP undertakes the correctness of the meter positions. The applicant/developer and the Authorised Person shall also countersign in Part IV of the Form WWO 46 to indicate their satisfaction of the correctness of the meter positions.

3.3 The existing sump and pump system shall be provided with a standby pumpset unless this proves to be impracticable.

3.4 Fullway gate valves shall be fitted before meter positions when the meters are sited at roof level.

3.5 The meter position for 15 mm diameter meter shall be constructed to include 20 mm x 15 mm bushes, or reducers, at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between. The tube shall be hollow with conspicuous holes drilled through the body. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. The meter position for meter of all sizes shall also be similarly provided with fittings of appropriate sizes. The length of the distance piece should be as follows:-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

3.5A For a section of copper pipe is used either before or after a water meter position, that section of copper pipe between the water meter position and the first pipe clamp should be jointed by screwed joints.

3.6 For meters arranged in groups, no meter position shall be lower than 300 mm nor higher than 1500 mm above the floor level. This requirement is also applicable for water meters installed inside meter boxes. For Housing Department estates where corridor meter arrangement is chosen and accepted, individual meter positions shall be at a suitable height not less than 750 mm but not more than 1500 mm above the floor level.

3.7 The connection to the sump tank will not be metered but a meter position shall be provided for the insertion of a check meter for checking and waste detection purposes. This meter position should be so located as to be free from flood and obstruction for ease of meter reading and maintenance at all times, and it should be located close to the lot boundary and connection to the Government mains or close to the point of connection from internal distribution mains whichever is applicable.

3.8 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position at each meter position on the inlet side of the meter where the meter is not sited at roof level and where the pressure is considered adequate.

3.9 All water pipes which come into direct contact with concrete shall be protected with suitable material. No water pipe shall be embedded within load bearing structural elements such as columns, beams and slabs in longitudinal direction. You are required to state explicitly in the submitted plumbing drawings that no water pipe will be embedded in load bearing structural elements. In this regard, vertical water pipes piercing through structural slabs and transfer plates; and horizontal water pipes piercing through beams, columns and structural walls may be permitted when such water pipes are protected by sleeving or other suitable means. It is advisable, whenever practicable, to arrange for inspection by the Water Authority prior to concreting on any pipework to be embedded in any structural elements or concealing any pipework by architectural features which cannot be easily removed for inspection and maintenance of the pipework after their installation. Moreover, in any event all underground pipework must be so inspected before it is backfilled or covered up.

3.10 Cast iron, ductile iron, unplasticized polyvinyl chloride (uPVC), lined galvanized steel or copper pipes of approved grades will be used for a fresh water inside service. All uPVC pipes must be properly supported and shielded from direct sunrays and must be painted with white acrylic paint when exposed. The type, make and duty of all pipe materials and water supply fittings to be used must be fully detailed on the Form WWO 46 "Application for constructing, installing, altering or removing an inside or fire service" when submitted.

3.11 In an occupied building, a temporary bypass arrangement shall be provided to maintain water supply to the various units of accommodation when plumbing work is being carried out on separate meter conversion. The temporary arrangement should be such that the consumption is till measured by the bulk meter. This bypass arrangement must be removed immediately after the new separate meters are fixed. The bulk meter should also be removed if no longer required.

3.12 The total volume of the roof storage tank and sump tank shall be on the basis of 135 litres for each of the first 10 flats and 90 litres thereafter for each additional flat. The proportion of capacity of sump tank to roof tank shall be in the order of 1:3 or as advised by the Water Authority.

3.13 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service.

3.14 The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

Chapter 4 : Installation of Storage Cisterns [or Water Tanks]

4.1 Cisterns shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply. In the case of a pumped supply to a single cistern, the cistern shall be fitted with an automatic control switch and without any stop valve. In the case of a pumped supply to twin cisterns, each cistern shall be fitted with an automatic control switch and a stop valve for temporary isolation purpose. The ball valve or control switch shall shut off the supply when the water level is 25mm below the invert of the overflow pipe or the warning pipe if there exists one. The invert of the inlet pipe or the face of the outlet nose of the ball valve shall be not less than 25mm above the top of the overflow pipe. All overflow and warning pipes of potable water storage cisterns shall be constructed of non-metallic pipe materials.

4.2 Fullway gate valves shall be provided on all the outlets of every cistern and provision shall be made for a drain-off pipe to enable the cistern to be emptied. The drain-off pipe shall be properly plugged or adequate means shall be provided to prevent any unauthorized operation of the control valve at drain-off pipe.

4.3 Every storage cistern shall be provided with an overflow pipe which shall discharge overflowed water to a conspicuous position in a communal area easily visible and accessible by the occupants. The overflow pipe shall be at least one commercial size larger than the inlet pipe and shall in no case be less than 25 mm in diameter. No part of the overflow pipe shall be submerged inside the storage cistern. A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern.

4.4 Where necessary a warning pipe may be installed in addition to an overflow pipe. Except that a warning pipe can be of any size not less than 25mm in diameter, it shall comply with all other requirements of an overflow pipe. The warning pipe shall be installed at a level below the overflow pipe and shall be extended to outside of the building periphery for roof cistern or outside the pump room for sump cistern.

4.5 Every storage cistern shall have a lockable close fitting rigid cover secured by mechanical means which excludes light and the ingress of particles and / or insects from the cistern. The cover shall be made of a material or materials which do not shatter or fragment when broken and which will not contaminate any condensate which may form on its underside or the stored water. For the potable water storage cistern, the cover and its base frame shall possess double upstand edges interlocking one another to provide additional protection.

4.6 Storage cisterns shall be so positioned that they are free from obstruction and readily accessible via safe access for cleansing and to facilitate repairs. It shall be located so as to minimise the risk of contamination of the stored water.

4.7 When the storage cistern for potable water is to be placed adjoining to a storage cistern for non-potable water, a physical break shall be provided between the two cisterns, i.e. walls and slabs of the two cisterns must be separated while tie beams linking the cisterns for structural requirements are acceptable. The tie beams shall be constructed in such a manner that cross contamination of two cisterns via the tie beams is not possible.

4.8 All outlet pipes from the storage cistern should, whenever possible, be positioned at the opposite side to the inlet supply pipe.

4.9 It is stipulated in Clause 5(1) of the Wells and Water Storage (Urban Council) By-Laws [HK Law Chapter 132] that every water storage tank and cistern shall at all times be kept in a clean and wholesome condition. In this respect, every cistern is recommended to be thoroughly cleaned and scrubbed with a solution of chloride of lime or bleaching powder containing not less than fifty parts of chlorine in one million parts of water at least once every three months. A notice plate/board should be provided to record the dates of cleaning of the water cisterns. The notice plate/board together with the cleaning date's records should be securely fixed at a conspicuous location easily accessible and visible by the residents and the building management staff.

4.10 Structural design of the cistern and its supports should be subject to the requirements of the Building Authority.

4.11 Fibreglass storage cisterns for potable water shall be of an approved type or certified to contain no toxic materials and to be suitable for storage of potable water.

4.12 The invert of an outlet pipe from a water storage tank with capacity less than 5000 litres shall be at least 30 mm above the bottom of the tank; this distance shall be increased to 100 mm if the storage tank capacity is 5000 litres or more.

4.13 To facilitate cleansing of water storage tanks, all internal surface of floors, walls (to full height) and soffits (except the cistern openings) of potable water storage cisterns should be lined with a white non-toxic smooth finish such as ceramic tiles. In connection with this, it is also advisable to have the same finish for the internal surfaces of floors and walls of flushing and fire service water storage cisterns.

Chapter 5 : Non-Centralized Hot Water System

5.1 When the factory test pressure of the heater is in excess of 1.5 times the maximum static pressure at the mains water supply point, non-pressure type heaters, cistern type water heaters, and instantaneous water heaters are permitted to be connected direct to the supply pipe without the necessity of providing storage. Unvented electric thermal storage water heaters satisfying the requirements stipulated in paragraphs 5.10 and 5.11 are also permitted to be connected direct to the supply pipe.

5.2 When the factory test pressure of the heater is less than 1.5 times the maximum static water pressure at the mains water supply point then, for premises on direct supply, a separate mains water storage cistern of 45 litres capacity shall be provided for each flat to supply the hot water apparatus.

5.3 Pressure type thermal storage heaters other than unvented electric thermal storage water heaters satisfying the requirements stipulated in paragraphs 5.10 and 5.11 shall be supplied from storage cisterns as stipulated in paragraph 5.2, no matter what the pressure at inlet point should be, except these are installed in flats supplied through the indirect or sump and pump system.

5.4 For flats supplied from the roof storage cistern of an indirect or sump and pump system, no separate storage for hot water apparatus will be required but the supply to the apparatus shall be by a separate down feed supplying the apparatus only unless the arrangement in paragraph 5.5 is applied.

5.5 If the flats on the indirect system are supplied through an oversized down feed pipe, the pipe supplying the hot water apparatus shall be branched from the down feed at a point above the top of the apparatus.

5.6 When gas geysers are to be installed on the top floor of a building supplied through storage cisterns, gas geysers with low pressure governors should be installed when the head available is less than 5 metres to the highest hot water draw-off point.

5.7 If mixing valves, water blenders or combination fittings are to be used, the cold water supply to these fixtures shall be drawn from the same source as is supplying the hot water apparatus in order to provide a balanced pressure and to obviate the risk of scalding should the supply at the source fail or be restricted for any reason.

5.8 Except for unvented electric thermal storage water heaters satisfying the requirements stipulated in paragraphs 5.10 and 5.11, all pressure type thermal

storage heaters shall be provided with a vent or expansion pipe taken from its highest point and discharge in the atmosphere above the storage cistern at sufficient height to prevent a constant outflow of hot water therefrom.

5.9 A loose jumper type valve shall be fitted on the inlet of the water heater if a non-return valve is not incorporated in such water heater, but this requirement does not apply to an electric water heater of the thermal storage type satisfying the requirements stipulated in paragraphs 5.10 and 5.11.

5.10 All unvented electric thermal storage water heaters shall comply with the safety requirements under the Electrical Products (Safety) Regulation (Cap. 406 sub. leg.)

5.11 Every system incorporating an unvented electric water heater of the thermal storage type shall be provided with:-

(a) a supply pipe that branches off from the feed pipe at a point above the top of the water heater, or some other device to prevent the water from draining down from the water heater if there is a failure at the source of water supply;

(b) an anti-vacuum valve complying with BS EN 13959 or some other device to prevent heated water from being syphoned back to the supply pipe; and

(c) a vessel to accommodate the expansion of heated water where that expansion is constrained by a non-return valve or some other device, incorporated at the inlet of the water heater.

5.12 It is advisable that lagged copper pipes are used for hot water system where re-circulation system is designed.

5.13 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service.

Chapter 6 : Centralized Hot Water System

6.1 The cold feed pipe from the roof storage cistern shall supply the hot water system only.

6.2 If mixing valves, water blenders or combination fittings are to be used, the cold water supply to these fixtures shall be drawn by a separate down feed from the hot water storage cistern. This outlet shall be slightly lower than the feed to the hot water system in order to provide a balanced pressure and obviate the risk of scalding should the mains supply fail or be restricted.

6.3 All centralised hot water systems utilising a boiler and cylinder, or calorifier, shall be provided with a vent or expansion pipe taken from the highest point of the cylinder or calorifier, or if a secondary circulation system, from the highest point of such system. In either case the vent or expansion pipe shall discharge to the atmosphere above the storage cistern at sufficient height to prevent a constant outflow of hot water therefrom.

6.4 Under no circumstances shall safety valves, air valves or relief valves be used as a substitute or replacement for a vent or expansion pipe nor should any control valve be installed on the vent or expansion pipes between the highest point of the cylinder or calorifier, and the free end of such pipes.

6.5 When a centralised hot water system of the boiler /cylinder or calorifier type is installed, in addition to the vent pipe as required in paragraph 6.3 above, a safety valve or pressure relief valve shall be provided to the boiler or to the primary flow pipe as close to the boiler as possible. Such valve shall be set to discharge when the pressure in the boiler exceeds 35kPa above that of the static pressure of the system.

6.6 No tap or other means of drawing off water, (other than a screwed plug with a removable key for emptying the system for cleansing and repair), shall be connected to any part of the hot water system below the top of the hot water cylinder in such a way that the level of the water in cylinder can be lowered.

6.7 In a hot water system comprising more than one storage cylinders at different levels, paragraph 6.6 should read as applying to the lowest cylinder.

6.8 To avoid wastage of water when repairs are being effected, a stop valve shall be fitted on the cold feed pipe at the outlet from the storage cistern.

6.9 If the storage cylinder is installed in a lower floor, and additional stop valve shall be fitted near the inlet to the cylinder.

6.10 Such stop valve as provided under paragraphs 6.8 and 6.9 shall have loose keys or hand-wheels which shall be kept in a safe place to prevent unauthorised interference.

6.11 A screwed plug with a removable key shall be provided at the lower part of the system for the purpose of draining down or emptying the system.

6.12 No stop valve shall be installed in the primary flow or return pipes except when a vent pipe is connected to the boiler and such installation shall only be made under skilled supervision.

6.13 It is advisable that lagged copper pipes are used for hot water system where re-circulation system is designed.

6.14 Installation of boilers/ steam boilers shall comply with the relevant Boilers and Pressure Vessels Regulations [HK Law Chapter 56].

6.15 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service.

Chapter 7 : Fresh Water Supply to Commercial and Industrial Buildings

7.1 For industrial buildings, the entire internal services shall be supplied from storage tanks with separate outlets / downpipes feeding independent systems to serve separately the industrial and processing purposes and the other general and ablution appliances. These independent systems should not be interconnected. The permissible capacity of storage tanks for industrial use is one-day demand when the industrial buildings are situated outside the full supply zones during water restriction.

7.2 For office buildings, theatres and other places of entertainment the provision of storage will not be obligatory, and if storage is to be provided, this shall not exceed the capacity determined by the Water Authority.

7.3 All pipework before meter positions shall be exposed or laid in a proper service duct to facilitate inspection and repairs. Provisions should be made for checking leakage from any pipework laid underground.

7.4 The meter position for 15 mm diameter meter shall be constructed to include 20 mm x 15 mm bushes, or reducers, at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between. The tube shall be hollow with conspicuous holes drilled through the body. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. The meter position for meter of all sizes shall also be similarly provided with corresponding fittings of appropriate sizes. The length of the distance piece should be as follows:-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

7.4A For a section of copper pipe is used either before or after a water meter position, that section of copper pipe between the water meter position and the first pipe clamp should be jointed by screwed joints.

7.5 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position before the meter on all connections up to and including 40 mm diameter.

7.6 For connections larger than 40 mm diameter, a gate valve shall be provided before the meter position and a non-return or check valve fitted on the delivery side as close as possible to the meter.

7.7 When the applicant submits the vertical plumbing line diagrams (VPLD), he/she will also be required to submit the layout and elevation plans of the meter rooms/boxes with dimensions, including the width and height of the entrances (door openings in case of meter boxes) for the Water Authority's approval. All water meters, including vacant meter positions and check meter positions, shall be arranged in groups and housed in meter rooms or meter boxes. The meter rooms/boxes shall be used solely for housing water meters to protect them against exposure to weather, falling objects and other undue external interferences. They shall not be used as store rooms/boxes, etc. No other building services such as drainage systems, fire hoses, E&M installations (equipment, cables and ducting, etc.) shall pass through or be placed inside the meter rooms/boxes except lighting, ventilation and drainage, etc. solely to facilitate meter reading and maintenance of water meters. Unless otherwise accepted by the Water Authority, a typical meter room/box shall comply with the following requirements:

(a) for meter rooms, the minimum distance between the outward face of the meter group and the wall/door opening directly opposite the meter group shall be 1000mm and there shall be no obstacles in between. Besides, if the door to the meter room is to be opened at an inward position and it is at the opposite side of the meter group, the minimum perpendicular distance between the outward face of the meter group and the door (the point on the door that is nearest to the meter group) when it is fully opened shall be 600mm;

(b) the clear width and height of the door entrance to the meter room shall not be less than 800 mm and 2000 mm respectively. The arrangement of the meter position(s) and the door opening of the meter box shall be arranged in such a manner that staff of the Water Authority would not be required to lean inwards to take meter readings or carry out maintenance works. For meter boxes, the clear depth measured from the outside face shall not be more than 800mm;

(c) when the meter room is occupied for taking meter readings and/or maintenance of water meters, the illumination shall not be less than 120 lux at meter positions and the mechanical ventilation shall not be less than 6 air-changes per hour;

(d) an entrance located at communal area for safe, free, and uninterruped access to the meter room/box shall be provided;

(e) provision of adequate drainage inside the meter room and the meter box positioned at floor level shall be made;

(f) the door(s) to the meter room/box shall not be equipped with any self-closing device. The lock of the door to the meter room shall be located at a level between 0.9m and 1.1m above the finished floor level. The door to the meter room shall be equipped with handle to facilitate door opening. The door handle shall be either in the form of long cylindrical or spherical shape to facilitate handling. Covered or flat sectioned handles shall not be used;

(g) the outside of the door(s) to the meter room/box shall be clearly marked「水錶」,"Water Meters" in both Chinese and English of font size not less than 28 pt for easy identification;

(h) if there are more than one water meter room/box inside a building block, master-key locks shall be used at all meter rooms/boxes and a duplicate master key for the Water Authority or his/her staff's sole use shall be kept at the management office. In case there are more than 300 water meters or 30 meter rooms/boxes, two duplicate master keys shall be kept for the sole use of the Water Authority.

(i) for high-rise building blocks, water meters shall be installed in meter rooms/boxes. For low-rise buildings with fenced-off area, water meters shall be installed in meter room(s)/box(es) located at the boundary and shall be accessible from the public area;

(j) meter rooms/boxes inside market/commercial complex shall be positioned in areas with clear access and with no risk of being obstructed by hawkers, etc.

(k) for check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

7.8 Fullway gate valves shall be fitted before meter positions when the meters are sited at roof level.

7.9 A loose jumper type stopcock shall be provided and placed with the spindle in vertical position at each meter position on the inlet side of the meter where the meter is not sited at roof level and where the pressure is considered adequate.

7.10 For building to be supplied via a sump and pump system, the connection to the sump tank will not be metered but a check meter position shall be provided for checking and waste detecting purposes. This meter position should be so located as to be free from flood and obstruction for ease of meter readings and maintenance at all times, and it should be close to the lot boundary and connection to the Government mains or close to the point of connection from internal distribution mains whichever is applicable.

The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

7.11 Spring taps, of non-concussive type and of approved pattern, shall be used for the public or communal lavatory basins except for those in private clubs in which the use of screw down tap is permissible.

7.12 All G.I. piping which comes into direct contact with concrete shall be bitumen-coated and wrapped with hessian or other suitable material or where such pipe passes through a wall or suspended floor, it may be protected by sleeving or other suitable means. It is advisable, whenever practicable, to arrange for inspection by the Water Authority prior to concreting any pipework to be embedded in any wall or suspended slab and in any event all underground pipework must be so inspected before it is backfilled or covered up. However, the pipework arrangement should be so designed as to minimize concealed piping as far as possible.

7.13 Individual stop valves shall be provided at all draw-off points or at a series of draw-off points if situated close together.

7.14 Cast iron, ductile iron, unplasticized polyvinyl chloride (uPVC), galvanized steel or copper pipes of approved grades will be used for a fresh water inside service. All uPVC pipes must be properly supported and shielded from direct sun rays and must be painted with white acrylic paint when exposed. The type, make and duty of all pipe materials and water supply fittings to be used must be fully detailed on the Form WWO 46 "Application for constructing, installing, altering or removing an inside or fire service" when submitted.

7.15 A sump and pump system shall be provided with a standby pumpset. The proportion of capacity of sump tank to roof tank shall be in the order of 1:3 or as advised by the Water Authority.

7.16 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) if the main pipe is a communal inside service.

7.17 Sufficient cleansing taps shall be provided at car parks of a building for car/floor washing. The cleansing supply at the car park shall be given from a fresh water cistern with a separate meter unless it is a part of the cleansing supply system of the building.

7.18 The meter position of a building supply to a construction site shall be provided within a meter room or meter box located at the hoarding recess area so that reading and maintenance of the meter can be carried out outside the construction site. Safe, free and uninterrupted access to the meter room/box should be provided and maintained at all time. The door of the meter room or meter box shall be made of chicken-wire or provided with see-through glass panel. Details of the meter room or meter box are subject to the approval of the Water Authority.

Chapter 8 : Flushing Supply from Government Mains [Fresh or Salt]

8.1 A separate water storage tank shall be provided for flushing purposes.

8.2 The water discharge mechanism of flushing devices shall either be one of the following types:

(a) with a flushing cistern:
  (i) valveless siphonic;
  (ii) drop valve;
  (iii) flap valve; or
  (iv) dual flush valve;

(b) without a flushing cistern:
  (i) flushing valve (flushometer valve).

They can either be actuated by mechanical means or by sensors.

8.2A Every flushing cistern shall have an overflow terminating in a conspicuous position.

8.2B The discharge volume of the flushing devices shall be preset at the smallest compatible with the toilet bowl to ensure that effective clearance can be achieved by a single flush of water.

8.2C The requirements on the use of valve type flushing cisterns (refer to paragraphs 8.2(a)(ii), (iii) and (iv) above) are as follows:

(a) The valve seal of the flushing devices shall be easily replaceable.

(b) A dual flush valve which is designed to give two different volumes of flush shall have a readily discernible method of actuating the flush at different volumes. Such method should be illustrated clearly and permanently displayed at the cistern or nearby.

(c) For dual flush devices, the reduced flushing volume shall not be more than two-thirds of the larger flushing volume.

(d) The components of all valve type flushing devices shall be resistant to salt water corrosion.

(e) The flushing devices must pass the 200,000-cycle endurance test.

8.2D The requirements on the use of flushing valves (refer to paragraph 8.2 (b) above) are as follows:

(a) Installation of a filter before a flushing valve or a group of flushing valves is required.

(b) The cartridge and other valve components shall be easily replaceable.

(c) The valve components shall be resistant to salt water corrosion.

(d) Flushing valves shall be used within the range of working pressures specified by the manufacturer.

(e) The flushing devices must pass the 200,000-cycle endurance test.

(f) Flushing valve shall only be used where there is a good maintenance management system for frequent inspection and cleaning of filters. Normally only public toilets (such as those administered by government, quasi-government bodies, hotel operators, commercial complex management offices, etc.) will be considered.

(g) To facilitate users to report defective flushing valves in case they occur, it is advisable to secure in a conspicuous place in the public toilet, where the flushing valves are installed, a plate etched with the name of the responsible party and the telephone number in both Chinese and English. Other effective arrangements may also be considered.

8.3 Not used.

8.4 For an existing building with permission to use mains water (fresh or salt) for flushing purposes, any existing flushing apparatus found unsuitable shall be replaced with a proper apparatus as specified under paragraphs 8.2 and 8.2A to 8.2D above.

8.5 It is the requirement under the Buildings Ordinance [HK Law Chapter 123] that all new buildings shall be provided with a plumbing system to supply water for flushing purposes and every part of such plumbing system (including the storage tank) shall be constructed of such materials that are suitable for use with salt water.

8.6 If the water supply pressure is high, a break pressure tank or cistern shall be provided at a suitable level to prevent excessive water pressure in the supply system. If this is not practicable, pressure reducing valves shall be provided to meet the following requirements:-

(a) a bypass arrangement shall be provided for the installation of a second pressure reducing valve allowing the other pressure reducing valve to be isolated for repair and replacement when necessary;

(b) a pressure indicator on the low pressure side of the pressure reducing valve shall be provided for pressure monitoring;

(c) the associated pipes and fittings shall be able to withstand the maximum permissible pressure that may arise upon the failure of the pressure reducing valve.

8.7 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided:

(a) for all underground water pipes;
(b) in a flushing system if the main pipe serves more than one domestic unit or commercial floor.

For Temporary Mains Fresh Water Flushing Supply

8.8 The inlet pipe to the separate storage tank should not be less than 40 mm diameter; its portion before meter position shall be exposed or laid in a proper service duct and extended to the lot boundary.

8.9 To facilitate meter installation, a meter position shall be provided in the communal area of the building as close to the existing potable supply meters as possible.

8.9A For check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

8.9B The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning

the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

8.10 The meter position for 15 mm diameter meter shall be constructed to include 20 mm x 15 mm bushes, or reducers, at both sides of the meter position with a 200 mm (clear effective length) distance piece of 15 mm tube placed in between. The tube shall be hollow with conspicuous holes drilled through the body. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side. The meter position for meter of all sizes shall also be similarly provided with corresponding fittings of appropriate sizes. The length of the distance piece should be as follows:-

Meter Size (mm)	15	25	40	50	80	100	150
Clear Effective Length of Distance Piece (mm)	200	311	346	310	413	483	500

8.11 A loose jumper type stopcock shall be provided and placed with the spindle in the vertical position before the meter on all connections up to and including 40 mm diameter.

8.12 For connections larger than 40 mm diameter, a gate valve shall be provided before the meter position and a non-return or check valve fitted on the delivery side as close as possible to the meter.

8.13 The capacity of the water storage tank shall be limited to 45 litres per flushing apparatus with a minimum of 250 litres.

8.14 In case of a temporary mains fresh water supply is proposed to be provided as the alternative source to augment an existing independent (not Government) supply, the storage tank for the flushing cistern shall be constructed in accordance with Waterworks Drawing No. W 1543/5B.

For Mains Salt Water Flushing Supply

8.15 The inlet pipe to the separate storage tank shall not be less than 40 mm diameter.

8.16 Salt water supply will not be metered, but a meter position shall be provided for the purpose of periodic checking of consumption. This meter position should be so located as to be free from flood and obstruction for ease of meter reading and maintenance at all times, and it should be close to the lot boundary and connection to the Government mains or close to the point of connection from internal distribution mains whichever is applicable.

8.17 A fullway gate valve shall be fitted at the inlet side of the meter position and a non-return or check valve shall be fitted on the delivery side as close as possible to the meter.

8.18 There is no specific requirement for the storage capacity, but a storage not less than half a day's consumption is recommended.

8.19 All flushing water tanks and associated fittings and pipeworks etc. must be of salt water resistant materials, e.g. uPVC, vitreous earthenware, cast iron, gunmetal etc. to the approval of the Water Authority. The type, make and duty of all materials to be used shall be fully detailed on the Form WWO 46 "Application for constructing, installing, altering or removing an inside or fire service".

Chapter 9 : Installation of a Fresh / Salt Water Fire Service

9.1 A fresh / salt water fire service must be entirely independent of the other water supply arrangements within the building or development concerned.

9.2 A fresh or salt water fire-fighting supply may be approved. A salt water installation may be "primed" with fresh water to inhibit corrosion etc. Such priming arrangements must be approved by the Water Authority prior to installation.

9.3 Cast iron, ductile iron, galvanized wrought iron, galvanized steel or copper pipes and fittings of approved grades will be used for a fresh water fire service. Consideration can also be given for the use of wrought iron pipe and black steel pipe without being galvanized, upon application, for a fresh water fire service after a positive air break (i.e. fire service tank or sump tank).

9.4 Cast iron, ductile iron and fittings capable of withstanding the corrosive effect of salt water must be used in a salt water fire service.

9.5 An independent connection shall be provided from the Government water mains for the fire service installation. The fire service connection will not be metered but a check meter position shall be provided for checking and waste detecting purposes. This meter position should be so located as to be free from flood and obstruction for ease of meter reading and maintenance at all times, and should be located close to the lot boundary and connection to the Government mains or close to the point of connection from internal distribution mains whichever is applicable. All pipework before the check meter position shall be exposed or laid in a proper service duct to facilitate inspection and /or repairs. Provision should be made for checking leakage from any pipework laid underground.

9.5A For check meter of 100mm diameter or smaller, a straight length of pipe of 5 x D (where D is the nominal bore of the meter) should be provided upstream of the check meter position and a straight length of pipe of 2 x D at downstream. For check meter of diameter larger than 100mm, the straight lengths upstream and downstream are 10 x D and 5 x D respectively.

9.5B The designer should provide minimum horizontally perpendicular and longitudinal working clearances at each check meter position. The table below stipulates the minimum horizontally perpendicular working clearance, meaning the shortest distance between the longitudinal centre line of the check meter position and a wall or any edge of a door when opened.

	Meter Size (mm)			
	40	50	80	100
Minimum horizontally perpendicular working clearance from the wall or any edge of a door when opened where the check meter position is clamped (mm)	310	310	380	400

The minimum longitudinal working clearance between both end of meter flanges of the check meter position and a wall or any obstruction should be 200mm.

9.6 A fullway gate valve and a non-return valve have to be installed on the fire service as close to the Government water supply connection as possible.

9.7 A tee-branch valve refers to an isolation valve at a branch pipe and which is located close to the main pipe. To facilitate maintenance and repair, tee-branch valves shall be provided for all underground water pipes.

Sprinkler / Drencher System

9.8 A dual connection from the Government unrestricted supply ring main will be provided for a fire service sprinkler / drencher system situated in the recognized Waterworks unrestricted industrial supply zone. Twin connections, one from an unrestricted supply main and one from a distribution main, will be provided for a fire service sprinkler / drencher system situated outside the recognized unrestricted industrial supply zone, where practicable.

9.9 Where it is not practical to connect the fire service sprinkler /drencher system to an unrestricted supply main, Fire Services Department may require the provision of fire service tank to serve as secondary source for the fire service installation. Dependent upon Fire Services Department's requirements, a single or dual connection can be given to serve the fire service tank of secondary source.

9.10 Where direct connections to sprinkler / drencher system are to be from the Government mains, an additional butterfly valve, without stop screw and lock nut on handle and strapped in open position, shall be installed at a point on the supply pipe before the fire service inlet and as close as possible to the control valves of the connections.

9.11 No part of any fire service sprinkler / drencher system supplied from the Government mains shall be used for supplying any other services including other fire service installations, e.g. hose reels, except that a common suction tank can be used for both sprinkler / drencher and hose reel systems. Any exemption

from this requirement should have the endorsement of the Director of Fire Services.

Hydrant / Hose Reel System

9.12 Common tank arrangements for fire-fighting and flushing or other purposes are not acceptable when a Government supply is involved. Where a building is to be provided with a non-Government flushing supply and where it is proposed to feed the fire service from that supply, the developer is advised to install an independent fire service system if it is envisaged that the fire service system may require to be connected to the Government mains at a later stage.

9.13 Supply to hydrant / hose reel system must not be fed directly from the Government mains.

9.14 Fire hose reel outlets shall be housed in glass-fronted cabinets secured under lock and key. The glass panel shall be of a frangible type and shall not exceed 1.5mm in thickness, and that it shall be of such size and design so as not to cause any undue obstruction to the free use of the hose reel. Furthermore, a metal or plastic striker shall be provided in the vicinity of the cabinet for the purpose of breaking the glass panel in case of emergency. To prevent misuse of fire hose reels, a sticker or plate carrying the following warning message should be securely fixed on or near every hose reel outlet and the message should be easily visible by the residents.

消 防 用 水
嚴禁作其他用途

USE OF WATER FROM FIRE SERVICES
FOR PURPOSES OTHER THAN FIRE
FIGHTING IS STRICTLY PROHIBITED

水務監督辦事處 Office of the Water Authority

Fire Service Ring Mains

9.15 Fire service ring main in a large industrial complex shall be connected to an unrestricted supply main, if practical. In case this is not practical, a "dual" connection from the Government ring main shall be given.

9.16 The fire service ring main shall not be connected to or used to supply any other services.

Chapter 10 : The Use of Pipes and Fittings and the Associated Installation Requirements in Inside Service

10.1 The type of pipe materials to be used in an inside service shall be detailed in the plumbing proposal. The licensed plumber shall also submit details of the pipes and fittings he intends to use in Form WWO 46 for the approval of the Water Authority.

10.2 Pipes and fittings shall conform to Schedule 2 of the Waterworks Regulations. From time to time the Water Authority may approve other pipe materials for use in cold water, hot water or salt water inside service. The following pipe materials may be used in cold water, hot water or salt water inside service as appropriate:

(a) cast iron pipe to BS 4622 (withdrawn in August 2013);

(b) ductile iron pipe to BS EN 545;

(c) copper pipe to BS EN 1057;

(d) unplasticized polyvinyl chloride (uPVC) pipe to BS 3505 Class D;

(e) chlorinated polyvinyl chloride (PVC-C) pipe to BS 7291 Parts 1 & 4;

(f) polyethylene (PE) pipe to BS 6730 or BS EN 12201;

(g) crosslinked polyethylene pipe to BS 7291 Parts 1 & 3;

(h) polybutylene (PB) pipe to BS 7291 Parts 1 & 2;

(i) lined (uPVC / polyethylene lining) galvanized steel pipe of the approved type.

10.3 uPVC fittings shall be used at the meter position if uPVC materials are used as inside service. Brass fittings shall be used at the meter position if copper, lined galvanized steel or thermo-plastic materials are used as inside service.

10.4 The metal work of an inside service shall not be used as an earth electrode. [Paragraph 12C(1)(b) of the Code of Practice for the Electricity (Wiring) Regulations, 1992 Edition]. Therefore, the use of non-metallic pipes or fittings should not have had any effect on the earthing arrangement of the building.

10.5 However, for some old buildings metallic water pipes might have been used to form part of the earthing arrangement. Under such circumstances, whenever an electrical insulation is to be introduced in the inside service, the applicant or his licensed plumber is advised to consult his registered electrician to confirm that the earthing arrangement in the premises / building is still acceptable. If the earthing arrangement becomes substandard, then actions should be taken to comply with the Electricity (Wiring) Regulations [HK Law Chapter 406].

Schedule 2 of the Waterworks Regulations (Cap 102A)

Part 4

Water Heaters

1. (1) Subject to subparagraph (2), a water heater shall be supplied with water from a cold water storage cistern.
   (2) The following type of water heaters may, with the written permission of the Water Authority, be connected direct to a main-
      (a) non-pressure type water heaters where no restriction of flow can be effected beyond the inlet control valve;
      (b) cistern type water heaters;
      (c) instantaneous water heaters where the guaranteed test pressure of the water heater is at least 1 1/2 times the static head available at the water heater;
      (d) unvented thermal storage type electric water heaters which comply with the safety requirements under the Electrical Products (Safety) Regulation (Cap 406 sub. leg. G). (L.N. 106 of 1999)
   (3) Where a water heater is connected direct to a main-
      (a) every draw-off point of the water heater shall be not less than 15 mm above the lowest part of the top edge of the receptacle supplied from the water heater;
      (b) if it is a water heater burning gas, the construction of the water heater shall be such that no leakage of gas into the water can occur;
      (c) if it is a water heater using electricity, the construction of the water heater shall be according to the relevant British Standards.

2. Where mixing valves, showers or water blenders are installed, the cold water supply to these fittings shall be from the same cold water storage cistern or main that supplies the water heater and the installation shall be such that the hot water flow will stop before that of the cold water in the event of a failure in the water supply.

3. Every water heater of the thermal storage type, other than an electric water heater of the type specified in paragraph 1(2)(d), shall be provided with an individual expansion pipe taken from its highest point and shall continuously rise without obstruction until it discharges to atmosphere above the storage cistern at a sufficient height to prevent a constant out-flow of hot water therefrom. (L.N. 286 of 1990)

4. No tap or other means of drawing off water (other than a screwed plug with a removable key for emptying the system for cleansing or repair) shall be connected to any part of the hot water system below the top of the hot water cylinder in such a way that the level of the water in the cylinder can be lowered.

5. No tap used for the purpose of drawing hot water shall be fixed at a greater distance (measure along the axis of the pipe by which the tap is supplied) from a water heater or hot water cistern, cylinder or tank, or from a flow and return system, than the distance appropriate to the largest internal diameter of any part of the said pipe as shown in the following table-

Table

Largest internal diameter of pipe	Distance in metres
(a) Not exceeding 20 mm	12
(b) Exceeding 20 mm but not exceeding 25 mm	8
(c) Exceeding 25 mm	3

6. A loose jumper type valve shall be fitted on the inlet of every water heater if a non-return valve is not incorporated in such water heater; but this requirement does not apply to an electric water heater of the thermal storage type that is not provided with an individual expansion pipe. (L.N. 286 of 1990)

7. Pipes used for conveying hot water shall be of galvanized steel, copper, or of some corrosion-resisting alloy: Provided that cast iron pipes of not less than 50 mm internal diameter may be used if suitable provision for their expansion is made. (L.N. 320 of 1992)

8. Every hot water cylinder or tank of a capacity of not less than 100 litres shall-
   (a) if made of mild steel, comply with the requirements for cylinders or tanks, as the case may be, of BS 417, Part 2 for galvanized mild steel cisterns, tanks and cylinders; and (L.N. 106 of 1999)
   (b) if made of copper, comply with BS 699 for copper cylinders for domestic purposes or with BS 1566, Parts 1 and 2 for copper indirect cylinders.

9. Every water heater of thermal storage type or the calorifier type shall comply with the requirements of BS 3456, Part 102, Section 102.21 for stationary non-instantaneous electric water heater or with BS 853 for hot water calorifiers respectively. (L.N. 106 of 1999)

10. (Repealed L.N. 320 of 1992)

11. (Repealed L.N. 106 of 1999)

12. Every system incorporating an electric water heater of the thermal storage type shall be provided with-
   (a) a supply pipe that branches off from the feed pipe at a point above the top of the water heater, or some other device to prevent the water from draining down from the water heater if there is a failure at the source of water supply;
   (b) an anti-vacuum valve complying with BS 6282 or some other device to prevent heated water from being syphoned back to the supply pipe; and
   (c) a vessel to accommodate the expansion of heated water where that expansion is constrained by a non-return valve, or a similar device, incorporated at the inlet of the water heater. (L.N. 286 of 1990)

(L.N. 252 of 1977)

Appendix E

Building Services Technical Guide
DBSG-305

		REFERENCE	CAT.
WATER PUMP INSTALLATION			
Determination of Water Tank Capacity			
1.	Fresh Water Storage Tank and Sump Tank:		A
	The total storage capacity of fresh water tank is calculated as follows:		
	a. domestic building on direct supply - NIL;		A
	b. domestic building on indirect supply - 135 litres for each of the first 10 flats and 90 litres for each remaining flat;		A
	c. 45 litres per point for each floor washing tap.		M
	d. Twin roof fresh water tanks of approximately equal volume shall be provided to make up the total storage capacity. For twin tanks system, provide pressure switch at discharge side of each upfeed water pump to stop the water pump should over-pressure occur. The corresponding fault signal is repeated at guard counter on GF of the block.	DCMBI No. D01/08 Minutes of BSDRP Meeting held on 14 Dec 2009---item 3.2.1.2.1 therein.	M

		REFERENCE	CAT.
2.	Flush Water Storage Tank and Sump Tank:		
	a. The total storage capacity of flush water tank is limited to 45 litres for each water closet if water supply is temporarily fresh water.		A
	b. Twin roof flush water tanks of approximately equal volume shall be provided to make up the total storage capacity. For twin tanks system, provide pressure switch at discharge side of each upfeed water pump to stop the water pump should over-pressure occur. The corresponding fault signal is repeated at guard counter on GF of the block.	DCMBI No. D01/08 Minutes of BSDRP Meeting held on 14 Dec 2009---item 3.2.1.2.1 therein.	M
	c. Provide bucket-type strainer before inlet of sump tank, which is cleansed at regular interval.	Minutes of BSDRP Meeting held on 14 Dec 2009---item 3.2.1.2.1 therein.	M
3.	Storage Distribution between Sump Tank and Roof Tank for Fresh and Flush Water:		A
	a. The total storage is to be distributed between the sump tank and roof tank. The ratio of the capacity of the sump tank and roof tank is to be in accordance with Hong Kong Waterworks Standard Requirements issued by WSD and that the effective volume of the sump tank is large enough for the pump to run for at least 3 minutes even at no in-flow condition.		
4.	Fire Services Water Tank:		A
	a. The capacity of the sump tank is large enough for the pump to run for at least 3 minutes even at no in-flow condition. For fire services roof storage tank, the capacity requirement is in accordance with the Code of Practice for Minimum Fire Service Installations and Equipment.		
5.	Effective Volume of Water Tank:		A
	a. For water tanks using float switches to control the		

		REFERENCE	CAT.
	inflow, the effective storage of water is the volume between the high level cut-out position and the low level cut-in position except FH/HR and sprinkler water tanks.		
	b. It is recommended to set the low level cut-in switches to 100 mm above the top of the outlet pipes of the roof water tanks as far as practicable.		

Determination of Pump Flow Rate

6.	The pump flow rate for the fresh and flush water pump systems is determined using the Plumbing Engineering Services Design Guide.		A
7.	The pump flow rate for the fire services feed pump system is such that the roof storage tank is to be filled up in less than 6 hours.		A
8.	The pump flow rates are to be counter-checked against those recommended by WSD. Where there is discrepancy, liaise with WSD to determine the flow rate.		A

Determination of Pump Head

9.	The pump head can be calculated from the following formula:		A

$$H_p = H_s + H_f + H_v$$

where H_p = pump total head
H_s = static head
H_f = head loss through straight pipe run + head loss through fittings
H_v = velocity head (=0)

10.	For reference, friction loss through pipework can be found by using Hazen-Williams formula in accordance with clause 18 of LPC Sprinkler Rules or alternatively, using the method in Plumbing Engineering Services Design Guide or CIBSE Guide.		A

Determination of Size of Water Rising Main

11.	The water rising main is sized such that:		A
	a. the flow velocity is limited to below 2.5 m/s;		
	b. the frictional loss is limited to below 10% of the equivalent length.		

Pipes and Valves

12.	a. Appropriate metallic pipes and valves are to be used in high pressure location which is subject to hydraulic shock and mechanical vibration, e.g. the discharge from the pumps, the rising mains to, and down		A

		REFERENCE	CAT.
	feeders from, the roof water tanks. During design of pipework and fittings inside pump room, take into account the maintenance consideration in regard of their mounting level. They can be mounted at 3m above finished floor level or under soffits of beams depending on particular situations at the discretion of PBSE.		A
b.	For outlet valves of roof tanks, considerations should be given to their accessibility for daily operation. The outlet valves should be located above the main roof such that the "level" drop is not the whole height of the domestic block, i.e. at the external façade. PA should be advised to allow sufficient working areas around the water tanks for pipe runs and for erecting the working platforms and cat ladders where required.		
13.	Gate and Globe Valves:		A
a.	A gate valve instead of globe valve at the discharge side of the water pumping system is recommended.		
14.	Ball Float Valves:		A
a.	Installation of ball float valve should be carried out by the sub-contractor. It is recommended to install as far as practicable the ball float valve at one side of the manhole, occupying part of the open area of the manhole and leaving sufficient clearance for entry to the tank for other purpose as shown in **Figure 1**.		

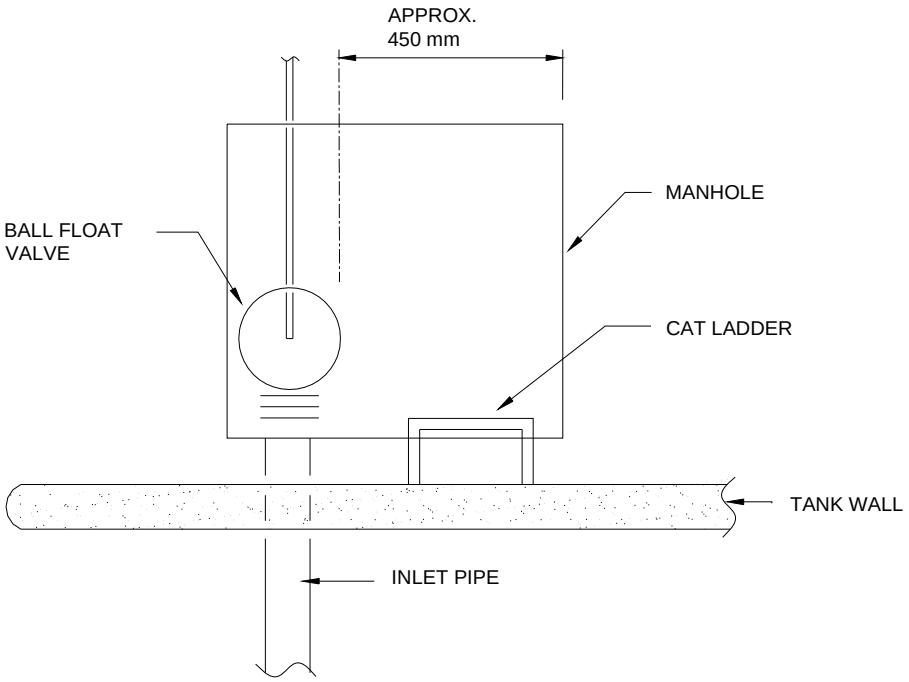


Figure 1

		REFERENCE	CAT.
	Drains for Water Leaked from Pump Seals in Pump Rooms		
15.	The water leaked from pump seals shall be properly connected and led to a drain point such as an open gully at **outside** of any pump room.		A
	WATER SERVICES INSTALLATION (By Main Contractor)		
16.	The scope of water services design by **Building Services Section** includes all pipework, valves and associated equipment up to and before the following points, including special connection details, where necessary :		A
	a. for potable water system		
	i. water tap for washing machine,		
	ii. mixer valve for kitchen sink, bathtub, shower cubicle and washing basin;		
	b. for floor washing system		
	i. water tap for floor washing;		
	c. for flushing water system		
	i. flushing cistern for water closet;		
	d. for fire services water system		
	i. FS roof water tanks.		
17.	The following design criteria and practices shall be followed:		M
	a. The working pressure at cold water taps is in the range of 0.5 – 5 bar.		
	b. The working pressure at flush cisterns is in the range of 0.2 – 5 bar. But in order to allow more margin for pressure fluctuation, a higher minimum working pressure of 0.7 bar instead of 0.2 bar should be designed for those domestic flats of which pressure reduction valves are installed in the system and/or when the downfeed pipes are in the form of U-configuration via G/F resulting in extra pressure loss due to mud/grit accumulation. For the latter, blow-off points should also be provided at the lowest points to allow purging of mud and grits periodically.		
	c. The minimum water pressure at the cold water inlet of towngas water heater is 1.7 bar in domestic block and domestic elements in non-domestic block. The following maximum pressure loss figures should be used as a reference in design of water supply system and calculation of available pressure before water	DCMBI No. D14/99	

		REFERENCE	CAT.
	heater. Where necessary, booster pump system shall be provided. i. Bath/shower mixer at 7 l/min. water flow rate – 0.25 bar ii. Shower hose and shower head at 7 l/min. water flow rate – 0.75 bar iii. Other pressure losses (static loss between height of shower head above heater cold water inlet (water heater installed at approx. 1200mm above floor) and pressure loss in water pipes and fittings, and at towngas water heater) – 0.7 bar		
d.	Adequate pressure margin shall be allowed in the system design to absorb the operating accuracy tolerances of PRV, typically in the range of +15% to –5% of the normal reduction ratio (for example, from 2:0.87 to 2:1.05 for 2:1 PRV). PRV shall be sized according to manufacturer's recommendations, for providing stable performance in particular. Generally the proper size may be smaller than the connecting pipework sized e.g. for flow rate less than 10 l/s, PRV may be sized at one commercial size smaller than that of the connecting water pipe.		A
18.	Pipework material shall be selected in accordance with the table in Annex 3.		
19.	Communal water pipes should not pass through domestic flats.		M
20.	Adequate clear space (at least 200mm around) should be reserved for installation of acoustic enclosure for PRV sets not located inside pipe duct room at typical floors.		A
21.	Provide vertical supports at the bottom of water pipe risers.		A
Equipotential Bonding for Connection of Pipes and Fittings of Dissimilar Metals Using Dielectric Fittings or Epoxy-coated Flanges			
22.	Equipotential bonding is to be provided by the Electrical Sub-contractor at connections of pipes and fittings of dissimilar metals such as copper to ductile/cast iron using dielectric fittings or epoxy-coated flanges to ensure the electrical continuity of the piping installations.		A
FRESH WATER BOOSTER PUMP INSTALLATION			
23.	Provide booster pump installation for fresh water system where necessary to provide sufficient available pressures stated in para. 16 above.		A
IRRIGATION SYSTEMS FOR PLANTING AREAS			

		REFERENCE	CAT.
24.	Installation of irrigation systems is to be limited to planting areas of restricted access. For planting areas in excess of 1500 m^2, water supply to irrigation pipes may be by using automatically controlled gravity feed system or manually/automatically controlled water pumps. Its adoption is dependent on the agreement with Estate Management Division.		A
25.	When pumps and/or automatically controlled irrigation systems are required to control the water supply, they are to be contained within a pump room. All electrical control apparatus, including any required automatic timers, are to be housed within the pump room. Outlet flanges from the pumped water supply are to be provided from the pump house to connect to the irrigation supply pipes serving one or more irrigation zones. For automatic systems the water supply from each zone's outlet flange is to be controlled by a solenoid or motorized valve located within the pump room. The design and specification of the pumping system and the associated electrical work are in accordance with the information detailed below. The installation is to be included in the Fire Services and Water Pump Sub-contract.		A
26.	Agree with PA on a suitable location for any pump house that may be required.		A
27.	Design all the work within the pump house, including duty and standby pumps, solenoid or motorized valves, and control panel. The individual irrigation zones are to be controlled by electric operated solenoid or motorized valves. These are to be located within the pump house with individual water supply pipes to each zone. The installations which are carried out by the Sub-contractor are confined to within the pump house. Installation of the irrigation system outside the pump room is carried out by a Specialist Nominated Sub-contractor under the supervision of PLA/PA. The Specialist Nominated Sub-contractor is required to provide to the PBSE the following information: a. the quantity of water required for the irrigation system, i.e. the design flow rate of the pump; b. the water pressure head required at pump discharge point for the irrigation system.		A

WATER FEATURE INSTALLATION

28.	Refer to Common Guide – Estate Facilities (External Works) as the standard in preparing preliminary design. To reduce maintenance cost, water features shall be designed not to support aquatic life. The requirements of water jets and underwater lights are determined by PA.	DCG-E-EW	A

REFERENCE **CAT.**

Design Consideration

29. Use the following design guidelines in selection of water treatment and water quality control methods in the design of all water features: A

a. Well-designed Water Circulation/Current:

Pool configuration, location of pump suction and discharge points are to be carefully designed to achieve good water circulation and to avoid stagnant spot(s) inside the pool which may lead to anaerobic decay of organic matters. Proper water flow direction helps carry floating objects and scums to concentrated location(s) along pool perimeter for easy removal. Prolonged stoppage of the circulation pump is often a fundamental cause of bad water quality;

b. Provision of Mesh Screen:

i. Pump suction is to be protected from entry of objects, fishes etc. by properly designed pump suction well and provision of mesh screen. Position of screen should be near to pool perimeter or other accessible location to facilitate removal of collected objects;
ii. A lever disconnect type basket strainer is to be provided before the pump suction.

c. Provision of Sand Filter:

Sand filter(s) is to be provided to remove suspended particles, organic matters and algae in water.

d. Provision of Cyclon Separator:

In addition to filters in large pools greater than 40 m^3 and for ponds where grits are likely to be present, cyclon separator is to be provided. It is a cost effective means to remove substances heavier than water such as grits that are carried into the pump system.

e. Provision of Vacuum Cleaning Fittings:

Vacuum cleaning fittings are to be provided on pool perimeter for connection of hose for vacuum cleaning of debris or sludges settled on pool bottom. Every part of the pool should be capable of being reached with a 15 m long hose. The vacuum can be produced by the suction of the water circulation pump. A set of 15 m long hose and vacuum brush is to be provided.

REFERENCE **CAT.**

f. Provision of Sufficient Aeration:

Sufficient aeration is to be provided, through the use of bubbler jets, foaming jets and cascades etc. so as to entrap sufficient oxygen in the water for aerobic decomposition of organic matters present in water.

g. Chemical Dosing:

Periodic chemical dosing such as algaecide, hypochlorite solution or tablets is to be arranged by the sub-contractor during the Maintenance Period in accordance with supplier's recommendation so as to inhibit growth of algae and anaerobic decay of organic matters.

30. The following design practices are to be followed: A

a. Piping Material:

i. inside pump pit/room:

- copper;
- cast iron;
- cement lined ductile iron;

ii. underground:

- copper (not exceeding 80 mm dia.);
- cast iron (not exceeding 80 mm dia.);
- cement lined ductile iron (exceeding 80 mm dia.);

iii. underwater:

- copper;

b. Pump Speed:

i. Unless situation warrants otherwise, 50 r/s pumps are to be used and no standby pump is required.

c. Filtration Rate of Sand Filter:

i. Filtration rate for sand filters is 2 to 6 turnovers per day.

d. Cable:

i. Where cables are submerged in water, submersible cables shall be used.

		REFERENCE	CAT.
PUMP ROOM NOISE CONTROL			
31.	Water sump tank and slab for pump installation inside pump room are to be fully isolated and supported with rubber bearing strips.	DCMBI No. P04/01	A
32.	The separation gap between the isolated slab for pump installation and abutting structure shall not be bridged by surface channel.	DCMBI No. P04/01	A
33.	High density corkboard is to be provided between water sump tank and abutting walls to enhance the vibration isolation effect.	DCMBI No. P04/01	A
34.	Modulating float valve is to be provided at the inlet of water sump tank to maintain a relatively stable water level. Anti-turbulence pipe is to be provided inside water sump tank.	DCMBI No. P04/01	A
35.	Pressure reducing valves (PRV) are to be provided at the water supply main pipes to prevent excessive water flow rate into the sump tank due to high water supply pressure. Two stages of pressure reducing valves should be used for pressure reduction in the event of excessively high incoming fresh water supply pressure to avoid likely valve cavitation, thus reducing the vibration and noise generated. Refer to **Annex 1** for guidelines on the selection of pressure reducing valve and modulating float valve and **Annex 2** for their selection examples.	DCMBI No. P04/01 & CDMBI No. P11/03	A
36.	Vibration isolators are to be provided for pipe supports in pump rooms. Vibration isolators are to be provided by the main contractor for supports of outgoing water supply pipework outside pump rooms at ground floor and those of upfeed pipe risers at first to third floors. A flexible connector is to be provided at fourth floor for each of the upfeed pipe risers before changing to rigid pipe supports.	DCMBI No. P04/01	A
37.	Pipework flexible connectors are to be provided before and after the pressure reducing valves and at the interfaces between pipework installed by the Sub-contractor and that by the Main Contractor to isolate the connecting pipework from the vibration and noise sources.	DCMBI No. P04/01	A
38.	Where long horizontal pipe run on roof is required before entering roof tank, provision of tee-off at roof horizontal pipe run immediately after the bend connecting to the upfeed riser is recommended to allow for installation of arrester for water hammer when needed.	DCMBI No. P04/01	A
FLUSH WATER SUPPLY			
39.	Design the routing of uPVC flush water pipe at canopy close to façade edge or by covering fence to avoid damages to pipe by falling objects. And to have pipes supported with pipe brackets on concrete block to facilitate pipe replacement.	FB No. TF110111	A

		REFERENCE	CAT.
40.	Design flush water pipe routing inside pump room far away from electrical equipment, motor and pump to avoid damages to electrical equipment inside pump room due to pipe bursting,	FB No. TF110111	A
41.	To ensure proper pressure rating of pipework (e.g. class E) & fitting (e.g. PN16) being specified to pipework against high system pressure.	FB No. TF110111	A
42.	Allow sufficient provision for checking and replacement of pressure gauge for PRV set e.g. isolating cock	FB No. TF110111	A
43.	Allow sufficient pipe brackets at turning point of uPVC pipe to avoid bursting of pipe, and to change the portion of pipes supporting PRV to ductile iron material.	FB No. TF110111	A
44.	To paint uPVC pipe on roof and canopy with white acrylic paint to minimize ageing due to prolonged exposure to direct sunlight.	FB No. TF110111	A
45.	To change uPVC to ductile iron pipe in areas susceptible to damage and in case where bursting of uPVC pipe shall lead to damage to electrical equipment.		A
46.	Provision of Automatic Self-cleaning Strainer a. To provide automatic self-cleaning strainer in flush salt water supply system for domestic buildings in public housing estates; b. To install automatic self-cleaning strainer at low level to facilitate routine maintenance works, and allow sufficient clearance for pulling out its filtering screen for maintenance; c. To reserve a vacant floor space of 2.0m x 1.5m near flush water pumps as far as possible in projects where the flush water supply from WSD is fresh water so that future provision of automatic self-cleaning strainer can be made when the supply is changed from fresh water to salt water by WSD. d. Wash-out pipes of automatic self-cleaning strainers should be diverted to properly design external gullies.	DCMBI No. D03/09	M
47.	Provision of PRV Fault Indication Panel To provide a PRV fault indication panel at guard counter with pressure switches at outlet of each PRV set for flush water down-feeding system.	Technical Feedback TF112018	M

		REFERENCE	CAT.
PROVISION OF RAINWATER PUMPING SYSTEM FOR UNDERGROUND CARPARK			
48.	Suitable provisions shall be made to avoid rainwater from flooding underground carpark as far as practicable. For carpark with driveway leading directly from open air to underground (basement) floor, PBSE shall advise Project Architect to provide a weather cover above the entrance driving ramp together with suitably sized drainage channels across the top and bottom of the ramp.	DDRP Meetings from Jan 2005 to June 2009	A
49.	Rainwater pumping system is required if rainwater collected cannot be discharged directly to the public sewer through gravity. The pumping capacity of the system shall be able to cater for the peak rainwater run-off which can be derived from the maximum rainfall intensity and the rainwater catchment area leading to the entrance driving ramp as advised by the Project Civil Engineer. The rainwater pumps shall be provided in duplicate with 100% standby capacity. A sump tank of suitable storage capacity shall be provided to avoid frequent pump start under mild raining situation. The power supply to the rainwater pumps shall be from the essential source.		
50.	For half-sunken carpark with openings other than the entrance ramp communicating with the open air, the possibility of rain penetration through such openings shall be taken into account in estimating the pumping capacity required.		A

Annex 1

Guidelines on Selection of Pressure Reducing Valve (PRV) and Modulating Float Valve for Incoming Water Supply System

1. Request WSD to confirm the minimum water supply pressure and to provide information on the names and top water levels of the service reservoirs from which water supplies are given to the project.

2. Determine the nominal sump tank infill rate (upfeed pump flow rate) and the direct feed system flow rate.

3. Determine the minimum sump tank infill rate (to be taken as equal to the night duty upfeed pump flow rate or upfeed pump flow rate if the former is not provided).

4. Refer to **Figure 2**. Select a suitable size of modulating float valve so that the nominal and minimum sump tank infill rates lie within its normal operating range. Size of valve can be smaller than that of the connecting pipework. **Do not oversize the modulating float valve**.

5. Find out the pressure requirements at the upstream side of the modulating float valve to maintain the nominal/minimum flow rates, and the pressure losses across the pipework and fittings at the downstream side of the 2nd stage PRV at the nominal/minimum flow rates.

6. Work out the downstream pressure of the 2nd stage PRV to be set so that the modulating float valve can maintain the nominal/minimum flow rates without having to modulate outside its normal operating range to the near-close position to avoid generation of excessive noise.

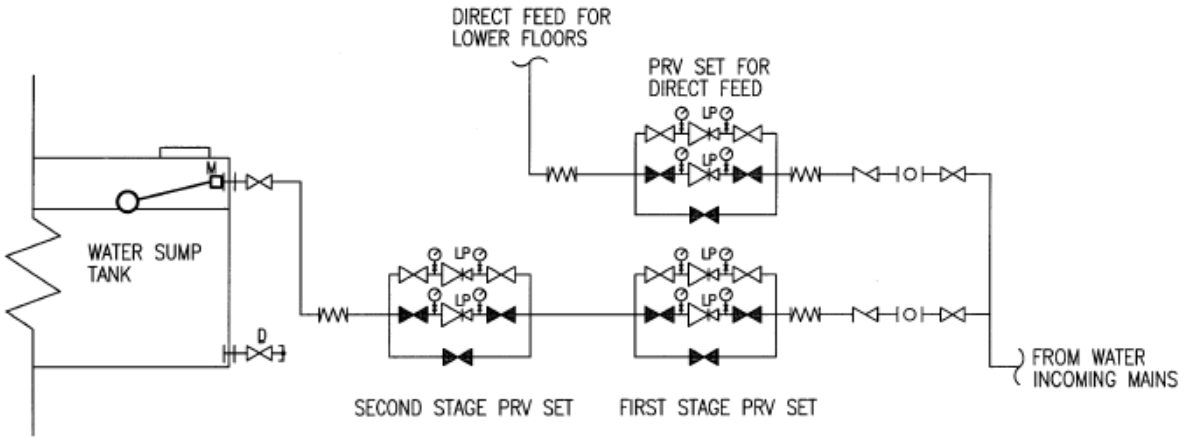


Figure 2

7. Basing on the top water level of the service reservoir from which water supply is given to the project and the PD level of the project site, work out the maximum water supply pressure at the site boundary.

8. Work out the maximum available upstream pressure at the 1st stage PRV taking into account the pressure loss across the pipework and fittings between site boundary and the 1st stage PRV under the nominal and minimum flow conditions.

9. Select a suitable size of 1st stage PRV and select the downstream set pressure at the 1st stage PRV in between the upstream pressure at the 1st stage PRV and the downstream pressure at the 2nd stage PRV, so that the nominal and minimum flow rates (sump tank infill rates) lie within the normal operating range of the PRV under the maximum available pressure differential. Size of PRV can be smaller than that of the connecting pipework. **Do not oversize the PRV**.

10. Check against PRV manufacturer's technical data to see whether cavitation occurs at the 1st stage PRV under the maximum available pressure differential. If cavitation does occur, change to a higher downstream set pressure to reduce the pressure differential so that cavitation no longer occurs.

11. Work out the available upstream pressure at the 2nd stage PRV by taking into account the pressure losses across the pipework and fittings between the 1st and 2nd stage PRVs under the nominal and minimum flow conditions.

12. Select a suitable size of 2nd stage PRV so that the nominal and minimum flow rates lie within the normal operating range of the PRV under the available pressure differential. Size of PRV can be smaller than that of the connecting pipework. **Do not oversize the PRV**.

13. Check against PRV manufacturer's technical data to see whether cavitation occurs at the 2nd stage PRV under the available pressure differential. If cavitation does occur, change to a higher downstream set pressure to reduce the pressure differential so that cavitation no longer occurs.

14. Check again that the modulating float valve can maintain the nominal/minimum flow rates without having to modulate outside its normal operating range to the near-close position under the higher upstream pressure due to the higher downstream set pressure of the 2nd stage PRV.

15. Check against modulating float valve manufacturer's technical data to see whether cavitation occurs under the higher upstream pressure. If cavitation does occur, change to a lower downstream set pressure at the 2nd stage PRV so that cavitation no longer occurs at the modulating float valve.

16. Change the downstream set pressure of the 1st stage PRV if necessary to avoid cavitation at the 2nd stage PRV

17. Repeat the PRV sizing, cavitation checking and downstream pressure setting process from step 9 to step 16 to fine-tune the water pressures.

18. For the direct feed system, work out the minimum required and maximum allowable supply pressures for direct feed downstream of the PRV. Select a suitable size of PRV and a suitable downstream set pressure so that the direct feed system flow rate lies within the normal operating range of the PRV and the PRV can operate at a reasonably low minimum flow rate under the available pressure differential. Size of PRV can be smaller than that of the connecting pipework. **Do not oversize the PRV**. Check against PRV manufacturer's

technical data to see whether cavitation occurs at the PRV under the available pressure differential. If cavitation does occur, change to a higher downstream set pressure to reduce the pressure differential so that cavitation no longer occurs. Re-select size of PRV if necessary.

Notes: a. The same procedures apply to the fresh and flush water supply systems except that there is no direct feed for the latter.

b. If the estimated incoming water supply pressure at the upstream side of the 1st stage PRV is lower than the minimum pressure required to operate it at the downstream set pressure, there is no need to provide the 1st stage PRV.

c. If the estimated incoming water supply pressure at the upstream side of the 2nd stage PRV is also lower than the minimum pressure required to operate it at the downstream set pressure, there is no need to provide the 2nd stage PRV.

d. Potential gain or loss should also be included in the calculation of pressure loss across pipework and fittings.

e. All standby PRVs shall be shut off when not in use.

f. Response of the PRVs shall be set at “slow” to avoid valve hunting due to fluctuating upstream pressure.

g. Response of the modulating ball float valve shall be set at “slow” to avoid causing water hammer when shut off.

Annex 2

PRV & Modulating Float Valve Selection Examples

Standard NH1 (with NAX5) Block

This selection example is based on the pressure/flow characteristics of a particular make of PRV and modulating float valve and is to be read in conjunction with the "Guideline on the Selection of Pressure Reducing Valve (PRV) and Modulating Float Valve for Incoming Water Supply System". As the pressure/flow characteristics of individual makes of valves would be different from one another, **PRV and modulating float valve shall be selected basing on the particular characteristics of the valves used**.

1. Pump Capacity
   - a. Fresh Water Direct Feed Flowrate = 3 l/s (up to 4/F)
   - b. Fresh Water Duty Pump Flowrate = 35 l/s (for 5/F & above)
   - c. Fresh Water Night Duty Pump Flowrate = 10 l/s

2. Pressure & Setting
   The following pressures and settings P1 to P6 would vary with site specific factors, such as incoming mains pressure, pressure reduction setting of PRV sets, flow demand, characteristics of PRV and modulating float valve used, and also pressure losses of pipework & fittings, etc.

P1:	Incoming mains pressure, 8 to 10 bar for majority of projects, sometimes exceeding 10 bar for new towns, e.g. TKO, however, 3 bar is the common reply from WSD.
P2:	Upstream pressure at 1st stage PRV.
P3:	Downstream pressure at 1st stage PRV, optimum setting at 5 bar.
P4:	Upstream pressure at 2nd stage PRV, 4.8 bar.
P5:	Downstream pressure at 2nd stage PRV, optimum setting at 1.5 to 2 bar.
P6:	Upstream pressure at modulating type ball float valve at sump tank, min. 0.6 bar to maintain flowrate, max. 2.2 bar to avoid cavitation.

3. Modulating Float Valve
   Ø100 mm modulating float valve (for 10–35 l/s at 0.6–2.2 bar pressure drop) is selected.

4. First Stage PRV Set

Upstream pressure P2 (bar)	Downstream set pressure P3 (bar)	Cavitation	Ø100 mm PRV (for 10–35 l/s)	
			Max. flowrate (l/s)	Min. flowrate (l/s)
10	5	no	49.2	10
8				7.6
6			44.8	4.4

5. Second Stage PRV Set

Upstream pressure P4 (bar)	Downstream set pressure P5 (bar)	Cavitation	Ø100 mm PRV (for 10–35 l/s)	
			Max. flowrate (l/s)	Min. flowrate (l/s)
4.8	2	no	49.2	7.3
	1.5			8.1
	1			8.6
	0.8	yes		9

6. PRV Set for Direct Feed

Upstream pressure (bar)	Downstream set pressure (bar)	Cavitation	Ø40 mm PRV (for 3 l/s)	
			Max. flowrate (l/s)	Min. flowrate (l/s)
10	6 *	no	6.1	1.1
9				1
8				0.8
7			5.5	0.5

* The minimum required and maximum allowable supply pressures for direct feed up to 4/F for NH1 Block are 3.6 bar and 6.9 bar respectively.

Annex 3
Selection of Pipework Material

Application				**Pipe Diameter** Note 1**, Ø (in mm)**	**Pipe Material** Note 2
Fresh cold water supply		Below ground installation		35≤Ø≤76.1	Copper (Grade R290)
				Ø>76.1	Ductile iron (Ø 100 or above)
		Above ground installation	Up-feed to and down-feed from storage tank; and mains pressure direct up-feed pipe; and distribution pipeworks up to the isolation valve inside domestic flats	Ø≤76.1	Bare Copper
				Ø>76.1	Ductile iron (Ø 100 or above)
			Pipeworks at re-entrant areas outside domestic flats		Bare Copper
			Pipeworks after the isolation valve inside domestic flats		Copper with factory applied polyethylene sheath
Fresh hot water supply				Ø≤76.1	Copper with factory applied castellated polyethylene sheath
Irrigation water supply	**From fresh water supply**	Below ground installation		35≤Ø≤76.1	Copper (Grade R290)
				Ø>76.1	Ductile iron (Ø 100 or above)
		Above ground installation		Ø≤76.1	Bare Copper
				Ø>76.1	Ductile iron (Ø 100 or above)
	From rainwater harvesting system	Below ground installation		35≤Ø≤76.1	Copper (Grade R290)
				Ø>76.1	Ductile iron (Ø 100 or above)
		Above ground installation	Distribution pipe from rainwater collection tank to inlet of 2-way valve	Ø≤76.1	Unplasticized PVC
				Ø>76.1	Ductile iron (Ø 100 or above)
			Distribution pipe from fresh water break tank to inlet of 2-way valve and distribution pipe from outlet of 2-way valve to irrigation point	Ø≤76.1	Unplasticized PVC
				Ø>76.1	Ductile iron (Ø 100 or above)

Application			**Pipe Diameter** Note 1**, Ø (in mm)**	**Pipe Material** Note 2
Flush water supply	Below ground installation			Ductile iron
	Above ground installation	Up-feed risers between up-feed pump, transfer tank and roof tank; Distribution pipe which is highly susceptible to vandalism (e.g. those at canopy) or for down feed pipe which is susceptible to water hammer (e.g. before break tank) or in case where bursting of uPVC pipe shall lead to substantial damage to electrical equipment.		Ductile iron
		Others	Ø≤150	Unplasticized PVC
			Ø>150	Ductile iron
Fire services water supply	Below ground Installation		Ø≤150	Galvanized steel (heavy grade) or Ductile iron
			Ø>150	Ductile iron
	Above ground Installation		Ø≤150	Galvanized steel (medium grade)
			Ø>150	Ductile iron
Overflow and warning pipe at all water tanks				Unplasticized PVC

Notes:
1. Pipe diameter estimated basing on copper pipe.
2. Ductile iron pipe shall not be installed downstream of copper pipe.

Appendix F

Technical Guide to
Public Housing Developments
DCG-D-502

		REFERENCE	CAT.
(Applicable to both PRH and HOS unless otherwise specified)			
1.	**WATER SERVICES INSTALLATION**		
a.	Project BSE shall consult WSD on the incoming water pressure for determination of the number of floors to be served by direct supply.		A
b.	All the fresh and flush water tanks shall be of twin tanks construction and sized according to the technical guide DBSG-305.	DBSG-305	A
c.	The fresh and flush water pump risers shall be sized according to the technical guide DBSG-305.	DBSG-305	A
d.	The range of residual working pressure for cold water taps and flush cistern shall be designed according to the technical guide DBSG-305. Booster fresh water pumps and tanks shall be added for topmost floors where necessary.	DBSG-305	A
e.	All fresh and flush water pipeworks shall not be concealed in structure.		M
f.	Water pipework at corridor shall be neatly aligned. Communal fresh and flush water pipework shall not pass through domestic flats. Copper pipes for cold water supply inside domestic flats shall be completed with factory applied plain polyethylene sheath. Copper pipes for cold water supply at external areas and common areas, including corridors, lobbies and plant rooms, shall be bare and without paint finishes. Copper pipes for hot water supply inside and outside domestic flats shall be completed with factory applied castellated polyethylene sheath.	Technical Feedback No. TF112175	M
g.	Label should be provided and fixed to isolation valve(s) for each upfeed / downfeed branch of flush water pipe risers to show the room number and floor number served.		A
h.	Where practicable, break tank in lieu of pressure reducing valves sets are more preferable at immediate floors for fresh and flush water supply system to limit the water pressure to the operating range.		A
i.	All water pipework shall not compromise fire separation and fire resistance.		M
j.	Water meters for the domestic flats shall be housed in water meter cupboards or water meter room on each floor.		A

		REFERENCE	CAT.
k.	Water supply for floor washing system shall be drawn from separate water outlet from the fresh water main roof tank with separate water meter.		A
l.	Multiple sets (with standby) of fresh water and flush water pumping system shall be provided. When necessary, night duty fresh water pumping system should be provided. For details, refer the technical guide DBSG-305.	DBSG-305	A
m.	Noise control measures shall be provided for pump rooms. Water sump tank and slab for pump installation inside pump room are to be fully isolated and supported with rubber bearing strips. The separation gap between the isolated slab for pump installation and abutting structure shall not be bridged by surface channel. High density corkboard should be provided between water pump tank and abutting walls to enhance the vibration isolation effect. For details of other noise control measures, refer technical guide DBSG-305.	DBSG-305	A
n.	Sufficient space in the pump rooms should be allowed for the pipe-runs and the pump sets in case that precast water tanks are to be used.		A
o	The water pipework from and to water tanks shall be so arranged that they shall run outside the MOE areas or above the main roof level as far as practicable to minimize the installation of FRP enclosure at refuge roof.		A
2.	**RAINWATER HARVESTING SYSTEM (RWHS) (For PRH only)**		
a.	Please refer to DCG-E-CF for information.	Technical Feedback No. TF113953 and DCG-E-CF-116	M

Appendix G

Technical Guide to
Public Housing Developments
DCG-D-607

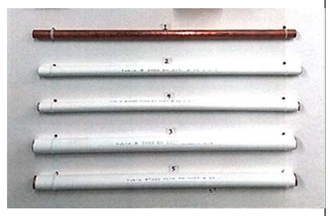
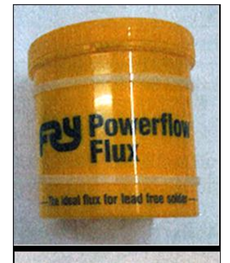
	REFERENCE	CAT.
(Applicable to both PRH and HOS unless otherwise specified)		
1. WATER METER ACCOMMODATION		
A hygienic environment shall be maintained inside meter rooms/boxes/meter cupboards to facilitate meter reading and maintenance of the water meters. Project team shall follow the detailed requirements in WSDCL No. 4/2003 for the provision of meter rooms/boxes.		M
Design Guidelines		A
Water meters are recommended to be housed in meter box with adequate drainage facilitates and sufficient space/access for inspection and maintenance.		
2. WATER TANK		
(a) Water tank shall be provided with lockable double-sealed cover and raised neck to prevent ingress of surface water and external contaminants.		M
(b) Self-closing non-return flap shall be provided for overflow pipe of water tank to eliminate external contaminants.		M
(c) Adequate drainage facilities and space/access for cleaning shall be allowed in water tank to facilitate cleaning, inspection and maintenance.		M
(d) The running of both drainage pipes above water tanks and flushing water pipes above potable water tanks shall be avoided.		M
3. WATER PIPEWORK		
(a) Fresh water mains of inside service shall be cleaned and sterilized before putting into operation. (Ref. : WSDCL No. 6/2002)		M
(b) To facilitate maintenance and reduce the risk of water flooding inside domestic flats due to bursting of pipework, public water pipe passing through domestic flats should be avoided.		M
To facilitate the need for repair and replacement of water pipe during the design life of the building, the routing of pipework should be designed off structural elements. (Ref.: PNAP 230)		M

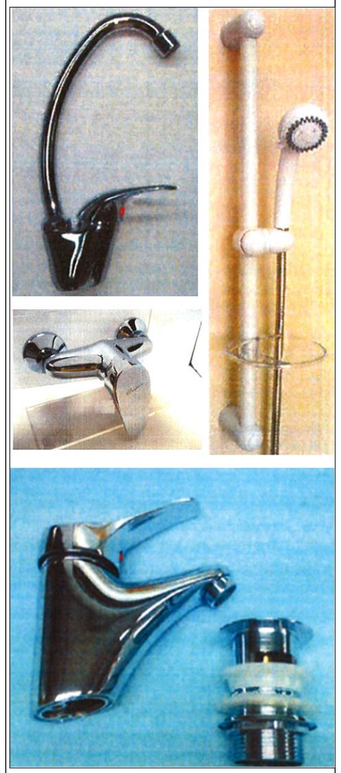
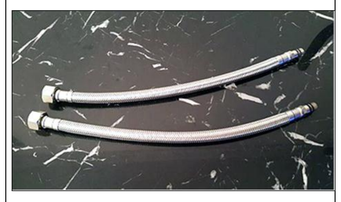
		REFERENCE	CAT.
Design Guidelines			
(a)	Prior to the commencement of the design, project teams should check with WSD the water pressure at the supply main.		A
(b)	Proper pipework materials capable of withstanding corrosion and water pressure should be specified. Adequate pressure controlling facilities such as break tanks or PRVs should be provided to limit the working pressure to avoid bursting of the pipework.		A
(c)	Should break water tank be used for regulating the water pressure, an adequate size of floor drain should be provided inside all break tank rooms to avoid overflow of fresh/flushing water from the break tank flooding into corridor and domestic flats.		A
(d)	Should PRVs be used to regulating the water pressure, the contingencies of having an extra PRV as spare should be allowed. The use of adjustable PRVs should be avoided.		A
(e)	All control valves and PRVs should be installed at locations where are not accessible by the general public. Adequate space should be allowed to facilitate repair and maintenance.		A
(f)	Dead-ends, stagnant corners and spurs in water pipework should be avoided as far as possible.		A
(g)	The entire plumbing system should be flushed clean upon testing and commissioning before putting into operation.		M
(h)	To improve the reliability of clean water supply and reduce the risk of water leakage, the water pipe at canopy should be routed as close to building facade edge as practicable in order to minimize the chance of damage of pipework due to falling objects.		A

		REFERENCE	CAT.
	(i) For uPVC lined G.I. pipe, the manufacturer's recommendations on the cutting, threading, chamfering and jointing of the piping system should be strictly followed to avoid G.I. surface being in contact with water leading to contamination of potable water.		A
4. FLUSHING DEVICE			
	Design Guidelines		
	(a) Every flushing cistern shall have an overflow terminating in a conspicuous position. An appropriate ball valve shall be used for the inlet of flushing cistern. The valve seal of the flushing device shall be easily replaceable. The components of valve type flushing device shall be resistant to salt water corrosion.		A
	(b) Flushing valve may be used in public toilets. To prevent the flushing valve from being blocked by the impurities in seawater, a filter or built-in strainer shall be installed before its inlet. Also, the valve components shall be resistant to salt water corrosion. (Ref. : WSDCL No. 4/2000, 1/2002 & 6/2003)		A
5. PREVENTIVE MEASURES FOR WATER CONDENSATION			
	Design Guidelines PBSE should be aware of condensation problem on the surface of metallic water pipework, appropriate preventive measures in accordance with the standard specification should be followed to mitigate it.		A
6. NOISE MITIGATION			
	Design Guidelines		
	a) To reduce the possible noise nuisance generated from pump room, the pump room should be located remote from and structurally isolated from the noise sensitivity receiver as far as possible. If any noise nuisance is perceived, pump room noise control measures stipulated in DCMBI No. P04/01 should be adopted.	DCMBI No. P04/01 & DBSG-305	A

		REFERENCE	CAT.
b)	To reduce water hammer problem, long horizontal run of up-feed pipe from water pump should be avoided in particular at low-pressure zone. If unavoidable, soft starter or water hammer arrestor is to be provided.		A
c)	To prevent excessive noise generated from water pipework, the water flow velocity should be limited to not exceeding 1.5 m/s. For water rising main and pipework inside pipe duct or plant room, the water flow velocity should be not exceeding 2.5 m/s.		A
d)	Noise generated from break tanks and PRVs should be properly addressed. The following practices are recommended –		A
·	The dimensions of break tank should be determined such that excessive turbulence of water inside the break tank will not be created during infill of water.		
·	Modulating float valve should be used for break tank.		
·	Anti-turbulence pipe should be provided for break tank.		
·	Adequate support should be provided for the modulating float valve and the pipe connecting to fiberglass break tank.		
·	PRVs should be installed inside designated room or enclosed by acoustic enclosure if noise nuisance to tenants is anticipated.		

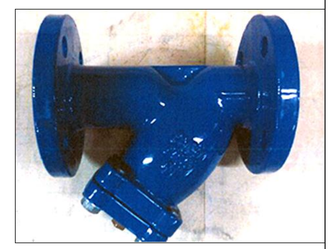
Specifications for Plumbing Materials in Housing Authority's Public Housing Developments

Item	Material Description	Current WSD Reqirements		Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
		WSD Approval Required (Y/N)	Standards (BS / BS EN)			
1	Copper Pipe	Y (Cat. C)	BS EN 1057	SL clause no. PLU1.M120 - Comply with BS EN 1057	Job Reference is attached in the **Sample Submission Form**. Quality Control Manager (QCM) / Architectural Quality Control Coordinator (AQCC) of the Contractor endorses the Material Information Sheets, Catalogue and Test Certificates to certify they are genuine documents and attach them in the **Sample Submission Form**; Housing Department (HD) site staff check and vet the attachment against Specification requirements and give recommendations in **DCMP-F716**, **F717** & **F718** to PA for approval; If approved, keep the sample board in site office for record; Upon delivery of the pipes/ fittings on site, HD site staff check its storage using standard form no. **DASM-F5003** if the materials, including copper pipes/ fittings, are stored at external area when necessary and appropriate; For installation works on site, HD site staff check its workmanship according to Architectural Site Inspection Guide, using standard form no. **DASM-F0001** At final inspection stage, HD site staff check the installed materials' logo/ labels/marking....etc. If in doubt, HD site staff will refer to the approved samples kept in site office or those installed in the Sample Flats/ Wings for confirmation; The Contractor conducts the Water Pressure Test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	
2	Copper Fittings	Y (Cat. C)	BS 864 (obsolete and replaced by BS EN 1254)	SL clause no. PLU1.M130 - Comply with BS EN 1254		
3	Lead Free Solder Wire and Flux	N	BS 864 (obsolete and replaced by BS EN 1254)	SL Clause: PLU1.M150 for brazing alloy - Comply with BS EN 1254-1, Table 6 Section VI - Use cadmium-free category brazing alloy to BS EN ISO 17672 - Do not use flux when brazing copper-to-copper jounts - For joints other than copper to copper, use only a flux that is recommended by the brazing alloy manufacturer SL clause no. PLU1.M160 for soldering alloy - Comply with BS EN 1254-1, Table 6 Sections II & III - Use of integral solder fittings is permitted provided they comply with BS EN 1254-1 - Use only lead-free category solders - Use only a non-corrosive type of flux that is recommended by the solder alloy manufacturer.	Job Reference is attached in the **Sample Submission Form**. QCM/AQCC of the Contractor endorses the Material Information Sheets, catalogue and the Test Certificates to certify they are genuine documents and attach them in the **Sample Submission Form**; HD site staff check and vet the attachments against Specification requirements and give recommendations in **DCMP-F716**, **F717** & **F718**, to Contractor manager's representative (CMR) for approval; If approved, keep the sample board in site office for record.	 

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
4	Sink & Basin Mixers, Shower Mixer with Flexible Hose and Handset	Y	General: **BS 5412: 1996** Temperature and Pressure Requirement: **BS 1415: Part 1: 1976** Performance Requirement: **BS 1415: Part 1: 1976** **BS 5412: 1996** **BS 5779: 1979** **BS 1010: Part 2: 1973**	**Mixers** (i) Standard- (SL clause: PLU2.M020(3)) ☐ BS 5412:1996; ☐ Material：chromium plated brass (ii) Submission Requirements- (SL clause: PLU2.M510(1)) ☐ - Sample, catalogue, details of the supplier and manufacturer ☐ - Approval by the Water Supplies Department ☐ - Flow rates calculation ☐- ISO 9001 and 14001 certifica ☐- Test (iii) Quality requirement : (SL clause: PLU2.M510(2)) ☐ - Design and construction requirements : Chromium plated brass ☐ - Pressure and temperature requirements : Suitability for both working and test pressure and temperature of the plumbing system in which it is installed ☐ - Water efficiency requirement : Grade 2 WELS with nominal flow rate not less than 6 litres/minute (basin and sink mixers) Grade 1 WELS with nominal flow rate not less than 7 litres/minute (Shower head) - Perfromance requirement : Flow rate; Water tightness tests; Pressure resistance tests Mechanical strength test; Endurance test of the operation mechanism; Endurance test of diverters (for bath mixer only); Endurance test of Swivel Nozzles (for sink mixer only); Pressure drop test (for bath mixer and shower mixer only); Blend Water Extreme Temperature; Flexible Hose Assembly with Stainless Steel Wire Braiding (since 2013); Mean spray spread angle (for shower handset only); Temperature drop (for shower handset only); Hot water resistance test (for shower handset only)	Job Reference is attached in the **Sample Submission Form**. QCM/AQCC of the Contractor endorse the Material Information Sheets, Catalogue and the Test Certificates to certify they are genuine documents and attache them together with Water Supplies Department (WSD) Approval Letter in the **Sample Submission Form;** HD Site staff check and vet the attachments against Specification requirements and give recommendations in **DCMP-F716**, **F717** & **F718** to CMR for approval; If approved, keep the sample board in site office for record; Upon delivery of the mixers on site, HD site staff conduct On-site Verification Check using standard form **DASM-F6210**. The Delivery Note, visual inspection on materials' surface quality and logo/ labels are conducted; HD site staff may use **DASM-F5003** for checking the storage of the materials including these mixers when necessary and appropriate, For installation works on site, HD site staff check its workmanship according to Architectural Site Inspection Guide, using standard form **DASM-F0001**; At final inspection stage, HD site staff check the installed materials' logo/ labels/marking....etc. If in doubt, HD site staff will refer the samples kept in site office or those installed in the Sample Flats/ Wings for confirmation. The Contractor conducts the water presuure test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	
5	Stainless Steel Braid Flexible Hose	Y	NA	PLU2.M510(2)(b)(i) & (2)(c)(i) (Mixers (Bath/Shower, Basin and Kitchen Sink) and Shower Handsets)	Job Reference is attached in the **Sample Submission Form**. QCM/AQCC of the Contractor endorses on the Material Information Sheets, Catalogue and the Test Certificates to certify they are genuine documents and attaches them together with WSD Approval Letter in the **Sample Submission Form**; HD site staff check and vet the attachments against Specification requirements and give recommendation in **DCMP-F716**, **F717** & **F718** to CMR for approval; If approved, keep the sample baord in site office for record;	

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
					Upon delivery of the mixers on site, site staff cconduct On-site Verification Check using standard form **DASM-F6210**. Its dimensions, visual inspection on its surface quality and logo/ labels are conducted; For installation works on site, HD site staff check its workmanship according to Architectural Site Inspection Guide, using standard form **DASM-F0001**; At final inspection stage, HD site staff check the installed material such as its logo/ labels/marking. If in doubt, HD site staff will refer the approved samples kept in site office or those installed in the Sample Flats/ Wings for confirmation; The Contractor conducts the water presuure test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	
6	CP Brass Bib Tap	Y (Cat. C)	BS 1010-2	SL Clause: PLU1.M680 - Comply with BS 1010-2	Job Reference is attached in the **Sample Submission Form** QCM/AQCC of the Contractor endorses on the Material Information Sheets, catalogue and the Test Certificates to certify they are genuine documents and attaches them together with WSD Approval Letter in the **Sample Submission Form**; HD site staff check and verifie the attachments and give recommendations in **DCMP-F716**, **F717** & **F718** to CMR for approval; HD site staff may use **DASM-F5003** for checking the storage of the materials including these valves & taps when necessary and appropriate; For installation works on site, HD site staff check its workmanship according to Architectural Site Inspection Guide, using standard form **DASM-F0001**; At final inspection stage, HD site staff check the materials installed, such as its logo/ labels/marking. If in doubt, site staff will refer the approved samples kept in site office or those installed in the Sample Flats/ Wings for confirmation; The Contractor conducts the Water Presuure Test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	
7	Loose Jumper Type Stop Cock	Y (Cat. C)	BS 5154 (obsolete and replcaed by BS EN 12288)	SL Clause: PLU1.M610 - Comply with BS EN 12288 where a) Body, bonnet and disc: bronze to BS EN 1982 b) Stem: high tensile brass to BS EN 12163		
8	Gunmatel Gate Valve	Y (Cat C.)	BS 5154 (obsolete and replcaed by BS EN 12288)			

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
9	Ductile Iron Resilient Seat Gate Valve	Y (Cat. C)	BS 5163 (obsolete and replaced by BS 5163-1, BS5163-2, BS EN 1074-1, BS EN 1074-2)	SL Clause: PLU1.M610 - Comply with BS 5163-1 SL Clause: PLU1.M620 - Components to comply with BS EN 1561 (for mechanical strength), BS EN 1563 (for mechanical strength), BS EN 1982, BSEN 12163 (same as requirement of gunmetal gate valve) or BS EN 10088-3 (for stainless steel construction) - Resilient non-metallic material to comply with BSEN 681-1	Job Referenc is attached in the **Sample Submission Form**. QCM/AQCC of the Contractor endorses on the Material Information Sheets, Catalogue and the Test Certificates to certify they are genuine documents and attaches them together with WSD Approval Letter in the **Sample Submission Form**; HD site staff check and verifie the attachments and give recommendations in **DCMP-F716**, **F717** & **F718** to CMR for approval; If approved, keep the sample baord in site office for record; HD site staff may use **DASM-F5003** for checking the storage of the materials including these valves when necessary and appropriate; For installation works on site, HD site staff will check its workmanship according to Architectural Site Inspection Guide, using standard form **DASM-F0001;** At final inspection stage, HD site staff check the installed materials' logo/ labels/marking. If in doubt, HD site staff will refer the approved samples kept in site office or those installed in the Sample Flats/ Wings for confirmation; The Contractor conducts the Water Presuure Test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	
10	Ductile Iron Pipe and Fitting	Y (Cat. C)	BS 4772 (obsolete and replaced by BS EN 545)	SL Clause: PLU1.M170) - Comply with BS EN 545		 
11	Flange Gasket	N	BSEN 681-1:1996 (Superseds BS 2494 : 1990, Type W (water)	WSP.M220 (Elastomeric Joint Rings)		
12	Gunmetal Puddle Flange	N	**Nil**	SL Clause: PLU1.M320 - Same as requirement for gunmetal gate valve		
13	Cast Iron Swing Check Valve with bronze trimmed for Fresh Water Installation	N	**Nil**	SL Clause: PLU1.M610 - Same as requirement of cast iron gate valve		

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
14	Gunmetal Pressure Reducing Valve	N	**Nil**	SL Clause: PLU1.M920 - Same as requirement of gunmetal gate valve		
15	Pressure Dial Gauge	N	**Nil**	Not Specified	Material Not Yet Submitted Site checking procedure same as that of items 9-14.	
16	Cast Iron Y Strainer	N	**Nil**	SL Clause: PLU1.M510 - Same as requirement of cast iron gate valve	Job Reference is attached in the Sample Submission Form Epoxy Coat approved by WRAS Site checking procedure same as that of items 9-14.	
17	Stainless Steel Flexible Connector	N	**Nil**	SL Clause PLU1.M220 - Material of bellow: austenitic chromium nickel or austenitic chromium nickel molybdenum stainless steel sheet to BS 1449-2 or BS EN 10029 or BS EN ISO 9445-2 or BS EN 10048 or BS EN 10051 or BS EN 10095 - Material of braiding: stainless steel wires or plates - Material of flange: corrosion resistant carbon steel	Job Referenc is attached in the **Sample Submission Form**. QCM/AQCC of the Contractor endorses on the Catalogue, Material Information & Test Certificates and attaches them together with WSD Approval Letter in the **Sample Submission Form**; Approval Letter in the Sample Submission Form, HD site staff checks and vet the attachments against Specification requriements and give recommendations in **DCMP-F716**, **F717** & **F718**, to CMR for approval; If approved, keep the sample board in site office for record; HD site staff may use **DASM-F5003** for checking the storage of the materials including this material when necessary; For installation works on site, HD site staff will check its workmanship according to Architectural Site Inspection Guide, using standard form **DASM-F0001**; At final inspection stage, HD site staff checks the installed materials' logo/ labels/marking. If in doubt, HD site staff will refer the approved samples kept in site office, The Contractor conducts the Water Presuure Test and cleansing/ disinfection to the water supply system and HD site staff witness the process.	

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
18	Fresh Water pump	N	**Nil**	SL clause no. FWP6.2.020 Casing - Grey cast iron to BS EN 1561 *(same as requirement of cast iron gate valve)* Impeller a. Bronze casting to BS EN 1982 *(same as requirement of gunmetal gate valve)* ; or b. Austenitic chromium nickel molybdenum stainless steel casting to BS 3100 grade 316. Diffuser (detachable) - Grey cast iron to BS EN 1561 *(same as requirement of cast iron gate valve)* Wearing ring a. Grey cast iron to BS EN 1561 *(same as requirement of cast iron gate valve)* ; or b. Copper-tin alloy to BS EN 1982 (same as requirement of gunmetal gate valve) Shaft - Stainless steel to BS EN 10088-3	Job Reference is generally attached in the submission. Upon delivery of the Fresh Water Pump on site, site staff conducts on-site checking according to Building Services Site Inspection Guide: DBSI-104. Site staff visually check the surface quality and general construction of the materials and nameplate/label/marking against the approved drawings and documents. Then record the delivered materials in site record book. During installation works on site, site staff checks its workmanship according to Building Services Site Inspection Guide: DBSI-207 (form DBSIP-F02-WP) and record the result in form DBSSF-F02-IR. At final inspection stage, site staff checks the installed materials, such as its logo/ labels/marking according to Building Services Site Inspection Guide: DBSI-208 &209 (form DBSFI-F03-WP for final acceptance & DBSWT-F04-WP for witness tests). The results of checking are recorded in form DBSCL-F05-WP. If there is any doubt, site staff will take the follow up action according to Building Services Site Inspection Guide: DBSI-104 &105, such as issuing Site Direction.	
19	Modulating float valve with ball cock	N	**Nil**	SL clause no. FWP4.8.020 Body & bonnet Cast iron to BS EN 1561 or ductile iron to BS EN 1563 *(same as requirements of cast iron or ductile iron gate valve)* . The body of the valve shall be coated with an epoxy based material both on internal and external surfaces; Disc Solid or trimmed with bronze to BS EN 1982 or ductile iron to BS EN 1563 for fresh water use *(same as requiremetns of gunmetal gate valve or ductile iron gate valve)* ; Seat Bronze or stainless steel trimmed as disc for fresh water use;	Site checking procedure same as fresh water pump (item 18)	

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
				Stem High tensile brass or leaded brass to BS EN 12163 *(same as requirement of gunmetal gate valve)* or 13% chromium stainless steel to BS EN 10088-3 for fresh water use; Ball float Spherical or cylindrical and comply with BS 1968 (for dimensional requirement); constructed of tinned copper or stainless steel		
20	Stainless steel pipe and fitting	Y (Cat. C)	BS 4127 (obsolete and replaced by BSEN 10312**)**	SL clause no. FWP3.1.2.050 item 1 - Comply with BSEN 10312 series 2	Job Reference is generally attached in the submission. Upon delivery of the Stainless steel pipe and fitting on site, site staff conducts on-site checking according to Building Services Site Inspection Guide: DBSI-104. Site staff visually check the surface quality of the materials and label/marking against the approved drawings, documents and samples. Then record the delivered materials in site record book. During installation works on site, site staff checks its workmanship according to Building Services Site Inspection Guide: DBSI-207, (form DBSIP-F02-WP) and record the result in form DBSSF-F02-IR. At final inspection stage, site staff checks the installed materials, such as its logo/ labels/marking according to Building Services Site Inspection Guide: DBSI-208 &209 (form DBSFI-F03-WP for final acceptance & DBSWT-F04-WP for witness tests). The results of checking are recorded in form DBSCL-F05-WP. If in doubt, site staff will take the follow up action according to Building Services Site Inspection Guide: DBSI-104 &105, such as issuing Site Direction.	
21	Ductile iron pipe and fitting	Y (Cat. C)	BS 4772 (obsolete and replaced by BS EN 545)	SL clause no. FWP3.1.2.010 - Comply with BS EN 545	Site checking procedure same as stainless steel pipe and fitting (item 20)	
22	Gate valve	Y (Cat. C)	BS 5154 (obsolete and replaced by BS EN 12288) for gunmetal gate valve	SL clause no. FWP4.1.020 - Comply with BS EN 12288	Site checking procedure same as fresh water pump (item 18)	
			BS 5163 (obsolete and replaced by BS 5163-1, BS5163-2, BS EN 1074-1, BS EN 1074-2) for cast iron and ductile iron gate valve	SL clause no. FWP4.1.020 - Comply with BS 5163-1 SL Clause no. FWP4.1.080 & 4.1.090 - Components to comply with BS EN 1561 (for mechanical strength), BS EN 1563 (for mechanical strength), BS EN 1982, BSEN 12163 (same as requirement of gunmetal gate valve) or BS EN 10088-3 (for stainless steel construction) - Resilient non-metallic material to comply with BSEN 681-1		

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
				SL clause no. FWP4.1.100 - Cast iron parts of all valves shall be coated with an epoxy based material both on internal and external surfaces. - Coating to BS 6920 and to the satisfaction of the Water Authority.		
23	Cast iron basket strainer	N	**Nil**	SL clause no. FWP3.1.5.030 - Same as requirement of cast iron gate valve	Site checking procedure same as fresh water pump (item 18)	
24	Stainless steel flexible connector	N	**Nil**	SL clause no. FWP3.1.4.030 - Material of bellow: austenitic chromium nickel or austenitic chromium nickel molybdenum stainless steel sheet to BS 1449-2 or BS EN 10029 or BS EN ISO 9445-2 or BS EN 10048 or BS EN 10051 or BS EN 10095 - Material of braiding: stainless steel wires or plates - Material of flange: corrosion resistant carbon steel	Site checking procedure same as fresh water pump (item 18)	
25	Pressure reducing valve	N	**Nil**	SL clause no. FWP4.6.030 - Same as requirement of cast iron gate valve	Site checking procedure same as fresh water pump (item 18)	
26	Pressure dial guage	N	**Nil**	SL clause no. FWP11.6.060 - Comply with BS EN 837-1	Site checking procedure same as stainless steel pipe and fitting (itme 20)	

Item	Material Description	WSD Approval Required (Y/N)	Standards (BS / BS EN)	Highlight of Current HD Specification Requirements	Site Checking Procedure	Photo
27	Pressure switch	N	**Nil**	SL clause no. FWP11.6.050 - with silver or Approved alloy plated contacts rated to suit the working voltage and current of the circuits controlled		
28	Non-return valve	Y (Cat. C)	**Nil**	SL clause no. FWP4.1.080 & FWP4.4.010 - Same as requirement of gunmetal, cast iron or ductile iron gate valve	Site checking procedure same as fresh water pump (item 18)	
29	Stainless steel pneumatic pressure vessel	N	**Nil**	SL clause no. FWP5.2.056 Construction to BS EN 13831 or equivalent international standards. Body, flange, bolts and nuts of AISI grade 304 stainless steel or better in corrosion resistivity.	Site checking procedure same as fresh water pump (item 18)	
30	Pressure transducer	N	**Nil**	SL clause no. FWP11.6.080 Enclosure and wetted parts Grade 316 stainless steel.	Site checking procedure same as fresh water pump (item 18)	

Annex 2
(Part 2)

Specification Requirements regarding Copper Pipe Joints for Fresh Water Supply System

		2004 Edition and 2008 Edition			2012 Edition and 2014 Edition	
1)	Storage tank downfeed	Size	Jointing method		Size	Jointing method
	(i) Maximum static pressure is less than or equal to 10 bar	Copper pipe, up to and including 159 mm	Up to and including 159 mm	"B" (Note 1)	Copper pipe, up to and including 76.1 mm (Note 4)	"B" or "S" (Note 1)
			Up to and including 108 mm	"B" or "S" (Note 1)		
	(ii) Maximum static pressure is more than 10 bar and less than or equal to 16 bar	Copper pipe, up to and including 76.1 mm	"B" or "S" (Note 1)			
2)	Meter assembly branch and pipework	Copper pipe, up to and including 54 mm	"B" or "S" (Note 2)		Copper pipe, up to and including 76.1 mm	"B" or "S"
3)	Meter outlet and consumer piping	Copper pipe, up to and including 32 mm	"B" or "S" (Note 3)		Copper pipe, up to and including 32 mm	"B" or "S" (Note 3)
4)	Consumer hot water piping	Copper pipe, 15 mm / 22 mm	"B" or "S" (Note 3)		Copper pipe, 15 mm / 22 mm	"B" or "S" (Note 3)

"B" = Brazed capillary joints
"S" = End feed / integral solder capillary joints

Notes
1) Flanged joint to be used for location where future disconnection is required
2) Compression or screw joint fittings for connection to valves
3) Compression or screw joint fittings for connection to valves, etc. or if capillary jointing is not practical
4) For pipe size above 76.1mm, ductile iron pipe should be used

COMPARISON OF SPECIFICATION OF HA and ARCHITECTURAL SERVICES DEPARTMENT (ArchSD) FOR FRESH WATER SUPPLY SYSTEM

<table>
<tr><th>ITEM</th><th>HA (2014 Edition)</th><th>ArchSD (2012 Edition)</th></tr>
<tr><td colspan="3">MATERIALS - PIPES, FITTINGS AND JOINTS</td></tr>
<tr><td rowspan="2">(1) COPPER PIPES (PLU1.M120)</td><td colspan="2">• BS EN 1057 : 2006 +A1:2010 for Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications</td></tr>
<tr><td>• Copper pipes for cold water supply
(a) inside domestic flats – completed with factory applied plain polyethylene sheath to BS 3412; and
(b) At external areas and common areas – bare without paint finishes.</td><td>• Copper pipes for cold water application shall be encapsulated with factory applied moisture resistant polyethylene sheath.</td></tr>
<tr><td>(2) COPPER PIPE FITTINGS (PLU1.M130)</td><td colspan="2">• BS EN 1254-1, 1254-2, 1254-4, 1254-5: 1998, for Copper and Copper alloys, plumbing fittings such as end feed capillary, integral solder capillary and compression type bushes, reducers, bends and tees.</td></tr>
<tr><td>(3) JOINTING OF COPPER PIPES (PLU1.M130)</td><td>• Requirements for different Pipe Diameters (Dia.) as follows –
<table><tr><td>Dia. ≤54mm</td><td>solder (end feed or integral) capillary fittings or brazed capillary fittings; compression or screw joint fittings for connection valves etc. , or if capillary jointing is not practical.</td></tr><tr><td>Dia. ≤ 76.1mm</td><td>solder (end feed or integral) or brazed capillary fittings;</td></tr><tr><td>Dia > 76.1mm</td><td>Ductile iron pipes are used</td></tr><tr><td>Bolted Flange Joints</td><td>brazed type to BS EN 1092-3: 2003 for flanges and their joints, including copper alloy flanges.</td></tr></table></td><td>• Requirements for different Pipe Diameter (Dia.) as follows –
<table><tr><td>Dia. ≤54mm</td><td>compression type, solder (end feed or integral) capillary fittings or brazed capillary fittings;</td></tr><tr><td>Dia. ≥ 54mm</td><td>solder (end feed or integral) capillary fittings;</td></tr><tr><td>Dia ≥ 108mm</td><td>brazed capillary fittings.</td></tr></table></td></tr>
<tr><td>(4) PREFORMED POLYETHYLENE SHEATHS FOR CAPILLARY TYPE JOINTS AND FITTINGS OF SHEATHED COPPER PIPES (PLU1.M140)</td><td>• BS 3412: 1992 for Polyethylene materials for moulding and extrusion;
• Be of “clip-on” type preformed polyethylene sheaths to BS 3412 or equivalent quality.</td><td>For jointing of copper pipes, fit “clip-on” type preformed polyethylene sheaths to cover the capillary type joints and fittings after jointing.</td></tr>
<tr><td>(5) BRAZING ALLOYS FOR COPPER AND COPPER ALLOY CAPILLARY FITTINGS (PLU1.M150)</td><td colspan="2">• Cadmium free brazing alloy;
• Comply with Table 6 in Section VI of BS EN 1254-1: 1998 with 2% nominal silver content.</td></tr>
<tr><td>(6) SOLDERING ALLOYS FOR COPPER AND COPPER ALLOY CAPILLARY FITTINGS (PLU1.M160)</td><td colspan="2">• Lead free soldering alloy;
• Comply with Table 6 Section II and III of BS EN 1254-1: 1998; and
• Non-corrosive type of flux recommended by solder alloy manufacturer</td></tr>
<tr><td>(7) DUCTILE IRON PIPES AND FITTINGS (PLU1.M170)</td><td>• BS EN 545: 2010 for ductile iron pipes (thickness is prescribed by a table in specification);
• Be coated with metallic zinc and bitumen finishing externally to BS EN 545 and lined with cement mortar internally, or be coated with metallic zinc and epoxy externally and lined with cement mortar and epoxy internally. Epoxy coating shall comply with BS EN 14901.</td><td>• BS EN 545: 2006, Class K12 for pipe size ≦200mm dia.;
• BS EN 545: 2010, Class 100 for pipe size >200mm dia. with internal cement lining and external bitumen coating.</td></tr>
</table>

ITEM	HA (2014 Edition)	ArchSD (2012 Edition)
MATERIALS - PIPES, FITTINGS AND JOINTS (CONT'D)		
(8) STAINLESS STEEL PIPES (PLU1.M190)	• BS EN 10312: 2002, pipe size ≤ 54mm; • BS EN 10217-7: 2005, pipe size > 54mm; • All pipes, including fasteners, shall be of stainless steel to BS EN 10088-1 Grade 1.4301.	• BS EN 10312: 2002 with amendment A1: 2005, pipe size ≤ 50mm; • BS EN 10217-7: 2005, pipe size > 50mm.
(9) STAINLESS STEEL PIPE FITTINGS (PLU1.M191)	• No universal standard; • Performance (pull out) test specified.	• No universal standard.
(10) JOINTING BETWEEN DIFFERENT METALS (PLU1.M130)	• Use dielectric fittings or epoxy coated flange with gasket for connecting copper pipe to pipes and fittings made of other metals.	
MATERIALS - STRAINER		
(11) STRAINERS (PLU1.M510)	• For nominal sizes up to and including 65mm - Body and cover: Bronze to BS EN 1982:2008 for ignots and castings Screen: Stainless Steel to BS EN 10088-1:2005 for list of stainless steel • For nominal sizes above 65 mm - Body and cover: (a) Grey cast iron to BS EN 1561: 2011 or ductile iron to BS EN 1563; (b) Grey cast iron components shall be coated with epoxy based material as specified in PLU1.M610 Screen: Stainless Steel to BS En 10088-1:2005	• For nominal sizes up to and including 50 mm - Body and cover: Copper alloy to BS EN 1982:2008 for ignots and castings Screen: Austenitic chromium nickel stainless steel or austenitic chromium nickel molybdenum stainless steel to BS EN 10088-1:2005 for list of stainless steel • For nominal sizes above 50 mm - Body and cover: (a) grey cast iron to BS EN 1561: 2011 or spheroidal graphite cast iron to BS EN 1563; (b) Cast iron components shall be coated with an epoxy based material Screen: Austenitic chromium nickel stainless steel or austenitic chromium nickel molybdenum stainless steel to BS En 10088-1:2005
MATERIALS - VALVES		
(12) VALVES FOR FRESH AND FIRE SERVICES APPLICATION (PLU1.M620)	• For nominal sizes up to and including 65mm, Body, bonnet & disc: Bronze to BS EN 1982:2008 for ignots and castings Stem: Brass to high tensile brass to BS EN 12163: 2011 • For nominal sizes above 65mm, Body, bonnet: Grey cast iron to BS EN 1561:2001 or ductile iron to BS EN 1563:2011 Disc or seat: Solid or trimmed with bronze to BS EN 1982:2008 Resilient material: BS EN 681-1:1996 Stem: Underground application or gate valve installed in fresh water - Stainless steel to BS EN 10088-3: 2005; For other applications, brass to high tensile brass to BS EN 12163 or stainless steel to BS EN 10088-3.	• For nominal sizes up to and including 50 mm, Body, bonnet & disc: Copper Alloy to BS EN 1982:2008 for ignots and castings Stem: Brass to high tensile brass or leaded brass to BS EN 12163: 2011 • For nominal sizes above 50 mm, Body, bonnet: Grey cast iron to BS EN 1561:2001 or spheroidal graphite cast iron to BS EN 1563:2011 Disc and seat: BS EN 1982: 2008 Resilient material: Same as HA Stem: Same as HA

ITEM	HA (2014 Edition)	ArchSD (2012 Edition)
MATERIALS – FIXED RATIO TYPE PRESSURE REDUCING VALVE		
(13) VALVE CONSTRUCTION (PLU1.M920)	• BS EN 1982: 2008, gunmetal body, or BS EN 10283: 2010, stainless steel body; • BS EN 10088-3: 2005, piston	• BS EN 1982: 2008, gunmetal body, or BS EN 10088-1: 2005, stainless steel body; • BS EN 10088-3: 2005, piston
ON SITE INSPECTION, SURVEILLANCE AND TESTING REQUIREMENTS		
(14) ON SITE INSPECTION	• Site inspection of work and PASS during construction stage.	• Site inspection of 'work in progress' from time to time.
(15) SURVEILLANCE	• Require type test certificate / reports for some materials e.g. pipes, elbows, valves etc.	• May require witness tests at local or overseas manufacturers' works.
(16) SITE SUPERVISION, GENERAL TESTING AND COMMISSIONING (T&C) REQUIREMENTS (PRE.B6.130, B6.340, PRE.B8.1420 to 1440)	• Building Contractor's Superintendents Requirements – (a) Quality Control Manager (QCM); (b) Architectural Quality Control Coordinator (AQCC); (c) Building Services Engineer (BSE); and (d) Site Agent, General Foreman & Block Foreman. Requirements on trade tested workers. • QCM shall organize, plan and supervise Quality Control Coordinators (QCC) in checking, endorsing and inspecting works. QCM shall also ensure works were inspected by respective QCC are in accordance with the specification and drawings before seeking approval to cover up. • AQCC shall check and endorse the following items – (a) Sample submission for materials and components; (b) Materials delivered on Site against Approved Samples; (c) Test reports for materials and components; (d) Request for inspection and tests; (e) Delivery vouchers, certificate of origin, etc. • BSE of the Building Contractor shall plan, organize, and monitor the T&C process, verify and endorse the test reports prepared by Nominated Sub-Contractors. • T&C shall comply with --- (a) Statutory obligations; (b) Specifications and standards; (c) Specification for Testing of Plumbing Installation in Public Housing Projects; and (d) Manufacturers' recommendations.	• Plumbing & Drainage (PD) sub-contractor shall keep on site a competent and technically qualified site supervisor to control, supervise and manage all his works. (Min. 5 years on site experience); • Refer to Special Conditions Contract relating to Qualified Tradesmen and Intermediate Tradesmen; • PD sub-contractor is required to appoint a competent and experienced Testing and Commissioning (T&C) Engineer --- (a) Planning, organizing, coordinating, supervising and monitoring of T&C; (b) Certifying all results and reports from the T&C works. This shall be signed by architect's representative who witnesses the process. • Certification includes confirming checking of pipes and fittings to conform to Part I of Schedule 2 of the Waterworks Regulations. • T&C shall comply with --- (a) Statutory obligations; (b) Specifications and standards; (c) Building Services Branch Testing and Commissioning Procedure for Plumbing and Drainage Installation in Government Buildings in Hong Kong; and (d) Manufacturers' recommendations.

ITEM	HA (2014 Edition)	ArchSD (2012 Edition)
(17) TESTING AND COMISSIONING (T&C) SPECIFIC REQUIREMENTS	• Pressure test of hydraulic systems; • Commissioning/adjustment of the system to ensure performance; • Water quality tests by HOKLAS accredited laboratory or HA's recognized laboratory; • Witness and endorse the cleaning and sterilization process by both the CM's representative and Contractors' representative; • Periodic supervision by Technically Competent Persons of Project Team; • The performance of the contractor is to be assessed by the Performance Assessment Scoring System (PASS). This shall be conducted quarterly to assess the quality of works including plumbing installations.	• Pressure tests of hydraulic systems; • Commissioning/adjustment of the system to ensure performance • Water quality tests by HOKLAS accredited laboratory; and • On site test of welds – refer extract of para. 4.1.1.2 of the "Testing and Commissioning Procedure for Plumbing and Drainage Installation in Government Buildings in Hong Kong" below – (a) *PBSE reserves the right to inspect at random 2% inspection of welded joints;* (b) *At least 2 welds per operative shall be inspected;* (c) *In addition, each weld made on pipes and fittings having a nominal diameter of 350mm or larger, and a 5% sample on all welds on pipes and fittings 300mm diameter and below shall be inspected using an approved non-destructive inspection process, e.g. radiographic or ultrasonic methods. Such non-destructive testing shall be carried out by specialized laboratories that both perform the test and analyse the results. (Remark: the tests are on mechanical strength of the weld and not on material content of the welds. The plumbing installation in HA projects normally comprise pipes as large as 150 mm in diameter. The HA does not have pipes and fittings as large as 300 mm in buildings of public housing projects)*
(18) SAMPLING AND ANALYSIS OF POTABLE FRESH WATER	• Water quality tests with analysis of samples by HOKLAS accredited laboratory or HA approved laboratories; • Test after completion of cleaning of plumbing installation; • Include samples taken at all the farthest point(s) of use in the distribution system from the storage tank, and at each potable water supply tank for human consumption in the building; • Sampling in accordance with ISO 5667; and • Submit detailed report for CM's approval within 2 months from date of completion.	• Water quality tests by HOKLAS accredited laboratory; • Sampling and analysis for quality of potable fresh water upon substantial completion of plumbing installation; • At all farthest points of use in the plumbing system from the storage tank; and shall include sampling for each water supply tank in the building as minimum; • Sampling and analysis shall use the standard techniques as listed below – (a) BS EN ISO 5667-1:2006, BS EN ISO 5667-3: 2003 and BS EN ISO 5667-7:2006 or equivalent; (b) Annex 4 of World Health Organization Guidelines for Drinking Water Quality 2nd Edition Volume 3 – Sampling methods for bacteriological testing; and (c) Section 1060 of the American Public Health Association Standard Methods for the Examination of Water and Wastewater 20th Edition. • Procedures for taking water sampling at water taps or water pump outlets are specified in para. 4.1.3.5.4 of the "Testing and Commissioning Procedure for Plumbing and Drainage Installation in Government Buildings in Hong Kong".

ITEM	HA (2014 Edition)	ArchSD (2012 Edition)
PLU2 SANITARY APPLIANCES		
MIXERS		
(1) STANDARDS (PLU2.M020)	• Taps and combination tap assemblies: - To BS 5412:1996; and - Material: chromium plated brass.	• Taps and combination tap assemblies to BS EN 200, exposed surfaces shall be either chromium plated or other non-chromium plated alternatives subject to approval by the SO. Cr-Ni coating shall comply with BS EN 248. (Para.19.03 of ArchSD specification)
(2) SUBMISSION REQUIREMENTS (PLU2.M510)	• Approval by the Water Supplies Department; • Flow rates calculation; • ISO 9001 and 14001 certificates for the manufacturing plant; and • Test reports showing full compliance with performance requirements.	• Comply with the Water Authority's requirements and Waterworks Regulations; (Para.19.01 of ArchSD specification) • Provide all other sanitary appliances as specified (Para.19.03 of ArchSD specification)
(3) MIXER TYPES (PLU2.M510)	• Mixer (Shower): Single lever wall mounted type with single outlet for shower point connection; Corrosion resisting copper alloy with chrome plated finish to body of mixer; • Mixer (Basin): Chromium plated brass monoblock basin mixer with non-ferrous or corrosion resisting pop-up waste and flexible hose assembly with stainless steel wire braiding; lever type fitted with removable type aerator/strainer at the spout; • Mixer (Kitchen Sink): Chromium plated brass deck mounted kitchen sink mixer consisting of flexible hose assembly with stainless steel wire braiding; Single leve type; Corrosion resisting copper alloy with chrome plated finish to body of mixer; • Performance requirements for Mixer include: - Flow rate (**BS 1415:Part 1:1976** for bath/shower mixer ; to **WSD's Water Efficiency Label Scheme (WELS) requirements** for basin and sink mixers); - Water tightness, Pressure resistance, Mechanical strength and Endurance (**BS 5412:1996**), - Blend Water Extreme Temperature (**BS 5779:1979**), - Flexible Hose Assembly with Stainless Steel Wire Braiding (**BS EN 13618 : 2011**) • Performance requirements for flexible hose assembly with stainless steel wire braiding include - leak tightness, tensile stress, resistance to corrosion and flexibility.	• Taps shall be: (a) Sensor tap shall conform to BS EN 816. Operating pressure between 0.3-10 bar. Flow rate not more than 6 litres per min. Max. water temp. 80 degree. Aerator. Self cleaning. Turn-off control pre-set 0-3sec. (b) Sensor mixer or cold. (c) Self – closing tap for time delay function. (d) Bib tap. (Para.19.07 of ArchSD specification)
(4) ON SITE DELIVERY VERIFICATION	• Surface quality check; and	• Inspect pipes and fittings inside and out before fixing; and

ITEM	HA (2014 Edition)	ArchSD (2012 Edition)
	• Logo and label check.	• Replace any appliances which are chipped or scratched.
(5) SURVEILLANCE TEST FOR MIXERSAND SHOWER HANDSET (PLU2.T310)	• Provide one set of test sample from the batch of material delivered, which shall consist of two specimens of mixers and shower handsets, and the accessories. • Testing method and acceptable standards for the performance requirements listed in item (3) above.	• No specific requirements.