Handbook on Plumbing Installation for Buildings



Water Supplies Department

HKSARG

W **Water Supplies Department**

Handbook on Plumbing Installation for Buildings

Contents **Page No.**

1. GENERAL **1**

1.1 Definitions 1

1.2 Abbreviations 2

1.3 Commonly Used Waterworks Pipes and Fittings 3

2. RESPONSIBILITIES OF WATER AUTHORITY AND CONSUMERS/AGENTS **5**

2.1 Divisions of Responsibilities 5

2.2 Obligations of Consumers/Agents 5

2.3 General Principles for Installing Plumbing Works 6

3. SUBMISSIONS OF PLUMBING PROPOSALS **7**

3.1 General 7

3.2 Submissions 7

3.3 Plumbing Proposals 8

3.4 Format 8

4. LICENSED PLUMBERS **9**

4.1 General 9

4.2 Commencement of Work 9

4.3 Interim Inspections and Final Inspections 9

4.4 Completion of Work 10

4.5 Works of a Minor Nature 10

5. METERING **12**

5.1 General 12

5.2 Meter Position 12

6. INSIDE SERVICE **14**

6.1 Fresh Water Supply 14

6.2 Flushing Supply 25

7. FIRE SERVICE **29**

7.1 Metering Requirement 29

7.2 Pipe Materials 29

7.3 Supply Types and Arrangements 30

8. STORAGE CISTERNS ,WATER PUMPS AND OTHER MISCELLANEOUS 33

8.1 STORAGE CISTERNS (OR WATER TANKS) 33

8.2 WATER PUMPS 36

8.3 VALVES AND TAPS 36

8.4 EARTHING 37

8.5 SEPARATE METERING IN EXISTING PREMISES 37

8.6 AUTHORIZING PRIVATE DEVELOPERS/AUTHORIZED PERSONS TO UNDERTAKE WATER SUPPLY CONNECTION WORKS 38

9. MAINTENANCE 39

APPENDIX A1: CHECKLIST FOR VETTING PLUMBING PROPOSALS 41

APPENDIX A2: COMMON MISTAKES BY PRACTITIONERS 51

List of Figures

Fig No.	Figure Title
Fig 1	Areas of Responsibility of Water Authority/Registered Agent/Consumers (Direct Supply System)
Fig 2	Areas of Responsibility of Water Authority/Registered Agent/Consumers (Indirect Supply System)
Fig 3	Typical Installation of a 15mm diameter Water Meter
Fig 4	Meter Dimensions
Fig 5	Direct Supply System
Fig 6	Indirect Supply system
Fig 7	Non-pressure Type Heater
Fig 8	Cistern Type Water Heater
Fig 9	Instantaneous Gas Water Heater
Fig 10	Layout of Unvented Electric Thermal Storage Type Water Heater
Fig 11	Pressure Type Thermal Storage Water Heater
Fig 12	Direct Centralized Hot Water System
Fig 13	Indirect Centralized Hot Water System
Fig 14	Salt Water Flushing Supply System
Fig 15	Flushing Supply Storage Cistern - Mixed Supply
Fig 16	Layout Drawing for Sprinkler System
Fig 17	Layout Drawing for Improvised Sprinkler System
Fig 18	Layout Drawing for Fire Hydrant/Hose Reel System
Fig 19	Layout Plan of the Typical Installation of DN150 Street Fire Hydrant
Fig 20	Section of the Typical Installation of DN150 Street Fire Hydrant
Fig 21	Typical Layout of Pressure Reducing Valves
Fig 22	Common Mistakes for Meter / Check Meter Positions
Fig 23	Common Mistakes for Inside Service
Fig 24	Common Mistakes for Sump and Pump System
Fig 25	Common Mistakes for Watering Flower Beds Plumbing System
Fig 26	Common Mistakes for Fire Service

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.info.gov.hk/wsd/.

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

Chief Engineer/Regional Administration
Regional Administration Division,
Water Supplies Department
Immigration Tower, 7 Gloucester Road, Hong Kong

1. General

1.1Definitions

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
GI	Galvanized Steel
HKWSR	Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings
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

2.1Divisions 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 inside 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 and Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings (HKWSR). 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.

3.2 Submissions

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.

3.3 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 for 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 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

A licensed plumber 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 after 1 October 1993 will be issued.*

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.

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 should 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 minor nature or the rewashering of a tap.

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.

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

(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.[1]

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.

Note: [1].....[1] denotes Addition added on 4 12.2006

5. Metering

5.1 General

Metering is required to measure water consumed for billing purposes. Meter position shall be provided by the licensed plumber (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 (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 (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

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 room shall be used solely for housing the water meters to protect them against exposure to weather, falling objects and other undue external interferences. Furthermore, adequate floor space, headroom, lighting, ventilation, drainage, hygienic environment and an independent entrance located at communal corridor should be provided to facilitate meter reading and maintenance of the water meters. Safe, free and uninterrupted access to the meter room should also be provided

and maintained at all times. Meter positions should not be installed in multi-function rooms such as those also serving as garbage room, fire hose reel room and plant room, or at locations not safe for staff of the Water Authority to reach such as central dividers in carriageway. It is also advisable to reserve additional space for additional water meters, if any, in the future. Meter boxes in line with the above requirements may also be considered in lieu of meter rooms. The door of the meter room / box shall be clearly marked 'Water Meters' in English and '水錶' in Chinese for easy identification. Siting and the details of the meter room / box are subject to the approval of the Water Authority. For meters arranged in groups, no meter should be positioned lower than 300 mm nor higher than 1500 mm above the floor level.

For building supply to a construction site, the meter position shall be provided within a meter room or meter box located within the site boundary and at a hoarding recess area so that reading and maintenance of the meter can be carried out outside the construction site. In order to prevent contamination to the water supply system by back siphonage, water to a construction site has to be supplied via a storage tank. For a construction site requiring high water consumption, the storage tank should be suitably sized in order to maintain uninterrupted water supply.

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.

6. Inside Service

6.1 Fresh Water Supply

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 6.1.9.

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 lining	✓	✓	×	✓	✓	BS 1387 & 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 6572(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 4127

✓: 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 Application for Approval of Water Supply 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.info.gov.hk/wsd.

6.1.4 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 (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 way 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. (Fig 6).

6.1.5 Plumbing Arrangements

6.1.5.1 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.

6.1.5.2 Direct Supply System

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

6.1.5.3 Indirect Supply System

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

6.1.6 Domestic Appliances

6.1.6.1 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, 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.

6.1.6.2 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.

6.1.7 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.

6.1.8 Supply to Temporary Structures and Modified/Converted Structures

6.1.8.1 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.

6.1.8.2 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.

6.1.8.3 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.

6.1.9 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 was commenced in June 2000. Six areas where the existing local pipe networks have capacity to cope with the additional demand for the wider use of water-cooled air-conditioning systems are selected for the pilot scheme. These areas are:-

(i) Wan Chai
(ii) Mong Kok
(iii) Pok Fu Lam
(iv) Tai Po Industrial Estate
(v) Yuen Long Industrial Estate
(vi) Hung Hom

Please contact staff of the Water Authority for details about the exact locations of these 6 selected areas and the requirements for approving applications for water supply to water-cooled air-conditioning systems under the pilot scheme.

6.1.10 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.

6.1.11 Hot Water Systems

6.1.11.1 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 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 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.

6.1.11.2 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.

The only exception to the above rule applies to premises on pre-1959 lease conditions which have not been redeveloped since 1965. Such premises are under no obligation to accept a salt water supply, even it is available, and mains fresh water for flushing may be given.

Premises on post-1959 lease conditions or those on pre-1959 lease conditions that have been re-developed after 1965 are required to accept salt water for flushing if it is available. Such premises will only be given mains fresh water if there is no suitable alternative. These premises are also required to have plumbing systems installed suitable for use with salt water.

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.

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. 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, 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.

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 Fire Services Department 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.

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 or with an automatic control switch and without any stop valve in the case of a pumped supply. 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. 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 tank 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.

Practitioner's Guidelines on the scheme are available at the website http://www.wpelb.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.

Points to Consider	Criteria
	(WWReg 27, HKWSR 1.4, 1.5, 1.11, 1.12, 1.16, 7.7, 7.10, 8.9 & 8.16)
(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

Points to Consider	Criteria
	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. - 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.

Points to Consider	Criteria
	- Double sealed covers with locking devices shall be provided for all storage 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

Points to Consider	Criteria
	provided and placed with spindle in the vertical position before the meter 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

Points to Consider	Criteria

	may, with the written permission of the 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 storage capacity not exceeding 200 litres;
	  ● 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

Points to Consider	Criteria
	for essential purposes other than industrial processes provided that system losses arise from evaporation 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)
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.

Points to Consider	Criteria
(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.
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.

Points to Consider	Criteria
	- 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 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.

Points to Consider	Criteria
	- 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	
(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.	

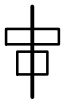
E) Common Mistakes for Fire Service (Fig 26)		
①	A fullway gate valve and a non-return valve are not installed on the fire service close to the government water supply connection.	HKWSR 9.6
②	Size of check meter is not indicated. Detailed drawing showing the arrangement of check meter position is not 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

LIST OF SYMBOLS

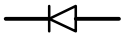

LOOSE JUMPER TYPE STOPCOCK


GATE VALVE


STORAGE CISTERN

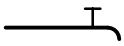

FLOAT SWITCH

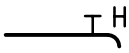

BALL VALVE / FLOAT OPERATED VALVE


NON–RETURN VALVE / CHECK VALVE

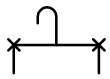


WATER METER

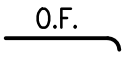

DRAW OFF POINTS – COLD WATER



DRAW OFF POINTS – HOT WATER


DRAW OFF POINT – COLD & HOT WATER

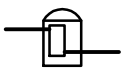

WASHOUT PIPE



OVERFLOW PIPE



PUMP SET


CALORIFIER



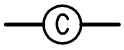
BOILER



SINK



FLUSHING CISTERN & WATER CLOSET



CHECK METER POSITION (FOR CHECKING AND WASTE DETECTION PURPOSES)



INSTANTANEOUS GAS WATER HEATER



PRESSURE REDUCING VALVE (SMALL END DENOTES LOW PRESSURE)



PRESSURE RELIEF VALVE / SAFETY VALVE



TEMPERATURE RELIEF VALVE



COMBINED TEMPERATURE AND PRESSURE RELIEF VALVE



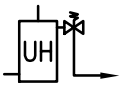
ANTI–VACUUM VALVE



EXPANSION VESSEL



BUTTERFLY VALVE



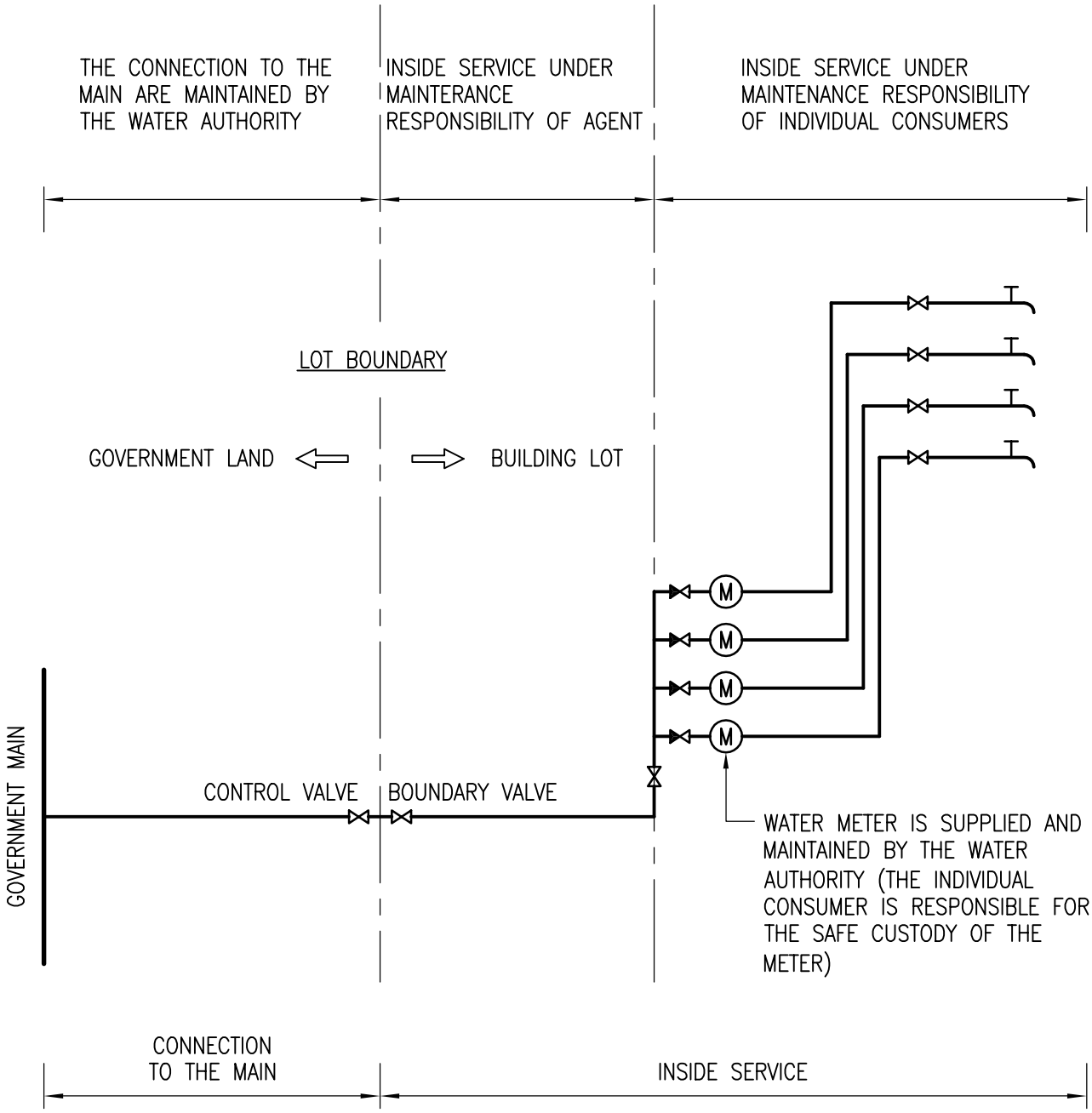
UNVENTED ELECTRIC THERMAL STORAGE WATER HEATER



PRESSURE TYPE THERMAL STORAGE WATER HEATER



NON–PRESSURE TYPE HEATER

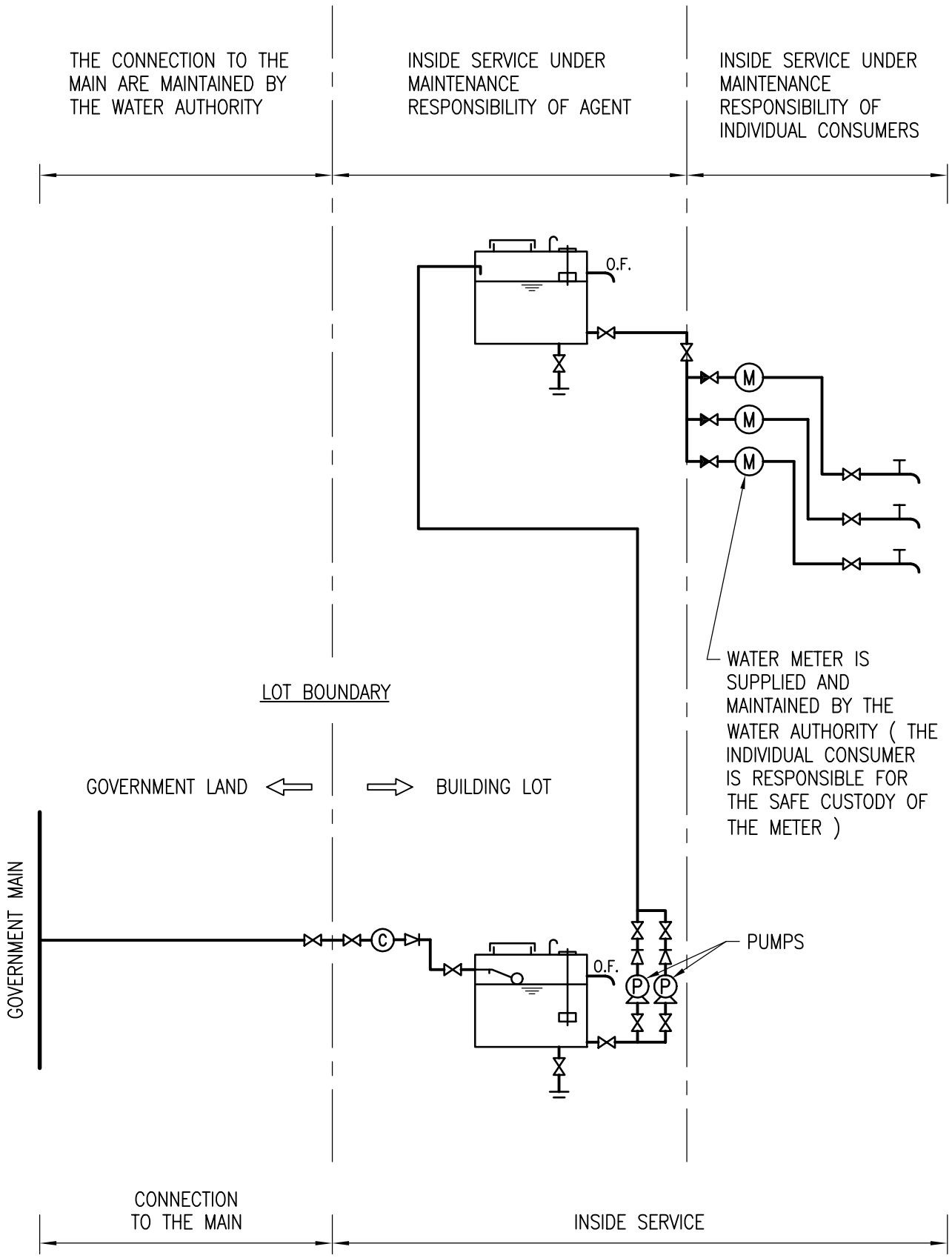


NOTE :

1. THE INSIDE SERVICE WITHIN THE LOT BOUNDARY IS MAINTAINED BY THE CONSUMER, EXCEPT THE COMMON PARTS OF THE INSIDE SERVICE BEING THE RESPONSIBILITY OF THE AGENT.

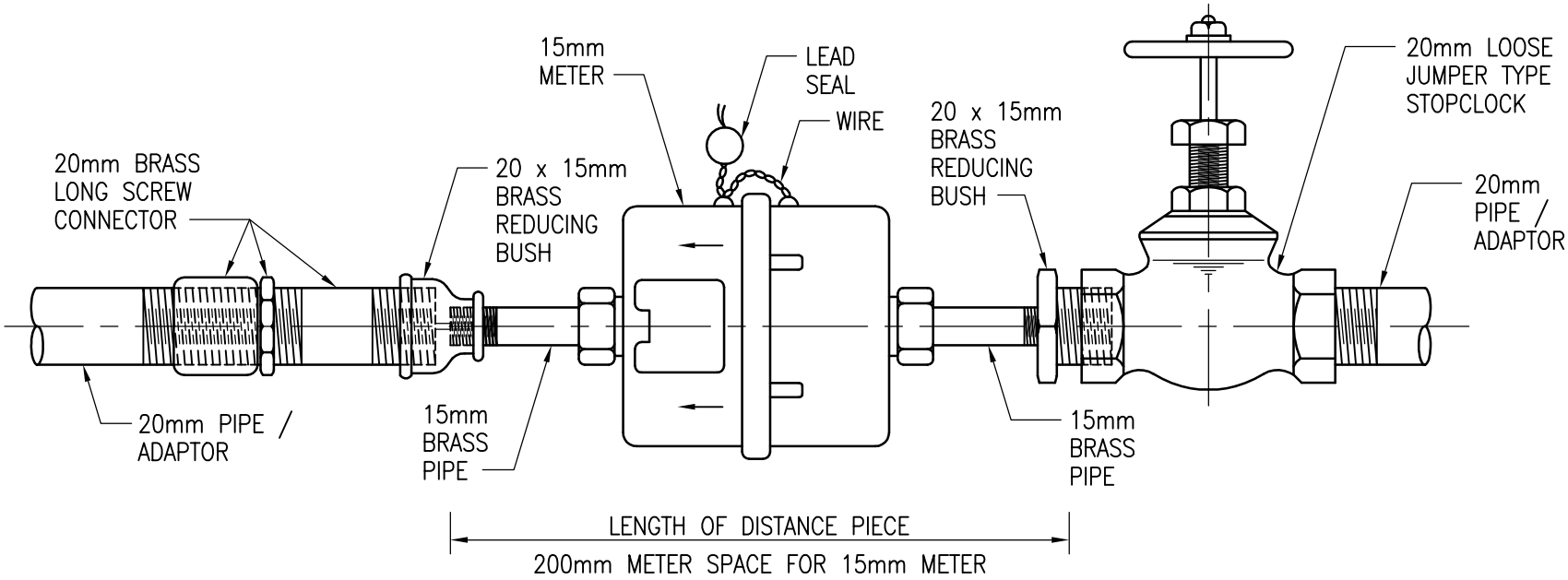
AREAS OF RESPONSIBILITY OF WATER AUTHORITY/AGENT/CONSUMERS (DIRECT SUPPLY SYSTEM)

FIG. 1



AREAS OF RESPONSIBILITY OF WATER AUTHORITY/AGENT/CONSUMERS (INDIRECT SUPPLY SYSTEM)

FIG. 2



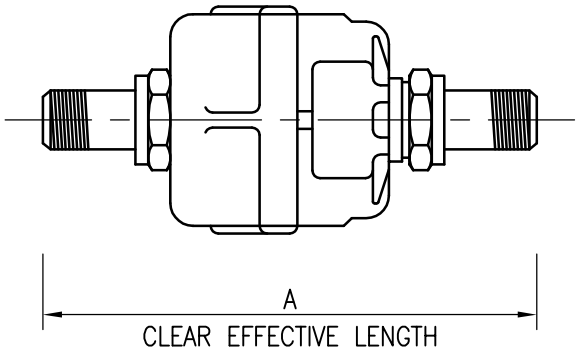
NOTES:

1. ALL THREADING TO BS 21.
2. METER POSITION TO BE USED FOR LINED G.I., COPPER AND THERMOPLASTIC INSIDE SERVICE.

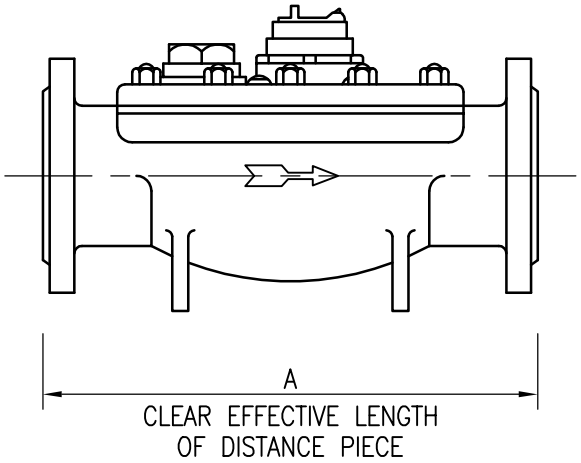
TYPICAL INSTALLATION OF A 15mm DIAMETER WATER METER

FIG. 3

METER SIZE (mm)	15	25	40
DIMENSION (mm) A	200	311	346

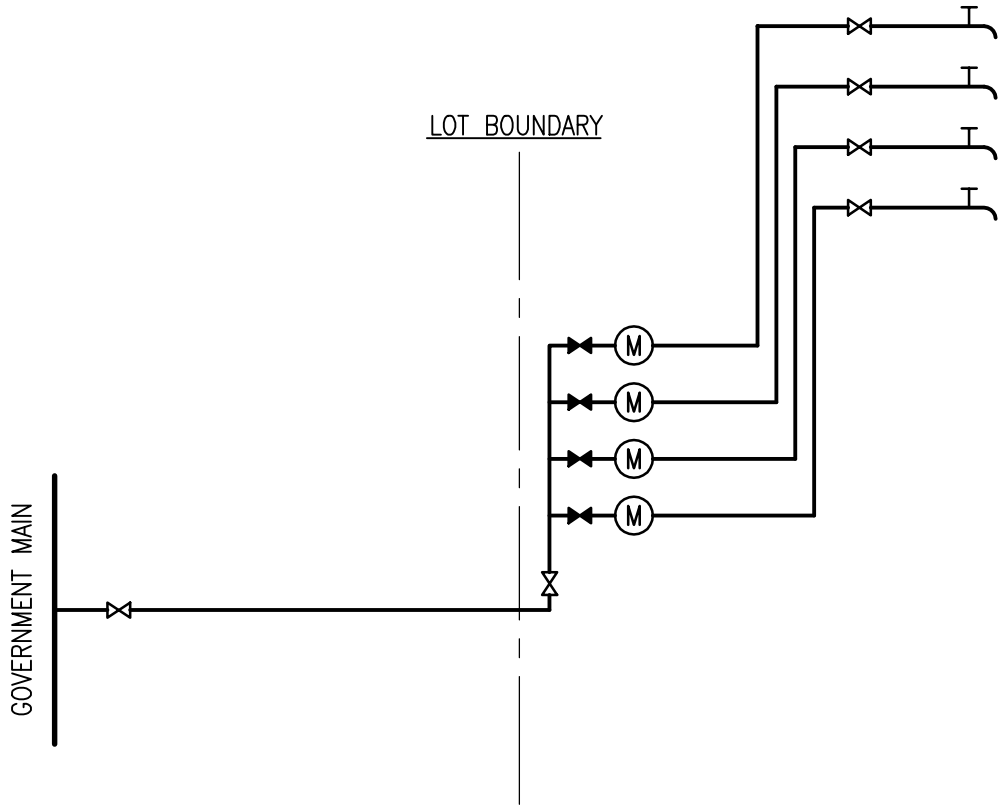


METER SIZE (mm)	50	80	100	150
DIMENSION (mm) A	310	413	483	500

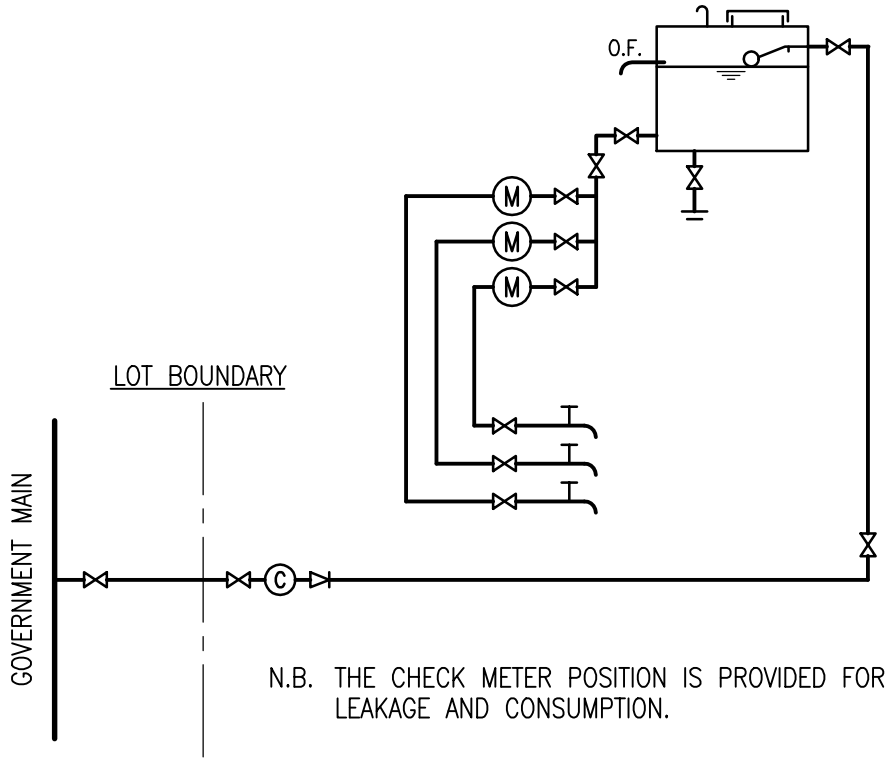


METER DIMENSIONS

FIG. 4



WITHOUT STORAGE TANK

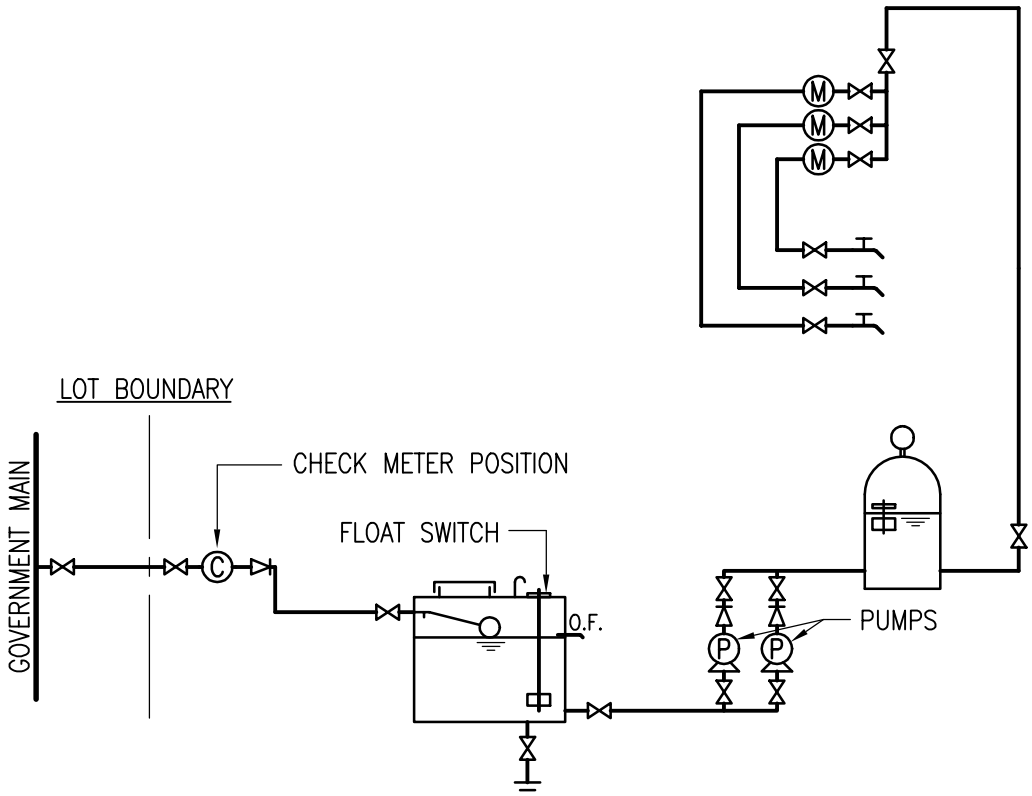


N.B. THE CHECK METER POSITION IS PROVIDED FOR CHECKING LEAKAGE AND CONSUMPTION.

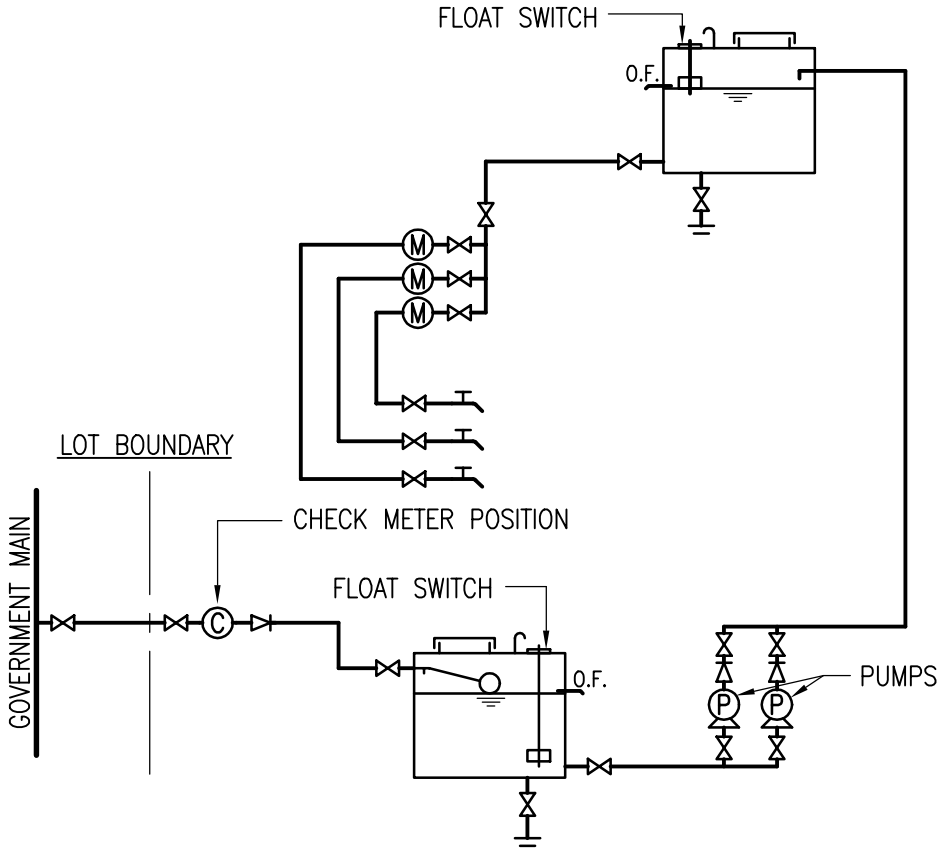
WITH STORAGE TANK

DIRECT SUPPLY SYSTEM

FIG. 5



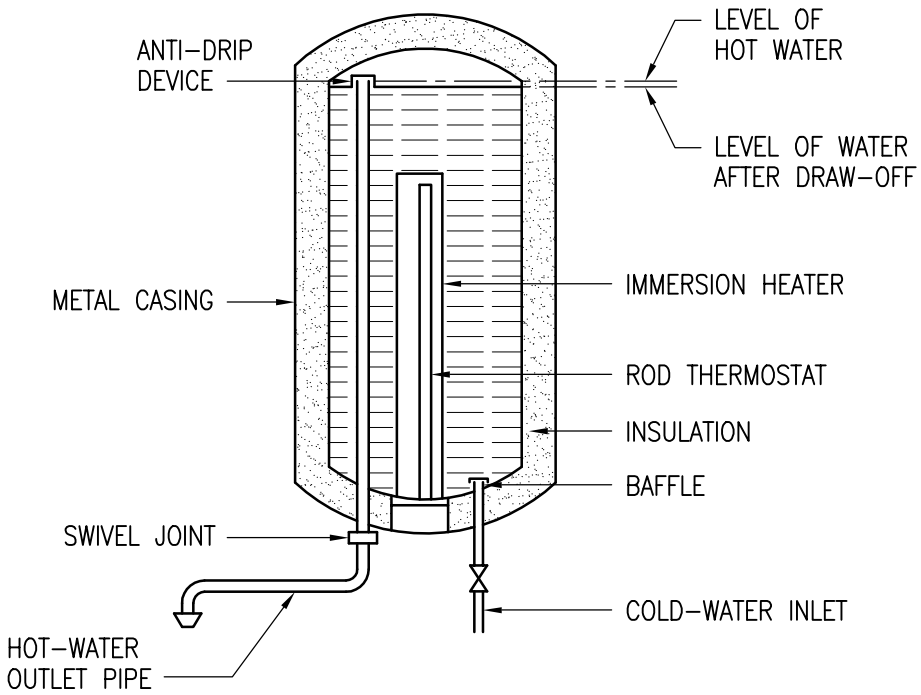
HYDRO PNEUMATIC PUMP SYSTEM



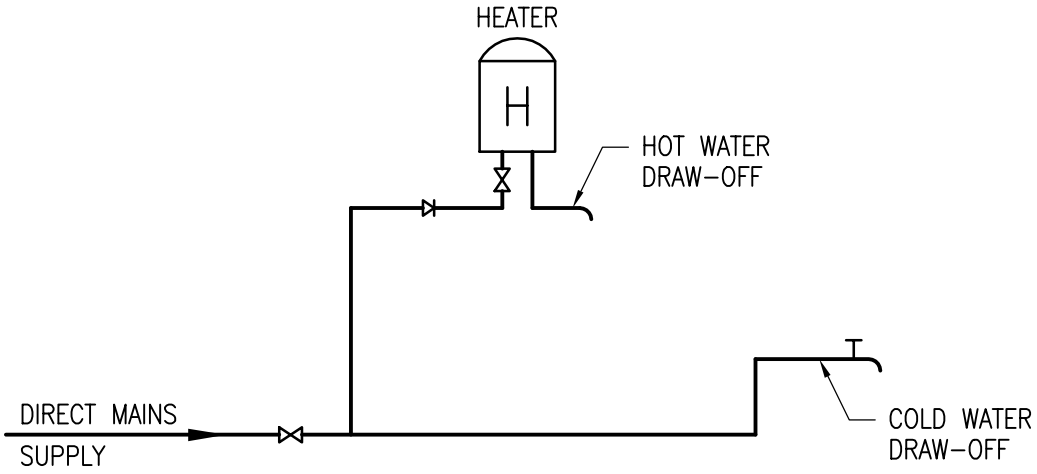
SUMP AND PUMP SYSTEM

INDIRECT SUPPLY SYSTEM

FIG. 6



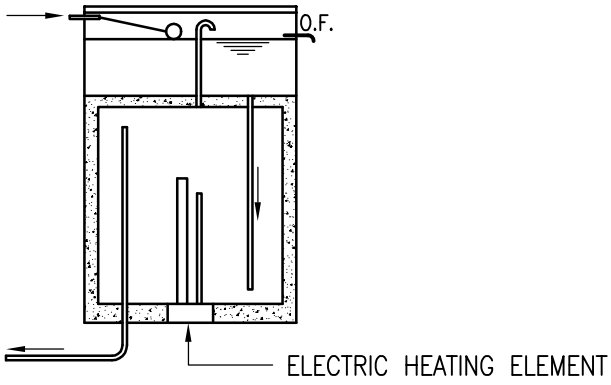
ESSENTIAL COMPONENTS OF A NON–PRESSURE TYPE HEATER



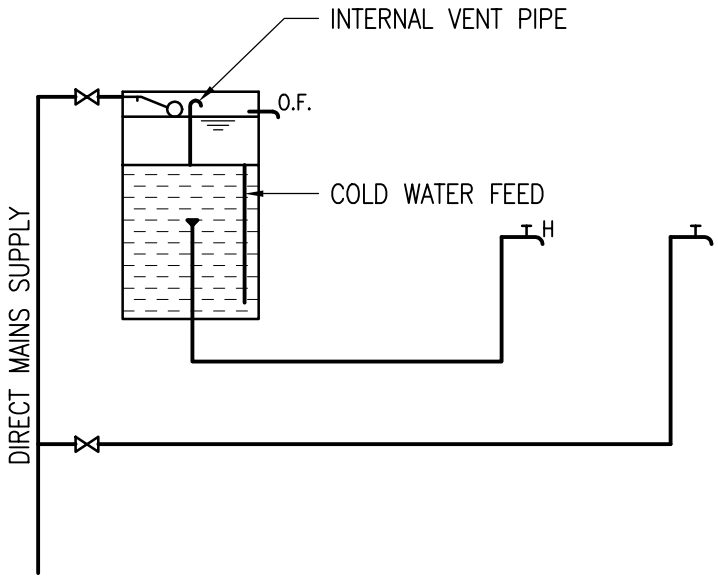
LAYOUT OF A NON–PRESSURE TYPE HEATER

NON–PRESSURE TYPE HEATER

FIG. 7



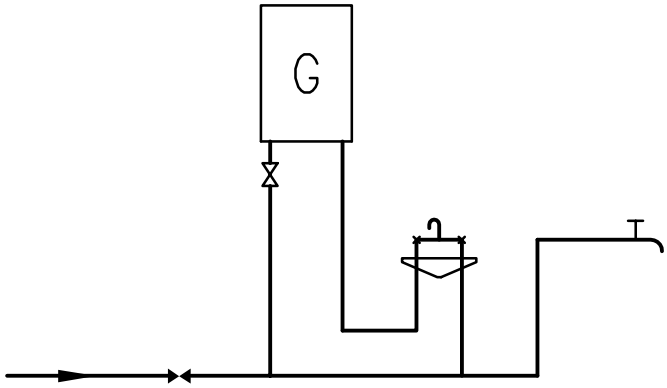
SECTION THROUGH A CISTERN TYPE WATER HEATER



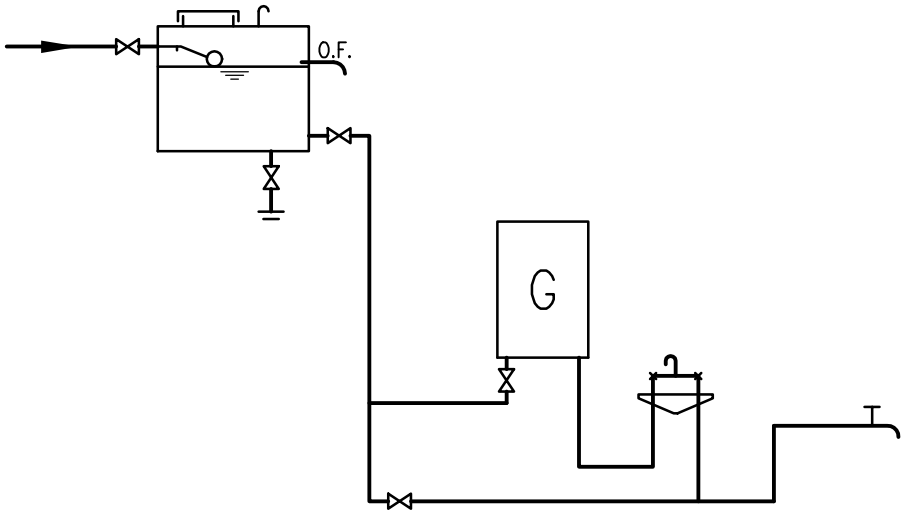
LAYOUT OF A CISTERN TYPE WATER HEATER

CISTERN TYPE WATER HEATER

FIG. 8



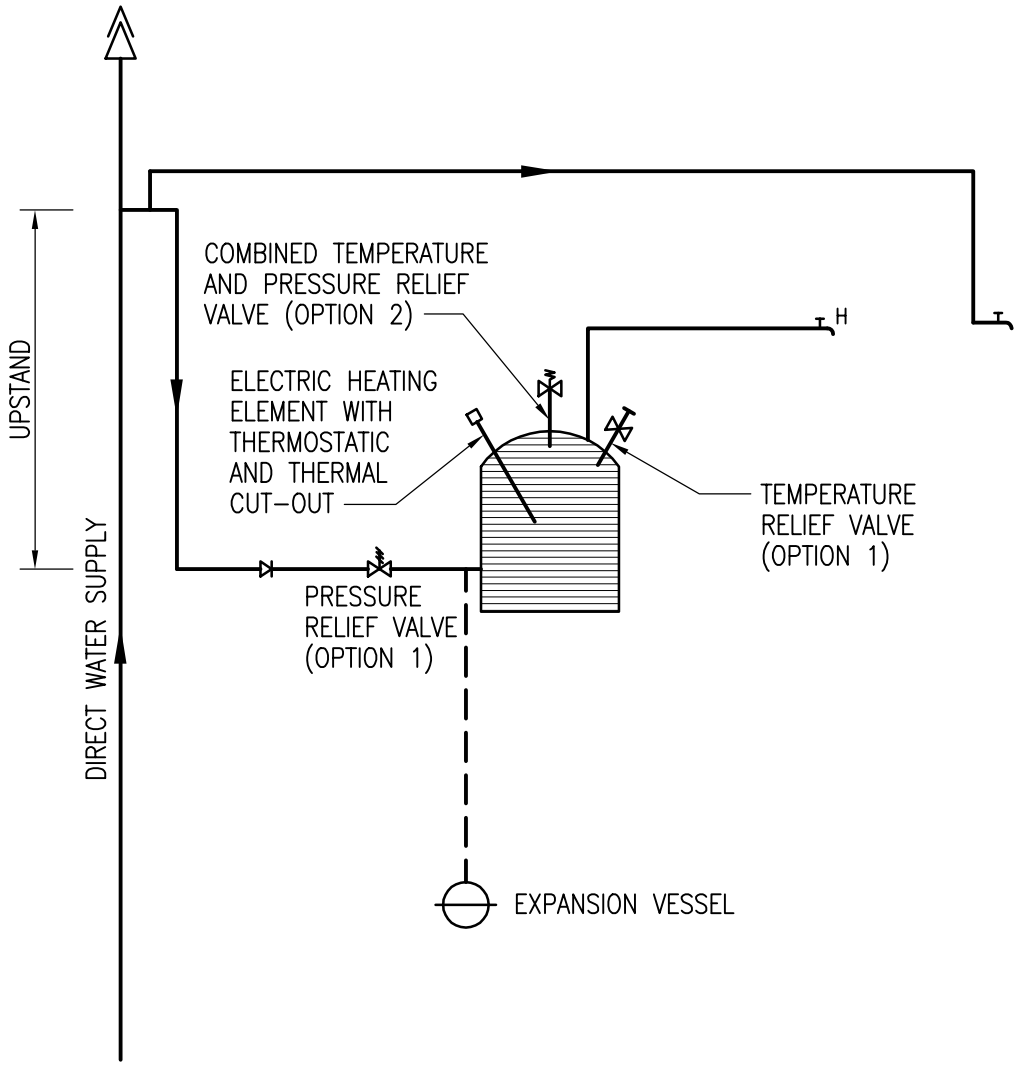
INSTANTANEOUS GAS WATER HEATER
CONNECTED DIRECTLY TO MAINS SUPPLY



INSTANTANEOUS GAS WATER HEATER
CONNECTED INDIRECTLY TO MAINS SUPPLY

INSTANTANEOUS GAS WATER HEATER

FIG. 9



LEGEND :

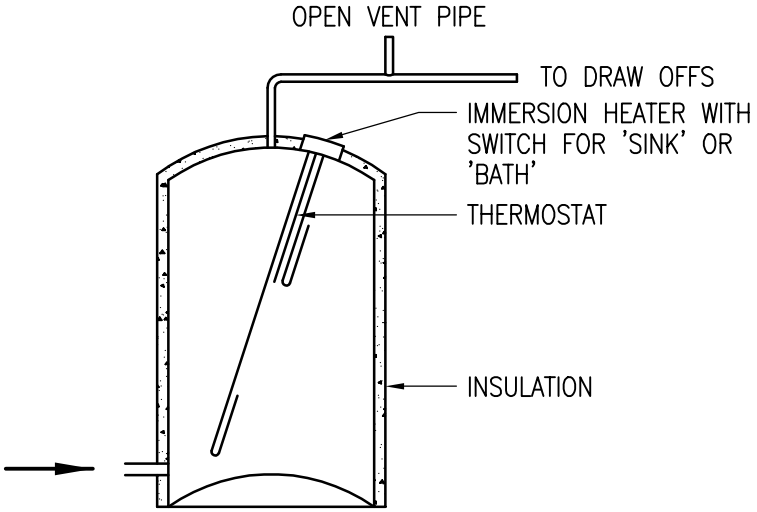
– – – OPTIONAL

NOTES :

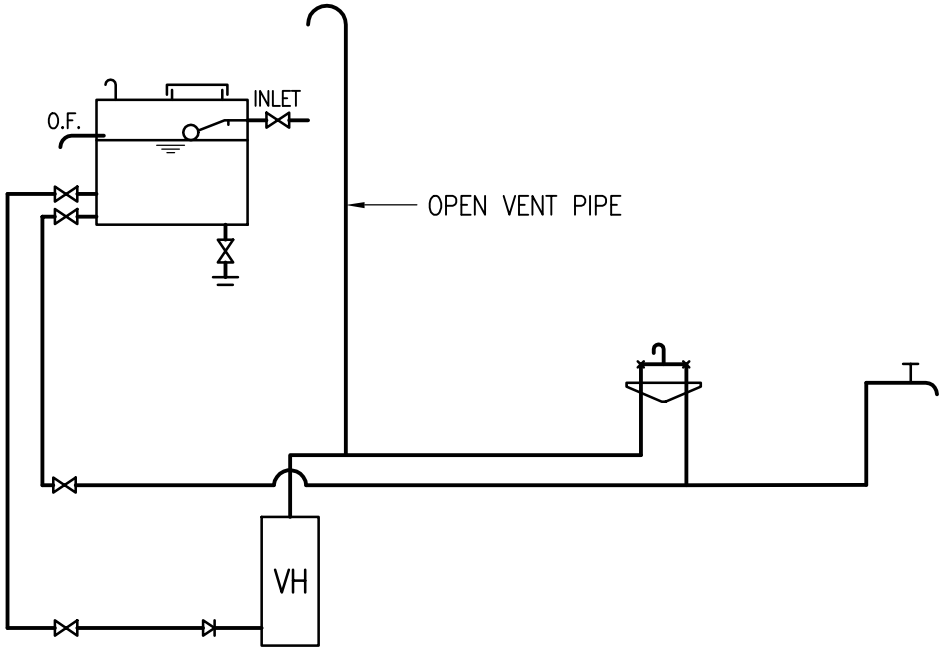
1. THE FACTORY TEST PRESSURE OF THE HEATER SHALL BE IN EXCESS OF 1.5 TIMES THE MAXIMUM STATIC PRESSURE AT THE MAINS WATER SUPPLY POINT.
2. A COMBINED TEMPERATURE AND PRESSURE RELIEF VALVE (OPTION 2) MAY BE USED IN LIEU OF A TEMPERATURE RELIEF VALVE AND A PRESSURE RELIEF VALVE (OPTION 1).
3. THE SAFETY DEVICES ARE UNDER THE CONTROL OF THE ELECTRICAL PRODUCTS (SAFETY) REGULATION ADMINISTERED BY THE ELECTRICAL AND MECHANICAL SERVICES DEPARTMENT.
4. EXPANSION VESSEL IS ONLY REQUIRED WHEN A NON–RETURN VALVE OR A PRESSURE REDUCING VALVE OF THE NON–BACKFLOW TYPE IS FITTED IN THE COLD WATER INLET.

LAYOUT OF UNVENTED ELECTRIC THERMAL STORAGE TYPE WATER HEATER

FIG. 10



ESSENTIAL COMPONENTS OF A PRESSURE TYPE THERMAL STORAGE WATER HEATER

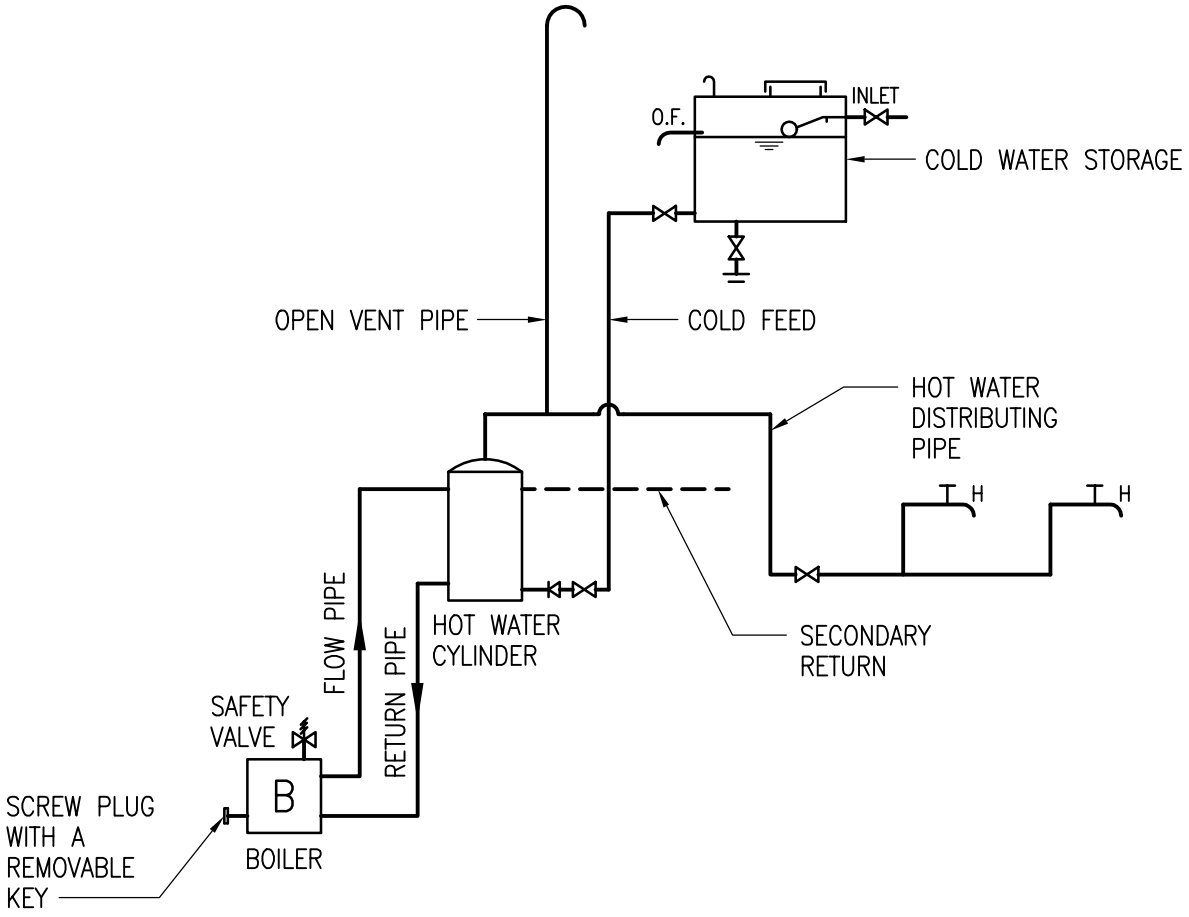


LAYOUT OF A PRESSURE TYPE THERMAL STORAGE WATER HEATER

NOTE: THIS TYPE OF HEATER SHALL BE SUPPLIED FROM A STORAGE CISTERN, EXCEPT IT IS INSTALLED IN FLATS SUPPLIED THROUGH THE INDIRECT OR SUMP AND PUMP SYSTEM.

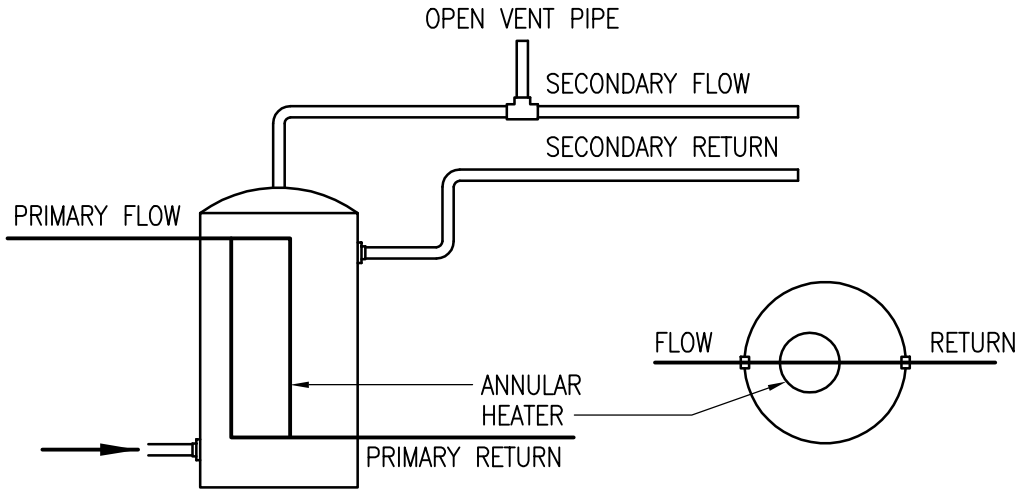
PRESSURE TYPE THERMAL STORAGE WATER HEATER

FIG. 11

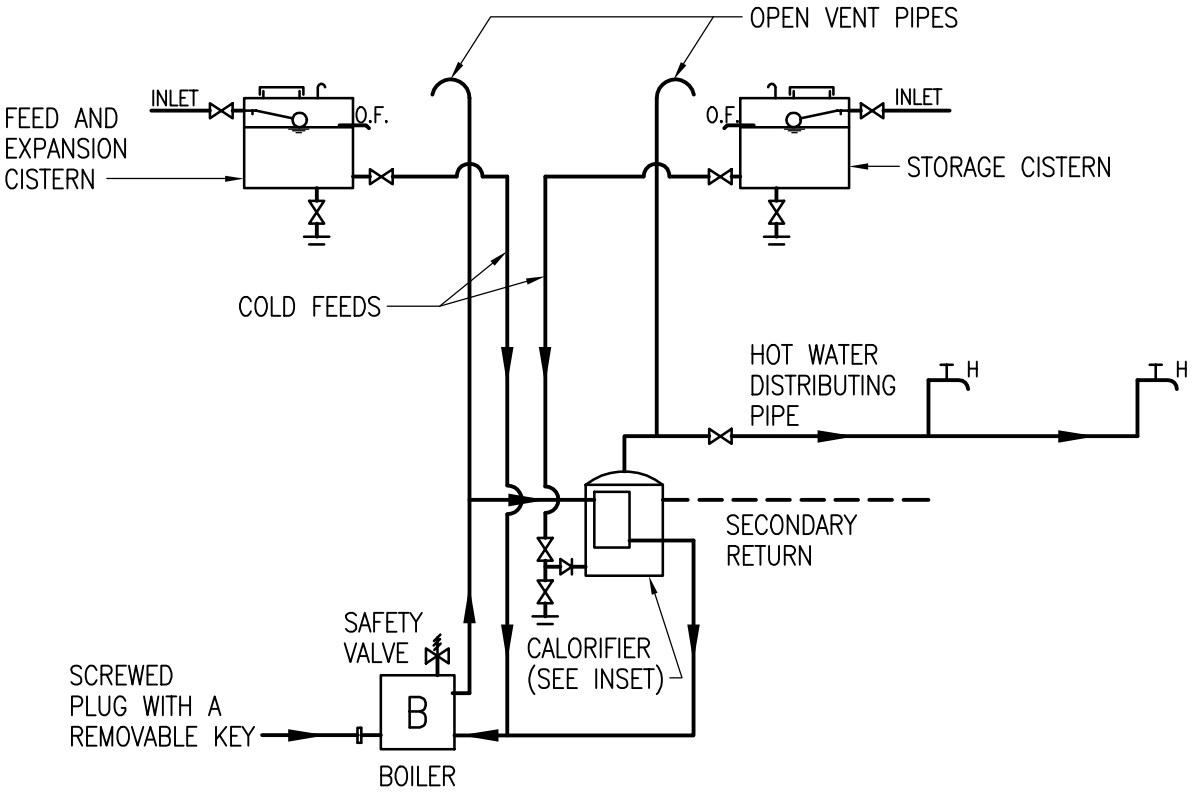


DIRECT CENTRALISED HOT WATER SYSTEM

FIG. 12

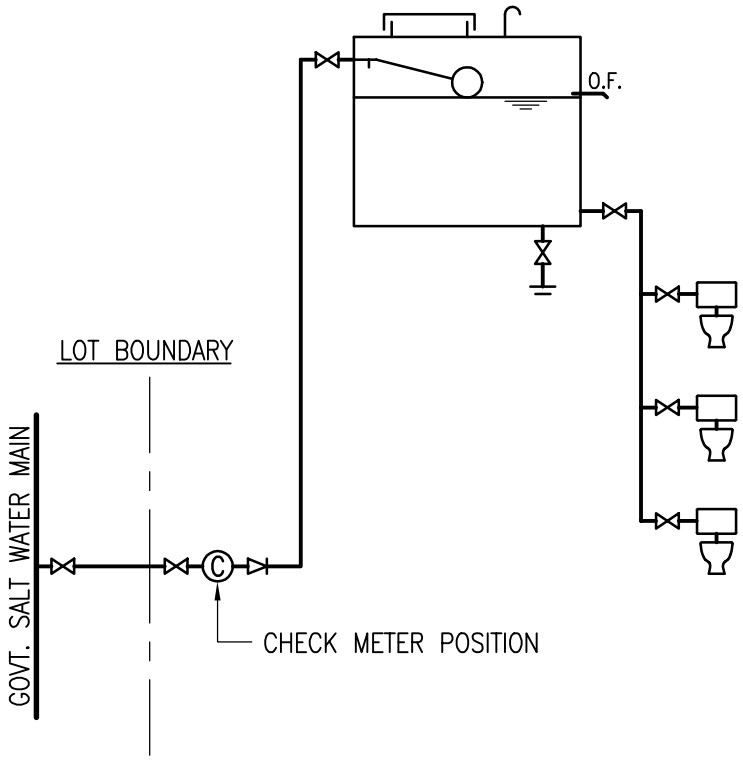


ESSENTIAL COMPONENT OF A CALORIFIER

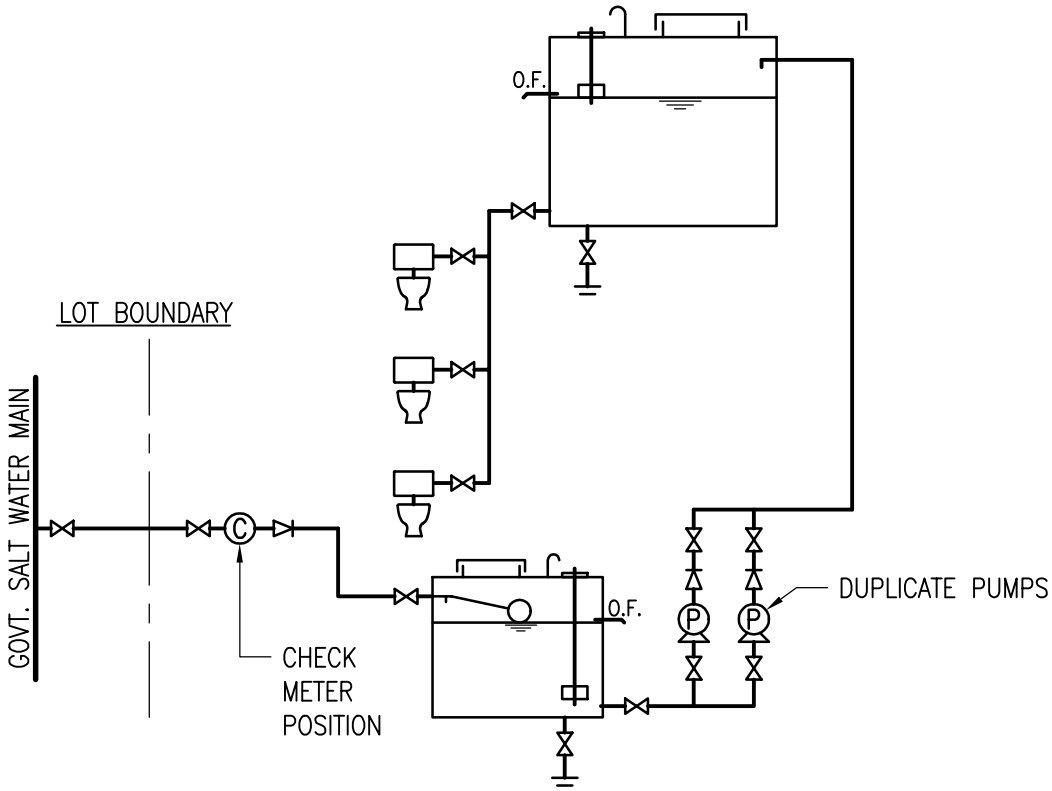


INDIRECT CENTRALISED HOT WATER SYSTEM

FIG. 13



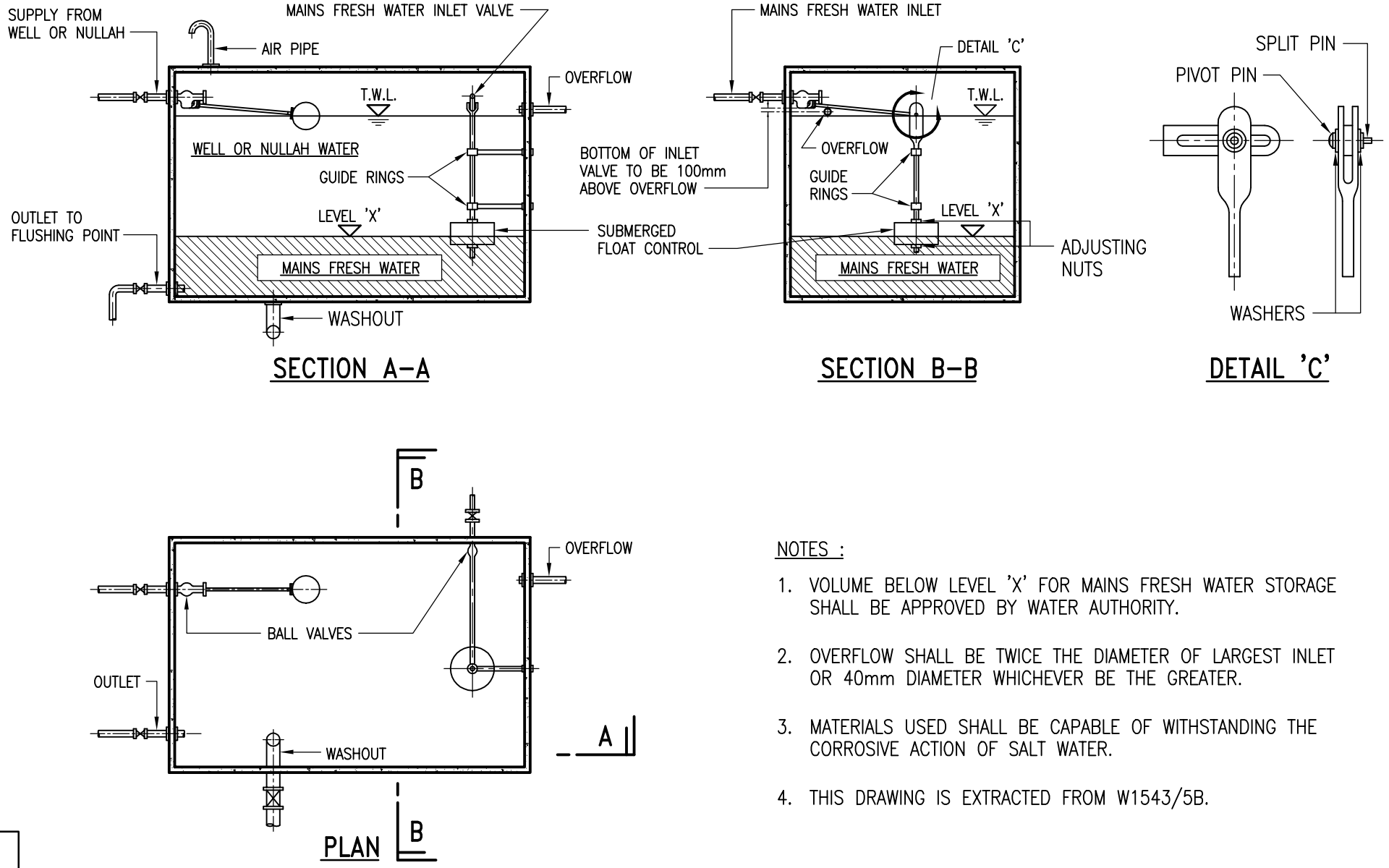
DIRECT SALT WATER FLUSHING SUPPLY SYSTEM



INDIRECT SALT WATER FLUSHING SUPPLY SYSTEM

SALT WATER FLUSHING SUPPLY SYSTEM

FIG. 14



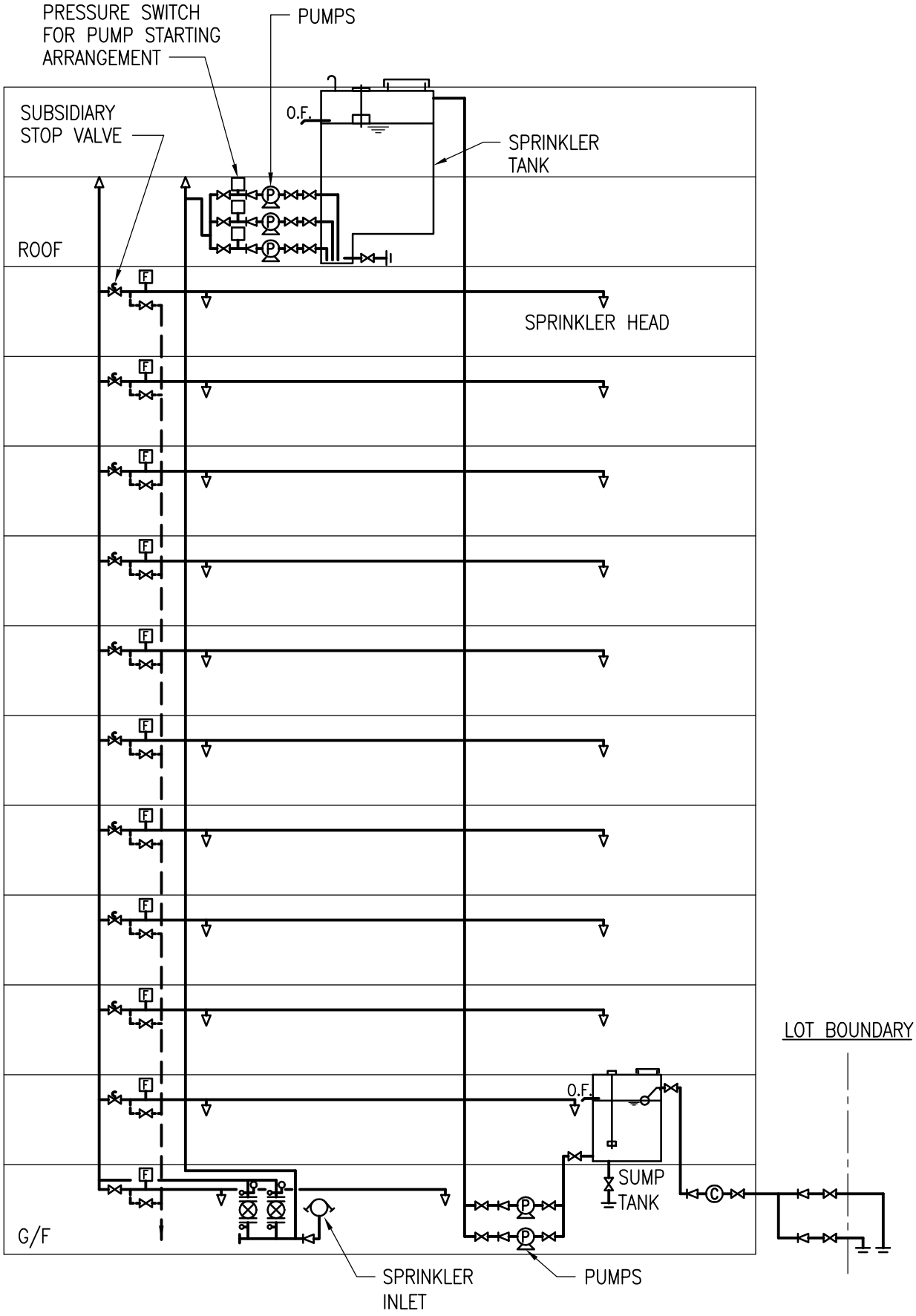
NOTES :

1. VOLUME BELOW LEVEL 'X' FOR MAINS FRESH WATER STORAGE SHALL BE APPROVED BY WATER AUTHORITY.
2. OVERFLOW SHALL BE TWICE THE DIAMETER OF LARGEST INLET OR 40mm DIAMETER WHICHEVER BE THE GREATER.
3. MATERIALS USED SHALL BE CAPABLE OF WITHSTANDING THE CORROSIVE ACTION OF SALT WATER.
4. THIS DRAWING IS EXTRACTED FROM W1543/5B.

FIG. 15

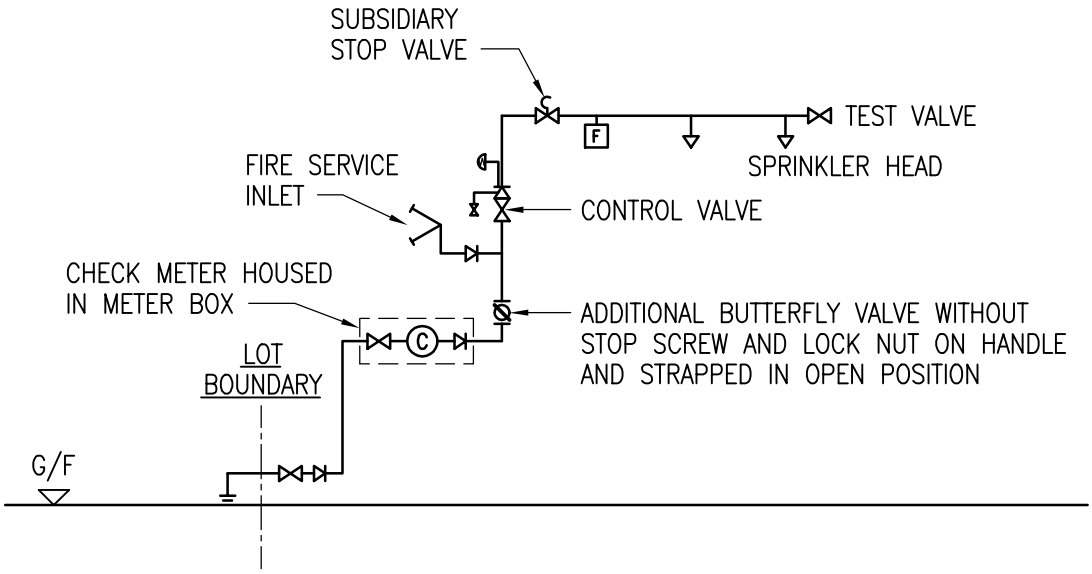
FLUSHING SUPPLY STORAGE CISTERN – MIXED SUPPLY

(NOT TO SCALE)



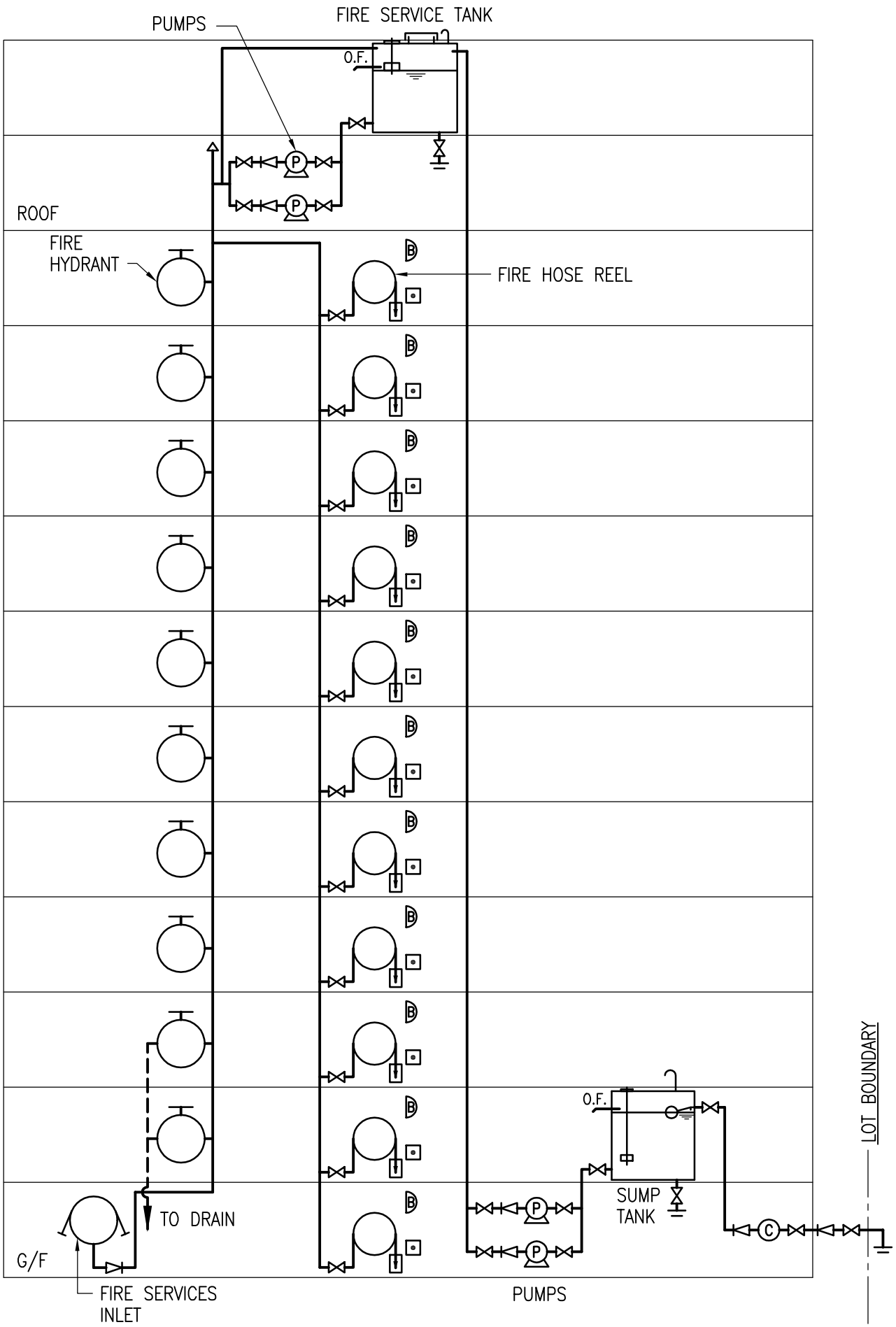
LAYOUT DRAWING FOR SPRINKLER SYSTEM

FIG. 16



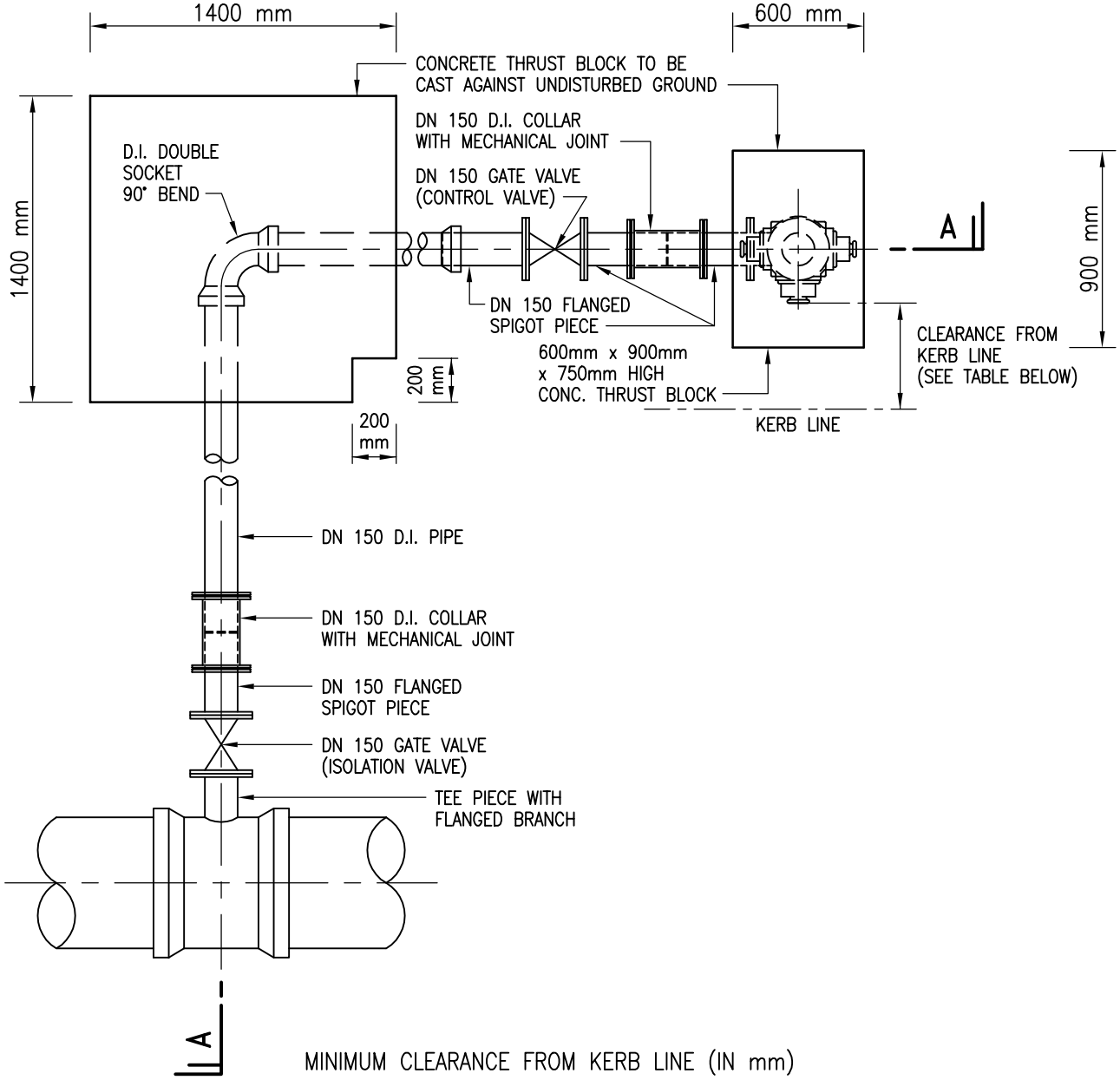
LAYOUT DRAWING FOR IMPROVISED SPRINKLER SYSTEM

FIG. 17



LAYOUT DRAWING FOR FIRE HYDRANT/HOSE REEL SYSTEM

FIG. 18



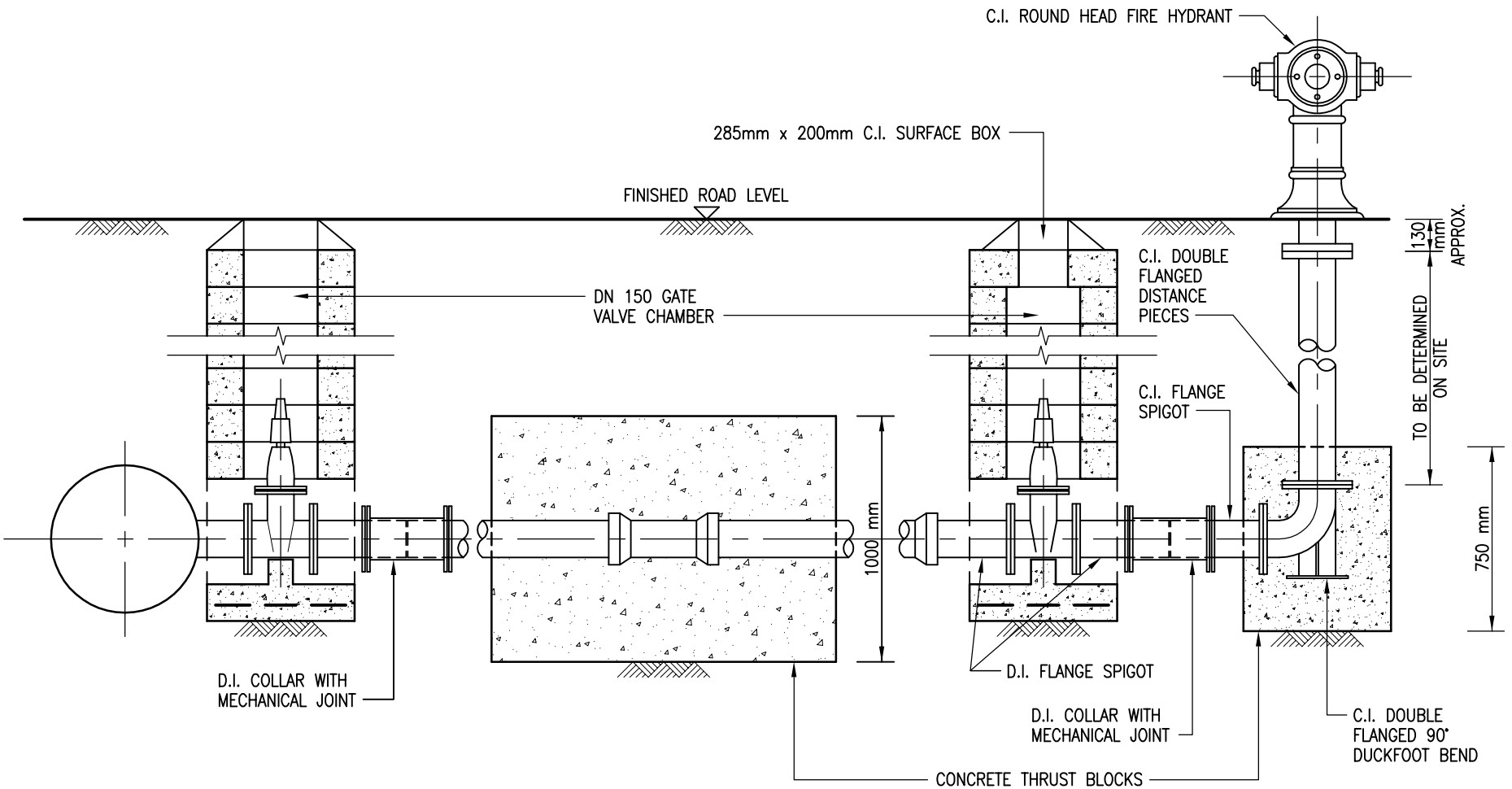
MINIMUM CLEARANCE FROM KERB LINE (IN mm)

CARRIAGEWAY DESIGN SPEED (IN km/h)	WHERE CARRIAGEWAY CROSS FALL IS	
	AWAY FROM HYDRANT OR TOWARDS HYDRANT BUT NOT STEEPER THAN 2.5%	TOWARDS HYDRANT AND STEEPER THAN 2.5%
⩽50	500	600
>50 AND <80	600	600
⩾80	1000	1000

NOTES : FOR ROADS (SUCH AS DISTRICT AND LOCAL DISTRIBUTOR ROADS, RURAL ROADS B AND FEEDER ROADS) WITH FOOTWAY ONLY AND WITHOUT VERGE, HYDRANTS CAN BE ERECTED CLOSER TO THE EDGE OF THE CARRIAGEWAY BUT NOT LESS THAN 200mm FOR ANY PART OF THE INSTALLATIONS. FOR ROADS WITH A SPEED LIMIT OF 70km/h OR ABOVE. STRICT COMPLIANCE WITH THE REQUIREMENTS OF THE ABOVE TABLE IS REQUIRED.

LAYOUT PLAN OF THE TYPICAL INSTALLATION OF DN 150 STREET FIRE HYDRANT

FIG. 19



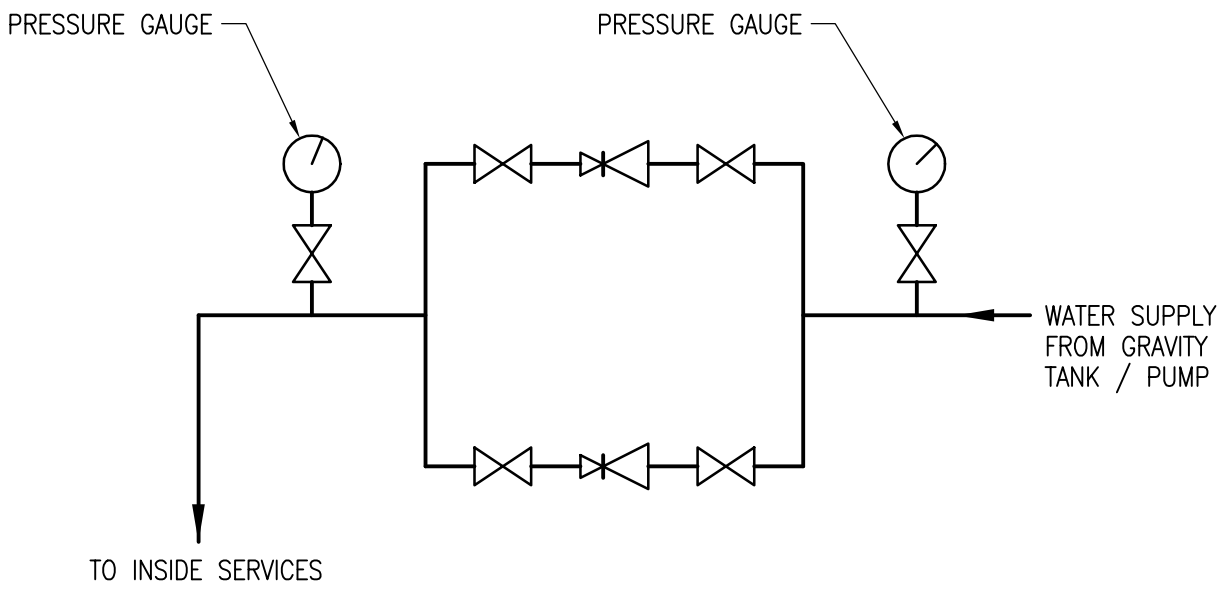
SECTION A – A

NOTES :

1. THE CAP OF THE CONTROL VALVE SPINDLE SHOULD BE AT 250mm APPROX. BELOW THE VALVE COVER AND IN NO CASE SHOULD THE DISTANCE BE MORE THAN 500mm.

FIG. 20

SECTION OF THE TYPICAL INSTALLATION OF DN 150 STREET FIRE HYDRANT



NOTES :

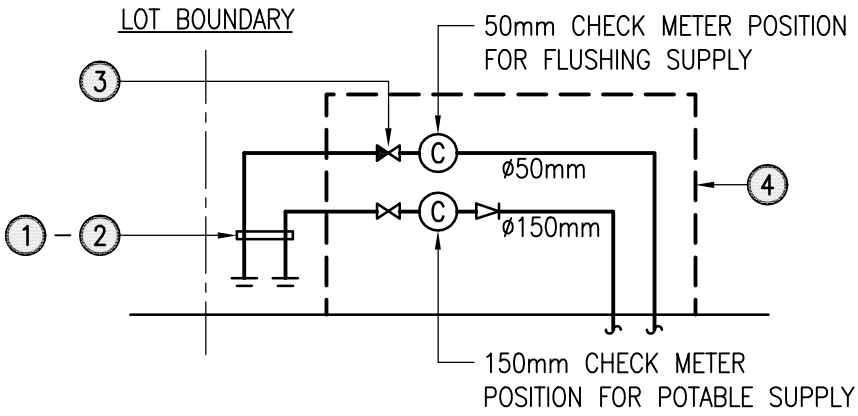
1. A BYPASS ARRANGEMENT WITH THE PROVISION OF A SECOND PRESSURE REDUCING VALVE TO ENABLE ISOLATION OF ANY DEFECTIVE PRESSURE REDUCING VALVE FOR REPAIR AND REPLACEMENT IS USED.

2. THE PRESSURE REDUCING VALVES FOR USE WITH FRESH WATER SHOULD BE MANUFACTURED FROM MATERIALS SUITABLE FOR USE IN CONTACT WITH PORTABLE WATER.

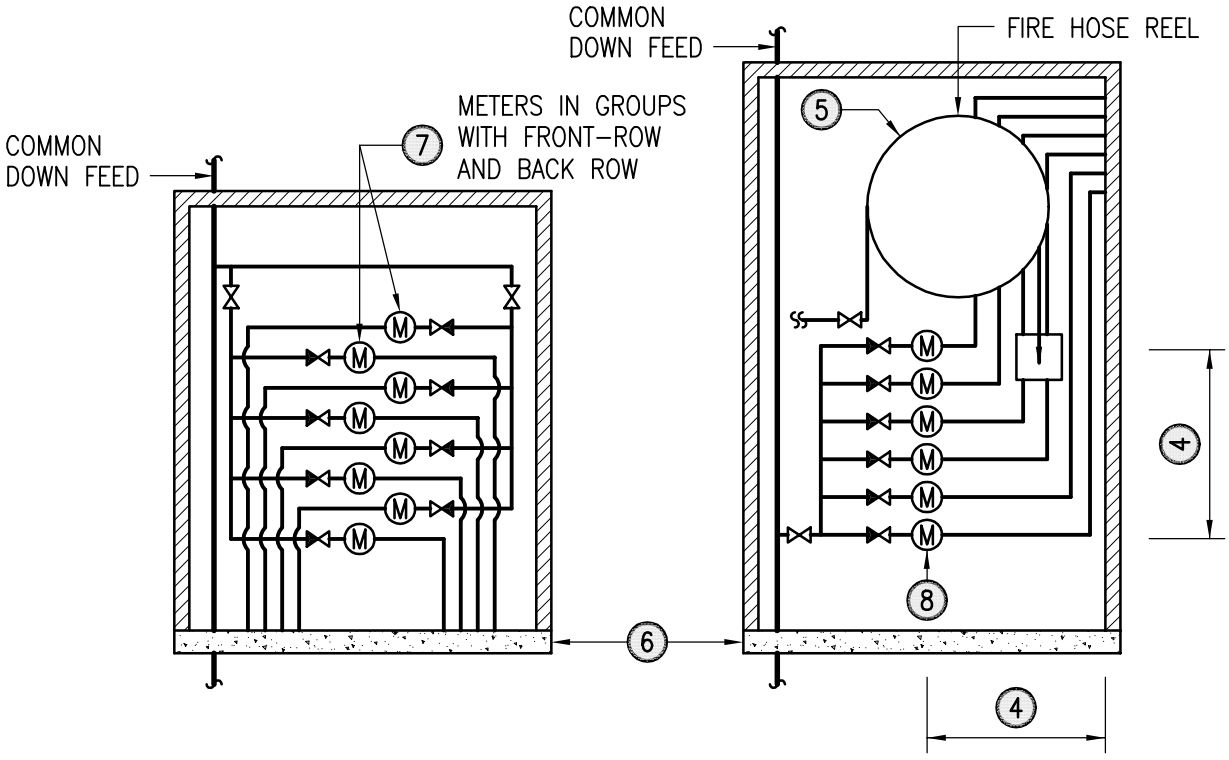
3. THE PRESSURE REDUCING VALVES FOR USE WITH SALT WATER SHOULD BE MANUFACTURED FROM MATERIALS CAPABLE OF WITHSTANDING THE CORROSIVE EFFECT OF SALT WATER.

SCHEMATIC LAYOUT OF PRESSURE REDUCING VALVES

FIG. 21



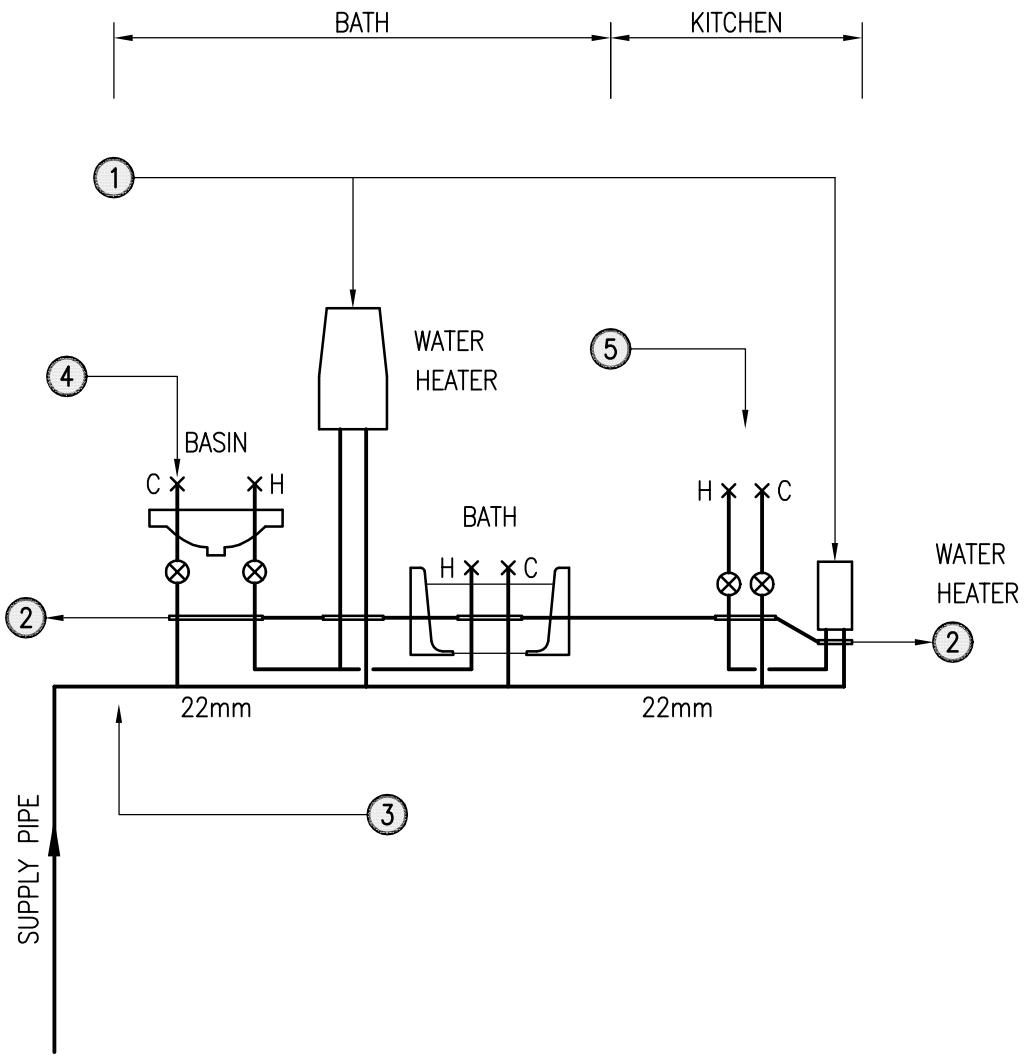
TYPICAL INSTALLATION DETAIL FOR METER/
CHECK METER POSITIONS IN METER CABINET



TYPICAL INSTALLATION DETAILS FOR METER
ARRANGED IN GROUP IN METER ROOM ON CORRIDOR

COMMON MISTAKES FOR METER/CHECK METER POSITIONS

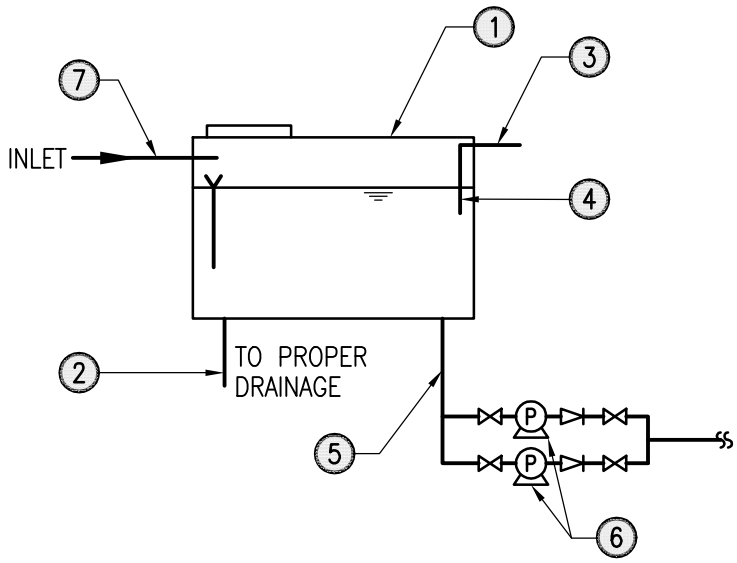
FIG. 22



TYPICAL ARRANGEMENT FOR INDIVIDUAL UNIT/FLAT IN RESIDENTIAL BUILDING

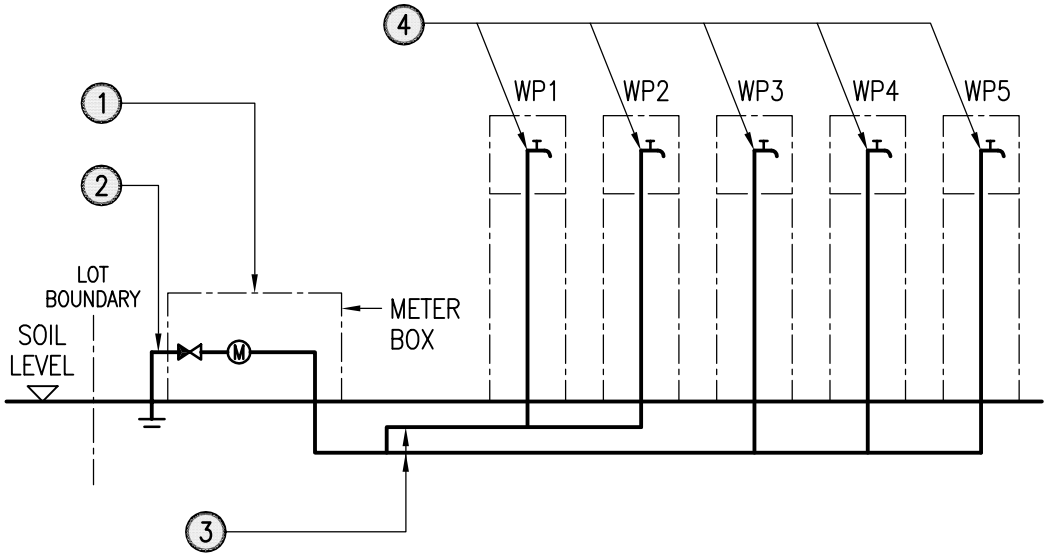
COMMON MISTAKES FOR INSIDE SERVICE

FIG. 23

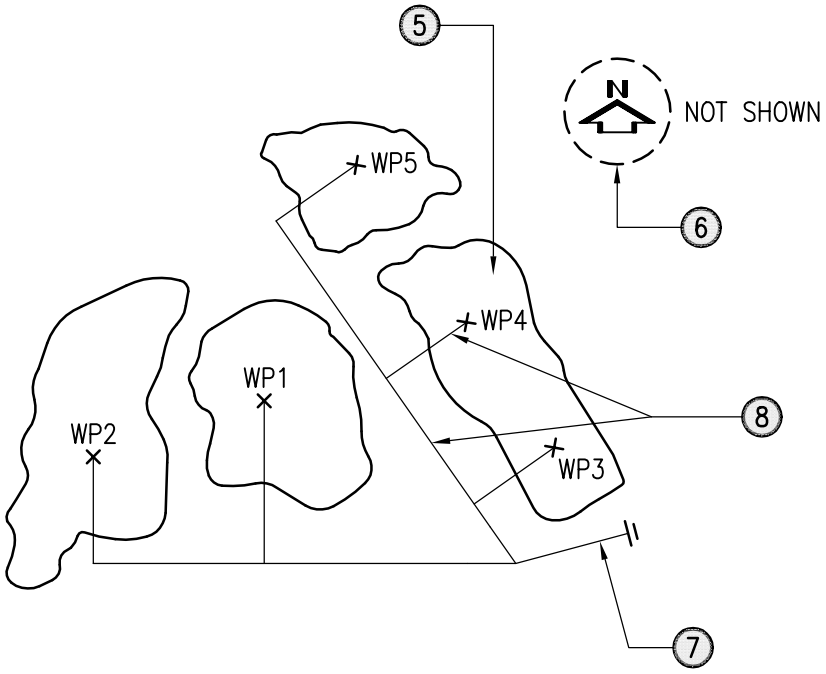


TYPICAL INSTALLATION DETAILS FOR
STORAGE CISTERN AND WATER PUMPS

COMMON MISTAKES FOR SUMP AND PUMP SYSTEM



VPLD FOR WATERING FLOWER BEDS



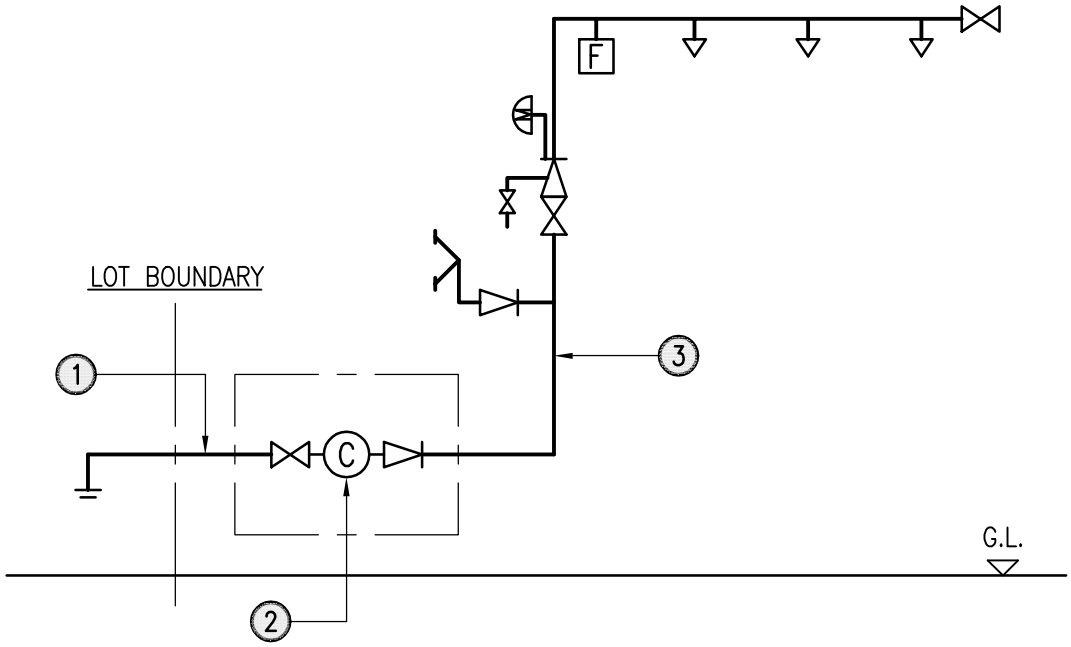
LAYOUT PLUMBING ALIGNMENT PLAN FOR WATERING FLOWER BEDS (NOT TO SCALE)

ABBREVIATION :

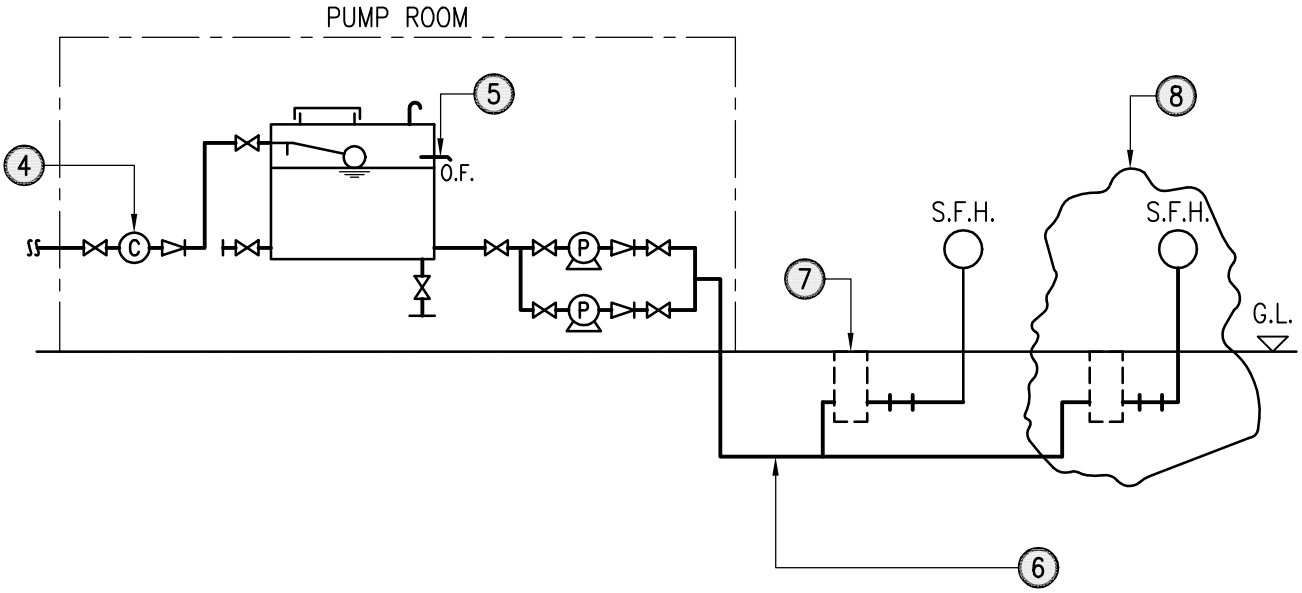
WP WATER POINT

COMMON MISTAKES FOR WATERING FLOWER BEDS PLUMBING SYSTEM

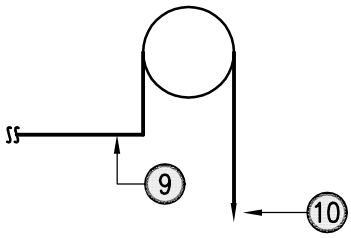
FIG. 25



VPLD FOR IMPROVISED SPRINKLER SYSTEM



VPLD FOR STREET FIRE HYDRANT SYSTEM



TYPICAL INSTALLATION DETAIL FOR FIRE HOSE REEL

ABBREVIATION :

S.F.H. STREET FIRE HYDRANT

COMMON MISTAKES FOR FIRE SERVICE

FIG. 26