



حكومة أبوظبي
GOVERNMENT OF ABU DHABI

GUIDE TO WATER SUPPLY REGULATIONS - ISSUE 3 (2017)

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List of Revisions

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Glossary

ADWEA	Abu Dhabi Water and Electricity Authority established under the Law.
Adequate Network Pressure	that the water pressure is not less than 1.25 bar (12.5 metres head) at the Distribution Company supply pipe to the Premises and that there is sufficient pressure to deliver water directly to the Roof Tanks of buildings not higher than 10 metres from the service connection pipe invert level.
Backflow	means flow upstream that is in a direction contrary to the intended normal direction of flow, within or from a water fitting.
Ball Float Valve	means any float-operated valve for controlling the inflow of water to a cistern or a tank
British Standard	means a standard or specification published under the authority of the General Council of the British Standards Institution, and shall be the current revision of the standard.
Bureau	the Regulation and Supervision Bureau for the Water, Wastewater and Electricity Sector in the Emirate of Abu Dhabi, established under the Law.
Check Meter	a Water Meter installed at the Entry Point of a multi-story/multi-tenant building used for the purpose of evaluating water balance and loss assessment.
Contamination	includes any alteration in chemical or biological quality of water due to a change in temperature or the introduction of polluting substances.
Customer	the person to whom the Distribution Company supplies water for domestic, industrial, agricultural and commercial purposes.
Distribution Company	a company or body holding a License from the Bureau,

pursuant to the Law.

Distributing Pipe

means any pipe not owned by the Water Distribution Company (other than a warning, overflow or flushing pipe) conveying water from a Ground Storage Tank, storage cistern, or from hot water apparatus supplied from a cistern and under pressure from that cistern.

Distribution System

means the system consisting (wholly or mainly) of water pipes owned or operated by a licensee and used for the distribution of Wholesome Water to the Point of Delivery to Premises or Customers and includes any plant and equipment, including metering equipment, owned or operated by the licensee in connection with the distribution of water.

Entry Point

means the physical connection point at which the water enters the Customer Water Fittings.

Fire Service

means the pipes, tanks, pumps and fittings installed for the purpose of firefighting.

Ground Storage Tank

means the receiving tank after the Point of Delivery to the Customer from the Distribution System for storing water for subsequent use, and which does not include a cistern.

Improvement Notice

means a notice prepared by the Distribution Company and approved by the Bureau for the purpose of instructing the Responsible Person to comply with the Regulations.

Law

means Law No (2) of 1998 Concerning the Regulation of the Water and Electricity Sector in the Emirate of Abu Dhabi, Law No (17) of 2005 and Law No (12) of 2008 concerning the Regulation of the Wastewater Sector, as amended.

Licence

means a licence issued by the Bureau pursuant to the Law.

Low-rise Building

means a building up to 10 metres height (G+1).

Overflow Pipe

means a pipe from a tank/cistern in which water flows only when the water level in the tank/cistern exceeds a

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	predetermined level
Point of Delivery	means the physical connection point at which the water leaves the Distribution System.
Premises	means a tract or plot of land and includes the buildings and any appurtenances on the land. Premises may contain more than one property or dwelling and more than one Customer.
Pressure Relief Valve (PRV)	means a pressure-activated valve which opens automatically at a specified pressure to discharge fluid
Responsible Person	means the person who assumes actual responsibility for the installation or the ownership of the Water Fittings. (That person can be a contractor, a consultant or others as appointed or authorized by the owner to liaise with the Distribution Company to fulfil the requirements of the water supply connection).
Roof Tank	means a fixed container, cistern, or break tank located on the roof of a building for the purpose of holding or storing water at atmospheric pressure and which does include a Ground Storage Tank.
Servicing Valve	means a valve for shutting off, for the purpose of maintenance or service, the flow of water in a pipe connected to a water fitting.
Stop Valve/Gate Valve	means a valve, other than a Servicing Valve, used for shutting off the flow of water in a pipe.
Tank Capacity	in relation to a cistern or tank, the volume of storage, excluding the unusable top level, measured up to the level of water that can be reached according to the inflow control device setting.
Terminal Fitting	means a water outlet device.
Vent Pipe	means a pipe open to the atmosphere which exposes the system to atmospheric pressure at its boundary.
Warning Device	means a device that is installed in water storage tanks (capacity >100,000 litres, or about 22,000 imperial

gallons) to indicate water is overflowing.

Water Fitting

means pipes, pipe fittings, joints, valves, and backflow prevention devices including the Customer's Ground Storage Tank or Roof Tank. Without limiting the foregoing, a Water Fitting shall include a pump, meter or any other relevant fittings required to facilitate the connection arrangement to the Customer.

Water Hammer Arrestor

means a device designed to provide protection against excessive surge pressure (hydraulic shock) in the building water supply system where water is abruptly stopped.

Water Meter

means a device used for measurement of water flow or volume which is either read manually or recorded remotely

Water Quality Regulations

the Water Quality Regulations issued by the Bureau under Article (62) of the Law.

Water Supply Regulations

the Water Supply Regulations issued by the Bureau under Article (62) of the Law.

Wholesome Water

means water that is in compliance with the Water Quality Regulations and is supplied for drinking, washing, cooking or food production.

Abbreviations

AC	asbestos cement
ADFCA	Abu Dhabi Food Control Authority
BS	British Standard
BSP	British Standard Pipe
CPVC	chlorinated polyvinyl chloride
DI	ductile iron
EU	European Union

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EPDM	ethylene propylene diene monomer
GI	galvanised steel
GRE	glass-reinforced epoxy
GRP	glass-reinforced plastic
HDPE	high-density polyethylene
ISO	International Standards Organisation
MAOP	maximum allowable operating pressure
MDPE	medium-density polyethylene
NSF	National Science Foundation (US)
PTFE	polytetrafluoroethylene (Teflon)
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
SDR	standard dimension ratio
uPVC	unplasticised polyvinyl chloride
UV	ultraviolet
WDC	Water Distribution Code
WQR	Water Quality Regulations
WRAS	Water Regulations Advisory Scheme (UK)
WRc	Water Research Council (UK)
WSR	Water Supply Regulations

Units

°C	degrees Celsius
bar	metric unit of atmospheric pressure (10m head)
g	grammes
gallon	imperial gallon (1 gallon = 4.55 litres)
hr	hour
kg	kilogramme
kgf	kilogramme force
kg/m³	kilogramme per cubic metre (density)
km	kilometre
l/s	litre per second (velocity)
m	metre
mg/l	milligram per litre (concentration)
ml	millilitre
mm	millimetre
MPa	megapascal (tensile strength) or pressure
m/s	metre per second (velocity)
N/mm²	newton per square millimetre (tensile strength) or pressure
W/m² K	watt per square metre per unit temperature difference (thermal conductivity)
”	inch
’	foot

Guide Overview

Background

1. The objective of this Guide is to explain:
 - (a) the water connection arrangement; and
 - (b) the water fittings requirementswhich a Distribution Company and its Customers must follow in order to prevent wastage, contamination and overconsumption.
2. This Guide has been developed in consultation with the Distribution Companies along with private and government organisations.

In developing this Guide, the Bureau has referred to the following standards, regulations and guidelines:

 - (a) Standard Specification for Water Works (Abu Dhabi Water and Electricity Authority);
 - (b) Unification of Water Supply and Plumbing Regulations – Gulf Co-operation Council;
 - (c) General Guidelines – Water Distribution – Abu Dhabi Distribution Company;
 - (d) Water Supply (Water Fitting) Regulations – UK;
 - (e) British Standard BS EN 806-1, BS EN 806-2, BS EN 806-3, BS EN 806-4, BS EN 806-5 and BS 8558;
 - (f) The Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks - The Regulation and Supervision Bureau, Abu Dhabi;
 - (g) Any relevant tankering regulations that may be in force;
 - (h) The Guide for Chemicals and Products that come in contact with drinking water - The Regulation and Supervision Bureau, Abu Dhabi;
 - (i) Uniform Plumbing Code of Abu Dhabi Emirate – Environment Agency, Abu Dhabi; and
 - (j) User Guide for the International Building Codes in the Emirates of Abu Dhabi – Department of Municipal Affairs, Abu Dhabi.
3. Other documents and regulations which define the requirements for the general arrangements of a distribution system, metering, electrical wiring and water quality are:
 - (a) Water Distribution Code (WDC) – the WDC is designed to govern the operation of the water distribution system and define connection

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arrangements at the entry and exit points. These arrangements are concerned with the planning, connection and operation of the distribution system;

- (b) The Water Quality Regulations (WQR) – these Regulations aim to ensure a high and consistent quality of product is delivered to Customers. The WQR define the permissible concentrations for a range of water quality parameters and the monitoring requirements for assessing compliance. They follow the World Health Organisation (WHO) Water Quality Guidelines and ensure water is fit for human consumption;
- (c) The Customer Metering Regulations – these Regulations define specifications for customers' water and electricity meters; and
- (d) The Electricity Wiring Regulations – these Regulations establish standards and principles that promote the design, construction and operation of safe and efficient wiring systems.

Purpose

- 4. This Guide provides guidance in support of the Water Supply Regulations.
- 5. The purpose of this Guide is to provide details of the general principles and basic design considerations which will ensure the safe, hygienic, reliable and secure construction and operation of customer service connections.
- 6. This Guide is intended to assist the designers, installers, Customer and the Responsible Person(s) in understanding the requirements for a sound and reliable water supply connection.
- 7. This Guide ensures compliance with applicable international and national standards and industry best practice.

Scope and application

- 8. This Guide shall apply to:
 - (a) any person applying for a new water connection, whether permanent or temporary;
 - (b) the person responsible for rearranging an existing connection, including a meter installation, or for disconnection from a Distribution Company's system; and
 - (c) the person, company or organisation, including water fittings manufacturers or suppliers/agents, engaged in any activities relating to the production, supply, erection, maintenance and operation of a plumbing system in a Customer's Premises.

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9. This Guide covers that part of the water supply installation between a Distribution Company's system and a customer's installation, which generally consists of a service connection, water fittings, meter, storage tanks and any direct connection to the kitchen in a low-rise, single metered Premises like villas and shabiat, if applicable.
10. The scope of this Guide does not include the water distribution system belonging to Distribution Companies, except for the fittings that are required at the interface with Customers.
11. The Bureau will ensure that regular reviews and updates are carried out after consultation with Distribution Companies and persons affected, and will publish reprints accordingly.

Existing arrangements

12. Any connection arrangement installed prior to 1 January 2017 shall not be subject to this Guide unless that arrangement contravenes material of construction, wastage or contamination requirements as given in the Regulations. A prior consent shall be granted by a Distribution Company before any additions or modifications to an existing connection arrangement are carried out.

Quality of installations

13. Distribution Companies have an obligation to ensure that hygiene procedures related to the installation of water fittings are followed during installation work. A Distribution Company may therefore request that individuals involved in such installation work undergo a competency test prepared in accordance with its practices and standards in order to ensure the quality of this work.

Quality of supply

14. As prescribed in the Water Supply Regulations, a Distribution Company shall:
 - (a) maintain a minimum pressure of 1.25 bar (12.5 metres) at the main supply pipe to a Customer during normal supply conditions;
 - (b) ensure that under normal operating conditions sufficient water is supplied to meet reasonable demand; and
 - (c) evaluate the size of any connection with consideration to friction losses for all types of service connections.
15. A Distribution Company shall also ensure the water it supplies meets the Water Quality Regulations.

Application for a connection

16. An application shall be accompanied by:
 - (a) a location site plan;

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- (b) an application form prepared by the appropriate Distribution Company;
 - (c) a scale drawing of the Customer internal water system plan; and
 - (d) any other relevant documents a Distribution Company may request, as specified in Annex A.
17. A cost estimate, material inventory and connection arrangements shall be prepared by a Distribution Company to facilitate the connection to Customers.

Operation and maintenance

18. The Responsible Person must ensure water fittings and storage tanks are inspected and maintained according to the procedures set out in this Guide and the Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks.
19. If, during inspection by a Distribution Company, it is found that a storage tank, including its water fittings, does not comply with the Regulations, it shall be considered non-compliant, and an Improvement Notice shall be issued by the Distribution Company to the Responsible Person.
20. Failure to comply with such an Improvement Notice, or with any follow-up inspection report or instructions from a Distribution Company, shall result in the Responsible Person being issued with a final notice, upon which the water supplied to the Premises shall be disconnected.
21. Following compliance by the Responsible Person, and upon further inspection and approval by the Distribution Company, the drinking-water supply shall be reconnected to the Premises.

1. Water storage tanks

Water demand and sizing criteria

- 1.1 The demand criteria in Table 1.1 should only be used as a guide when calculating the size of storage tanks. They may also be used by the Distribution Company for sizing new water service connections and fittings. However, in line with Distribution Company demand management practices, which ensure that 'reasonable demand' is constantly monitored, consumption rates may be modified. Please refer to the relevant Distribution Company for updated rates.
- 1.2 The figures in Table 1.1 are estimates of daily demand rate in both litres and imperial gallons for various types of residential and commercial Premises. Sizing of water connections to agricultural, industrial and other high-consumption Customers shall be determined by the Distribution Company's supply and demand management policies.
- 1.3 The provision of Ground Storage Tanks at Customer Premises (particularly in buildings not higher than 10 metres) shall be considered following consultation with the relevant Distribution Company to verify the availability of Adequate Network Pressure as prescribed in the Water Supply Regulations.

Table 1.1

Type of Premises & consumption categories	Description	Estimates of daily rate of consumption (imperial gallons)	Rounded estimates of daily rate of consumption (litres)
Hotel ¹	per one bed	100-150	450-675
Car wash station (CWS)	per manual channel	800	3600
Car wash station (CWS)	per automatic channel	2400	10800
Hospital	per one bed	150	675
Day clinic	per medical practitioner	100	450
Day clinic (with dental)	per medical practitioner	150	675
Common market	per square metre	1.1	5
Mosques <300m ²	per square metre	5.5	25
Mosques >300m ²	per square metre	3.5	16
Female praying rooms	per square metre	2	9
Workers' Housing	per capita	44	200
Public toilets	per sanitary piece	35-50	160-225
Schools / universities	per student	5/10	25/45
Hostel	per student	44	200
Villa and shabiat	per capita	77	350
Villa / shabiat	per small service block	250	1100
Villa / shabiat	per large service block	450	2000
Villa / shabiat	per external majlis	150	675
Villa / shabiat	per maid's room	50	225
Villa / shabiat	per guard room	100	450
Villa and shabiat ²	per bedroom	110	500
Villa and shabiat	swimming pool/m ²	4-5	18-22
General services ³	per plot square metre	0.2	0.9
Services in a building	up to 5 floors	165	750
Services in a building	from 6 to 10 floors	330	1500
Services in a building ⁴	above 10 floors	660	3000
Offices & shops ⁵	per sanitary piece	35-50	160-225
Offices & shops	per square metre	1	4.5
Restaurants	per meal	2	9
Offices & shops	(per person)	10	45
Residential flat	Studio	100	450
Residential flat	1 bedroom	120	550
Residential flat	2 bedrooms	180	820
Residential flat	3 bedrooms	220	1000
Residential flat	4 bedrooms	280	1250
Residential flat	5 bedrooms	350	1600
Residential flat	per maid's room	50	225
Residential flat	per capita	50	225

Table 1.1 Notes

1. Hotel category up to 5 stars. Hotels/resorts above 5 stars will be subject to assessment.
2. For the shabiat and villa category, a reduction factor may be applied for every additional bedroom according to the Distribution Company's own criteria.
3. 'General services' means water used for internal gardening and general cleaning purposes for a standard-size shabiat and villa.
4. Rates of consumption for buildings higher than 20 floors shall be adjusted proportionally.
5. All consumption rates for sanitary pieces shall be calculated based on water-efficient plumbing fittings, as required by ESTIDAMA.

Note (a): Water consumption rates for other uses, e.g. swimming pools, cooling services, shall be determined following consultation with the Distribution Company.

Note (b): For some of the categories, the Responsible Person has a choice of consumption rate which is subject to the Distribution Company approval

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Firefighting reserve

- 1.4 The Department of Civil Defence is the only reference for determining the quantity and the application of water allocated for firefighting purposes for Premises, which are classified as those requiring internal fire-fighting systems. The tank capacity shall be sufficient to cater for the duration of fire flow as determined by the Department of Civil Defence and shall not be less than 60 minutes, subject to Civil Defence approval in all cases.
- 1.5 Where Ground Storage Tanks are considered (and in order to avoid contamination in tanks), the allocation of separate tanks for firefighting purposes is prohibited if the total required capacity is less than three times the average daily water demand, unless prior approval has been obtained from the Distribution Company. The lower part of that tank shall be reserved for the Fire Service by maintaining a constant water level either by means of a suction pipe invert level, or another approved device. The allocated fire reserve shall be held completely within the ground tank's actual capacity.
- 1.6 If the total required capacity exceeds three times the average daily water demand, then a dedicated firefighting water reserve tank shall be provided. It shall be totally separated from the domestic water supply system to avoid contamination and water stagnation. Separate firefighting reserve tanks should have a circulation pump that automatically circulates 20% of the water volume in 8 hours/day to prevent stagnation. It is recommended that the dedicated firefighting water reserve tank should be cleaned at least annually.
- 1.7 The Department of Civil Defence should be consulted to determine the firefighting systems and actual quantity of firefighting water reserve required. The construction of fire services shall comply with the requirements of the UAE Fire and Life Safety Code of Practice, Fire Service regulations and instructions issued by the Department of Civil Defence in the Emirate of Abu Dhabi. Final approval from the Department of Civil Defence shall be obtained for fire fighting systems after incorporating all the requirements of the Distribution Company.

Tank storage capacity

- 1.8 Total storage capacity of ground storage tank and roof tanks or cistern shall be as per the following limits:
- (i) Minimum Capacity = 1 x daily consumption + firefighting reserve; and
 - (ii) Maximum Capacity = 2 x daily consumption + firefighting reserve
- 1.9 The roof tank should always be sized to hold sufficient water to supply between 12 and 24 hours of the Premises' total daily consumption, irrespective of the provision of Ground Storage Tanks. In situations where no ground tanks are allowed for, the

actual roof storage capacity shall be sized to meet the requirements of Clause 1.8 above.

- 1.10 The Distribution Company shall decide the specific storage capacity requirement (between maximum and minimum) that the Responsible Person can install in the Premises. The Distribution Company should evaluate the capacity with consideration to the type of supply (intermittent or continuous) and the security of supply in terms of pressure and flow conditions in the area where the Premises are located.
- 1.11 Although the storage requirement shown above is vital for the security of supply, it should be noted that water stagnation is not recommended. This is to ensure water quality in the tanks does not deteriorate due to possible depletion of residual chlorine which may result in microbiological contamination. If water stays inside the tank for more than four days without being used, the tank shall be inspected and the water tested before its use. This should be done in line with the Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks.
- 1.12 For high-consumption Customers, water storage tank capacity is determined by daily demand, site-specific conditions and Distribution Company policy regarding demand side management.
- 1.13 For high-consumption, non-residential Customers (such as hotels and hospitals) provided with Ground Storage Tanks only, the complete water capacity may be held in the Ground Storage Tank if the Premises are metered prior to the tank's installation, and the Distribution Company has approved the boosting arrangements.

Ground storage tank and roof cistern general requirements

- 1.14 The general requirements are concerned with location, installation, construction material, protection, testing and disinfection of ground and roof tanks.
- 1.15 Diagrams illustrating common connection arrangements for storage tanks are included in Annex D. These are for illustration only. Detailed drawings shall be submitted in accordance with Annex A.

Tank placement and location

- 1.16 The tank shall be located away from any source of pollution, particularly if it is buried in the ground, and properly protected from ingress of foreign objects.
- 1.17 The distance between the tank wall and any part of the wastewater drainage system shall not be less than 1500mm.
- 1.18 Ground or below-ground tanks shall be located as per the Distribution Company's instructions and in a location that will preserve the quality of the water. The tanks shall be placed where there is no industrial, hydro-carbon activity which may result in water contamination.

- 1.19 Tanks in basements or contained in other below-ground infrastructure must be located in such a way that they are accessible for inspection, maintenance or replacement without the need to disturb the associated infrastructure.
- 1.20 No storage cistern or tank shall be buried directly in the ground. Underground tanks are only permitted in basements or in purpose built underground pump rooms, as illustrated schematically in digram D10 in Annex D, upon approval of the Distribution Company. All storage tanks must be placed to avoid potential flooding. However, where an underground water storage tank has been selected and approved by the Distribution Company, a suitable backflow prevention device and water overflow arrangements shall be considered. This is to ensure water overflowing from the tanks is directed to the drain and that no water returns to the tank following an overflow.
- 1.21 All tank access and inspection openings shall be at least 300mm above ground level or the highest known flood level. A suitably-sized sump-pump shall also be installed when and where applicable.
- 1.22 Storage tanks used for industrial, livestock, agricultural and other purposes that may come into contact with any other fluid or foreign material should be dedicated for that use only, and provided with suitable backflow prevention devices, overflow arrangements and an air gap of not less than 50mm.

Fittings and accessories of tank and cistern

- 1.23 The maximum height of the inlet to the Premises' Ground Storage Tanks shall not exceed 4000mm from water main service connection invert level.
- 1.24 Float-controlled valves or equivalent flow control inlet devices should be securely and rigidly attached to the cistern or the tank and installed so that the valve closes when the level of the water is not less than 25mm and preferably not more than 50mm below the overflow level of the tank or roof cistern.
- 1.25 All inlets to storage tanks and roof cisterns should be provided with a Servicing Valve to facilitate maintenance and a float-operated valve, or some other no less effective device, which is capable of controlling the flow of water into the cistern. The Servicing Valve should be fitted as close as is reasonably practicable to the float-controlled valve or other device.
- 1.26 All outlets other than vent pipes, overflow pipes and warning pipes relating to storage tanks or cisterns supplying water shall be fitted with a Servicing Valve as close to the cistern or tank as is reasonably practicable. Where practicable, all outlets from a cistern should be taken from the bottom of the cistern; a sump pit (600 x 600 x 200mm) shall be provided for tanks and cisterns larger than 10,000 litres. The tank floor should be sloping down towards the sump pit at a gradient of 2.5%.

- 1.27 Tanks 2000mm and more in depth shall be equipped with a water level indicator arrangement. One common level indicator for a group of connected tanks is acceptable, subject to the Distribution Company's approval.
- 1.28 All tanks should have a rigid, close-fitting and securely-fixed cover which is not airtight but which excludes light and insects from the cistern. It shall be made of a material or materials which does/do not shatter or fragment when broken and which will not contaminate the water quality. Cisterns storing more than 1,000 litres of water shall be constructed and placed so that the cistern may be inspected and cleaned without it having to be wholly uncovered.
- 1.29 The storage tank shall be designed to ensure that any maintenance activities for all water fittings, particularly to foot valves and float-controlled valves, can be made without the need for draining or causing any damage to the tank structure.
- 1.30 At least one capped or down-facing air vent shall be installed per water tank. One additional vent shall be provided per 40 square metres of tank area or at a spacing of 7 metres, evenly distributed over the tank area. The vent shall be at least 65mm in diameter, equipped with a stainless steel mosquito screen, and shall be cleaned by the end user at regular intervals. The tank shall have a clear height (free-board) of not less than 300mm but not exceeding 500mm between the top water level and roof (inside surface).
- 1.31 Where the water level in the tank is more than 1500mm, an internal ladder (external ladder for non-buried tanks) shall be installed. The internal ladder shall be made of a non-metallic material (approved plastic or GRP) or of stainless steel grade 316. An external ladder shall be made of a material capable of withstanding the prevailing weather conditions. It shall be properly fixed under or near to the tank access. It shall have a width of not less than 400mm, with the distance between steps not more than 250mm, and the height between the last step and ground not more than 300mm.
- 1.32 A name-plate not less than 300 x 200mm shall be securely attached to the tank exterior, by stainless steel grade 316 bolts and nuts or a similar approved arrangement, in a clearly visible and accessible location, preferably on the tank inlet side. The name-plate shall be made of a material not affected by weather conditions. The following data shall be engraved on the plate:
- (a) material;
 - (b) design/operating parameters (pressure/temperature);
 - (c) capacity;
 - (d) corrosion allowance;
 - (e) name of manufacturer or brand (trade) name;

- (f) serial number/tank size or capacity/volume (in cubic metres) or imperial gallons;
- (g) year of manufacture;
- (h) test pressure;
- (i) date of test; and
- (j) design code.

Water storage tanks: material and construction

- 1.33 Tanks constructed for the storage of potable water shall be made of a material that does not cause contamination or change the aesthetic quality of water supplied by the Distribution Company. Tanks may be made of fibreglass (glass-reinforced plastic), reinforced concrete (cement), reinforced plastic (polyethylene, polypropylene, CPVC) and stainless steel or any other material approved by the Distribution Company.
- 1.34 Tanks and cisterns holding potable water shall be of a suitable grade and material to meet the provisions of BS 6920-1 or equivalent standards approved by the Bureau. The tank construction material, lining, gaskets, adhesives, coating or any other part in contact with the stored water shall not impart taste, colour, odour or toxicity, nor promote microbiological growth. A certificate from the relevant authorities in Abu Dhabi and/or recognised international institutions such as NSF or WRc may be requested, to ensure the tank's fitness for storing potable water in the prevailing climatic conditions in compliance with the Guide of Chemicals and Products that come in contact with drinking water issued by the Bureau.
- 1.35 The tank shall be constructed of a watertight material of adequate strength, and shall be suitable for the storage of potable water at 52°C, at atmospheric pressure. The temperature of the stored water needs ideally to be kept at less than 30°C in order to restrict microbiological growth.
- 1.36 In case tanks are used for storing water for firefighting purposes and domestic consumption together, no hazardous material or materials likely to contaminate the water inside, e.g. GI, should be used anywhere in the firefighting system connected to such tanks e.g. suction pipes and fittings, breaching inlets and testing lines. Use of vertical submersible turbine pumps shall be avoided, even if coated with an approved coating.
- 1.37 Externally-bolted panelled base tanks shall have 500mm minimum clear access between the bottom base panels and finished ground level. Other tanks shall be at least 200mm above the finished floor level of the surrounding area.

- 1.38 No tank or fitting intended for conveying or storing water shall be lined or coated internally with coal tar or any other substance that includes coal tar. All internal or external coatings of water storage tanks shall be approved by the Distribution Company.
- 1.39 Water storage tank design and engineering shall include consideration of all types of loads the tank will be subjected to: it must be ensured that all design calculations have allowed for safety factors which will enable tanks to withstand the internal and external forces to which they are subjected.

Overflow and warning pipe arrangements

- 1.40 The location of the cistern or tank overflow (warning or overflow pipe) must be readily identifiable and the discharge should be in a conspicuous and visible position. Every storage tank larger than 1000 litres (220 gallons) shall be fitted with an overflow pipe. Storage tanks larger than 100,000 litres (22,000 gallons) must be fitted with an overflow pipe and an instrument or device (audible or visual) or both, depending on the Distribution Company's instructions, which will indicate that water is about to overflow and will enable any overflow to be controlled. Any additional requirement shall be approved by the Distribution Company.
- 1.41 A warning/overflow pipe made of rigid pipe should be twice the internal diameter of the inlet pipe and not less than 19mm (bore) internal diameter. The actual internal diameter of the pipe(s) installed should be capable of taking any possible flow in the pipe arising from any failure of the inlet valve. When determining the size of an overflow pipe, account should be taken of any insect or vermin screens installed which may reduce the nominal flow capacity of the overflow pipe.
- 1.42 Where two or more cisterns have a common warning pipe, that pipe shall be installed so that the source of any overflow may be readily identified and shall be so arranged that any overflow from the tank or cistern cannot discharge into another.
- 1.43 Where it is not possible to fit an overflow pipe, an audible or visual alarm operating independently from the inflow control device is required. Where necessary, the Distribution Company may require a water level indicator to be fitted, particularly for tanks of 100,000 litres and above.
- 1.44 Connection of the overflow pipe of a Roof Tank to Ground Storage Tanks may be allowed as long as there is no risk of water contamination. In case internal meters are installed, the overflow pipe from the Roof Tank shall be connected to the Ground Storage Tank or underground tank, providing the construction of underground tank has been allowed. Such a connection must be approved by the Distribution Company. The Customer/Responsible Person is responsible for any water losses within the plumbing system and may be charged for any such losses as stipulated in Clause 4.17.

Tank protection

- 1.45 All water storage tanks with a capacity of more than 50,000 litres shall be partitioned, in order to allow maintenance activities to take place without causing supply interruptions (unless a second tank is available). If the tank is internally partitioned, each compartment shall be treated as an independent water tank. As far as these guidelines are concerned, the partition must extend the full height of the tank, and each compartment must be capable of supporting water on either side with one side empty. All other inlet and outlet connection arrangements must be considered, and separate inlet and outlet connections, overflow, flow control, drainage and isolation valves provided.
- 1.46 All water storage tanks or cisterns manufactured from translucent material (plastic polymers) shall be protected from solar heat gains by factory-made insulation. The insulation shall be made of rigid foam of suitable thickness calculated in accordance with BS EN 1057, resistant to ultraviolet radiation, or as approved by the Distribution Company.
- 1.47 The water storage tanks and associated fittings shall be designed with consideration to the prevailing climatic conditions of the Emirate of Abu Dhabi, and shall be suitable for the storage of desalinated water, well water and/or a mixture of both unless specifically mentioned otherwise. Prevailing climate conditions as a minimum:
- (a) maximum ambient temperature in the shade: 52°C;
 - (b) minimum ambient temperature: 1°C;
 - (c) maximum ambient relative humidity: 100%; and
 - (d) wind speed: 22 km/hr.
- 1.48 Every water storage tank and cistern shall be adequately supported to prevent thermal movement or distortion or damage to it, or to any water fitting connected to it. Any water jet shall be directed away from the tank sides and joints.
- 1.49 Tank foundation and, where required, shed installation, should be of rigid construction, permanent in nature and of a durable weather-resistant material. The expected life of the shed and foundation shall be more than, or similar to, that of the tank itself. The tank foundation shall be rigid, smooth and level. The shed roof shall extend beyond the boundaries of the water tank by one metre. The roof space above the cover shall be no less than 400mm and no more than 800mm.

Storage tank testing and disinfection (new installations)

- 1.50 After completion of tank installation, the tank shall be hydrostatically tested in accordance with the following:

- (a) before testing is carried out, the tank shall be filled with water to the top level of the side panels, and the overflow, drain and other pipes shall be blanked off. The static water test shall be for a period of not less than one hour;
 - (b) continuous inspection shall be carried out for the whole testing period. All leaks found shall be repaired, and the static test repeated until no leakage is observed. Repairs shall conform to manufacturers' recommendations or instructions and be carried out by persons competent in that work;
 - (c) while the tank is being emptied, precautions shall be taken to ensure that the design vacuum is not exceeded;
 - (d) the testing medium shall be potable water. In order to avoid waste, pumping from one tank into another during testing may be allowed; and
 - (e) the hold time between completion of the filling and start of emptying shall not be less than 24 hours in order to allow the tank to settle. Discharging of the water shall be carried out in a controlled manner to avoid scouring or flooding.
- 1.51 After completion of the testing, each tank shall be disinfected in accordance with the procedure below (tank disinfection shall be carried out only after completion of service connection flushing and disinfection where applicable). In case of existing customer storage tanks disinfection procedures stipulated in the Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks shall be followed.
- 1.52 The general disinfection procedure for tanks with a capacity of less than 5000 litres is to flush the tank, introduce the disinfectant (approved type of hypochlorite to 20mg/l) and leave it for a one-hour contact period at a level just below the overflow pipe. If the concentration is satisfactory (5mg/l and above), the tank should be drained and thoroughly flushed. Tank disinfection shall be carried out by a specialised contractor. The disinfection of tanks with a capacity greater than 5000 litres should only be carried out according to the following procedures:
- (a) the tank shall be filled to a depth of 300mm with potable water;
 - (b) sufficient sodium hypochlorite (approved type) shall be added to give a solution containing approximately 20mg/l, or to a concentration approved by the Distribution Company; this solution shall then be mixed thoroughly. Where other disinfectants are used, the concentration and the procedure shall be as per the manufacturer's recommendations and must be approved by the Distribution Company;
 - (c) a small portable pump shall be temporarily mounted outside the tank with suction and discharge hoses extending through the tank main openings;
 - (d) the discharge hose shall be equipped with a suitable nozzle or pipe reducer to provide a sufficient flow of chlorinated water, when discharged from the portable pumps, to reach all parts of the tank interior;

- (e) the interior of the tank shall then be sprayed intermittently to ensure its entire internal surface is disinfected;
- (f) safety precautions shall be taken to avoid injury to personnel: these include the provision of the appropriate protective rubber clothing, chlorine gas masks, etc. It is recommended that the pump be placed outside the tank to avoid the additional hazard associated with the presence of carbon monoxide exhaust fumes inside the tank;
- (g) after disinfection, the chlorine solution shall be drained to waste to a location approved by the relevant authorities, or as recommended by the Distribution Company. The tank shall then be flushed and sealed;
- (h) if required by the Distribution Company, the Responsible Person shall arrange to have the water tested at an approved water quality testing facility to ensure the water quality is wholesome; and
- (i) special attention should be taken when high chlorine concentrations and other disinfectants are being used, as they may affect new coatings or linings in tanks and cisterns.

Operation of and maintenance procedure for storage tanks

- 1.53 All tanks shall be operated and maintained by the Responsible Person, to provide wholesome drinking water at all times. Tanks are subject to cleaning and inspection frequency and procedures as stipulated in The Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks.
- 1.54 Storage tanks above ground and of less than 5000 litres capacity shall be visually inspected by the Responsible Person at intervals of not greater than one year, to ensure that the tank is not leaking and has not suffered physical damage (for example scratches, dents, holes, deformation of any kind) or material degradation (for example, corrosion to glass reinforcement or resin delamination, oxidation of metallic parts) to the tank structure, its fittings and supports, including overflow arrangements. Damage to tanks, fittings and any supports shall be repaired immediately on observation by the appropriate means for that tank type.
- 1.55 Storage tanks in or below ground and not exposed for visual inspection, and tanks greater than 5000 litres in capacity, shall be subject to a static leakage or drop test carried out by the Responsible Person at intervals not greater than one year. Leaks shall be identified and the tank repaired or replaced as appropriate.
- 1.56 All repairs shall conform to best practice in terms of workmanship and materials, and shall conform to manufacturers' recommendations.
- 1.57 Replacement tanks and fittings shall comply with the Water Supply Regulations and its Guide applicable at the time of replacement.

- 1.58 Improvement notices shall be prepared as appropriate and should be applicable for the circumstances prevailing, such that human health and hygiene impacts are resolved as soon as possible, but after no longer than 1 week. “Do Not Drink” warning notices shall be issued to all consumers of water supplied from the failed tanks. Structurally damaged and leaking facilities may warrant a less urgent time scale, but no longer than 1 month.
- 1.59 Follow-up inspections, to lift the improvement notice, shall be undertaken at a timely interval and water quality tests performed, at the owner’s expense, to ensure the water stored is wholesome.
- 1.60 Appropriate written notices, giving no less than 48 hours’ notice, shall be provided by the Responsible Person to all Customers within the Premises prior to any maintenance work, advising them of any possible interruptions to the water supply or any precautions that need to be taken while the maintenance work is being carried out.

Reinforced concrete water storage tanks and reservoirs

- 1.61 The following information details the minimum requirements for design consideration when constructing reinforced concrete reservoirs. In general, constructions of underground reinforced concrete water storage tanks and reservoirs shall be avoided for Low-rise Buildings unless approved by the Distribution Company.

Basic design considerations

- 1.62 A site survey and soil investigation are required at the proposed location of the reinforced concrete tank.
- 1.63 The reservoir foundation shall be free of unsuitable material to the level required as per survey/soil investigation recommendations.
- 1.64 The quality of concrete (minimum to be of grade 40 N/mm²), other materials and workmanship shall be adequate for safety, serviceability and durability.
- 1.65 The concrete reservoir shall be designed in such a manner that it sustains all loads and deformations of normal construction and use, and has adequate durability and resistance to the effects of arid desert conditions and winds.
- 1.66 The specification for concrete reservoirs should be in accordance with ADWEA Standard Specification for Water Works NO. W-C-SS-007, or as approved by the Distribution Company for small storage tanks.
- 1.67 The dividing wall (where constructed) shall be designed such that either compartment may remain full of water (to under roof soffit) whilst the other compartment is empty. The minimum free-board (top water level) shall be 300mm to roof soffit.
- 1.68 The reservoir roof shall be designed for the dead load from the concrete roof slab and other fixtures, live loads and an allowance for personnel working on the roof as

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approved by the designer or owner's representative (consultant). The reservoir roof shall have an access manhole with a minimum clear opening of 800 x 800mm covered by light duty access cover resting on 200mm high concrete upstand

- 1.69 Thermal effects due to temperature variations shall also be considered in the design. All reservoir components shall be constructed of reinforced concrete, and their form shall be determined by the allocated site dimensions and the need to allow for future storage and downstream distribution facilities.
- 1.70 Joints in reservoirs may be used in conjunction with a corresponding proportion of reinforcement, to control the concrete crack widths arising from shrinkage and thermal changes to within acceptable limits, and in accordance with BS EN 1992-3. Provision of expansion joints shall be made with caution and a minimum number of expansion joints is recommended. Joints in the floor slab of the reservoir shall be repeated on the screed below to avoid non-uniform movement. PVC water bars of approved size and make shall be provided at all joints.
- 1.71 Roof slabs shall be designed as flat slabs with all interior joints acting as construction joints so that the slab is structurally monolithic. Where roof and walls are monolithic, movement joints in the roof shall correspond with those in the walls to avoid the possibility of sympathetic cracking.
- 1.72 Tanks installed outdoors without a protective shed above them shall have a 1% minimum slope towards one or two sides, or any other effective system for draining the tank roof. No water shall be allowed to accumulate on the tank roof. For panelled tanks, the roof joints shall be made flush with the surrounding panel to prevent any type of accumulation.
- 1.73 The tank inlet and outlet connections shall be a complete arrangement of flanged water inlet and outlet fittings to BS EN 1092-1 and BS EN 1092-2 , along with a puddle flange either cast or welded on connection and shall be properly aligned both in the horizontal and vertical planes to ensure a watertight joint.

Reinforced plastic water storage tanks

- 1.74 The following information details the minimum requirements for design consideration when installing plastic water tanks.

Basic design consideration

- 1.75 Every tank shall be accompanied with a copy of the manufacturer's catalogue showing operational and maintenance instructions, and precautions to be taken by the end users. Certificates to indicate suitability of material for storing potable water shall be provided, as well as other test certificates as required by the Distribution Company. The Distribution Company may also request additional tests to be undertaken by the relevant international and national testing authorities.

- 1.76 Manufacturers' instructions and guidelines concerning the storage of tank parts and accessories, general site conditions for final tank location, installation methodology, and usage and commissioning of the tank shall be strictly observed.
- 1.77 Tanks shall be erected, tested and commissioned as per supplier/manufacturer instructions. Following installation, the tank shall be tested, cleaned and flushed before being put into service.
- 1.78 The internal and external surface of the shell or panel shall be smoothly finished and free of defects so as to prevent the adhesion of foreign matter such as dust, dirt, moss, algae, bacteria, scale formation and rust.
- 1.79 All domestic water tanks used for storing drinking water shall be protected from excessive heat, direct sun and ultraviolet rays. The tank exterior shell/panel, fastener, supports, etc. shall be protected against direct weather conditions for the duration of their expected life. This means the tank shall be either UV stabilised with suitably insulated material, kept indoors or under a protective structural shed.
- 1.80 The tank material shall be opaque (95 % and above) to help reduce evaporation of disinfectant and inhibit algal growth; the colour of the tank panel and protective wrapping shall aid in reducing heat absorption.
- 1.81 Sealant materials used shall be non-toxic, flexible and resistant to ultraviolet rays. Sealants should maintain these qualities for the expected life of the tank. The internal tank joints of panels shall be made flush with tank panels to prevent the accumulation of deposits and facilitate cleaning. Sealant must not protrude outside joints hindering the cleaning process and aiding dirt accumulation; when sealant is extruded, it must be trimmed back flush with the tank panel.

Installation and erection

- 1.82 All reinforced plastic tanks shall be erected above ground level with a flat supporting base. Tanks shall have a clear access of not less than 600mm all around and shall be suitably fixed in accordance with manufacturers' recommendations.
- 1.83 Each tank with a capacity of 10,000 litres and above shall have a complete arrangement of flanged water inlet and outlet fittings to BS EN 1092-1 and BS EN 1092-2; otherwise tank connection fittings shall comply with BS EN 10226-1/BS 21, along with water fittings suitable for connection to tank inlet and supply pipes.
- 1.84 Flexible connectors shall be used wherever necessary to prevent stress and vibration being transferred to the water tank.
- 1.85 Externally-located tanks shall be installed on a stable foundation and bolted or clamped if necessary to protect them from settlement and to enable them to withstand external forces that may cause movement.

Tank fittings and accessories

- 1.86 All metallic parts in contact with water such as panels, bracing, tie rods, angle plates, roof supports etc., shall be of stainless steel grade 316. If other than stainless steel grade 316 is used, a non-metallic plastic shrinkable tube or an approved similar protective material shall be used.
- 1.87 At least one access cover shall be provided for each water tank. Two access covers shall be allowed for in tanks with a capacity greater than 10,000 litres. The cover shall be an elevated, lockable hinged cover with gasket and locking mechanism. Access holes shall have a suitably-sized clear opening of not less than 600mm in diameter if circular, or 600 x 600mm if square. In small cylindrical tanks, access covers shall be located within reachable distance of float-operated valves for ease of maintenance.
- 1.88 All connections between panels shall be externally flanged for ease of maintenance, cleaning and hygiene considerations. Bolts and nuts shall be of stainless steel grade 316 (other materials can be used provided that bolt heads are cap-protected by a non-metallic material such as rubber).
- 1.89 Panel type tanks shall be supplied with at least one concave section bottom panel fitted with an arrangement to drain the tank; alternatively, the panels adjacent to the tank bottom shall be sloped, or so designed that water is effectively channelled to drain the panel, leaving no water accumulated within the tank. The minimum size of the drain shall not be less than the size of the inlet pipe. Cylindrical tanks shall be fitted with a drain connection to allow complete draining of the tank. All tanks shall be located in a well- drained location.

Glass-reinforced plastic (GRP) water storage tanks

Basic design consideration

- 1.90 Manufacturing and design shall conform to ADWEA standard specification No. W-M-SS-013 or equivalent for glass fibre-reinforced plastic cisterns for cold water storage.
- (a) the maximum tank height shall not exceed 4000mm;
 - (b) the GRP panel safety factor shall be a minimum of 6;
 - (c) wind velocity shall be based on 22 km/hr;
 - (d) the roof panels of the tank shall withstand a maximum load of 100 kgf and dead load of structure; and
 - (e) earth loads shall be determined by the rational soil mechanics method.
- 1.91 The tanks shall be manufactured from hot-pressed moulded GRP Panels. The tank material shall meet the requirements of the WRc (Water Research Council, UK), the WRAS (Water Regulations Advising Scheme, UK) or equivalent approved standards.

Cold-pressed moulded GRP panel tanks are acceptable subject to the Distribution Company's approval.

- (a) the internal and external surface of the shell or panel shall be smoothly finished; no fibre shall project out and the surfaces must be free of defects such as crazing, wrinkles, crevices and pinholes so as to prevent the adhesion of foreign matter such as dust, dirt, moss, algae, bacteria, scale formation and rust;
- (b) the GRP sheet moulding compound shall have ultraviolet protection features to ensure long panel life;
- (c) the base panels shall be of a convex shape to assist in the complete draining of water;
- (d) all tank openings shall be flanged, with the flanges rated and drilled to match the supply/discharge pipeline ratings; otherwise to BS EN 1092-1 and BS EN 1092-2. All nozzles shall be of uPVC;
- (e) GRP tanks shall be constructed with internal partition walls to provide separate sections so that one section can be isolated for maintenance while the other section(s) is/are still operational. In this case, each section shall be provided with the specified accessories to allow for safe isolation;
- (f) all tanks shall be fitted with roof supports manufactured from uPVC pipes. Tanks up to 5000 x 5000 x 3000mm (H) shall be fitted with an internal bracing system comprised of angle brackets manufactured in stainless steel grade 316 or above;
- (g) tanks with dimensions above 5000 x 5000 x 3000 mm (H) shall be fitted with a hot-dipped galvanized external bracing structure. Each tank shall be permanently equipped with an internal ladder of uPVC or GRP and a hot-dipped galvanized external ladder;
- (h) each tank shall be fitted with a hot-dipped galvanized mild steel beam/channel skid. The steel skid shall be fixed on the concrete beams by anchor bolts and levelled. The allowable deflection of the steel footing shall not exceed 3mm; and
- (i) all bolts, nuts and washers shall be in stainless steel grade 316L (or above) when in contact with water. Bolts, nuts and washers not in contact with water shall be of stainless steel grade 316 and above.

1.92 For outdoor bolted tanks, insulated GRP panels shall be utilised to withstand the temperature extremes. The insulated tank panels shall be factory insulated with at least 25mm of polyurethane foam or 40mm of expanded polystyrene. The insulation shall not be exposed to external weather conditions. It shall be covered with a permanently-fixed external cover made of the same material as used in the GRP

panels, and should be resistant to ultraviolet radiation, weather-resistant and watertight.

Storage tanks installation

- 1.93 The tank foundation shall be designed to withstand the total weight of the tank with water, including an adequate factor of safety as per the applicable design standards.
- (a) the construction of the tank foundation shall be carried out in accordance with the tank manufacturer's requirements. Tank foundation shall be rigid and smooth and have an elevated surface; and
 - (b) the foundation construction shall allow for adequate drainage of water away from the tank, so that moisture may not accumulate under the tank. Externally-bolted panelled base tanks shall have a 500mm minimum clear access below their base panels.
- 1.94 Gaskets and bolting shall be furnished for all access holes, hand-holes and other openings which call for blind flanges or covers. At least two sets of gaskets of the same materials shall be furnished; one set for testing and one set unused and packed separately with proper protection and markings.

Galvanized steel tanks

- 1.95 Installation of household water storage tanks made from galvanized mild steel sheets is not recommended. This is due to manufacturing quality as well as the observation that poor conditions and rust have adversely affected the quality of water stored in many existing tanks. Such tanks can only be installed in exceptional circumstances upon Distribution Company approval.

2. Water Fittings

Materials and substances used in water fittings

General

- 2.1 Materials or substances, either alone or in combination, which cause, or are likely to cause, deterioration to the quality of water should not be used in the construction, installation, renewal, repair or replacement of any water fitting which conveys or receives water supplied for domestic or food production purposes.
- 2.2 For non-metallic materials, this requirement is deemed to be met by compliance with British Standard BS 6920-1, or the equivalent approved standard.
- 2.3 Water fittings and materials for water fittings complying with paragraph 2.1 should be tested by an approved test house, and the results certificates shall be provided to the Distribution Company upon request.
- 2.4 The following factors should be considered when determining the suitability of materials and fittings which are, or will be, in contact with the water supplied:
- (a) internal and external temperatures to which they will be subjected;
 - (b) presence of contamination in the ground based on soil investigation;
 - (c) the effect of internal and external corrosion;
 - (d) compatibility of different materials;
 - (e) the effect of ageing, fatigue, durability and other; and
 - (f) permeability.

Joining of different types of materials

- 2.5 Except for plastic pipes, new pipework should not be connected to existing lines or other pipework without appropriate protection being provided against galvanic corrosion.

Plastics and permeable materials

- 2.6 Water fittings should be installed to minimise any risk of contamination by permeation of fluids through the material or materials used.
- 2.7 Water fittings made of a material susceptible to permeation by any fluid that causes, or is likely to cause, contamination of water passing through the fitting should not be laid or installed in such a location.
- 2.8 Water fittings made of plastics or other materials which are likely to be damaged by exposure to oil, petrol or any other contaminant should not be laid in contaminated ground, or should be protected.

- 2.9 Pipes or connections buried near contaminated locations should be made of pipe material that is impermeable or protected by appropriate material.
- 2.10 The minimum distance between the service connection and all other services shall not be less than 350mm from all directions except sewerage lines, where the distance should not be less than 1500mm.

Dezincification-resistant materials

- 2.11 Water fittings are to be resistant to corrosion and, where specified, to dezincification.
- 2.12 All concealed water fittings, except terminal fittings, (including those buried underground), together with backflow prevention devices, are required to be manufactured of gunmetal or other dezincification-resistant materials.

General protection and control measures

- 2.13 Every water fitting shall be:
- (a) immune to or protected from corrosion by galvanic action or by any other process which is likely to result in contamination or waste of water;
 - (b) constructed of material of such strength and thickness as to resist damage from any external load, vibration, stress or settlement, pressure surges, or temperature fluctuation to which it is likely to be subjected;
 - (c) watertight, and be so constructed and installed as to:
 - (i) prevent ingress by contaminants;
 - (ii) be so installed as to minimize the risk of permeation by, or deterioration from, contact with any substance which may cause contamination; and
 - (iii) be adequately supported;
 - (d) no water fitting shall be installed, connected or used which is likely to have a detrimental effect on the quality or pressure of water in a water main or other pipe of the Distribution Company;
 - (e) no water fitting shall be embedded in any wall or solid floor;
 - (f) no fitting which is designed to be operated or maintained, whether manually or electronically, or which consists of a joint, shall be a concealed water fitting;
 - (g) no pipe, cistern, tank or other apparatus used for conveying or receiving potable water shall convey or receive non-potable water; and
 - (h) water fittings should be adequately protected against damage from any cause, including the environment through which they pass.

Water tightness of fittings

- 2.14 Water fittings are to be watertight and suitable for the prevailing temperatures likely to be encountered within the installation.

Fixing of water fittings

- 2.15 Water fittings should be adequately supported, the spacing for support being dependent on the material of the pipes.
- 2.16 Allowance should be made to accommodate any reasonable foreseeable movement, including thermal movement, in accordance with BS EN 806-1, BS EN 806-2, BS EN 806-3, BS EN 806-4, BS EN 806-5 and BS 8558.
- 2.17 No bend or curve in any pipe shall be made so as to significantly diminish or alter the internal diameter or strength of the pipe in any part.
- 2.18 Every pipe shall be properly and adequately supported, and shall be laid and fixed so as to avoid sagging, the development of air locks or reverberation.

Stop Valves, Servicing Valves and drain taps

- 2.19 Draw-off taps, Stop Valves, Servicing Valves and draining taps should be designed so that, where applicable, their seals:
- (a) can be readily renewed or replaced;
 - (b) do not incorporate a loose washer plate;
 - (c) can be designed and manufactured so that they may be easily closed to shut off the supply of water; and
 - (d) can be operated at the appropriate water temperature and pressure.

Pressure requirements

- 2.20 All water fittings should be capable of withstanding an internal water pressure of not less than 1.5 times the maximum operating pressure.
- 2.21 In determining the maximum operating pressure to which the system is subjected, the increase in static pressure in the following instances should be taken into consideration:
- (a) pressure in the supply pipe during night periods when there may be little demand on the system;
 - (b) pressure caused by pumps in any water supply installation where pumps are installed; and
 - (c) pressure resulting from static head or building height.
- 2.22 No water filter, water softener or any other device shall be installed directly in water supply piping or service connections which may cause pressure loss to the customer

Premises. All other water fittings, meters, backflow prevention devices and valves shall be sized correctly in order to minimise pressure losses.

- 2.23 Where Water Fittings are subjected to excessive pressure due to high water supply pressure or pump pressure or pressure drop, the Responsible Person must ensure a pressure regulator adjusted to the requirements of the Distribution Company is installed.

Surge pressures

- 2.24 Where a Customer is connected directly to a supply pipe, the internal test pressure applied to the installation must take into consideration any transient or surge pressures which may be generated within the system.
- 2.25 Transient pressure increases or surge (water hammer) may be generated by the rapid closure of a valve, for example, float-operated valves, spherical valves or disc valves. When installed, attenuation devices or water hammer arresters may reduce the effects of surge. Pipe and/or fittings manufacturers should be consulted for recommended surge pressure limits whilst designing for such transient situations.

Back-syphonage

- 2.26 The method of installation of all pipes, fittings or apparatus shall be such that:
- (a) the creation of a negative pressure of air in the pipes shall be avoided;
 - (b) pipes, fittings and apparatus shall be free from backflow and back-syphonage at all times and that waste or contamination of the water supply shall be prevented; and
 - (c) backflow is prevented by using the appropriate type of prevention arrangement.

Location of water fittings

- 2.27 Unless they are located in an internal wall which is not a solid wall, a duct which may be readily exposed, or under a suspended floor which may, if necessary be readily removed and replaced, or to which there is access, water fittings should not be:
- (a) located in the cavity of a cavity wall;
 - (b) embedded in any wall or solid floor; or
 - (c) installed below a suspended or solid floor at ground level.

Accessibility of fittings

- 2.28 Except where specifically approved by the Distribution Company, all pipes and fittings shall be arranged so as to be readily accessible and, where enclosed, the casing or duct shall be so constructed as to afford ready means of access to the pipes and fittings for examination, repair, replacement and operation.

- 2.29 The point of discharge of any pipe shall be in a position readily accessible for inspection. Duct ends must be sealed to prevent ingress of foreign material.

Concealed fittings

- 2.30 In this paragraph 'concealed water fitting' means a water fitting which:
- (a) is installed below ground;
 - (b) passes through or under any wall, footing or foundation;
 - (c) is enclosed in any chase or duct; or
 - (d) is in any other position which is inaccessible or renders access difficult.
- 2.31 A concealed pipe may be installed in a pipe sleeve or duct located under or within a solid floor provided that the pipe can be readily removed and replaced.

Depth of pipes laid in the ground

- 2.32 Every service pipe laid in the ground shall be 750mm deep, and at no time less than 500mm or more than 1000mm below the surface of the ground, measured from the top of the pipe to the ground surface, except where the depth is reduced at the entry to and exit from a meter chamber. When passing through the foundations of a building, the service pipe shall be fitted in a sleeve or duct installed during the construction of the building.
- 2.33 No service or distributing pipe shall be laid or fixed so as to pass into or through any sewer or drain, or any manhole connected thereto, or into or through any manure hole, cesspool, septic tank, soakaway or refuse pit.
- 2.34 No pipe shall be laid or installed in any foul soil or other substance which could cause either contamination of the water in the pipe or deterioration of the pipe material.
- 2.35 No pipe made of any material susceptible to permeation by any gas or other substance which could cause contamination of the water in the pipe shall be laid, installed or allowed to remain in a position where such permeation could reasonably be expected to occur, for example at or near petrol filling stations.
- 2.36 Every water fitting and every component of a water fitting or any pipe below ground which may be in contact with water shall be resistant or immune to dezincification.
- 2.37 Where compliance with the minimum cover of 500mm is impracticable, and with the written approval of the Distribution Company, the water fittings should be installed as deep as is practicable below the finished ground level and be adequately protected against damage.

Jointings of fittings

- 2.38 Jointing should be by threaded connections to BSP, taper thread to BS EN 10226-1/BS 21 or to flanged connections drilled to BS EN 1092-1 and BS EN 1092-2.

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- 2.39 Water fittings installed underground, embedded in any wall or solid floor should not be jointed or connected to any other water fitting by adhesives.

Irrigation supply

- 2.40 Every pipe supplying a tap used for garden watering or other outdoor use shall be provided with a non-return valve, unless fed independently from a storage cistern.

Operational fittings

- 2.41 Operational fittings such as Stop Valves, Servicing Valves and drain taps should be readily accessible for operation and maintenance.
- 2.42 Operational fittings may be located in a duct or access chamber provided with a hinged door or removable cover which is visible at all times. The door or cover should not be covered with any decorative material such as carpet, wall or floor tiling or wallpaper, which requires removal to access the door or cover.

Stop Valves to Premises

- 2.43 Every supply and distributing pipe providing water to Premises should be fitted with a Stop Valve to control the supply to those Premises only. Shutting off the supply to a Premises means that it will be the only Premises disconnected.
- 2.44 Every supply and distributing pipe providing water in common to two or more Premises is to be fitted with a Stop Valve (whether inside or outside the Premises) to which each occupier of the Premises has access.
- 2.45 Stop Valves shall be located inside Premises, above floor level, and shall prevent the supply of water to any part of the Premises.

Cross connection to unwholesome water and backflow prevention

- 2.46 Any water fitting conveying:
- (a) rainwater, recycled water, treated grey water or well water and any fluid other than water supplied by a Distribution Company; or
 - (b) any fluid that is not potable water,
- shall be clearly identified so as to be easily distinguished from any supply pipe or distributing pipe.
- 2.47 No internal distribution pipe or pump delivery pipe drawing water from a storage tank shall convey, or be connected so that it can convey, other than potable water supplied by the Distribution Company unless a backflow device approved by the Distribution Company is installed.
- 2.48 To prevent contamination to any part of the water installation, and to prevent the backflow of water from the installation to the supply mains, backflow prevention shall be provided on any tank, supply pipe or internal distribution pipe.

- 2.49 The method of backflow prevention and the type shall be in accordance with BS EN 806-1, BS EN 806-2, BS EN 806-3, BS EN 806-4, BS EN 806-5 and BS 8558:
- (a) where it is necessary to prevent backflow between separately occupied Premises; or
 - (b) where the Distribution Company or Bureau or person authorised in accordance with these Regulations has given notice that such prevention is needed for the whole or part of any Premises.

Provision of Servicing Valves

- 2.50 Inlets to all float-operated valves and all cisterns should be provided with a Servicing Valve to facilitate maintenance.
- 2.51 Servicing Valves should be fitted as close as is reasonably practicable to float-operated valves or the other inlet devices of an appliance.
- 2.52 Servicing Valves may be of the screw-down or spherical type.

Float-operated valves

- 2.53 Float-operated valves and other fittings for controlling flow to cisterns or tanks should:
- (a) be capable of controlling the flow of water into any cistern or apparatus and, when closed, be watertight and remain watertight;
 - (b) incorporate, as applicable, a renewable seat and a washer which are resistant to both corrosion and erosion by water, or have some other no less effective valve closure assembly;
 - (c) as applicable, have a float which is constructed of a non-corrosive material capable of withstanding without leaking any water temperature in which it operates or is likely to operate, and have a lifting effort such that when not more than half immersed, the valve is capable of drop-tight closure against the maximum operating pressure at that elevation in the building; and
 - (d) when acting via an operating lever, and when the valve is closed, withstand without bending or distorting a force twice that to which it is ordinarily subject and, in the case of a 15mm size valve, be constructed so that the water shut-off level may be altered or adjusted without bending the float lever.
 - (e) preferably, the level in the Roof Tank should be controlled by an electric float switch in order to alleviate any water hammering effect on the transfer pump and Water Fittings downstream of the pump.
- 2.54 Float-operated valves which are subject to hot water at the inlet should be constructed of materials capable of withstanding, without leaking, any ordinary operating water temperature to which they are likely to be subjected. So far as is reasonably practicable, their operation should not be prevented or impaired by scale.

With regard to any scale likely to be deposited on the valve or float, the valve should be capable of being adjusted to prevent any flow through the valve above the required water level.

- 2.55 Every device or valve installed for controlling the inflow of water (other than float-operated valves) shall be capable of controlling the flow of water into the cistern.

Disconnection, redundant fittings and dead ends

- 2.56 Any draw-off fitting that is permanently removed from the installation should have the branch pipe serving the fitting disconnected at its source. The owner/Responsible Person should apply to the Distribution Company for the supply to be disconnected. This Guide applies in particular to consumers who wish to demolish a building to which a supply pipe has been laid. Such consumers must, prior to the commencement of demolition work, apply to the Distribution Company to have the supply disconnected to prevent damage, waste or contamination of the water supply.

Setting out

- 2.57 All service pipework shall be accurately located in plan and elevation to suit the requirement of the water supply layouts and general arrangement drawings and as required by the approved design.
- 2.58 Sight rails shall be set in position, using a surveyor's level and properly established benchmarks alongside the work. The practice of "transferring" levels by means of a straight edge and spirit level shall not be permitted.

Installation of pipes and ducts

- 2.59 The water supply pipes shall preferably be installed in straight lines, with proprietary fittings used at any change in direction or level. All socketed pipes shall be laid with the sockets facing upstream. All pipes shall be fully supported at the required intervals using mounting that is in strict accordance with the recommendations of the pipe manufacturer.
- 2.60 Immediately prior to laying, all pipes and fittings shall be examined carefully to ensure that they are sound. No damaged or defective items shall be used. Any part length used shall be cut squarely and cleanly at the end. All pipes shall be clean before installation and jointing.
- 2.61 All water supply pipes may include bends, tapers, junctions and other special pipes of a particular pattern as required.
- 2.62 When pipes pass through walls, floors or ceilings they shall be sleeved and sealed. All concealed pipes within walls, ceilings or floors shall be run within a protective conduit.

- 2.63 Before commencement, and for the smooth progress of the pipework installation, the Responsible Person shall coordinate and finalise the routes, ground/invert levels, positions of the manholes etc. with the Distribution Company.
- 2.64 All changes in the design shall be subject to the approval of the Distribution Company.

Detectable tape

- 2.65 Where Water Supply Systems are run underground, pipe shall be adequately protected and marked using detectable tape. Tape shall be installed 250mm above the buried pipe and shall be in accordance with the following specification:
- (a) tape width – 250mm
 - (b) tape material – plastic
 - (c) tensile strength – 10 N/mm²
 - (d) detection strip width – 50mm
 - (e) detection strip material – plastic aluminium coated⁵
 - (f) colour – blue
 - (g) printing – CAUTION – WATER PIPE BELOW (in Arabic and English)

Pipe bedding and surrounding material

- 2.66 Pipe bedding and surrounding material shall be well rounded, not angular. When the excavated material is suitable, the bottom of the trench shall be trimmed and loosened to form the bed; otherwise the trench shall be excavated to a depth below the invert level to allow for the thickness of bedding material. No sharp material shall be in contact with the supply pipe.
- 2.67 When dug material is not suitable, imported granular material shall be used to provide 100mm bedding and surrounding material, see Table 2.1.
- 2.68 Requirements for imported material for bedding and surrounding nominal pipe size (complying with BS EN 12620).

Table 2.1

Range of pipe: nominal diameter	Pipe bedding and surrounding material
Up to 65mm	Fine or Coarse sands up to 5mm nominal size depending on pipe material
80mm to 150mm	10 to 14mm nominal single sized or 5 to 14mm graded aggregate
150mm and over	10, 14 or 20mm single sized or 5 to 14mm or 5 to 20mm graded aggregate

- 2.69 All surround and backfill materials up to 500mm above the pipe shall be loose laid and hand compacted only.

⁵ The detection strip shall be sealed along its edge

- 2.70 If the excavated material contains stones larger than 40mm, the bedding material must be extended 150mm around the circumference of the pipe. Alternatively, the backfill can be graded to eliminate stones exceeding 40mm, and this selected backfill used for the first 300mm around the circumference of the pipe. The remainder of the trench may be backfilled with suitable excavated material.

Valve chambers and pits

- 2.71 All chambers and pits shall be constructed of reinforced concrete or of solid concrete blocks to the internal dimensions laid out in BS 5834-4, or of a material approved by the Distribution Company. Chambers and pits shall be designed for the vehicular or other loading to which they will be subjected. Valve chambers, pull chambers, and Water Meter chambers shall not be located in traffic areas including parking areas. Special approval shall be obtained from the Distribution Company if such a requirement cannot be met.
- 2.72 Foundations to chambers and pits shall be of concrete complying with the relevant clauses of the Concrete Specification and shall finish flush with the chambers and pit sides unless specifically otherwise required.
- 2.73 The internal surfaces of concrete block walls shall be rendered with cement and sand 1:2 mortar 10mm thick, and the rendering shall be finished with a smooth and even surface. The ends of all pipes shall be built neatly into the blockwork and finished flush with mortar. External surfaces shall be waterproof to prevent external ground or surface water from entering the valve chamber. Valve chambers and pits shall be provided with a soak-away pit filled with gravel. The soak-away shall have a minimum size of 100 x 100 mm plan dimension.
- 2.74 Where subsequent pipework is to be installed, an adequate length of free end is to be left for later coupling.
- 2.75 Where the depth of invert of manholes exceeds one metre below the finished ground level, aluminium steps as specified in BS EN 13101 shall be built in at vertical intervals of 300mm, with alternate steps in line vertically and at 225mm centre to centre horizontally.
- 2.76 Entry to deep manhole chambers (>1500mm) shall be by means of one or more caged vertical aluminium ladders.
- 2.77 Manhole covers and frames shall be of blue epoxy coated ductile iron complying with BS EN 124 or an equivalent standard, and shall be designed for the loading category to which they will be subjected. Normally, if not exposed to traffic loads, they shall be of minimum Class B125. Any manhole cover located in traffic areas, including parking, are subject to Distribution Company approval.

Testing, disinfection and flushing

Testing

- 2.78 The whole installation up to the roof tank should be tested hydraulically on completion by subjecting all supply and distribution pipes, fittings and connections to an internal test pressure of 1.5 times the maximum allowable operating pressure (MAOP) for the installation or the relevant part for a maximum of 3 hours.
- 2.79 For systems that do not include any plastic pipes (that is, rigid pipe materials such as copper, stainless steel etc.), the requirement shall be in accordance with BS EN 806-1, BS EN 806-2, BS EN 806-3, BS EN 806-4, BS EN 806-5 and BS 8558.

Testing procedure

- 2.80 The water supply pipelines, joints and fittings shall be tested prior to surrounding, backfilling, building into walls and floors, or other concealment.
- 2.81 All tests shall be performed in convenient sections for each system in the presence of and to the satisfaction of the Distribution Company where requested.
- 2.82 Prior to the commencement of testing, the system shall be thoroughly cleaned by flushing with potable quality water to ensure no foreign matter remains within the pipe.
- 2.83 The pipes shall then be filled and allowed to stand for a period of 24 hours before testing.
- 2.84 During the filling operation, care must be taken to ensure that there is no entrapped air in the system. The test pressure shall be applied gradually by means of a suitable pump connected to the pipe in a manner satisfactory to the Distribution Company.
- 2.85 All gauges used shall be in good operating condition and shall be accompanied by the relevant valid calibration and test certificates and be of a condition that is satisfactory to the Distribution Company.
- 2.86 During the test, all exposed pipes, joints, fittings, valves, etc. shall be carefully examined, and any joint or item showing signs of leakage shall be rejected.
- 2.87 All sections or items rejected shall be removed and replaced, and the test shall be repeated to the satisfaction of the Distribution Company.

Disinfection

- 2.88 For a service connection larger than 50mm in diameter, the following shall be considered:
- (a) Sodium hypochlorite (food grade):
- (i) The system must be filled with chlorinated water at an initial concentration of 20mg/l for a contact period of 1 hour. If the free residual chlorine measured at the end of the contact period is less

than 10mg/1, the disinfection process shall be repeated until 10mg/1 is reached, or as instructed by the Distribution Company.

- (ii) After successful chlorination, the system shall be immediately drained and thoroughly flushed with clean water. Flushing shall continue until the free residual chlorine is at the level present in the potable water supplied.

(b) Other disinfectants:

- (i) The system shall be filled with the approved disinfectant solution at the initial concentration and for the contact time specified by the manufacturer. If the residual amount of the approved disinfectant at the end of the contact time is less than the manufacturer's recommendation, the disinfection procedure shall be repeated.

2.89 For a service connection less than 50mm in diameter, the Distribution Company must be satisfied that the water supplied is wholesome.

2.90 Should the hydrostatic test fail, and repair work involve emptying the pipeline, the disinfection and subsequent testing procedures shall be repeated.

2.91 Once flushed, the water in the new pipelines shall be allowed to stand for a further 24 hours. Samples shall then be taken from locations directed by the Distribution Company and immediately submitted for chemical and bacteriological testing at an approved laboratory.

2.92 Chemical and bacteriological tests shall normally be undertaken by the Distribution Company laboratory or a laboratory approved by the Bureau.

Acceptance criteria for disinfection

2.93 The pipeline shall not be considered acceptable until faecal coliforms are undetectable in a 100ml sample. As for the bacterial count, the recorded total chlorine (minimum of 0.2 and maximum 0.5mg/l) and the pH shall be within acceptable limits as defined within the Water Quality Regulations. If the tests show that a satisfactory potable water standard has not been achieved, the test shall be repeated.

Flushing

2.94 After all hydrostatic testing and disinfection has been completed and the pipeline is ready in all other respects, the new pipeline shall be flushed out with potable water from the existing mains to which the new pipeline or network is or will be connected. Flushing entry and exit points shall be designed to allow a minimum of 1.0m/s water velocity in the main pipeline to remove any sand or other debris. The quantity of flushing water shall be calculated as the equivalent to 3 times the volume of the pipeline to be flushed unless directed otherwise by the Distribution Company.

- 2.95 Flushing water shall be discharged via temporary discharge lines to the surrounding open desert area or into the existing storm water system or, if feasible, into road tankers. Discharge of flushing water into the existing storm water system shall be subject to the approval of the relevant Authorities.

3. Water pumps and treatment apparatus

General requirements

- 3.1 It is strictly prohibited to install any type of suction pump, whether externally or internally located, for the purpose of directly or indirectly drawing water from the Distribution Company's water supply system (Diagram no. 5). Only under special circumstances will the Distribution Company consider approving such installations.
- 3.2 It must be noted that all electrical wiring arrangements and electrical connections to the pump-sets and associated equipment must comply with the Bureau's Electricity Wiring Regulations.
- 3.3 All pump-sets must be covered and installed in a clean and dry location, and be protected from dirt and fumes. Pump-sets must be located to allow safe access for maintenance activities, including the removal or replacement of parts.
- 3.4 All pump-set accessories and associated electrical and mechanical equipment shall be installed, tested and commissioned in accordance with manufacturer recommendations.
- 3.5 The installation of pressure-reducing valves or pressure regulators shall be considered in the internal distribution system where pressure is likely to exceed 2.5 bar, or as specified by the Distribution Company.
- 3.6 Diagrams illustrating common connection arrangements to pumps are included in Annex D. These are for illustration only; detailed drawings shall be submitted in accordance with Annex A.

Transfer/booster pumps

- 3.7 Where required, transfer pump(s) shall be installed for the purpose of pumping water from the Ground Storage Tank to the Roof Tank or cistern. The flow rate of the pump shall be selected in such a way that the roof tank is filled within one to two hours after receiving a low-level signal. A high-level signal should be at least 50mm below the overflow pipe of the roof tank. Level control or float switches in contact with water shall be made of material that is safe and does not affect the water quality in any circumstances.
- 3.8 The required capacity of the pumping system shall also be determined with consideration to the building's overall rate of consumption and with consideration to friction losses. Water velocity must not exceed 2.0 m/s in the riser pipe unless approved by the Distribution Company.
- 3.9 It is recommended that two pumps are installed as a minimum (one duty and one standby) for security of supply purposes, particularly in multi-tenanted buildings.

- 3.10 The alternative method of supply is by a direct boosting system from the Ground Storage Tank directly to the Premises by the use of a transfer pump and pressure vessel system. However, this system is recommended only for commercial and public buildings and must be approved by the Distribution Company and all calculations regarding riser pipe and branches must ensure that demand is supplied based on the appropriate consumption rate.

Pressure-maintaining pumps

- 3.11 For multi-storey buildings and high-rise buildings supplied by roof tanks, the top floors shall be fed by one or more pressure-maintaining pumps, along with a pressure vessel by drawing water from the roof tanks. The purpose of this is to maintain constant pressure and overcome the low pressure and loss of supply problems that may occur if the distance between the roof tank and top floor levels is approximately 10 metres or less.
- 3.12 For villas and Low-rise Building supplied by roof tanks pressure-maintaining pumps may also be installed to supply the top floors, if required, with a mechanism to regulate the discharge pressure e.g. pressure reducing valve. Any outdoor water requirements shall be satisfied separately by gravity and not by the pressure-maintaining pump serving the top floors.
- 3.13 The pressure-maintaining pump shall be sized to meet the plumbing system requirements and the residual pressure shall in no case be less than 1.25 bar and not more than 2.0 bar, or as specified by the Distribution Company.
- 3.14 A by-pass from the roof tanks to the pressure-maintaining pump shall be provided in case of pump failures.

Suction pumps

- 3.15 As noted above, it is prohibited to use suction pumps to draw water from the Distribution Company mains or system unless prior approval is obtained from the Distribution Company.
- 3.16 Design drawings including such a pump shall not be approved. Furthermore, permanent water connection shall be withheld until such pumps are removed.

Circulation pumps

- 3.17 Circulation pumps shall be provided for tanks of an irregular shape or with narrow passages or closed parts. The flow rate of such pumps shall ensure that the whole tank capacity is circulated within six hours.

Water Treatment apparatus

- 3.18 No domestic water treatment apparatus, water softener, ion exchange unit, desalination unit, activated carbon or any other filtration system shall be connected directly to the service connection.

- 3.19 Water treatment apparatus installed at the Customer Premises which utilises chemicals for water disinfection, or treatment processes that may alter water quality characteristics prior to metering, shall not be installed. Where further treatment is required for certain applications, the Responsible Person must consult the Distribution Company or the authority concerned.
- 3.20 Central filtration systems or any other water treatment equipment installed, particularly in multi-tenanted and commercial buildings, must be maintained and operated according to the manufacturer's recommendations. By-pass arrangements shall be considered in case of system failures.
- 3.21 Almost all water supplied by the Distribution Companies in the Emirate of Abu Dhabi is desalinated water, therefore water treatment equipment specified must be considered following a technical evaluation by the Responsible Person. The Responsible Person may wish to seek information and data on the water quality supplied to the area of residence from the Distribution Company (e.g. Total Dissolved Solids, pH, Chlorine and Hardness... etc.) to verify whether additional treatment is required.

4. Water meter provision and installation arrangements

General arrangements

- 4.1 All potable water outlets supplying water to Customer Premises and connected directly or indirectly to the water main, or sub-main of the Distribution Company's water network, shall be metered in a manner approved by the Distribution Company using an approved measuring device.
- 4.2 Any building, part of building or Premises divided into isolated flats (separate occupation) shall be separately metered.
- 4.3 Open commercial spaces with one or more self-contained units located separately shall also be metered separately.
- 4.4 Service or utility water requirements: air conditioning, housekeeping, garbage room, public toilets, filtration system and general services must all be metered by one or more meters as approved by the Distribution Company.
- 4.5 Swimming pools (both above and below ground level) larger than 50 cubic metres with a fixed water supply connection shall be metered separately. Similarly, separate meters shall be installed on fixed water supply connections for any non-domestic use e.g. for irrigation and cooling systems.
- 4.6 The size and type of meter shall be appropriate for the individual Customer's overall consumption pattern and maximum flow rates.
- 4.7 Access to metering installations shall be made available to authorised officers of the Distribution Company for the purpose of meter reading, installation of a remote reading device, maintenance etc.
- 4.8 Diagrams illustrating common locations of Water Meters are included for illustration purposes only. Detailed drawings showing the location of the proposed meter(s) shall be submitted in accordance with Annex A.
- 4.9 A metering installation must meet the following requirements:
- (a) the Customer Metering Regulations;
 - (b) the relevant section of BS EN 806-1, BS EN 806-2, BS EN 806-3, BS EN 806-4, BS EN 806-5 and BS 8558; and
 - (c) the relevant parts of the Guide.

Meter standards and regulations

- 4.10 All Water Meters used for measuring any supply of water for revenue purposes must be in compliance with the Customer Metering Regulations issued by the Bureau. They should be approved by the Distribution Company and conform to the relevant standards included in the regulations.
- 4.11 Water Meters using electronic principles are acceptable so long as they are approved and compliant with the Distribution Company's requirements.
- 4.12 The meter numbering system must be approved by the Distribution Company. The meter number, if unprotected, must be engraved on the meter body on the same side as the reading display window. If the meter number is written on the counter face of the meter, it should be protected by a toughened clear plastic or glass cover.

Illegal tampering

- 4.13 The meter must be protected by the Responsible Person from illegal tampering, and access to components which may affect its metrological characteristics must be prevented. The meter must be installed in a secure location and have a valid manufacturer's or other approved agent's seal in place as specified by the Distribution Company. Where seals have become damaged or removed, the Customer shall inform the Distribution Company.
- 4.14 No Customer shall be permitted to remove or replace a meter. Only the Distribution Company, or a person authorized by the Distribution Company, may replace or remove a meter. A Customer shall be legally liable if found responsible for such an act.

Water meter housing

- 4.15 Water Meters are calibrated measurement devices, and require some degree of protection against physical shock, maltreatment and tampering. In order to provide this protection, Water Meters shall be housed in an approved manner in either cabinets or chambers or rooms as approved by the Distribution Company.

Check meters

- 4.16 The service pipe supplying multi-storey and multi-tenanted metered buildings or Premises shall also be fitted with a Check Meter for water balance purposes. This is to ensure water losses or leakages inside the Premises' boundary are detected and repaired.
- 4.17 The Distribution Company may charge the Customer/Responsible Person for any water losses within the plumbing system i.e. for the difference between the Check Meter reading and the sum of Customer Water Meter readings.

Externally-installed meters

- 4.18 Externally-installed Water Meters of sizes up to and including 25mm diameter should be housed in cabinets intended for use on service connections. The cabinet should be manufactured of press-moulded fibreglass (GRP) or a material approved by the Distribution Company. The Water Meter cabinet shall be of robust construction and shall be made of GRP with a UV stabilizer.
- 4.19 Externally-located meters 40mm in diameter and above:
- (a) Threaded type Water Meters shall be housed in cabinets intended for use on service connections. The cabinets shall be manufactured of press-moulded fibreglass (GRP) or a material approved by the Distribution Company. The Water Meter cabinet shall be of robust construction and shall be made of GRP with a UV stabiliser.
 - (b) Flanged type Water Meters shall be installed in the ground and housed in watertight chambers and shall be sized so that ample space as specified by the Distribution Company is available for maintenance activities. The chamber shall be fitted with a cover marked 'Water Meter', of a sufficient strength to carry anticipated loads, or as per the Distribution Company's recommendation.
- 4.20 Water Meter cabinets shall have either louvered panels or shall have visible reinforced glass doors opening sideways, depending on the location and as per the Distribution Company's recommendation. A PVC sleeve shall be provided with a pull rope from a Water Meter cabinet to the nearest electrical room to facilitate any future remote reading and metering data management system.
- 4.21 Water Meter cabinets shall either be installed on a support outside the boundary wall or mounted in a recess in the boundary wall and made flush with the boundary wall external face. The cabinet shall be placed at such a height that the centre of the reading window is approximately 1500mm above the finished ground level or sidewalk level or as approved by the Distribution Company according to site conditions.
- 4.22 A multi-meter cabinet can be used, provided that the spacing between meters is as specified and that all other requirements of the Distribution Company are met. All cabinets shall be provided with locks and drain outlets connected to an approved drain system by the Distribution Company.
- 4.23 Where required by the Distribution Company, examples of Water Meter cabinets submitted for approval must be complete with all the necessary internal fittings, such as the Water Meter and lockable valve and secured as if ready for connection.

Internally-installed water meters

- 4.24 Internally-installed Water Meters, commonly used in multi-tenanted buildings, can either be installed in wall-mounted cabinets with doors made of aluminium and reinforced glass, or in a separate meter room. Internal meters shall be located in safe and easily accessible locations.
- 4.25 Rooms housing Water Meters shall have the following characteristics:
- (a) a standard room size of a width not less than 1000mm and suitable length;
 - (b) an electric light shall be provided where and if required;
 - (c) a drain pipe not less than 32mm in diameter shall be provided for each meter housing chamber or cabinet connected to the building's floor draining system;
 - (d) the meter(s) shall be fixed in a vertical position with suitable support;
 - (e) an engraved sign reading 'WATER METER ROOM', not less than 200 x 100mm in size, shall be fixed to the outside of the door of the room;
 - (f) lights, switches and sockets inside the Water Meter room shall have the degree of protection of IP65 or above;
 - (g) a PVC sleeve shall be provided with a pull rope from a meter room or cabinet to the nearest electrical room to facilitate any future remote reading and metering data management system; and
 - (h) the door of a Water Meter room or cabinet shall be provided with a master key system approved by the Distribution Company.

Water meter identification tags

- 4.26 Tags shall be of rigid plastic material and be at least 60 x 60mm in size.
- 4.27 Tags shall carry the following information engraved in different colours:
- (a) the account number specified by the Distribution Company; and
 - (b) title of the Premises served by the meter.
- 4.28 Tags shall be screwed to the wall or the back of the cabinet.

Water meter installation

- 4.29 Each Water Meter up to and including 40 mm diameter shall be provided with a lockable ball valve upstream of the meter and a gate valve downstream of the meter, all of the same size as the meter, and suitable connectors to facilitate future meter changes. For meters larger than 40mm diameter, a gate valve on each side of the meter shall be provided, and a non-return valve downstream of the meter. Where multiple meters are installed inside a single cabinet or a room, one main gate valve

shall be provided inside the same room or cabinet in order to isolate that group of Water Meters. Where a drain valve is required, it shall be installed immediately downstream of the meter.

- 4.30 Pipework shall be firmly fixed to prevent movement of the flexible joints within the meter assembly. Adhesive or plastic clamping is not permitted.
- 4.31 Meters can be fixed horizontally or vertically so long as they are designed to operate in such orientation and depending on the meter's nominal diameter. Meters of 40mm and larger are generally installed horizontally or according to the Distribution Company's requirements and manufacturer's recommendations.

Grouping of water meters

- 4.32 Water Meters can be installed in groups of not more than 20 meters.
- 4.33 Centre-to-centre spacing of meters shall not be less than 170mm for meters less than 40mm in diameter.
- 4.34 Multi-meter cabinets can be used with the approval of the Distribution Company, provided the size is increased to accommodate all the meters. Centre-to-centre spacing of meters should not be less than 170mm, and the clearance from the edge of the meter to the cabinet side not less than 100mm.

Pressure-reducing valves

- 4.35 Pressure-reducing valves (PRV) shall be used on the upstream side of the meter if the pressure at that point is likely to exceed 2 bar, or as specified by the Distribution Company.
- 4.36 Where required, one pressure-reducing valve shall be installed for each group of meters located in each floor of the building. This generally applies to the floors where pressure in the riser pipe feeding individual Customers exceeds 20m water head (2 bar). If the pressure is between 20 to 30m water head (2-3 bar) then a by-pass line fitted with a gate valve shall be provided for each PRV. If the pressure is greater than 30m water head (3 bar) then a by-pass line fitted with a PRV and gate valve on either side shall be provided. The gate valves on by-pass lines shall be normally closed.
- 4.37 Each pressure-reducing valve shall have a quick-isolation valve on either side and shall have provision for both a pressure gauge connection and a drain cock.
- 4.38 Pressure-reducing valves may be installed inside the meter cabinet or room.
- 4.39 The diameter of the distribution pipe from overhead tanks to consumers shall be gradually reduced if the height of the tanks above kerbstone level is more than 50 metres.

- 4.40 Where the Water Meter is susceptible to regular intermittent supply, the Distribution Company shall specify an appropriate meter that does not account for air volumes, or an approved air-venting device must be installed prior to the meter.

Location of water meters

- 4.41 Locations shall be individually determined by survey of the existing or proposed position of the ground water tank in each plot. Such locations shall be plotted on a scale plan of the sector and the proposed positions of the meter cabinet indicated. The plans shall be submitted to the Distribution Company for approval.
- 4.42 The location of the meter cabinet for each plot shall generally be positioned outside the plot boundary or mounted on the boundary wall at a standardised height for single supplied properties (for example villas), and shall be installed inside the property boundaries for Premises supplied from a common service connection.
- 4.43 Meter locations shall be approved by the Distribution Company and meters should not be installed in any of the following locations:
- (a) inside the customer Premises;
 - (b) inside rooms reserved for other services such as electricity or telephones, garbage rooms, filter rooms, pump rooms; and
 - (c) over the top roof of the building where access is by means other than the main concrete staircases, unless approved by the Distribution Company.

Meter installation

- 4.44 The flanged connection shall be drilled according to ISO 7005-2 raised face. The flange pressure rating shall be as given in the particular specification or data sheet.
- 4.45 A straight length of pipeline shall be provided upstream and downstream of the flow-meter to prevent flow turbulence affecting the accuracy of the flow measurement.
- 4.46 The straight length at the inlet of the Water Meter shall be at least 10 times the meter's nominal diameter, and the length at the outlet shall be at least 5 times the meter's nominal diameter.
- 4.47 The installation of the flow meter shall be such that it is possible to remove the meter at any time and replace it with the appropriate length of spool piece.

Setting out

- 4.48 Prior to final installation and operation of any Water Meter it shall be confirmed by the installer that the pipeline, meter body and fittings are free of debris and potential pollutants.

5. Service connection

- 5.1 A water service connection is a water connection performed by the Distribution Company or performed under the supervision of the Distribution Company. No other party is allowed to perform this connection unless authorised by the Distribution Company. The connection is laid from the water distribution network main pipe by installing a service connection pipe generally made of polyethylene, including all auxiliary fittings from the tapping point up to the consumer Entry Point.
- 5.2 The most common service connection sizes to households are 20mm and 25mm in diameter, made from MDPE (Medium Density Polyethylene Pipe). Distribution Companies shall ensure that under normal operating conditions water is supplied at reasonable demand with minimum pressure of 1.25 bar (12.5 metres) measured at the main supply pipe to the Customer. The Distribution Company shall evaluate the size of the connection with consideration to friction losses for long service connections.
- 5.3 Diagrams illustrating the various connection arrangements are included in Annex D. Detailed drawings shall be submitted in accordance with Annex A.

Standard service connection

- 5.4 Service connections are provided to consumers when the distribution main is available in the vicinity of the plot. Temporary supply through other means may however be offered in accordance with the Distribution Company's existing policy and arrangements.
- 5.5 Fittings for polyethylene service connection pipes such as tees, connectors, adaptors, elbows, couplings etc. shall be compression type or push-fit type as per the particular specifications.
- 5.6 The size of the service connection will only be determined by the Distribution Company. For guidance, the standard service connections for villas and houses are normally of sizes 15, 20, 25, 40 or 50mm nominal bore diameter, and predominantly 20mm.
- 5.7 MDPE service connections pipes and fittings are used for the available pressure found in the network; however, HDPE may be used in certain high-pressure systems (9 bar and above), and in connections larger than 65mm in diameter. Only DI fittings (puddle flanges, spigot pieces, flange adapters and spool pieces) shall be used inside the chambers for connections larger than 65mm and they shall be in accordance with ADWEA standard technical specifications.

Service connection tapping

- 5.8 Service connections are generally tapped to a distribution main using ferrules of size 15, 20, 25, 40 and 50mm by installing the polyethylene service connection pipe (including all auxiliary fittings) from the tapping point up to the consumer Entry Point.
- 5.9 Saddle straps with a flat boss shall be installed on the main water pipeline. The tapping to the pipeline shall be done through the saddle strap using a tapping machine approved by the Distribution Company. Screw-down ferrules shall be fitted to the saddle straps. The ferrule valve shall be closed until the service connection work is completed and tested.

Water service connection pipes

- 5.10 Water service pipe material is classified to two nominal sizes; up to 50mm nominal diameter and 65mm and above. The requirements in respect of pipes and pipe specifications are included in Annex B. The Distribution Company's approval is needed prior to making any pipe material selection from the list below.
- (a) Water service pipes of 50mm diameter and smaller shall be of one of the following:
- (i) Medium Density Polyethylene Pipes (MDPE) PE 80 (The most common type of service connection pipe used by the Distribution Companies);
 - (ii) High Density Polyethylene (HDPE) PE 100 may be used in high-pressure systems;
 - (iii) Polypropylene random copolymer (PP-R) pipes;
 - (iv) Cross-linked polyethylene (PE-X) pipes and fittings; and
 - (v) pipes of higher specification e.g. stainless steel, subject to their being approved by the Distribution Company or the Bureau.
- (b) Water service connection pipes of 65mm diameter and larger shall be of one of the following:
- (i) High Density Polyethylene (HDPE) pipes and fittings to ISO 4427 Parts 1, 2, 3 and 5 type PE 100 and ADWEA Standard Specification for Water Works No. W-P-SS-005. Medium Density Polyethylene Pipes (MDPE) PE 80 may be used in low-pressure systems;
 - (ii) Ductile Iron (DI) pipes and fittings to ISO 2531 or equivalent; and
 - (iii) pipes of higher specification e.g. stainless steel, subject to their being approved by the Distribution Company or the Bureau.
- 5.11 Polyethylene pipe shall be laid without joints or unnecessary bends from the ferrule up to the consumer Entry Point. Connectors, bends and adaptors shall be provided

as necessary. The polyethylene pipe shall be installed in a uPVC protection pipe (duct) class 10 for protection and ease of maintenance. The uPVC pipe shall be 110mm in diameter for 15, 20 and 25mm polyethylene pipes, and 160mm in diameter for 40 and 50mm polyethylene pipes, or as required by the Distribution Company.

- 5.12 uPVC protection pipe shall be provided in all green and unpaved areas. In sidewalk and paved areas, the uPVC protection pipe shall be encased in reinforced concrete. Warning tape shall be provided over the polyethylene pipe/uPVC protection pipe in green and unpaved areas.

Service connection fittings

- 5.13 Gate Valves shall be provided for all types of service connection to allow for the isolation of the customer connection. The valve shall be installed at a point as near as possible to the tapping point. For 15, 20 and 25mm service connections, the gate valve shall be installed in a concrete chamber or in a GRP cabinet. For connections equal to or greater than 40 mm (1½"), the gate valve shall be installed in the concrete meter chamber, or as specified by the Distribution Company.
- 5.14 For 15, 20 and 25mm service connections, GRP Water Meter cabinets fixed as described in Clause 4.21 shall be provided. The cabinet shall contain Water Meter, valves and fittings as described in Clause 4.29. The portion of the polyethylene service connection pipe between the finished surface level and the GRP Water Meter cabinet shall be protected with 110mm polyethylene protection tube fixed to the wall inside a recess, if practical, using 2 No. brass clamps.
- 5.15 For connections 40mm (1½") and above the following arrangement shall apply:
- (a) For 40 and 50mm service connections either GRP Water Meter cabinet (for threaded type Water Meters) or concrete chamber shall be provided containing Water Meter, valves and fittings as described in Clause 4.29.
 - (b) For service connections larger than 50mm concrete chamber shall be provided containing Water Meter, valves and fittings as described in Clause 4.29.
 - (c) Externally-installed meters shall be housed as described in Clause 4.18 and 4.19. If concrete chamber is used a meter reading display unit shall be provided which shall be fixed to /recessed in the boundary wall of the consumer plot/Premises.
 - (d) The internal plan dimensions of chamber for different sizes of service connections shall be as follows or as agreed by the Distribution Company:
 - (i) 600 x 600 x 400 mm for 15, 20 and 25mm service connections.
 - (ii) 1200 x 800 x 400 mm for 40 and 50mm service connection

- (iii) For service connections larger than 50mm the chamber size shall be as per ADWEA standard specification and drawings.

- 5.16 Concrete pulling boxes shall be provided at locations where the polyethylene service connection pipe changes direction at a 90° angle, or as instructed by the Distribution Company.
- 5.17 All concrete chambers for service connection shall have a ductile iron cover as specified by the Distribution Company.
- 5.18 The top level of the chambers shall be raised or lowered according to the level of the nearest sidewalk or road kerbstone.

Service connection terminal points

- 5.19 The polyethylene service connection pipe shall be terminated within a chamber or meter cabinet, or as instructed by the Distribution Company.
- 5.20 Fittings required for service connection are dependent on the type of connection. The connections in general are terminated with a gate valve and a Water Meter.

Service connection to HDPE

- 5.21 MDPE service connections to HDPE pipelines shall be made using electro-fusion tee branches and MDPE pipe. Joints can be made either by electro-fusion or butt-fusion in accordance with the Distribution Company's/manufacturer's recommendations.

Bulk consumers service connection

- 5.22 Bulk consumers such as palaces, commercial and industrial Premises shall be provided with a suitably-sized service connection approved by the Distribution Company.

Tee-connection

- 5.23 For bulk water consumers, a service connection could be arranged by using a Tee-connection from the distribution main. Such connections are generally 80mm and above in size. All such connections should be valved.
- 5.24 Each bulk consumer measuring point shall be equipped with the following as a minimum:
- (a) provision for installing flow measuring instruments; and
 - (b) a sample valve which can be used as an air vent.

Piping arrangements

- 5.25 The piping arrangements for installation, shall be followed as defined within the relevant sections of ADWEA Water Works Standard Specification for the construction, testing and commissioning of piping works and systems for ductile iron, MDPE and HDPE shall be followed.

Type of service connections

5.26 There are two types of service connections:

- (a) temporary – made to the Premises for a limited period and as approved by the Distribution Company; and
- (b) permanent – made to the Premises for an unlimited period and as approved by the Distribution Company.

5.27 Connections can be divided according to the intended use:

- (a) residential;
- (b) commercial;
- (c) industrial;
- (d) agricultural;
- (e) institutional;
- (f) recreational; and
- (g) others.

6. Approvals, inspection, safety and quality control

Approval of water fittings

- 6.1 For the purpose of ensuring that Water Fittings comply with this guide, Customers, Responsible Persons, fittings suppliers or manufacturers' agents shall apply in writing and, if required to do so, shall submit standard samples of pipes, fittings, and apparatus, etc. to the Distribution Company for approval of their products.

Inspection and testing

- 6.2 The Distribution Company reserves the right to inspect the water fitting installation on the Premises at any time during work progress to ensure the requirements under this Guide are complied with.

Quality control

- 6.3 A copy of the quality assurance/quality control programme or QA/QC Certificate shall be submitted to the Distribution Company if it is deemed necessary to ensure the Responsible Person has in place a quality control system compliant with ISO 9001 or equivalent.
- 6.4 The Distribution Company has the right to ensure that hygiene procedures related to the installation of water fittings are followed during work carried out by the Responsible Person. The Distribution Company may request that individuals involved in the work undergo a qualification test prepared in accordance with the Distribution Company's practices and standards to ensure a satisfactory standard of work is delivered.

Safety requirements

- 6.5 All necessary precautions shall be taken to ensure the safety of personnel and property. Work practices shall comply with applicable national or local codes, regulations and safety orders and practices of the Distribution Company covering working conditions, trenching, hoisting, scaffolding, clothing, fire and explosion hazards, safety equipment, solvents, chemicals, lighting, venting and grounding of tanks.
- 6.6 Rags and other waste material soiled with paints, thinners or solvents shall be kept in tightly-closed metal containers while not in use, and disposed of in an environmentally appropriate fashion once the work is completed.
- 6.7 Extreme precautions shall be taken when working with paint materials, cleaning fluids etc., especially in close proximity to oxygen piping or oxygen equipment. Heavy

concentrations of volatile or toxic fumes shall be avoided. When working in confined areas, blowers or exhaust fans shall be used.

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Annex A: Water connection process and drawing approval requirements

Main steps for water connection process

The Distribution Companies use a 5-step process for water connections. These steps may vary slightly between the companies, however, in general the following applies:

- Step 1 : Water Demand Notification (WDN) submission – this step includes providing connection location, estimated water demand and timescale for this anticipated new demand to occur.
- Step 2 : Drawings approval – this step includes approval of detailed demand calculations and design drawings for the water supply system.
- Step 3 : Water connection – this step establishes the new connection assets required to supply the Premises along with approvals from other governmental entities for the approval of the proposed route and the physical work required to make the connection.
- Step 4 : Inspection of water supply system – this step confirms that the supply system is constructed to the approved design drawings, and issue internal meter, if required.
- Step 5 : Service agreement and final connection - this step includes signing of service agreement and commissioning the connection.

For the exact requirements and any applicable fees refer to the Distribution Company specific process.

Documents and procedure required for drawing approval

- A.1 Submit a detailed overall drawing showing building (Riser/Diagram) as well as horizontal plans for the building's floors including architectural details.
- A.2 Details shall include the following:
 - (a) location and size of the main connection chamber;
 - (b) size and type of the pipes feeding the ground tanks, the encasing sleeves and float valves;

- (c) locations, dimension and actual net capacity for ground and overhead water tanks with water piping details;
- (d) location of tanks' access covers, type of access covers and respective sizes;
- (e) location and size of tanks' sump pit and drain pit if any;
- (f) sizes of tanks' ventilation pipes, roof cistern overflow pipes, distribution pipes;
- (g) state head and duty of water-lifting pumps to roof cistern and booster pumps to specific building floor/water utility locations;
- (h) show head and duty of tanks' drainage pumps and drain location;
- (i) location of firefighting pumps;
- (j) location of Water Meters and housing rooms or meter cabinet; and
- (k) details of vertical cross sections showing dimensions of levels, material types and capacity for:
 - (i) water tanks;
 - (ii) main connection chamber;
 - (iii) meter cabinets;
 - (iv) single line diagram for water pumps; and
 - (v) single line diagrams for water tanks complete with internal distribution system.

- A.3 Use the metric system of units in drawings except for tank capacities, which shall be stated both in imperial gallons and litres.
- A.4 Unless otherwise specified, the recorded water tank capacities in drawings shall be the actual water capacities, not volumes.
- A.5 Attach a Water Meter schedule with details of floor no., unit name, no. of units/floor; meter size, cumulative horizontal meters, meter type and total no. of meters (commercial buildings).
- A.6 Unless specified by the Distribution Company, approval of preliminary drawings is valid for a maximum of two years; otherwise a re-approval request shall be submitted.

Annex B: Pipes and fittings specifications

Pipes

Polyethylene pipes and fittings

- B.1 Polyethylene service connection pipes and fittings shall be black PE80 medium-density polyethylene pipes (MDPE) and shall comply with the requirements of ISO 4427 Parts 1, 2, 3 and 5 or EN 12201 Parts 1, 2, 3 and 5. The pipes shall have a SDR (standard dimension ratio) of 11.
- B.2 The polyethylene pipes and fittings shall be suitable for use above ground and underground for conveying potable water at a working pressure of up to 12 bar. Connection by fusion is the recommended method of joining polyethylene pipes wherever possible.
- B.3 The polyethylene pipe shall meet the minimum requirements of the following specification:
- (a) minimum density measured according to ISO 1183-2 shall be between 945 and 955kg/m³;
 - (b) melt flow rate measured according to ISO 1133-1 with a 5kg load shall be between 0.75 and 0.95g/10min;
 - (c) tensile strength at yield, measured according to ISO 6259 shall be at least 18MPa;
 - (d) elongation at break, measured according to ISO 6259 Parts 1 and 2 shall be at least 350%; and
 - (e) thermal stability, as measured by the oxidation induction time, in accordance with ISO 11357-6 and at a temperature of 200°C shall be a minimum of 20 minutes.
- B.4 The pipes shall be manufactured from polyethylene containing only those antioxidants, carbon black and other additives necessary for the manufacturing of the pipes and conforming to the requirements of ADWEA and international specifications.
- B.5 If reworked material is added or used, it shall be clean, derived from the same resin, reground under the supervision of the same manufacturer, and shall be compatible with the material to which it is added.
- B.6 The material of the polyethylene pipe which is in contact with or likely to come into contact with wholesome water shall not constitute a toxic hazard, shall not support microbial growth and shall not give rise to unpleasant taste, odour, cloudiness or discoloration of the water.

- B.7 The concentration of substances, chemical and biological agents leached from materials in contact with potable water, and measurement of the relevant organoleptic/physical parameters, shall not exceed the maximum values recommended by the World Health Organisation in its "Guidelines for Drinking Water Quality" or the EEC Council Directive on the "Quality of Water Intended for Human Consumption", whichever is more stringent in each case.
- B.8 Polyethylene pipes shall be clearly marked at intervals of one metre indicating the manufacturer's name, nominal diameter, standard number, pipe class, pressure rating and date of pipe manufacture. The word "WATER" shall also be marked every one metre. The marking shall be by means of paint or engraved marks. All markings shall be blue in colour. The pipes shall be supplied in coils of 150m and shall be kept shaded at all times. The coils shall be wrapped and shall not be exposed to direct sunlight.

Ductile iron pipes and fittings

- B.9 Ductile iron pipes, fittings and jointing of the pipes and fittings should conform to ADWEA Standard Specification for Water Works No. W-P-SS-001 or to ISO 2531 or equivalent BS.

Polypropylene random copolymer (PP-R) pipes and fittings

- B.10 PP-R pipes, fittings and jointing of the pipes and fittings should conform to BS EN 1852 (Specification of Polypropylene Pipes and Fittings), BS EN ISO 15874 (Specification for Polypropylene Pipes for Hot and Cold Water) or an equivalent international standard.

Cross-linked polyethylene (PE-X) pipes and fittings

- B.11 PP-X pipes, fittings and jointing of the pipes and fittings should conform to BS 7291-1, BS 7291-3, ISO 15875 and AWWA C904. Other relevant standards for PEX and PEX Systems include:
- (a) ASTM F876 -Materials, Dimensions and Performance for Tube
 - (b) ASTM F877 -Performance Standard for Tube/Fitting Systems
 - (c) ASTM F2023 -Chlorine Resistance test method
 - (d) ASTM F2657 –UV Resistance test method
 - (e) AWWA C 904 –Standard for PEX service lines

Service connection fittings (mechanical)

- B.12 Fittings for polyethylene service connection pipes such as tees, connectors, adaptors, elbows, couplings, etc shall be compression type or push-fit type, as per the particular specifications.

Compression fittings

- B.13 Compression fittings shall meet the requirements of BS EN 1254-1, BS EN 1254-2.
- B.14 Compression fittings shall be made from gunmetal to BS EN 1982. The fittings shall be suitable for direct connection to polyethylene pipes. The compression ring shall be of EPDM and suitable for potable water.
- B.15 The thread shall be BSP to BS EN 10226-1/BS 21. The inserts shall be of copper and male/female fittings, and shall be chamfered to aid assembly and to avoid the crossing of threads.
- B.16 The fittings shall be capable of sustaining a working pressure of up to 16 bar without leakage.
- B.17 The rubber compression rings shall be reusable at least 10 times.
- B.18 The fittings shall be resistant to pull-out. No solvent welding shall be used in assembly.

Push-fit fittings

- B.19 Push-fit fittings shall be suitable for use in underground and above-ground installations, and shall be compatible with polyethylene pipes. The fitting shall consist of a body with internal taper, grip ring for end load resistance, 'O' ring for water tightness seal and liner. The fittings shall be suitable for working pressure of up to 16 bar without leakage.
- B.20 The fittings shall be of acetyl or polypropylene material supplied complete with pre-assembled and captive grip ring and 'O' ring. The grip ring shall be made of acetyl and the 'O' ring of EPDM. The seal of the joint shall be made using water pressure as a thrust medium and no other tools or nuts shall be used to obtain a watertight joint.
- B.21 The ends of the polyethylene pipe shall be marked at two locations corresponding to the two points of resistance provided by the grip ring and the 'O' ring.
- B.22 Extractor tools for the dismantling of push-fit fittings shall be supplied with the fittings. Five sets of metal extractor tools shall be supplied with each consignment. The tools shall be suitable for the diameter and type of push-fit fittings supplied.
- B.23 The push-fit fittings shall carry the name of manufacturer, size and standard number.

Saddle straps

- B.24 Saddle straps for service connections shall be of the flat-boss type suitable for tapping up to 2" diameter ferrule or equivalent. The strap shall be suitable for making

service connections under pressure or dry, using an approved tapping machine into DI, AC, Steel or PVC pipes. The saddle shall be of two parts fitted with an EPDM sealing gasket in a groove on the underside of the flat boss.

- B.25 The flat boss shall be cast with a hole or marking through the boss to facilitate the drilling and tapping process. The straps shall be supplied undrilled. If required by the Distribution Company, the saddle strap may be used as a blanking strap to seal existing holes in the water pipelines after the removal of existing service connections.
- B.26 The saddle strap shall be of gunmetal to BS EN 1982, with stainless steel nuts, bolts and washer to ISO 3506, and shall be suitable for a working pressure of up to 16 bar. The name of manufacturer, patent number, pipe diameter for which the strap is suitable, and pipe material shall be engraved on the saddle strap.

Ferrules

- B.27 Ferrules shall be the screw-down valve type allowing for the shut-off of the flow by means of a ½" square head spindle extending from the top cap for opening and closing. The valve shall close clockwise.
- B.28 The ferrule outlet shall be a push-fit type or compression type to fit polyethylene service connection pipes.
- B.29 The ferrule stem, banjo, spindle, inner plug and top cap shall be of gunmetal to BS EN 1982. The washers shall be of EPDM and shall provide the sealing between the outer body and the ferrule stem. The ingress of dirt shall be prohibited by a polyethylene top plug.
- B.30 The ferrule shall be designed as a main stem with a 360° swivel outlet at 90° with control of water flow via the threaded inner plug. The inlet shall be a male taper thread to BS EN 10226-1/BS 21.
- B.31 The ferrule shall be suitable for potable water at a temperature of up to 45°C and capable of sustaining a working pressure of up to 16 bar without leakage.
- B.32 The ferrule shall permit the installation of service connections using under-pressure tapping through flat-boss saddle straps.
- B.33 The name of the manufacturer, standard number and patent number shall be engraved on the body.

Stop Valves (medium pattern)

- B.34 The Stop Valve shall be of the medium pattern type with female ends, manufactured and tested in accordance with the requirements of BS 5433. The spindle shall be fitted with a brass crutch head. The valve shall be manufactured according to the following specifications:
- B.35 The body, valve head and spindle head shall be manufactured from gunmetal to BS EN 1982.

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- B.36 The head works, consisting of the spindle, gland nut and washer plate shall be manufactured from brass to BS EN 12165, and the washer plate nut in gunmetal.
- (a) the washer shall be manufactured from EPDM rubber to BS 3457;
 - (b) the sealing between the valve body and head shall be achieved by the provision of an EPDM rubber head seal;
 - (c) the packing between the spindle and the valve head shall consist of one piece of PTFE impregnated graphite aramid fibre valve packer;
 - (d) the Stop Valve shall withstand a working pressure of 16 bar without leakage;
 - (e) the valve shall close clockwise; and
 - (f) the name of the manufacturer, patent number and flow direction shall be engraved on the body.

Gate valve

- B.37 The gate valve shall be of the non-rising stem type with female ends, manufactured and tested in accordance with the requirements of BS 5154/ BS EN 12288. The spindle shall be fitted with a handwheel. The valve shall be manufactured according to the following specifications:
- (a) the body and valve gate/wedge shall be manufactured from gunmetal to BS EN 1982;
 - (b) the gate valve handwheel shall be of aluminium;
 - (c) the gate valve shall withstand a working pressure of 16 bar without leakage; and
 - (d) the valve shall close clockwise.
- B.38 The name of the manufacturer, patent number and flow direction shall be engraved on the body.

Lockable ball valve

- B.39 The service Water Meter, where installed in a wall-mounted GRP meter cabinet, shall be isolated by a lockable ball valve. The valve body shall be made of brass and suitable for a working pressure of up to 16 bar without leakage. Valve materials shall be as follows:
- (a) valve body – brass to BS EN 12165 or BS EN 12163, BS EN 12164, BS EN 12167;
 - (b) ball – nickel-plated brass;
 - (c) sealing – PTFE;
 - (d) 'O' ring – viton; and
 - (e) retaining ring – brass.

- B.40 The valve shall be suitable for water temperatures up to 45°C. The valve ends shall be female threaded ends BSP to BS EN 10226-1/BS 21. All valves shall be supplied with a lock and a master key. One key shall be provided for every 20 valves supplied.
- B.41 The name of the manufacturer, patent number and flow direction arrow shall be engraved on the body.

Non-return valve

- B.42 Non-return valves shall be of gunmetal to BS EN 1982. The valves shall be suitable for a working pressure of up to 16 bar without leakage.
- B.43 The valve ends shall be female threaded ends BSP to BS EN 10226-1/BS 21. The valves shall be suitable for horizontal and vertical upward flow installation.
- B.44 The name of the manufacturer, patent number and flow direction arrow shall be engraved on the body.

Drill tap

- B.45 Drill taps should be suitable for use with ductile iron water pipes, combined drill and tap with BSP thread to BS 21/BS EN 10226-1, especially hardened, given a hardness range of 63 degree Rockwell for Talbot pressure tapping machine and for insertion of swivel balancing ferrule.
- B.46 Drill bit size should be ¾" standard pattern. Cup drill and taps size 1 ½" BSPP-11 TPI-for Machine No 2.

Draw-off taps

- B.47 Every metal-bodied or plastic-bodied tap or draining tap shall comply with the relevant requirements of BS EN 200 or 2879 or approved equivalent standard.

GRP wall-mounted Water Meter cabinets

- B.48 The Water Meter cabinet shall be of robust construction of GRP with a UV stabiliser gelcoat. The box shall have a lockable main door and a Water Meter reading/inspection lockable door to enable meter reading without opening the main door. One set of master keys shall be provided for every 20 meter cabinets supplied, with a minimum of one set.
- B.49 The box shall be fixed to the wall using stainless steel expansion bolts of a minimum 10mm diameter.
- (a) body – high-class GRP, wall thickness 3mm;
 - (b) size – 600 x 250 x 200mm (Length x Width x Depth), or as instructed by the Distribution Company;
 - (c) colour – as approved by the Distribution Company prior to ordering;
 - (d) hinges – stainless steel;

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- (e) locking – main door: two locks with square key, Water Meter reading door: one lock with square key;
- (f) window – toughened clear glass (replaceable) bedded in rubber grommet;
- (g) text – Water Meter (in both Arabic and English, as approved by the Distribution Company); and
- (h) accessory – each box shall be manufactured complete with the following:
 - (i) rubber grommet installed in groove at the main door (all around) to make the box water- and dustproof;
 - (ii) brass clamps (2 Nos.), incl. 8mm diameter SS bolts, nuts and washers;
 - (iii) each box shall be supplied with 4 No. 10mm diameter stainless steel expansion bolts and washers for wall fixing; and
 - (iv) the box shall be provided with vent and drain holes.

Jointing materials and compounds

- B.50 Soft solder for capillary jointing of copper or copper alloy water fittings should consist of Tin/Copper, Alloy No. 23 or 24, or Tin/Silver, Alloy No.28 or 29, complying with BS EN ISO 9453.
- B.51 Silver solder or silver brazing filler metals and copper-phosphors brazing filler metals for capillary jointing of copper or copper alloy pipes should conform to BS EN ISO 17672, Table 2; Group AG (AG14or AG20) or Table 3: Group CP (CP1 to CP6), respectively.
- B.52 Silver solder or silver brazing material for capillary jointing of stainless steel pipes should be cadmium-free.
- B.53 Jointing compounds used for sealing screwed water fittings should comply with BS 6956: Part 5.
- B.54 Unsintered polytetrafluoroethylene (Teflon) tape (PTFE) tape for thread-sealing applications should comply with BS EN 751-3, and the material should also satisfy the requirements of BS 6920: Part 1.

Annex C: List of standards and specifications relevant to this guide

Codes and regulations

Code	The Water Distribution Code
Code	The Metering and Data Exchange Code
Code	Code of Practice for the Inspection and Cleaning of Customer Water Storage Tanks
Regulations	The Water Quality Regulations
Regulations	The Customer Metering Regulations
Regulations	The Water Supply Regulations
Regulations	Tankering Regulations (under development)

International Organization for Standardization (ISO)

ISO 161-1	Thermoplastic pipes for the conveyance of fluids – Nominal outside diameter and nominal pressure – Part 1: Metric series
ISO 1133-1	Plastics - Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics - Part 1: Standard method
ISO 1183-2	Plastics - Methods for determining the density of non-cellular plastics -- Part 2: Density gradient column method
ISO 2531	Ductile iron pipes, fittings, accessories and their joints for water applications
ISO 3506-1	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs
ISO 3506-2	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 2: Nuts
ISO 3506-3	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 3: Set screws and similar fasteners not under tensile stress
ISO 3506-4	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 4: Tapping screws
ISO 4014	Hexagon head bolts – Product grades A and B
ISO 4032	Hexagon regular nuts (style 1) – Product grades A and B
ISO 4064-1	Water meters for cold potable water and hot water - Part 1: Metrological and technical requirements
ISO 4427-1	Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply - Part 1: General
ISO 4427-2	Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply - Part 2: Pipes
ISO 4427-3	Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply - Part 3: Fittings
ISO 4427-5	Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply - Part 5: Fitness for purpose of the system
ISO 4633	Rubber Seals – Joint rings for water supply, drainage and sewerage pipelines – Specification for materials
ISO 7005-2	Metallic flanges -- Part 2: Cast iron flanges
ISO 9000	Quality management systems -- Fundamentals and vocabulary
ISO 11922-1	Thermoplastic pipes for the conveyance of fluids – Dimensions and tolerances Part: 1: Metric series
ISO 12162	Thermoplastic materials for pipes and fittings for pressure applications – Classification, designation and design coefficient
ISO 17855-1	Plastics -- Polyethylene (PE) moulding and extrusion materials - Part 1: Designation system and basis for specifications

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Abu Dhabi Water and Electricity Authority (ADWEA) standard specifications

W-C-SS-007	Specification for Concrete Reservoirs
W-C-SS-012	Specification for Water Supply Systems
W-C-SS-015	Specification for Non-Toxicity Requirements for Paints and Coatings
W-P-SS-001	Specification for Ductile Iron Pipes, Fittings and Accessories
W-P-SS-003	Specification for Stainless Steel Piping Materials
W-P-SS-006	Specification for uPVC Pipes, Fittings and Accessories
W-P-SS-016	Specification for Construction Testing and Commissioning of uPVC Piping Systems
W-P-SS-008	Specification for Water Service Connection Materials & Installation
W-M-SS-012	Specification for Carbon Steel Bolted Tanks
W-M-SS-013	Specification for GRP Bolted Tanks

British Standards

BS 21	Pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric).
BS EN 10226-1	Pipe threads where pressure tight joints are made on the threads. Taper external threads and parallel internal threads. Dimensions, tolerances and designation
BS 143 and 1256	Malleable cast iron and cast copper alloy threaded pipe fittings
BS 143 and 1256	Threaded pipe fittings in malleable cast iron and cast copper alloy
BS 1212-1	Float operated valves. Specification for piston type float operated valves (copper alloy body) (excluding floats)
BS 1212-2	Float operated valves. Specification for diaphragm type float operated valves (copper alloy body) (excluding floats)
BS 1212-3:	Float operated valves. Specification for diaphragm type float operated valves (plastics bodied) for cold water services only (excluding floats)
BS 417-2	Specification for galvanized low carbon steel cisterns, cistern lids, tanks and cylinders. Metric units
BS 534	Steel pipes and specials for water and sewage
BS EN 10311	Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids
BS EN 10224	Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids. Technical delivery conditions
BS 1566-1+A1	Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods
BS EN 1254-1	Copper and copper alloys. Plumbing fittings. Fittings with ends for capillary soldering or capillary brazing to copper tubes
BS EN 1254-2	Copper and copper alloys. Plumbing fittings. Fittings with compression ends for use with copper tubes
BS EN 1254-3	Copper and copper alloys. Plumbing fittings. Fittings with compression ends for use with plastics pipes
BS EN 10255	Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions
BS EN 1301-1	Aluminium and aluminium alloys. Drawn wire. Technical conditions for inspection and delivery
BS EN 1301-2	Aluminium and aluminium alloys. Drawn wire. Mechanical properties
BS EN 1301-3:	Aluminium and aluminium alloys. Drawn wire. Tolerances on dimensions
BS 1564	Pressed steel sectional rectangular tanks

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BS 1710	Identification of pipelines and services
BS EN 10241	Steel threaded pipe fittings
BS EN 10253-1	Butt-welding pipe fittings. Wrought carbon steel for general use and without specific inspection requirements
BS EN 10253-2	Butt-welding pipe fittings. Non alloy and ferritic alloy steels with specific inspection requirements
BS 1968	Floats for ball valves (copper)
BS EN 12201-1	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). General
BS EN 12201-2 +A1	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes
BS EN 12201-5	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Fitness for purpose of the system
BS 2456	Specification for floats (plastics) for float operated valves for cold water services
BS 7874	Method of test for microbiological deterioration of elastomeric seals for joints in pipework and pipelines
BS EN 681-1	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Vulcanized rubber
BS EN 681-2	Elastomeric seals. Material requirements for pipe joint seals used in water and drainage applications. Thermoplastic elastomers
BS EN 682	Elastomeric seals. Materials requirements for seals used in pipes and fittings carrying gas and hydrocarbon fluids
BS EN 1057+A1	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS EN 12420	Copper and copper alloys. Forgings
BS EN 12165	Copper and copper alloys. Wrought and unwrought forging stock
BS EN ISO 1452-1	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized polyvinyl chloride (PVC U). General
BS EN ISO 1452-2	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized polyvinyl chloride (PVC U). Pipes
BS EN ISO 1452-3	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized polyvinyl chloride (PVC-U). Fittings
BS EN ISO 1452-4	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized polyvinyl chloride (PVC U). Valves
BS EN ISO 1452-5	Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure. Unplasticized polyvinyl chloride (PVC U). Fitness for purpose of the system
BS 4213	Cisterns for domestic use. Cold water storage and combined feed and expansion (thermoplastic) cisterns up to 500 l. Specification
BS 4346/BS EN 1452	uPVC Joint and Fittings for Cold Potable Water
BS EN 1092-1+A1	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges
BS EN 1092-2	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Cast iron flanges
BS EN 1092-3	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Copper alloy flanges
BS EN 598+A1	Ductile iron pipes, fittings, accessories and their joints for sewerage applications. Requirements and test methods
BS EN 969	Ductile iron pipes, fittings, accessories and their joints for gas pipelines. Requirements and test methods
BS EN 545	Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test

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	methods
BS 5388	Spray taps
BS 5433	Underground Stop Valves for water services
BS EN 14364	Plastics piping systems for drainage and sewerage with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP). Specifications for pipes, fittings and joints
BS EN 1796	Plastics piping systems for water supply with or without pressure. Glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resin (UP)
BS 5505	Bidets Part 3: Vitreous china bidets, over-rim supply only
BS EN 14154-1+A2	Water meters. General requirements
BS 5834-4	Surface boxes, guards and underground chambers for the purposes of utilities. Specification for utility chambers
BS 6501-1	Metal hose assemblies. Guidance on the construction and use of corrugated hose assemblies
BS EN ISO 10380	Pipework. Corrugated metal hoses and hose assemblies
BS EN 12201-1	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). General
BS EN 12201-2 +A1	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Pipes
BS EN 12201-5	Plastics piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Fitness for purpose of the system
BS EN 806-1	Specifications for installations inside buildings conveying water for human consumption. General
BS EN 806-2	Specifications for installations inside buildings conveying water for human consumption. Design
BS EN 806-3	Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages Specification
BS EN 806-4	Specifications for installations inside buildings conveying water for human consumption. Installation
BS EN 806-5	Specifications for installations inside buildings conveying water for human consumption. Operation and maintenance
BS 8558	Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806
BS 6920-1	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water. Specification
BS 7181	Specification for storage cisterns up to 500 L actual capacity for water supply for domestic purposes
BS 7291-1	Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings. General requirements
BS EN 1057+A1	Copper and copper alloys. Seamless, round copper tubes for water and gas in sanitary and heating applications
BS EN 1982	Copper and copper alloys. Ingots and castings
BS EN 13280	Specification for glass fibre reinforced cisterns of one-piece and sectional construction, for the storage, above ground, of cold water
BS EN 1992-3	Eurocode 2. Design of concrete structures. Liquid retaining and containing structures
BS EN 14620-3	Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0°C and -165°C. Concrete components
BS EN 14620-4	Design and manufacture of site built, vertical, cylindrical, flat-bottomed steel tanks for the storage of refrigerated, liquefied gases with operating temperatures between 0°C and -165°C. Insulation components
BS EN 12620+A1	Aggregates for concrete
BS EN 13101	Steps for underground man entry chambers. Requirements, marking, testing and evaluation of conformity

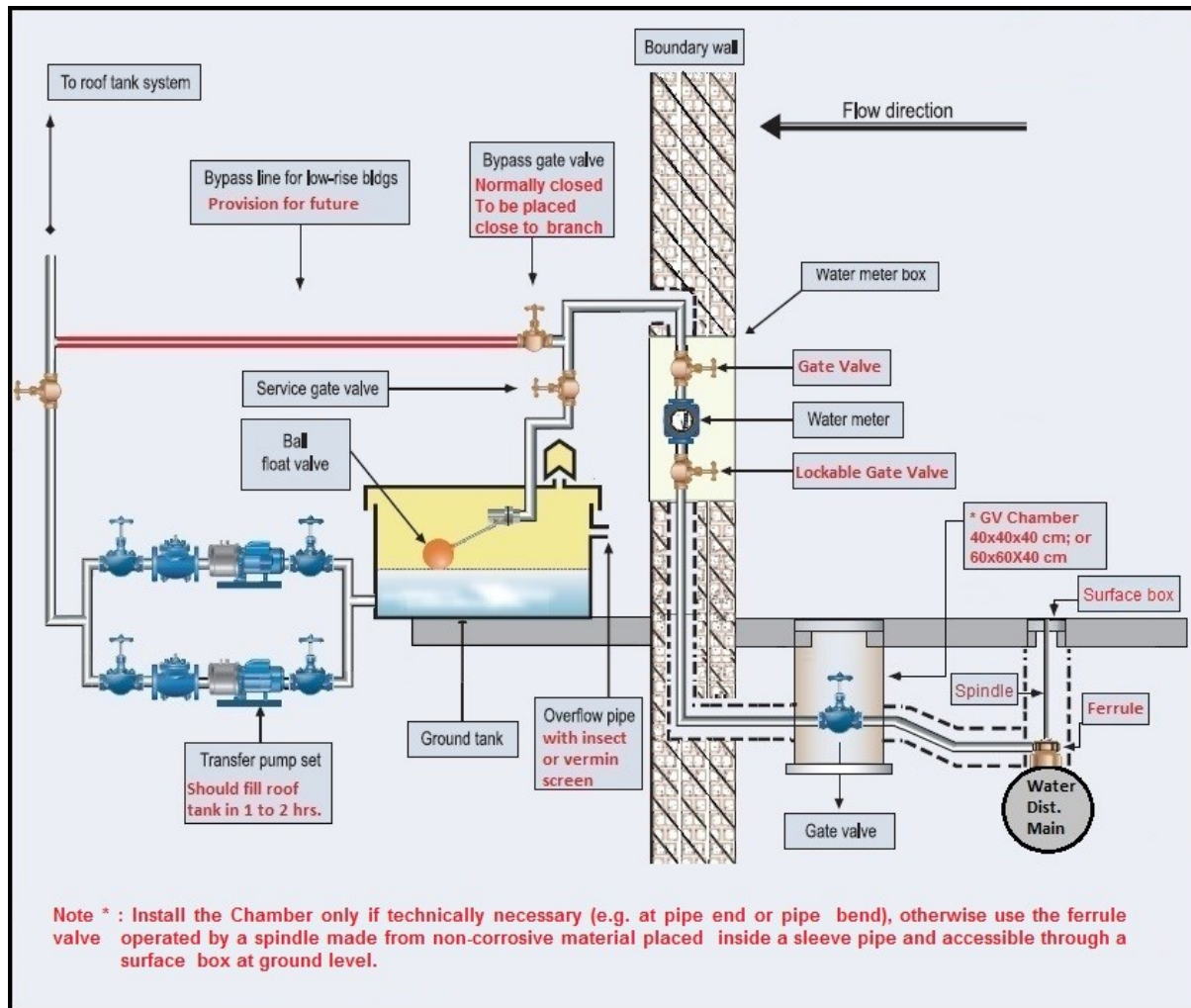
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BS EN 124, Parts 1-6	Gully tops and manhole tops for vehicular and pedestrian areas. Design requirements, type testing, marking, quality control
BS EN 12163	Copper and copper alloys. Rod for general purposes
BS EN 12167	Copper and copper alloys. Profiles and bars for general purposes
BS EN 12164	Copper and copper alloys. Rod for free machining purposes
BS 7291-1	Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings General requirements
BS 7291-2	Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings Specification for polybutylene (PB) pipe and associated fittings
BS 7291-3	Thermoplastics pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings. Specification for crosslinked polyethylene (PE-X) pipes and associated fittings
BS 5154	Specification for copper alloy globe, globe stop and check, check and gate valves
BS EN 12288	Industrial valves. Copper alloy gate valves
BS EN 200	Sanitary tapware. Single taps and combination taps for water supply systems of type 1 and type 2. General technical specification
BS 2879	Specification for draining taps (screw-down pattern)
BS EN ISO 9453	Soft solder alloys. Chemical compositions and forms
BS EN ISO 17672	Brazing. Filler metals
BS 6920-1	Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water. Specification
BS 6956-5	Jointing materials and compounds. Specification for jointing compounds for use with water, low pressure saturated steam, 1st family gases (excluding coal gas) and 2nd family gases
BS EN 751-3	Sealing materials for metallic threaded joints in contact with 1st, 2nd and 3rd family gases and hot water. Unsintered PTFE tapes

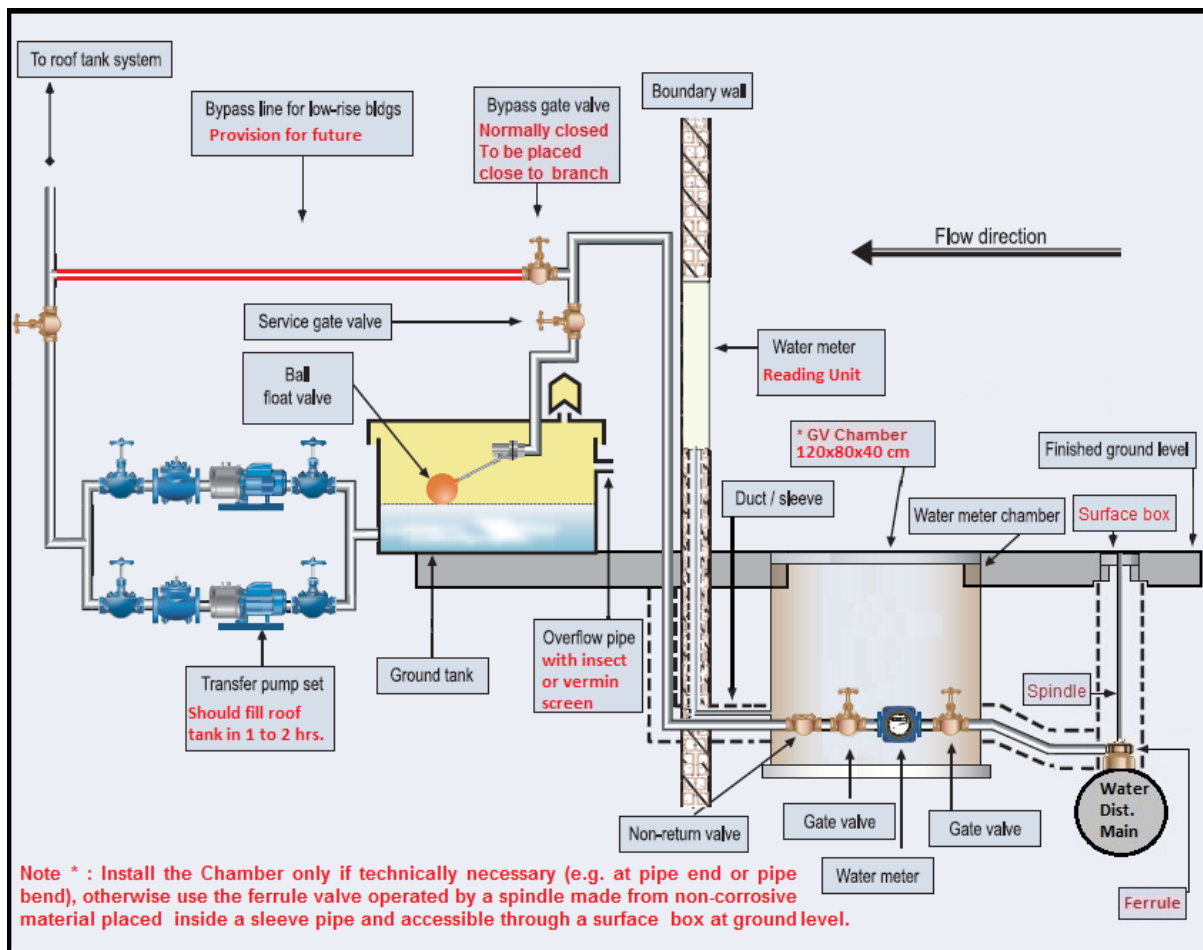
Annex D: Diagrams

D.1 - Typical arrangement for small-size connections up to 25mm in diameter such as villa, shabiat or other similar low-rise Premises, from the main distribution pipe to Customer Premises with ground tank and by-pass arrangements. (Inadequate pressure).



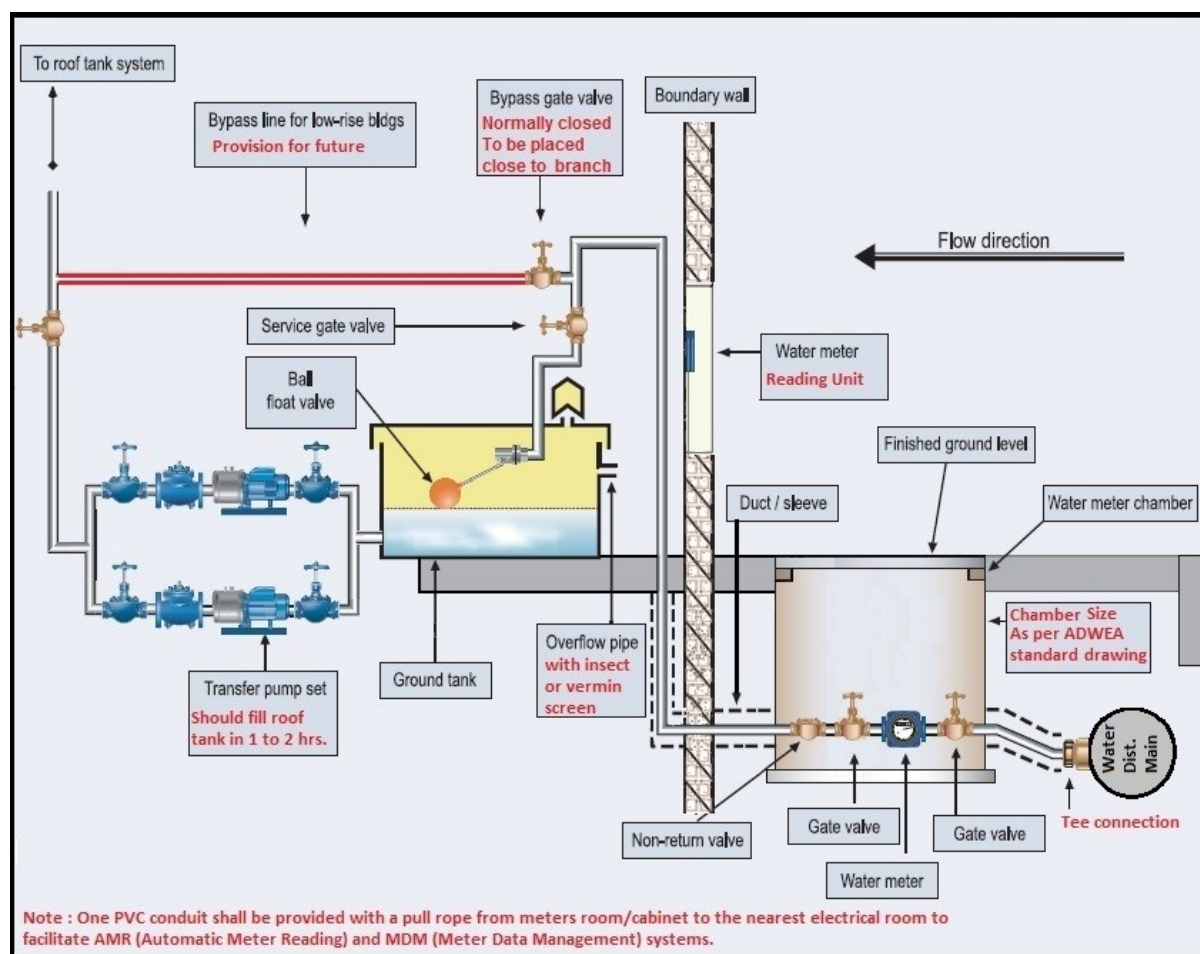
The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements.

D.2 - Typical connection arrangement for water service connection of 40mm and 50mm from the main distribution pipe to a Customer low-rise Premises with ground tank and by-pass arrangement. (Inadequate pressure)



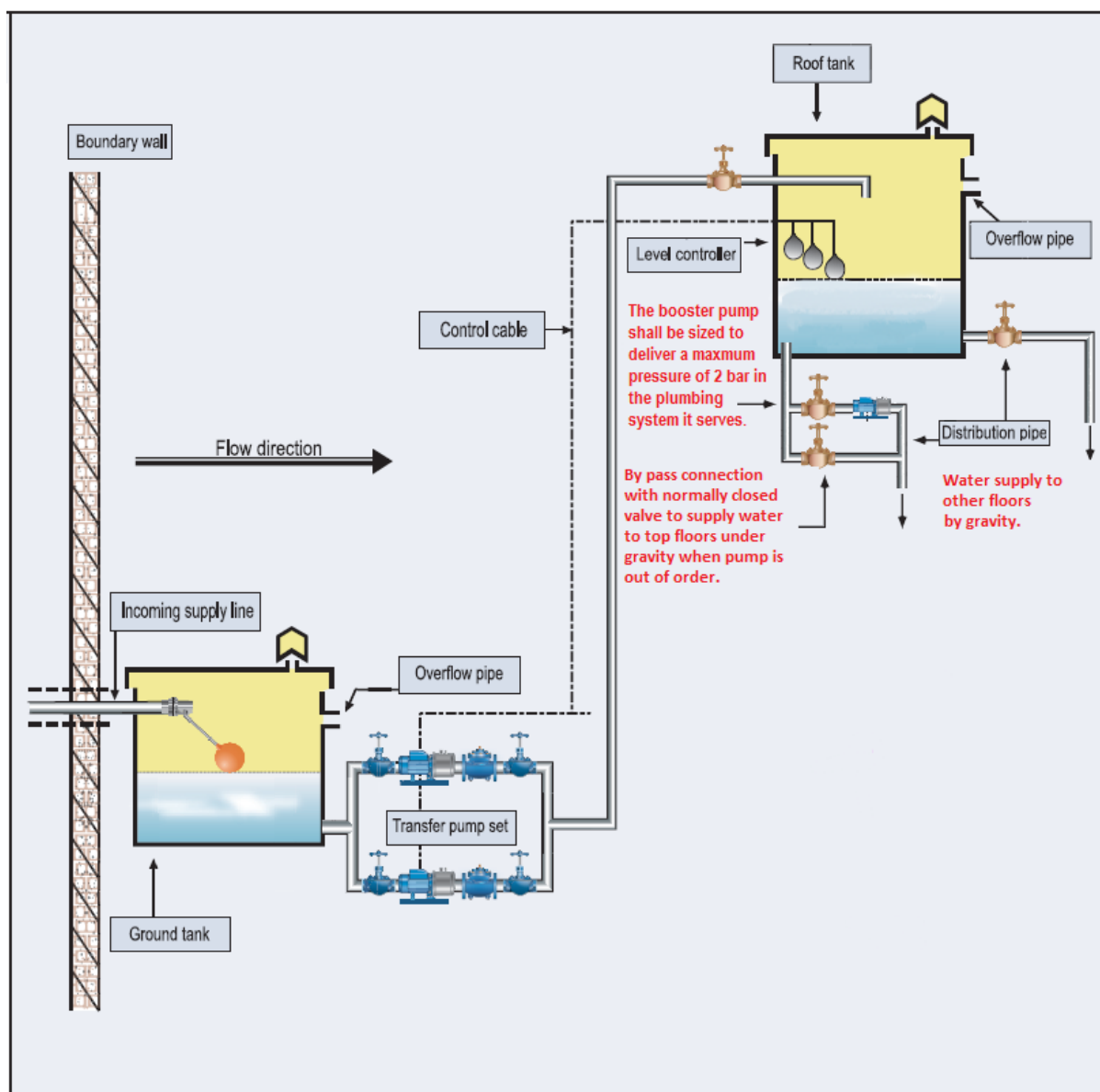
The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements.

D.3 - Typical connection arrangement for water service connection larger than 50mm (2") (Bulk Connection)



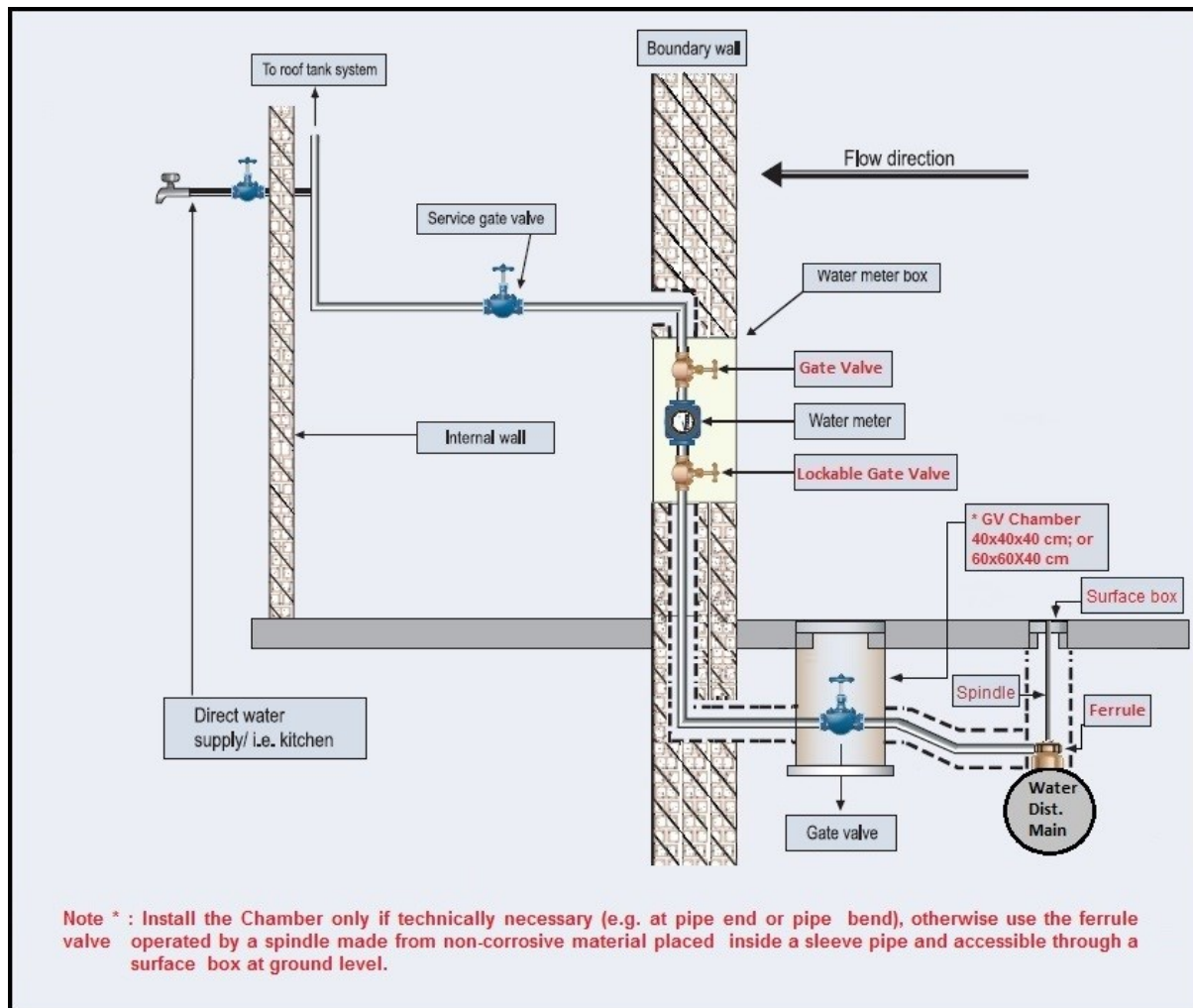
The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements.

D.4 - Typical connection arrangements between ground and roof tank in low-rise and high-rise buildings.



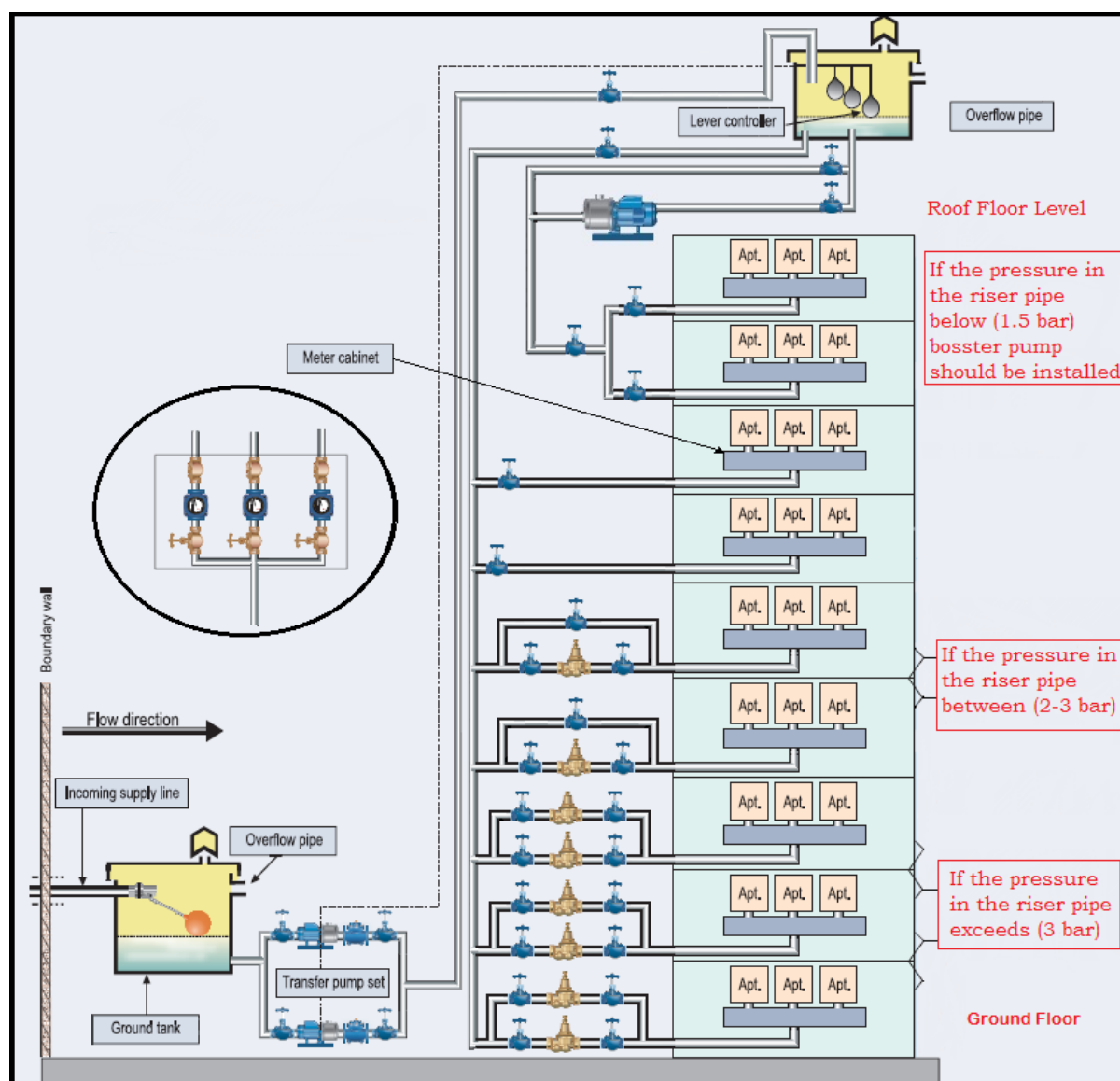
The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements. Flow-control devices shall be suitable for the system application.

D.5 - Typical connection arrangement for various connection sizes from the main distribution pipe to a low-rise single occupancy building (metered externally) provided there is sufficient pressure to roof tank. (Adequate pressure).



The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements.

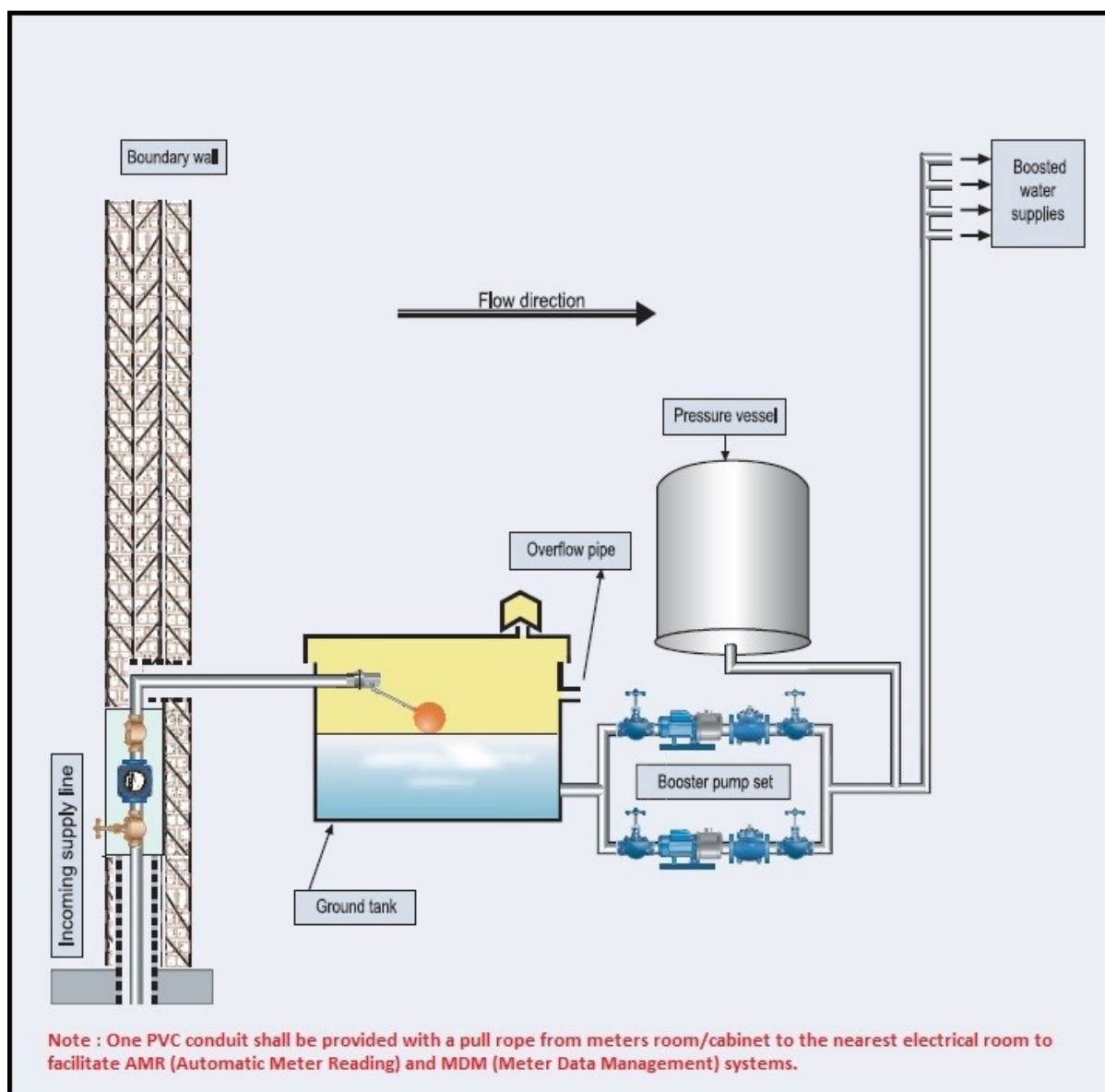
D.6 - Typical internal connection arrangement for a high-rise building (metered internally).



The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements. Metering for building services and shops shall be in accordance with the approved floor plan.

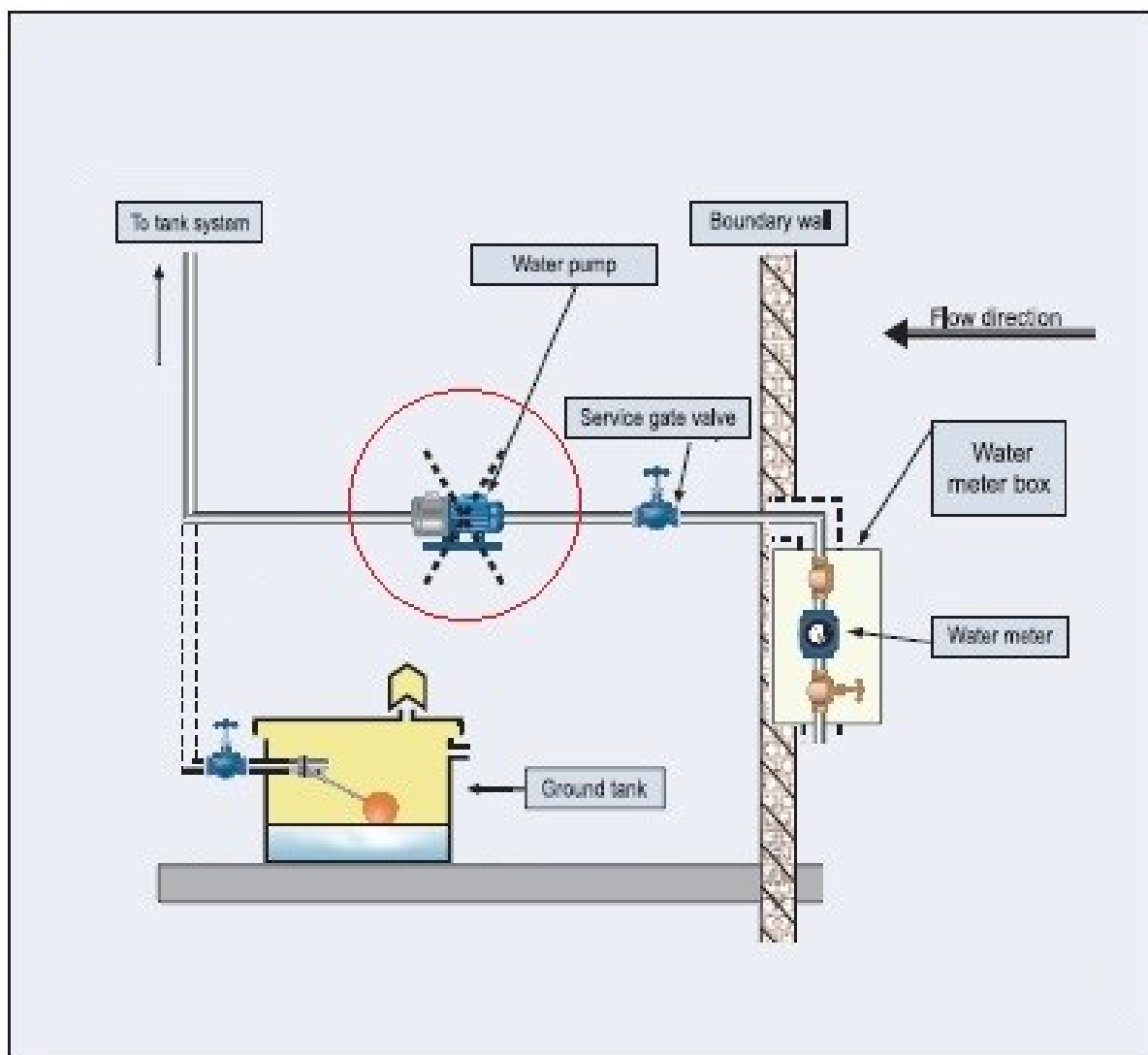
The valves layout in meter cabinet shall be fitted with pressure-reducing valve where applicable and the valve cabinet location may change subject to the Distribution Company's approval.

D.7 - Typical connection arrangement for certain applications such as hotels and hospitals (metered externally).



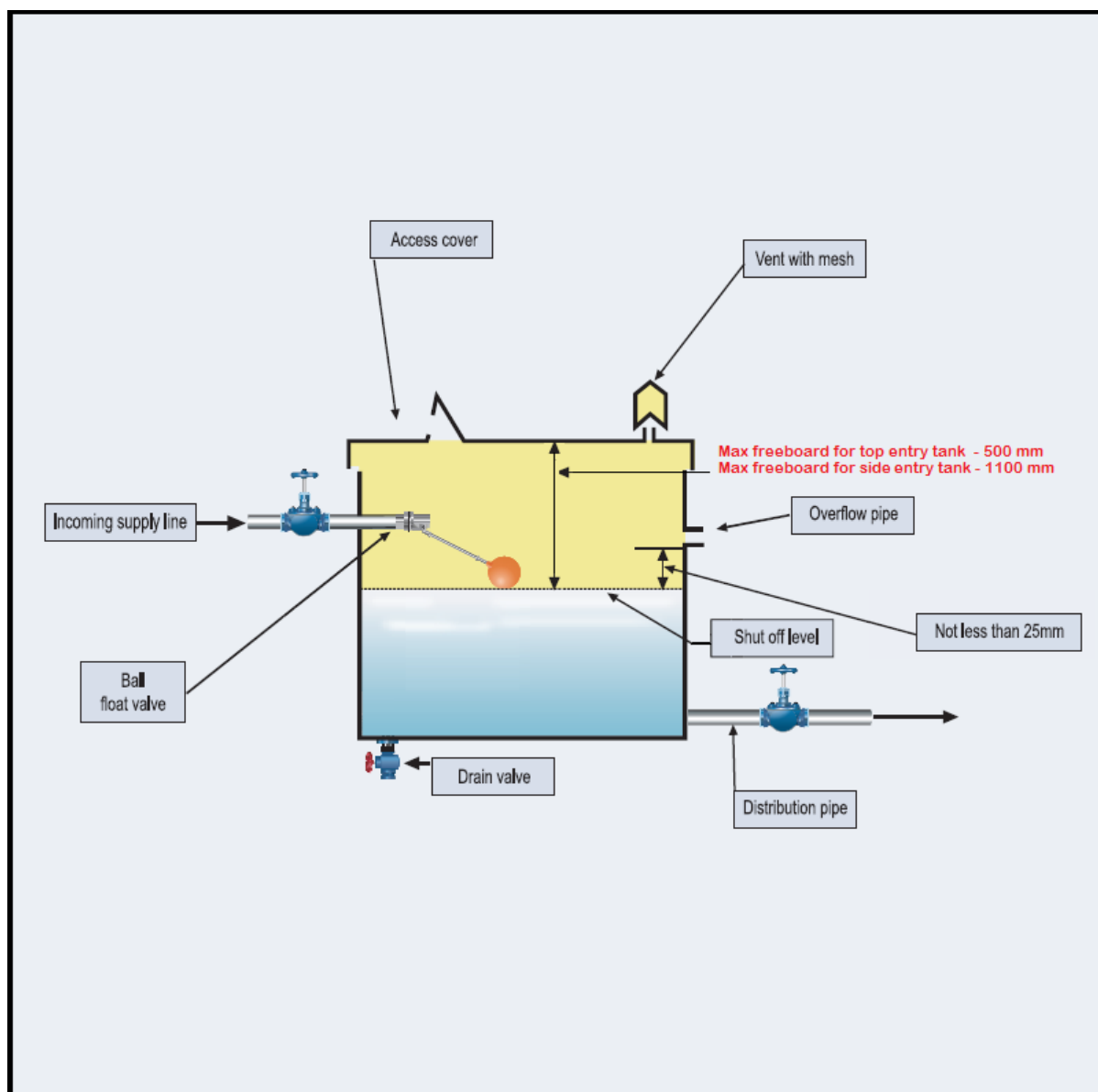
The above drawing is for illustration purposes only. All drawings shall be submitted in accordance with Annex A of this Guide complete with all details. It should be noted that this part of the system shall comply with Distribution Company specific arrangements.

D.8 - Prohibited connection arrangement: the installation of an on-line pump that draws water directly or indirectly from the main distribution pipeline.



The above drawing is for illustration purposes only. It demonstrates that pumps installed for the purpose of drawing water from the main distribution pipe are not allowed and are considered contrary to the Regulations.

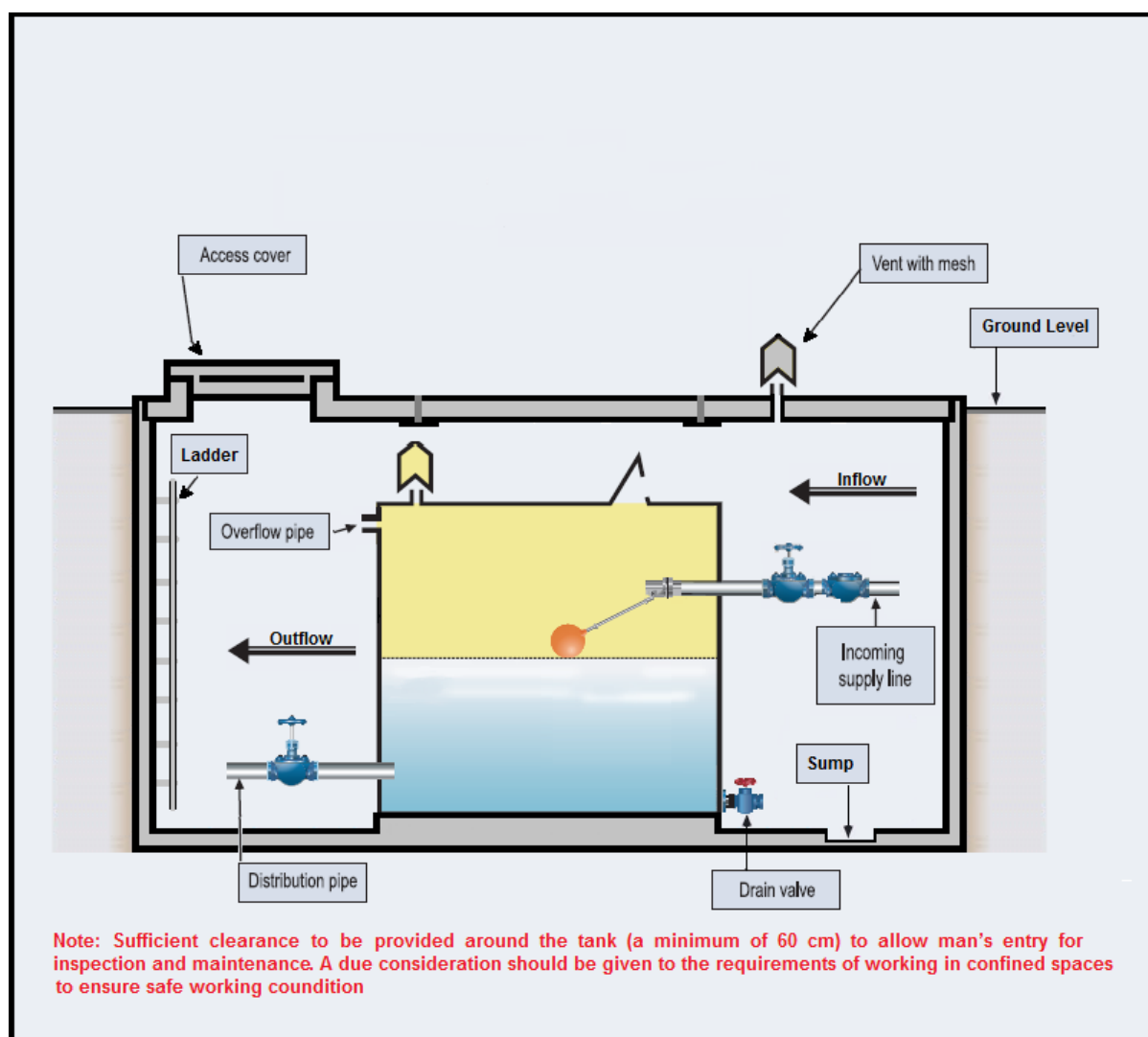
D.9 –Typical roof / ground tank connection arrangement.



The above drawing is for illustration purposes only. General requirements for tank connection, fittings and accessories are dependent on the tank location, volume, height and material of construction as prescribed in this Guide. However, the standard requirements for a tank are that it should be provided with a flow-control device (float-operated valve), an overflow pipe, access/ an access cover, service valves, a vent and drain connection (as necessary).

The air gap between the shut-off level and overflow pipe can vary according to the overflow control device and the end use of the water.

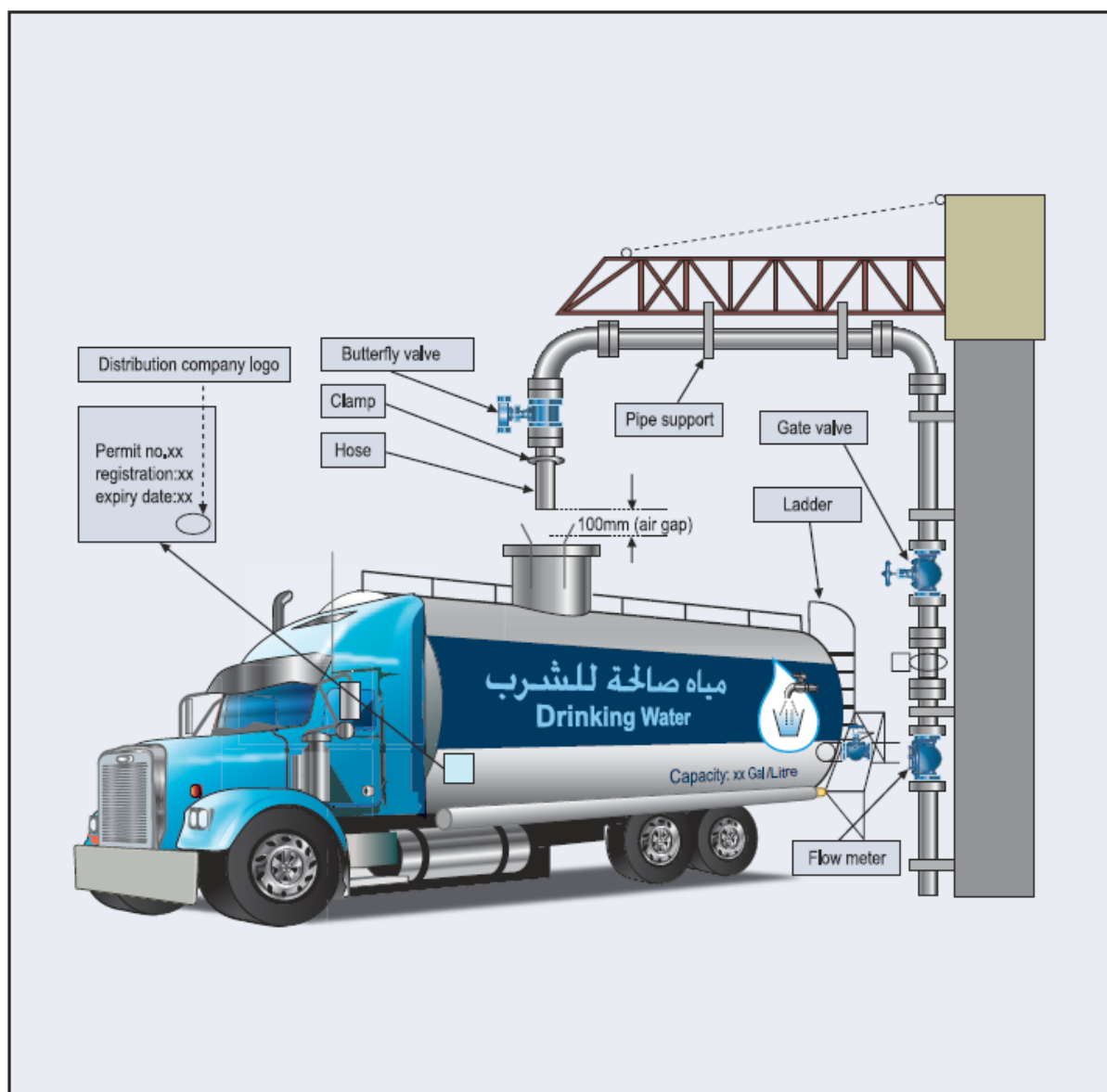
D-10 –Typical underground tank installation arrangement.



The above diagram is for illustration purposes only. Underground tanks are only permitted in basements or in purpose built underground pump rooms upon approval of the Distribution Company.

Overflow arrangements shall be made to ensure no water returns to the tank after an overflow. A suitable backflow prevention arrangement shall be considered. A suction pipe connected to the foot valve should be fitted in such a way that it can be assembled, dismantled and removed without the need to drain the tank for future maintenance and replacement works.

D.11 - Typical connection arrangement for a water tanker filling station together with water tanker main features.



The above diagram is for illustration purposes only. All potable water tankers must comply with the relevant clauses of the Water Supply, Tankering and Water Quality Regulations, in addition to the Distribution Company's own requirements.

The main requirements are:

- 1) the tanker information sticker/label must have all the required details clearly written on it on both sides;
- 2) All connection accessories must be kept in a closed cabinet along with the filling hose; and
- 3) An air gap must be allowed for during the filling process.