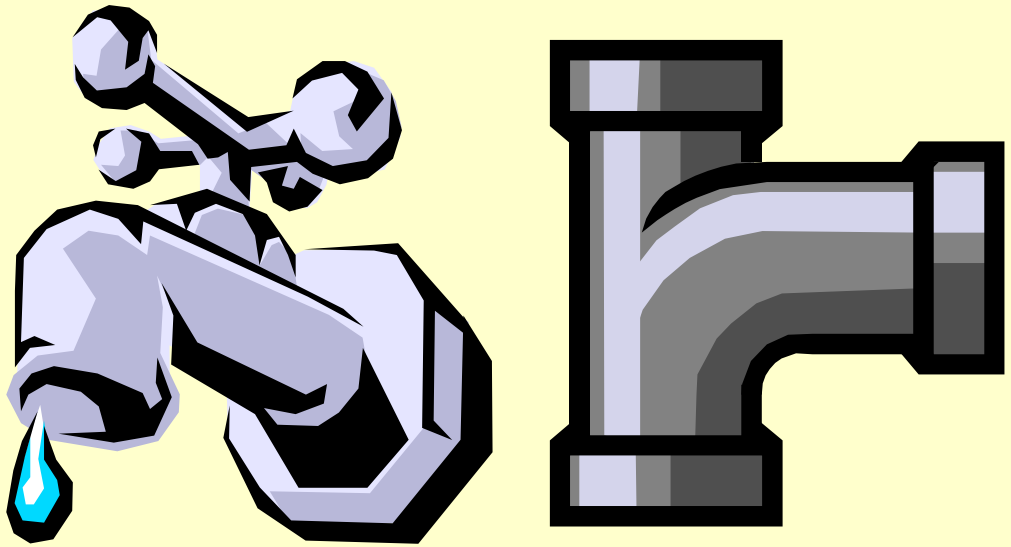

4. Plumbing and Drainage Part 2

4.1 Regulations and codes

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Contents 內容

- Local regulations
- Plumbing practice
- Hot water systems in HK
- Water quality & management

Local regulations

- Legislative framework:
  - Ordinances & Regulations
- Technical documents:
  - Codes of Practice (CoP) & design manuals
  - Technical memorandum & technical notes
  - Guidelines & guidebooks
  - Practice notes, notices & circular letters
  - Standard drawings
  - Technical Specifications

Local regulations

- Examples of related codes in Hong Kong:
  - CAP123 Building Ordinance & Regulations
  - Various codes of practices (COP) from ArchSD, BD, FSD, EMSD, WSD and power companies
  - Technical circulars & practice notes
  - General specifications
- Standards from other countries
  - British Standards, IEC, JIS, ASHRAE

Local regulations

- Statutory requirements & standards in HK, e.g.
  - Waterworks Ordinance (Cap 102) & its subsidiary legislations
  - WSD guidelines, handbooks & circular letters
- Related guidebooks & standards, e.g.
  - IOP Guide
  - ASPE Plumbing Engineering Design Handbook
  - International Plumbing Code
  - BS EN 805, 806, 6700

Relevant guides & handbooks from WSD (https://www.wsd.gov.hk)

- WSD, 2020. *Guide to Application for Water Supply* (November 2020 version), Water Supplies Department (WSD), Hong Kong.
- WSD, 2020. *Practice Guide on Carrying Out Plumbing Works*, April 2020 2nd Edition, Water Supplies Department (WSD), Hong Kong.
- WSD, 2020. *Technical Requirements for Plumbing Works in Buildings* (November 2020 version), Water Supplies Department (WSD), Hong Kong.
- WSD, 2018. *Handbook on Plumbing Installation for Buildings*, Water Supplies Department (WSD), Hong Kong.
- WSD, 2017. *Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings*, Water Supplies Department (WSD), Hong Kong.
- WSD, 2008. *Fresh Water Plumbing Maintenance Guide*, Water Supplies Department (WSD), Hong Kong.
- WSD & CIC, 2017. *Good Practice Guide on Plumbing Works*, Water Supplies Department (WSD) & Construction Industry Council (CIC), Hong Kong.

水務署
Water Supplies Department

Related ordinances in Hong Kong
(Can be read at https://www.elegislation.gov.hk/)

Major ones:

- Buildings Ordinance (Cap. 123) 《建築物條例》(第123章)
- Land Drainage Ordinance (Cap. 446) 《土地排水條例》(第446章)
- Sewage Services Ordinance (Cap. 463) 《污水處理服務條例》(第463章)
- Waterworks Ordinance (Cap. 102) 《水務設施條例》(第102章)

Related ones:

- Buildings Energy Efficiency Ordinance (Cap. 610) 《建築物能源效益條例 》(第610章)
- Electricity Ordinance (Cap. 406) 《電力條例》(第406章)
- Fire Safety (Buildings) Ordinance (Cap. 572) 《消防安全(建築物)條例》(第572章)
- Gas Safety Ordinance (Cap. 51) 《氣體安全條例》(第51章)

Related government departments & bodies in Hong Kong

1. Buildings Department (BD) 屋宇署 http://www.bd.gov.hk/
    - Building safety - Defective Drainage https://www.bd.gov.hk/en/safety-inspection/building-safety/index_bsi_drainage.html

2. Drainage Services Department (DSD) 渠務署 http://www.dsd.gov.hk/
    - Sewerage 除污淨流 https://www.dsd.gov.hk/EN/CoreBusiness/Sewerage/

3. Water Supplies Department (WSD) 水務署 http://www.wsd.gov.hk/
    - Plumbing and Engineering 內部喉管及技術 https://www.wsd.gov.hk/en/plumbing-engineering/
    - Water Safety in Buildings 建築物食水安全 https://www.wsd.gov.hk/en/water-safety/

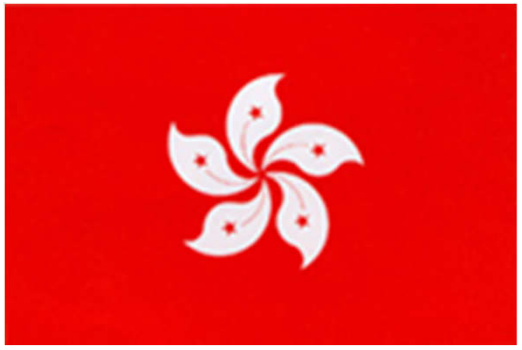
4. Electrical and Mechanical Services Department (EMSD) 機電工程署 http://www.emsd.gov.hk/
    - Electricity Safety 電力安全 https://www.emsd.gov.hk/en/electricity_safety/
    - Energy Efficiency and Conservation 能源效益及節約 https://www.emsd.gov.hk/en/energy_efficiency/
    - Gas Safety Office (GasSO) 氣體標準事務處 https://www.emsd.gov.hk/en/gas_safety/

Hong Kong Planning Standards and Guidelines (香港規劃標準與準則)

https://www.pland.gov.hk/pland_en/tech_doc/hkpsg/

Chapter 7 Utility Services (公用設施)

- Electricity Supply 電力供應
- Gas Supply 氣體供應
- Telephone Service 電話服務
- Radio Telecommunications and Broadcasting Service 無線電通訊及廣播服務
- Water Supply 供水
- Drainage Services 渠務設施
- Dedicated Utility Reserves 公用設施專用範圍
- District Cooling System 區域供冷系統



(Source: Planning Department, HK)

Local regulations

- Sanitation statutory requirements in HK:
  - Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulations (Cap 123 i) https://www.elegislation.gov.hk/hk/cap123I
    - Residential buildings
    - Workplaces
    - Places of public entertainment
    - Sports stadia
    - Cinemas, shopping arcades, etc.
    - Restaurants

Example: Standards of sanitary fitments for workplaces

Number of male persons in workplace	Number of watercloset fitments	Number of urinals
Not more than 10	1	Nil
11–100	1 for every 25 male persons or part of those persons 50 such persons, or part thereof, over 100	1 for every 50 male persons or part of those persons
More than 100	4 plus 1 for every 50 male persons, or part of those persons, over 100	2 plus 1 for every 50 male persons, or part of those persons, over 100

Number of female persons in workplace	Number of watercloset fitments
Not more than 10	1
11-25	2
More than 25	2 plus 1 for every 25 female persons, or part of those persons, over 25

(Source: Buildings Ordinance, Cap 123I)

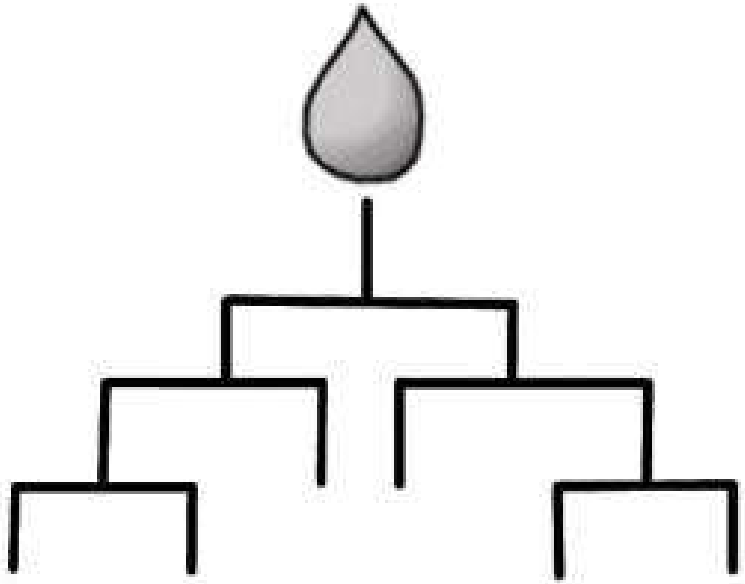
Local regulations

- Licensed Plumbers (持牌水喉匠)
  - A person licensed under the Waterworks Ordinance to construct, install, maintain, alter, repair or remove water supply plumbing
    - Grade I – for construction, installation, maintenance, alteration, repair or removal of a fire service or inside service of any type
    - Grade II – for maintenance and repair of a fire service or inside service; and for installation, maintenance, repair or removal of water appliances

(Source: https://www.wsd.gov.hk/en/plumbing-engineering/licensed-plumbers/)

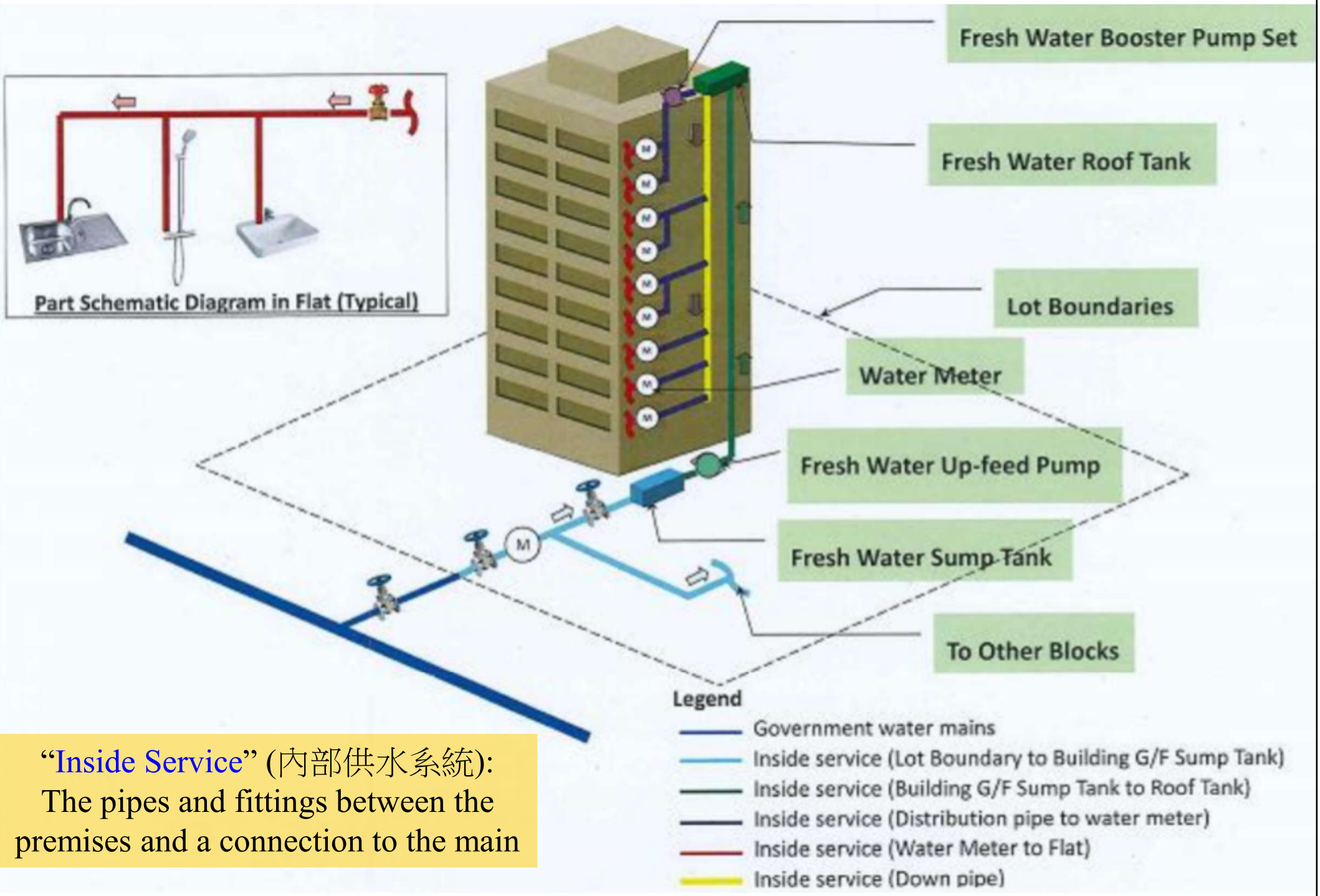
Plumbing practice

- Distribution network of water supply
  - Main reservoir
  - Pumping stations
  - Water treatment plants
  - Pumping substations
  - Service reservoirs
  - Trunk mains or service trunks
  - Street mains or water mains (into buildings)



- For fresh/flushing water supply & fire services

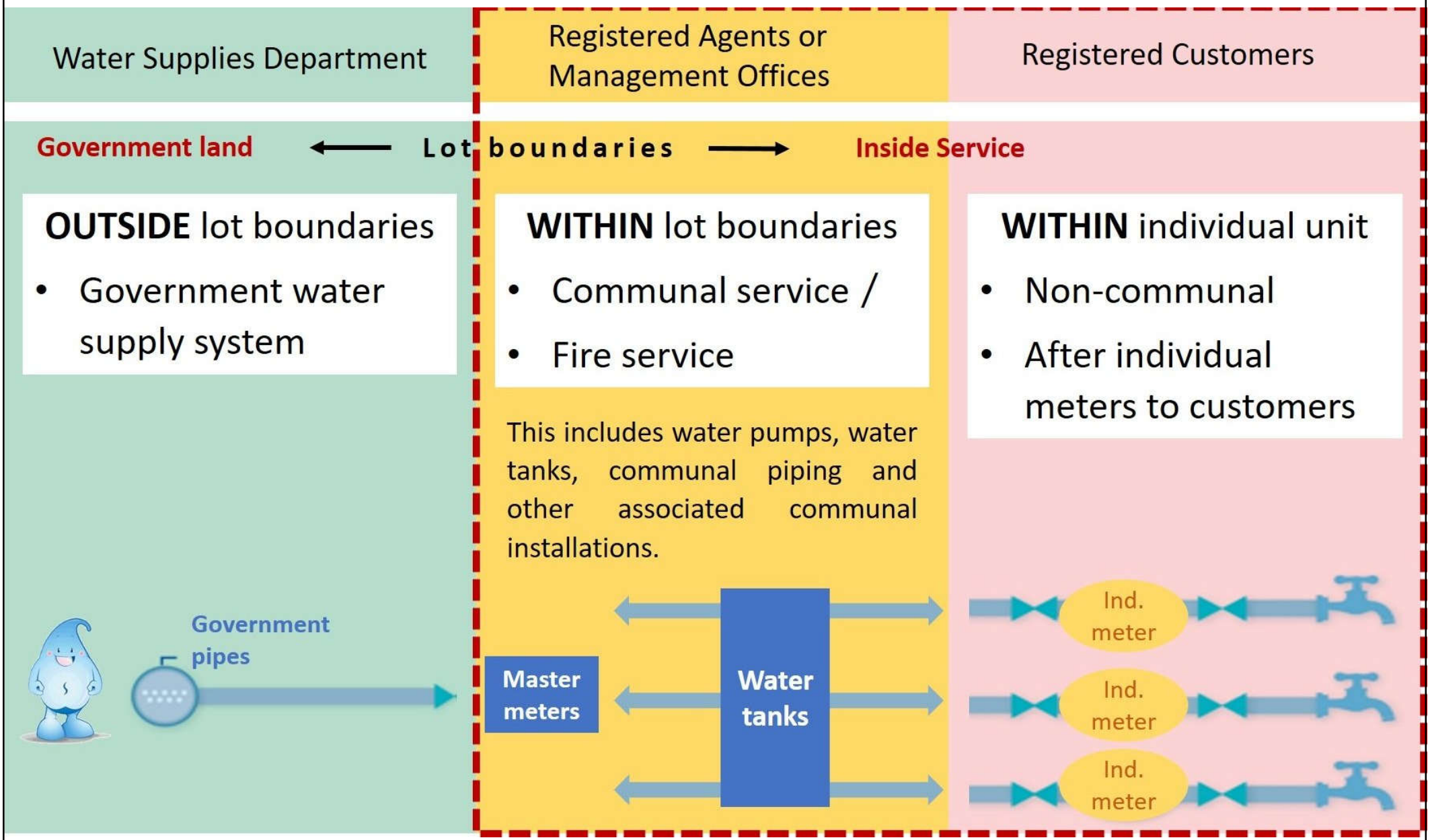
Schematic diagram of a typical inside service



"Inside Service" (內部供水系統):
The pipes and fittings between the premises and a connection to the main

(Source: https://www.devb.gov.hk/filemanager/en/Content_3/TF_Final_Report.pdf)

Maintenance responsibility of government waterworks and inside service



(Source: https://www.brplatform.org.hk/en/defects-and-orders/common-building-defects/defective-fresh-water-pipe)

Plumbing practice

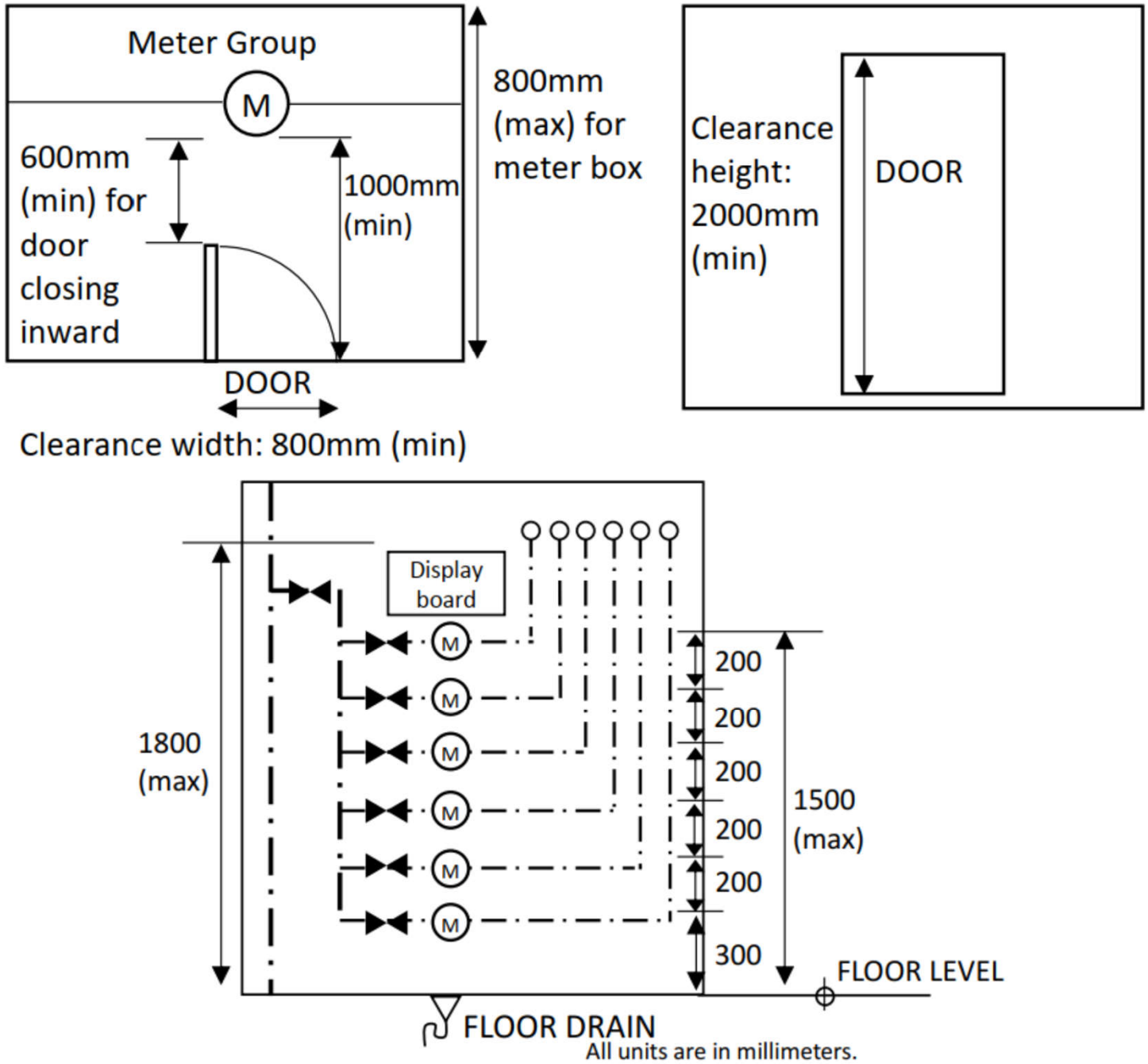
- Preliminary info required:
  - Nature of the building & conditions of the site
  - Types of water supply (fresh & flushing water)
  - Type of water main available
  - Available water pressure
  - Single or double-end feed main supply (for Fire Services)
  - Location of tee off points & size of connection points

Plumbing practice

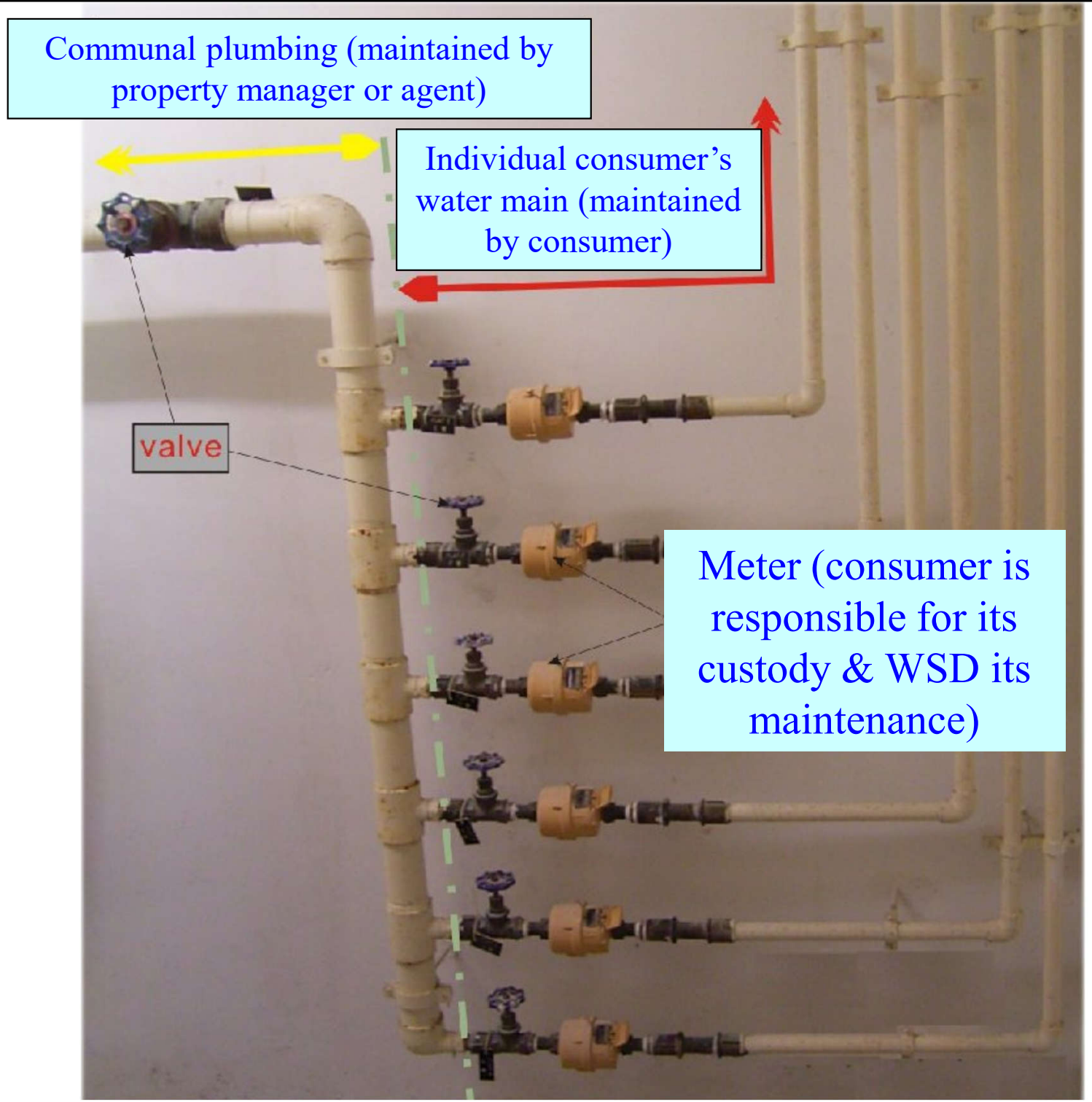
- Pressure of water supplies in HK
  - Fresh water supply: 15-30 metres head
  - Salt water supply: 15 metres head
  - They are maintained in the distribution systems except at their extremities
  - Reduction of the minimum residual pressure (since 2007): lower from 30- to 20-metre head
- Master meter, sub-meters & check meters

(See also: WSD, 2018. *Handbook on Plumbing Installation for Buildings*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/handbook-on-plumbing-installation/)

Typical arrangement of water meters in a meter box/chamber/room



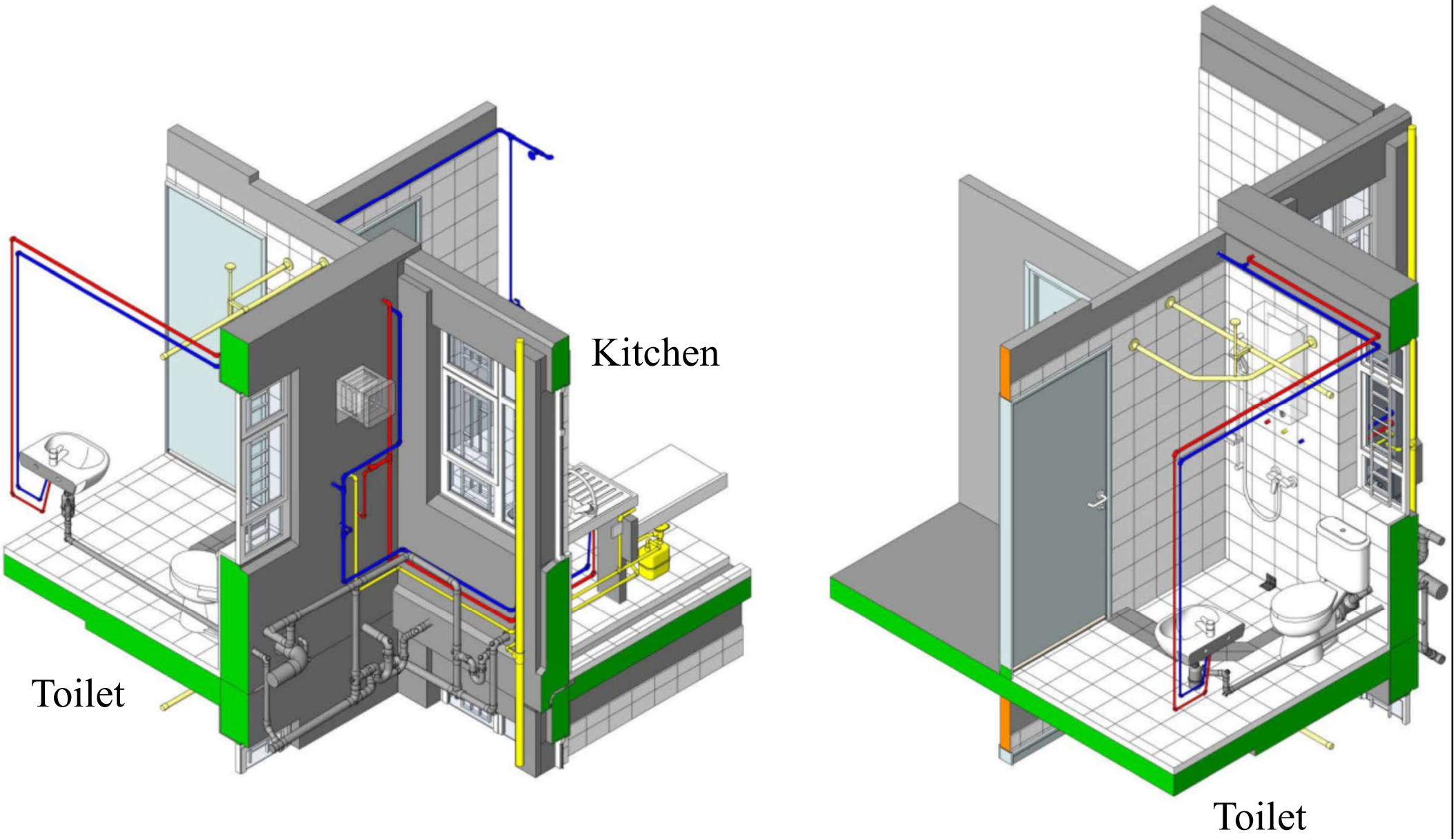
(Source: WSD, 2020. *Technical Requirements for Plumbing Works in Buildings (November 2020 version)*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/technical-requirements-for-plumging-works-in-bldgs/)



(Source: Water Supplies Department www.wsd.gov.hk)

(Source: Water Supplies Department www.wsd.gov.hk)

Typical plumbing layout inside a residential flat



(Source: Housing Authority Hong Kong)

Plumbing practice

- Sub-systems of fresh water supply:
  - Potable & non-potable water supply systems
  - Irrigation water supply
  - Cleansing water supply
  - Water make-up to A/C, water feature, water scrubber/hydro-vent or swimming pool
  - Hot water system
- Plan the sizes & locations of various plant rooms & water tanks

Plumbing practice

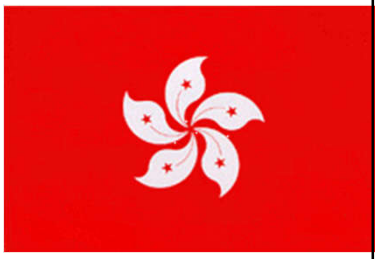
- Determine mode of water supply (depending on the available head pressure of water mains & complexity of plumbing installation)
  - Direct feed supply
  - Indirect supply system
  - Combination of direct & indirect supply system
- Preliminary schematic diagrams
- Estimation of water demand (loading unit), water storage (tanks) & water pumping

Design flow rates and loading units

Outlet fitting	Design flow rate (l/s)	Minimum flow rate (l/s)	Loading units
WC flushing cistern single or dual flush (to fill in 2 min.)	0.13	0.05	2
WC trough cistern	0.15 per WC	0.10	2
Wash basin tap size ½-DN 15	0.15 per tap	0.10	1.5-3.0
Spray tap or spray mixer	0.05 per tap	0.30	---
Bidet	0.2 per tap	0.10	1
Bath tap, ¾-DN 20	0.30	0.20	10
Bath tap, 1-DN 25	0.60	0.40	22
Shower head (will vary with type of head)	0.2 hot or cold	0.10	3
Sink tap, ½-DN 15	0.20	0.10	3
Sink tap, ¾-DN 20	0.30	0.20	5
Washing machine size – DN 15	0.2 hot or cold	0.15	---
Dishwasher size – DN 15	0.15	0.10	3
Urinal flushing cistern	0.004 per position	0.002	---

(Source: Garrett, R. H., 2008. *Hot and Cold Water Supply*)

Hot water systems in HK

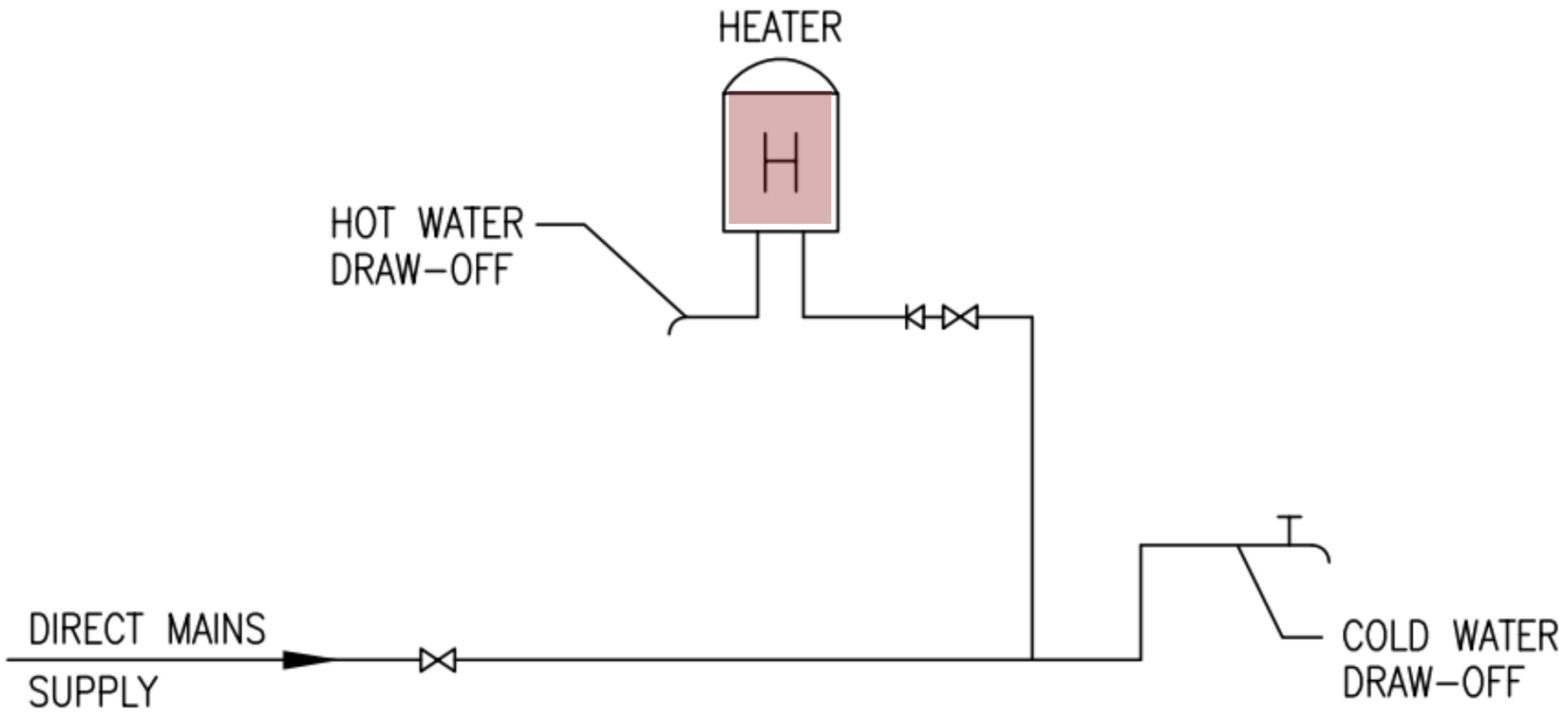


- Types of systems:
  - Non-centralised hot water systems
  - Centralised hot water systems
- Safety and statutory requirements
  - Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings (HKWSR)
  - Gas safety (by EMSD) e.g. GU mark
  - Electricity safety (by EMSD)
  - Boilers & pressure vessels (by Labour Dept.)

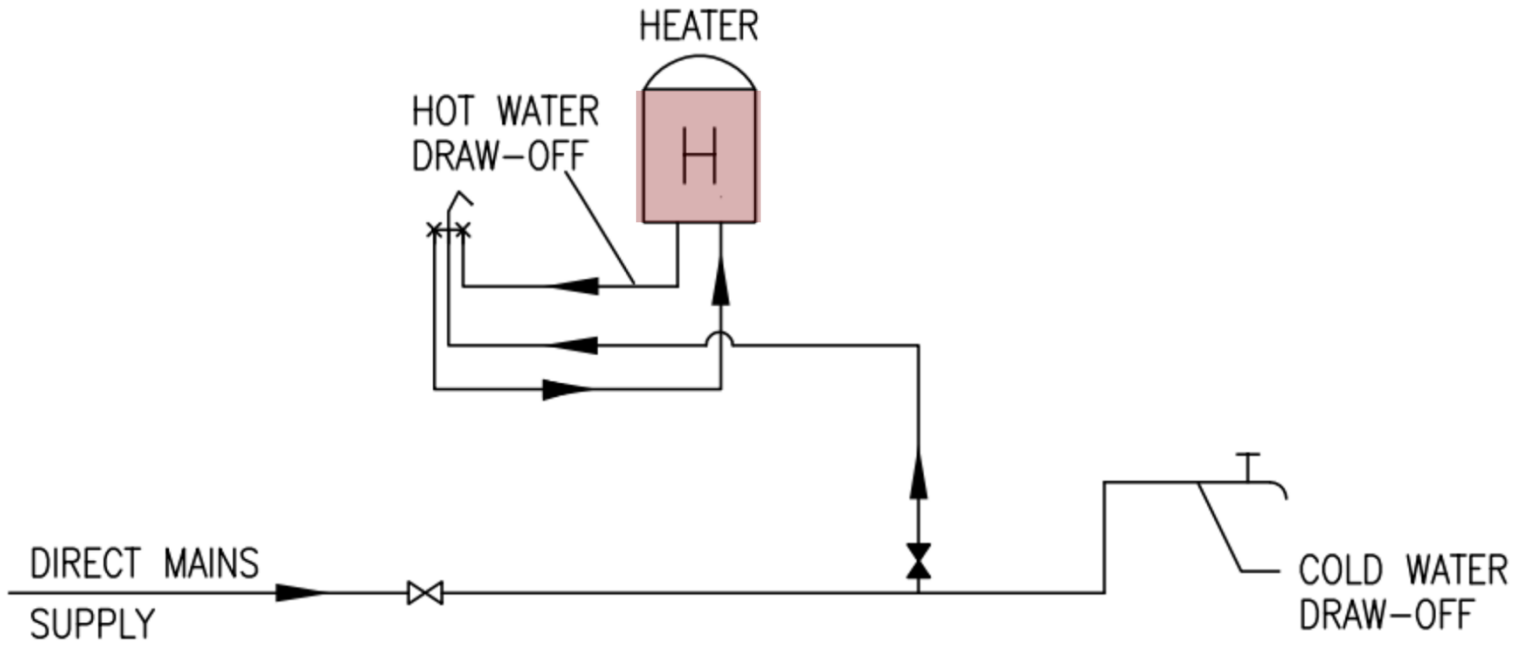
Requirements for non-centralised hot water systems

Type of water heater	Requirements for direct connection (without storage tank) to supply pipe
Non-pressure type heaters Cistern type water heaters Instantaneous water heaters	The factory test pressure of the heater is in excess of 1.5 times the maximum static pressure at the water mains supply point
Unvented electrical thermal storage water heaters	HKWSR Clause 5.11 and with safety devices complying with Electrical Products (Safety) Regulation
Pressure type thermal storage heaters other than unvented heaters	Storage tank is required in all cases with a vented pipe

(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)



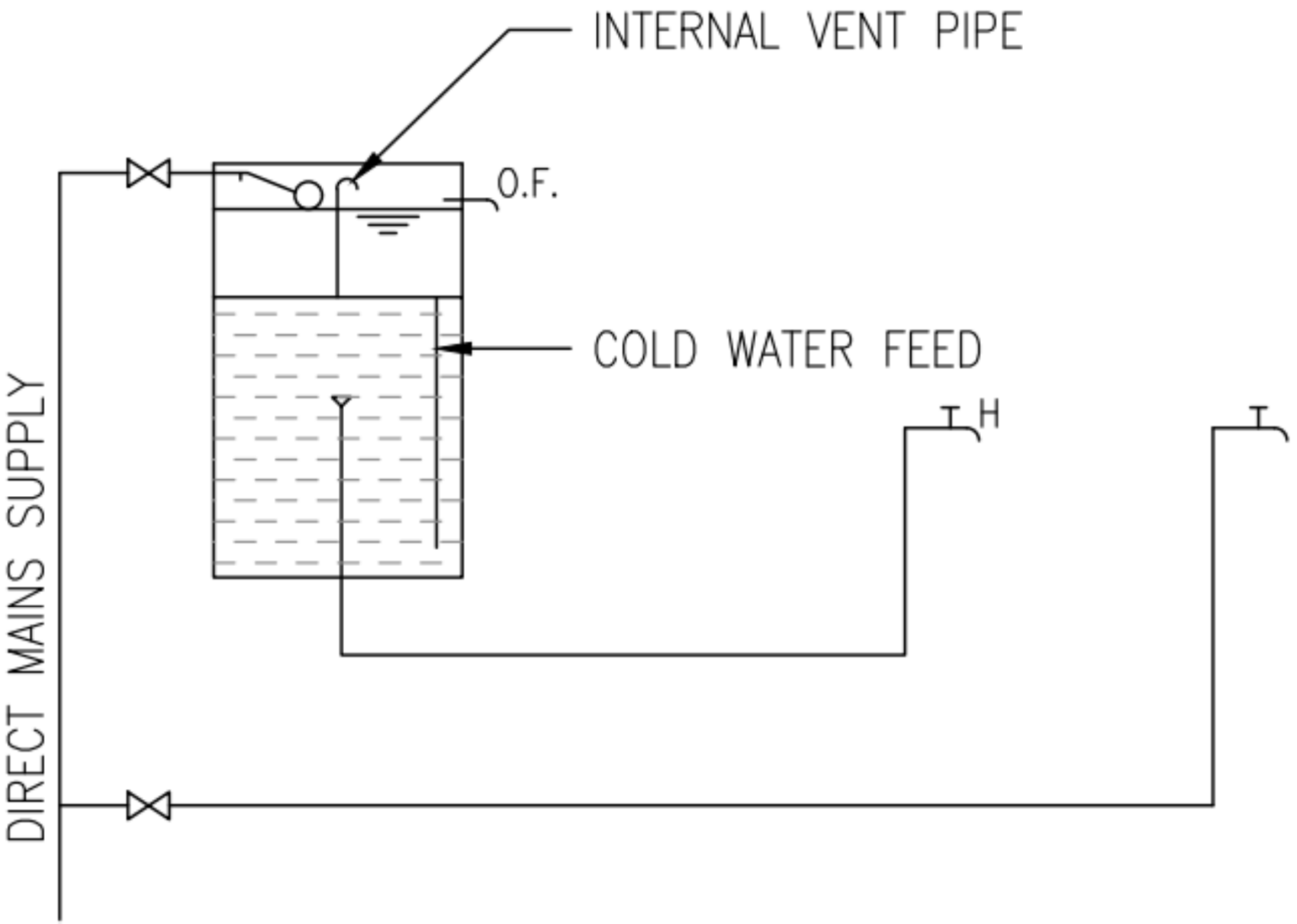
Non-pressure type heater



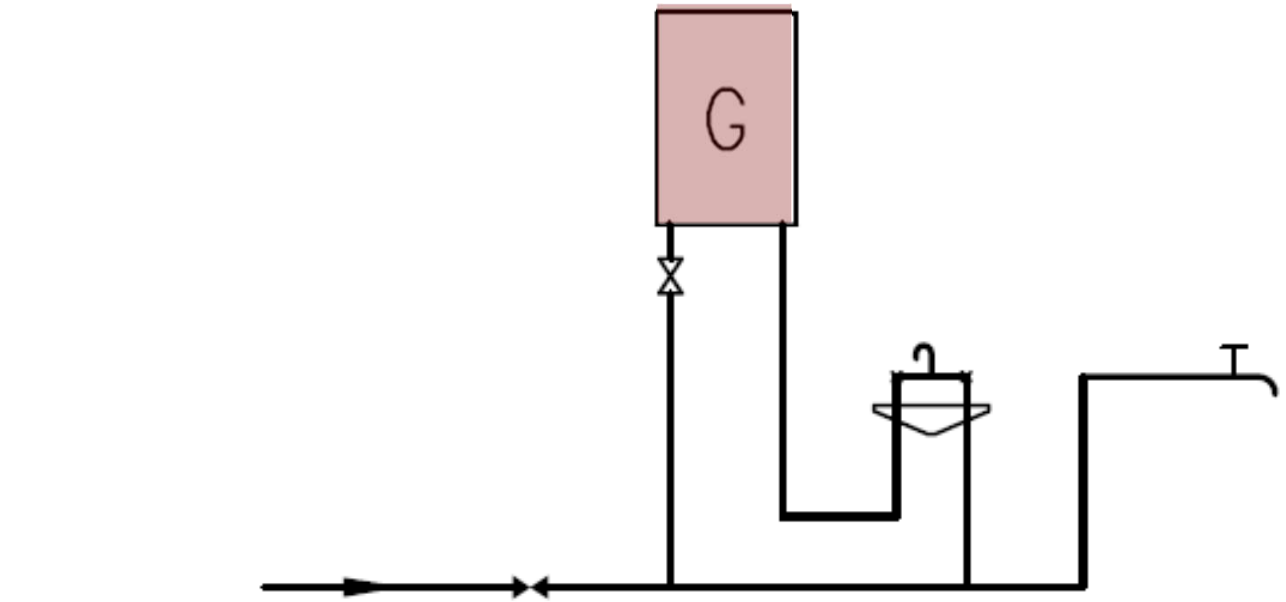
Non-pressure type heater with loose jumper type stopcock

(Source: WSD, 2020. *Technical Requirements for Plumbing Works in Buildings (November 2020 version)*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/technical-requirements-for-plumging-works-in-bldgs/)

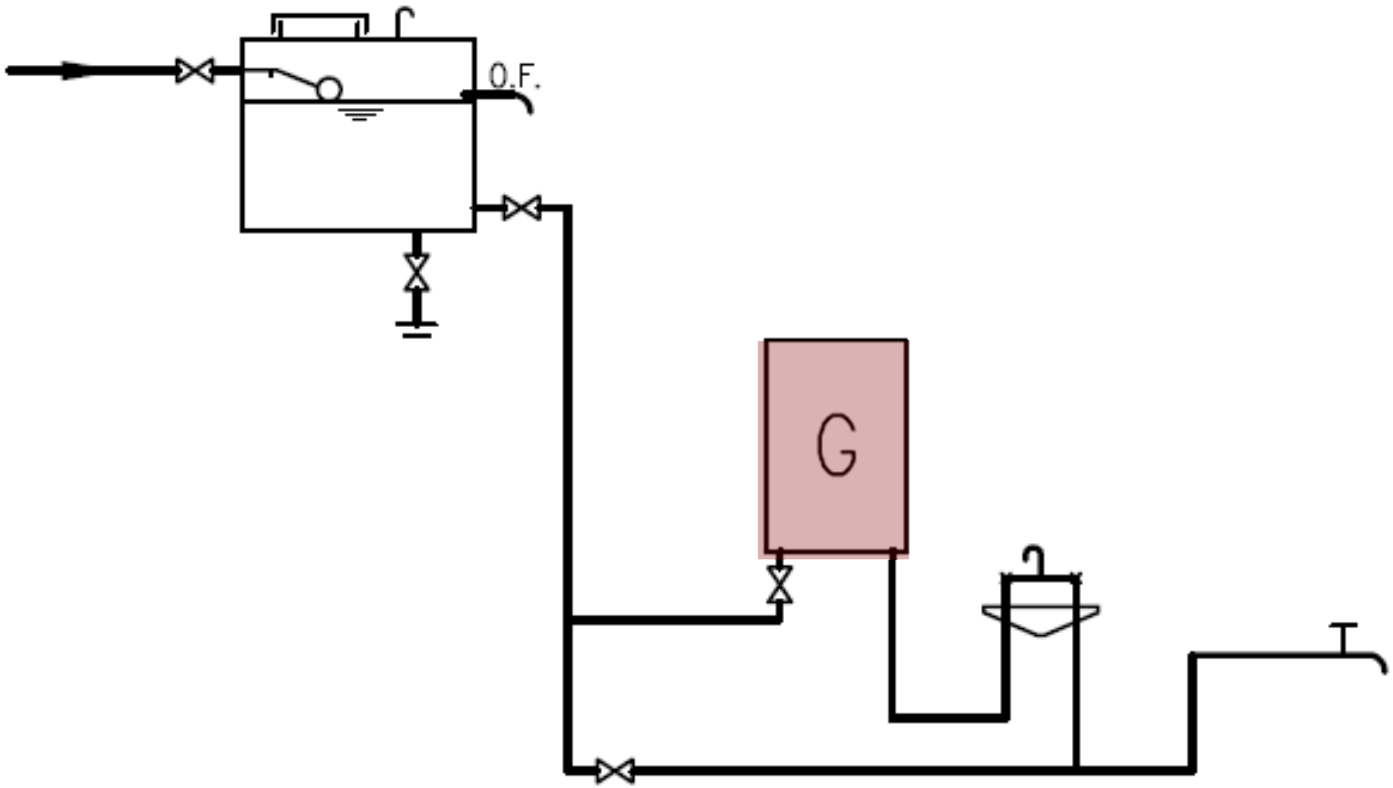
Cistern type water heater



(Source: WSD, 2020. *Technical Requirements for Plumbing Works in Buildings (November 2020 version)*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/technical-requirements-for-plumging-works-in-bldgs/)



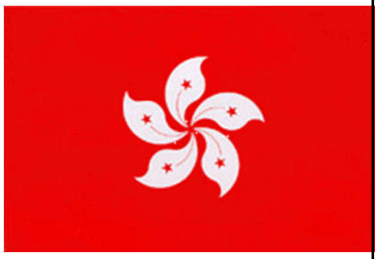
Instantaneous gas water heater connected directly to mains supply



Instantaneous gas water heater connected indirectly to mains supply

(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)

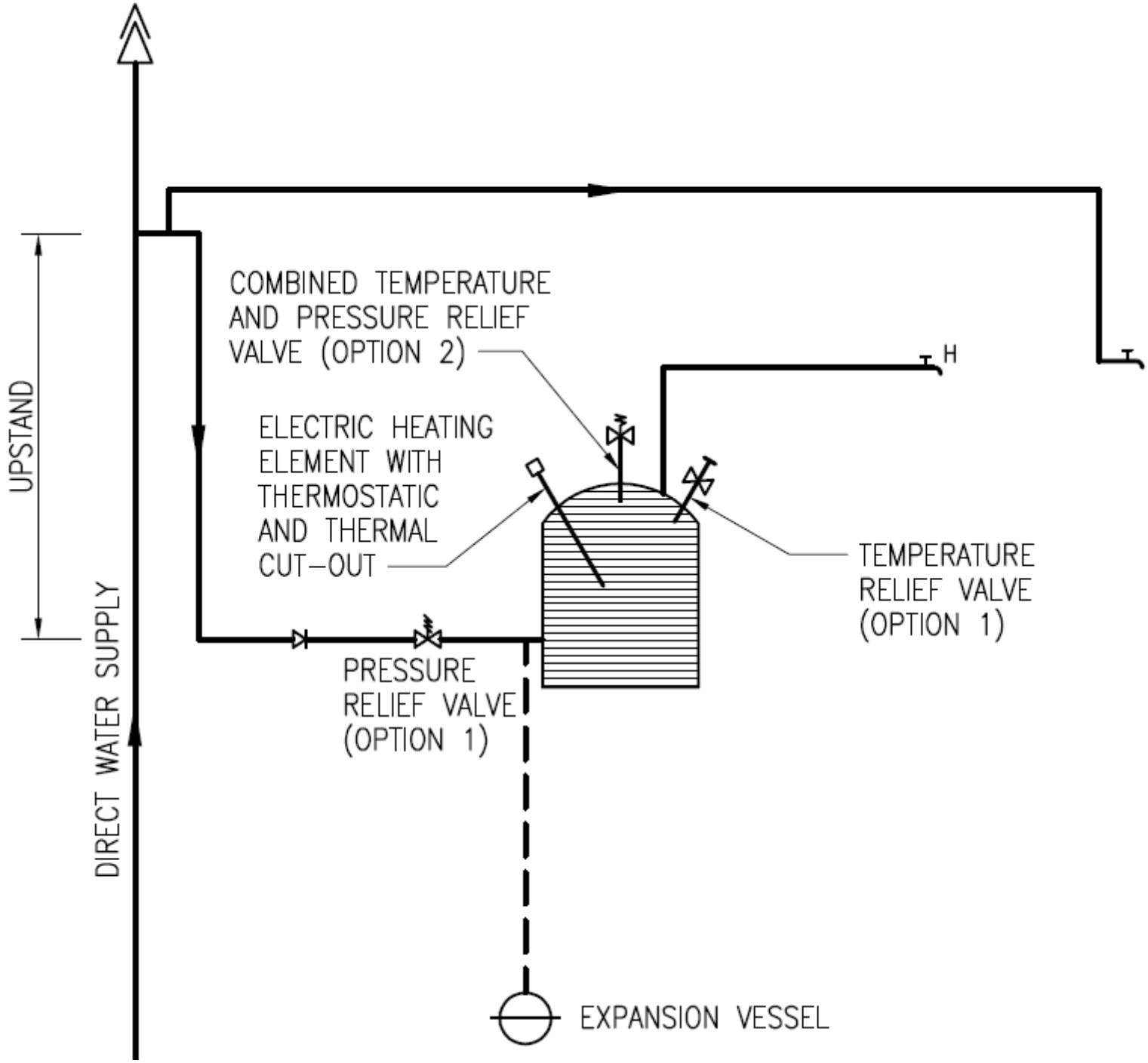
Hot water systems in HK



- Unvented electric water heater of storage type (HKWSR Clause 5.11):
  - A supply pipe that branches off from the feed pipe at a point above the top of the water heater, or some other device to prevent the water from draining down from the water heater if the source of water supply fails
  - An anti-vacuum valve complying with BS 6282 or some other device to prevent heated water from being syphoned back to the supply pipe
  - A vessel to accommodate expansion of heated water where that expansion is constrained by a non-return valve or some other device, at the inlet of the water heater

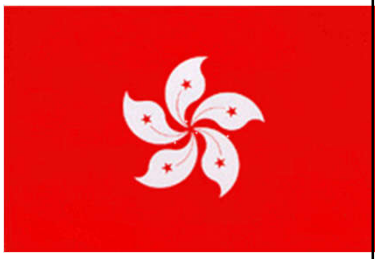
(See also: Safety Tips for Using Electric Water Heaters (EMSD)
https://www.emsd.gov.hk/en/electricity_safety/publications/guidance_notes_guidelines/safety_tips_for_using_electric_water_heaters/)

Unvented electric thermal storage type water heater



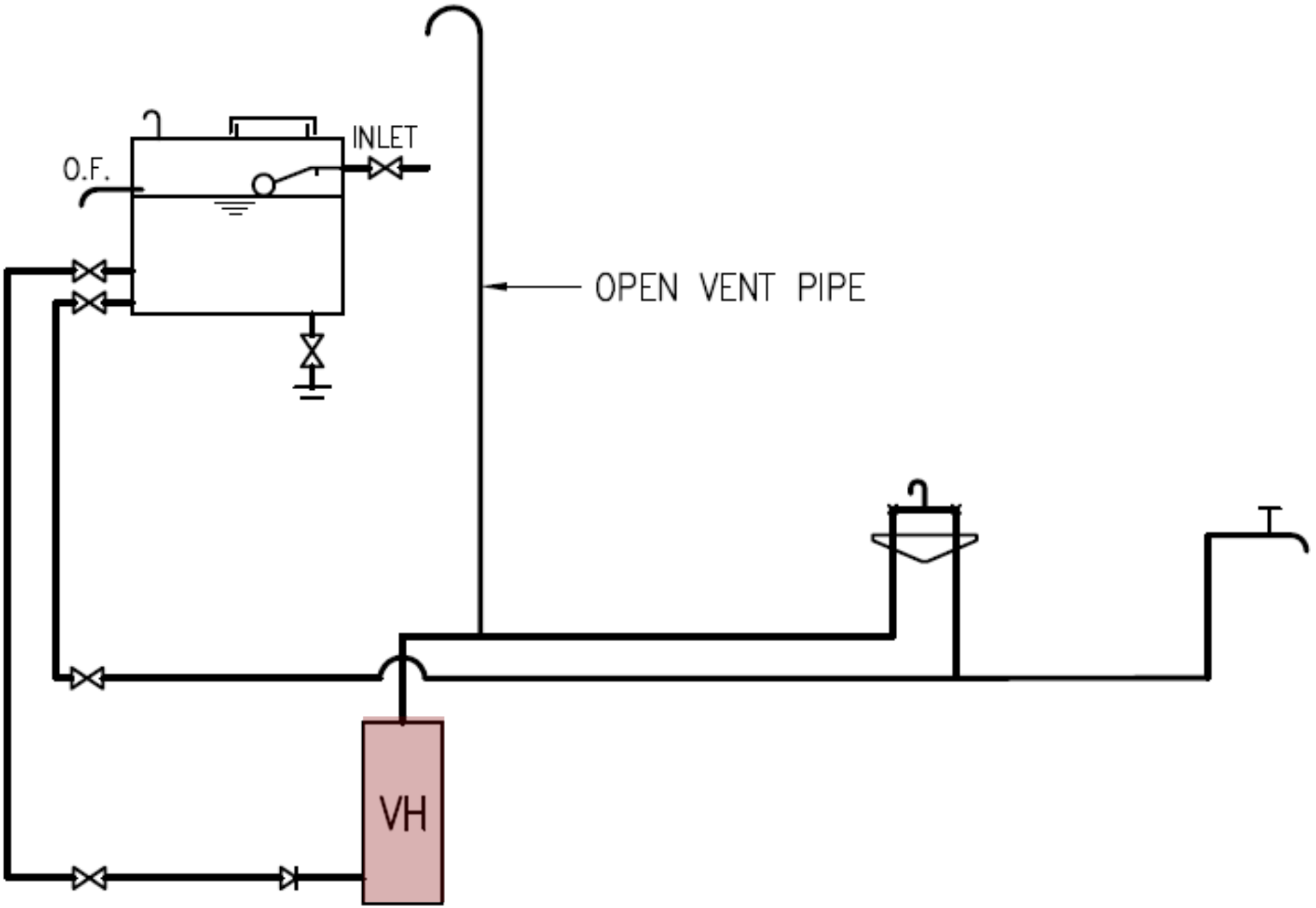
(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)

Hot water systems in HK



- Pressure type thermal storage water heater:
  - Supplied from a separate water storage cistern, except these are installed in flats supplied through indirect or sump and pump system
  - A vent or an expansion pipe taken from its highest point and discharge in the atmosphere above the storage cistern at sufficient height to prevent a constant outflow of hot water

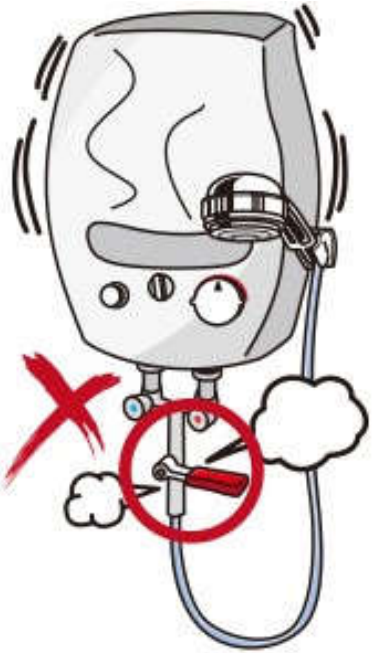
Pressure type thermal storage water heater



(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)

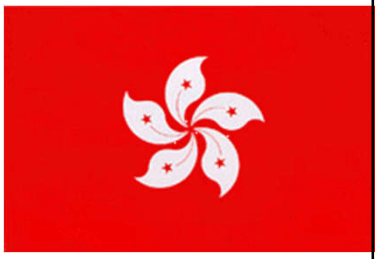
Hot water systems in HK

- Requirements for non-centralised systems
  - Minimum pressure & flow for proper functioning
  - Mixing valves, water blenders or combination fittings (provide a balanced pressure)
  - Electricity (Wiring) Regulations
  - Electric Products (Safety) Regulations
  - Relief valves and drain pipe
  - Max. hot water pipe length



(Source: WSD, 2017. *Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/previously-used-documents-hkwsr-hpi/)

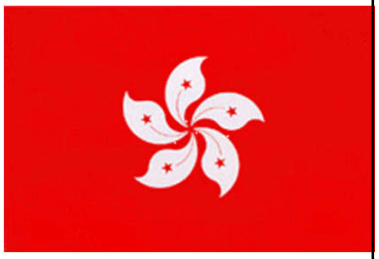
Hot water systems in HK



- Requirements for centralised systems
  - Vent or an expansion pipe from the highest point
  - Safety valve or pressure relief valve
  - Mixing valves, water blenders or combination fittings (provide a balanced pressure)
  - Draining down or emptying the system
  - Avoid waste of water
- Major components: boiler, hot water storage cylinder/calorifier, cold water tank/pipework

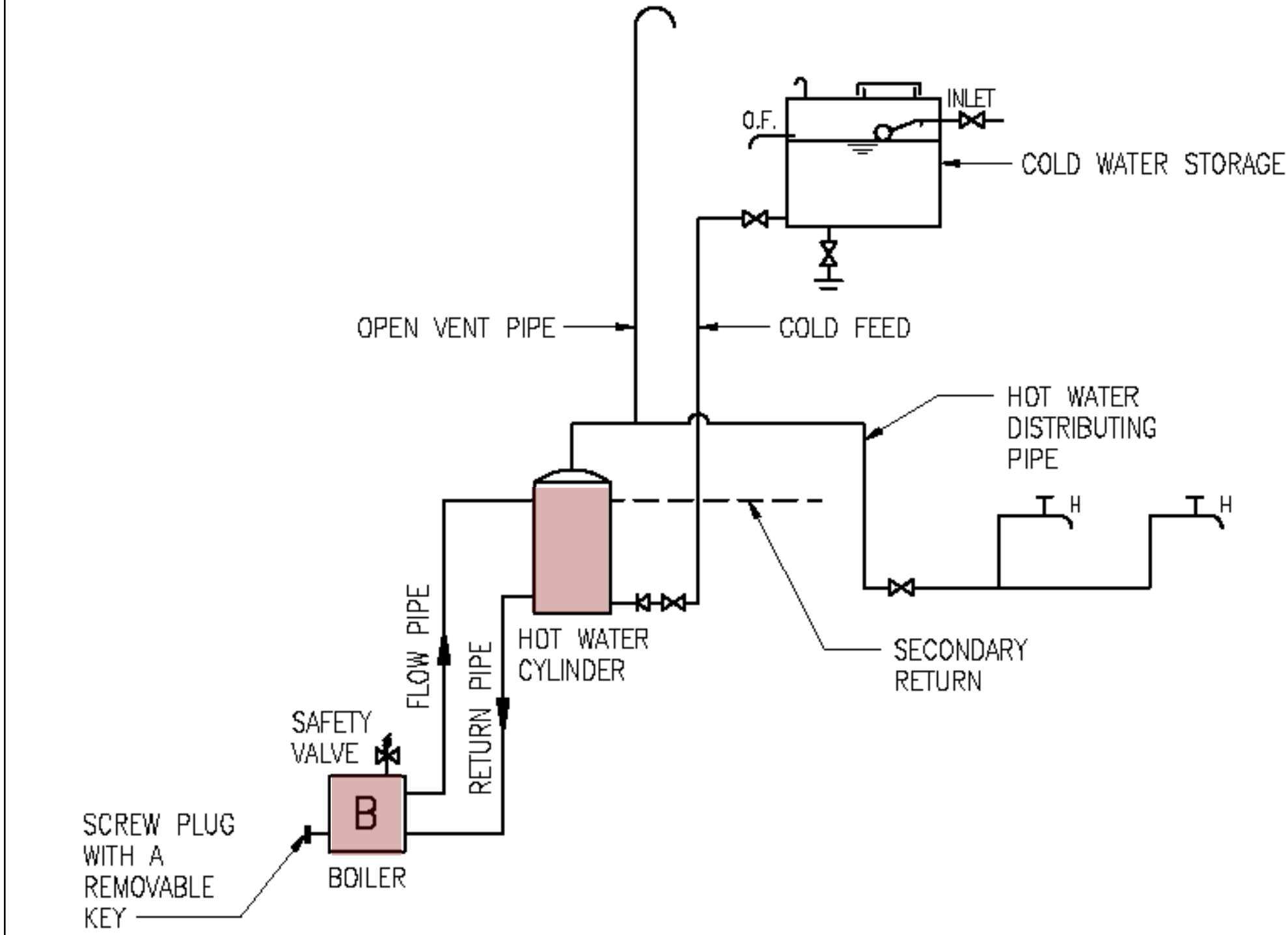
(Source: WSD, 2017. *Hong Kong Waterworks Standard Requirements for Plumbing Installation in Buildings*, Water Supplies Department (WSD), Hong Kong. https://www.wsd.gov.hk/en/plumbing-engineering/requirements-for-plumbing-installation/previously-used-documents-hkwsr-hpi/)

Hot water systems in HK



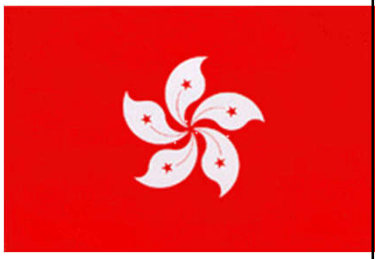
- Direct centralised hot water system
  - Water through the boiler can be drawn off from the taps
  - Saves the cost of a storage and expansion cistern and associated pipework
  - Heated quicker
  - Adequate pressure on the main
  - Sealed primary circuit can be pumped or can circulate by natural convection

Direct centralised hot water system



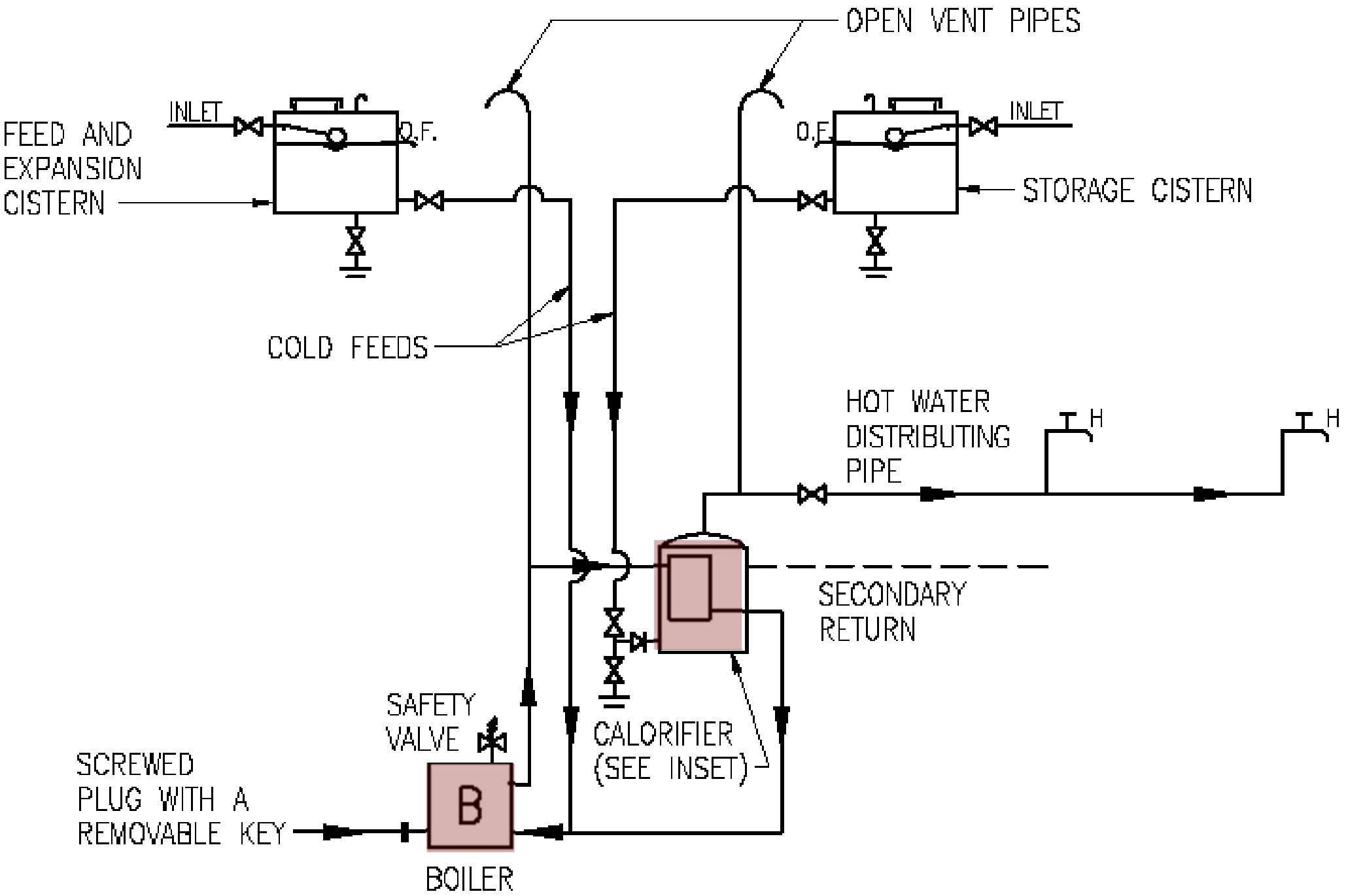
(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)

Hot water systems in HK



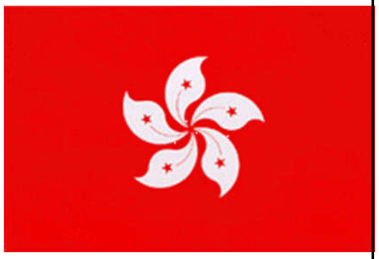
- Indirect centralised hot water system
  - Separate circuit for the water drawn off at taps
  - Used in hard water areas to prevent scaling of boiler and pipes
  - Used when heating is combined with the system
  - It costs more than direct system but requires less maintenance
  - An expansion vessel in primary pipework to eliminate the need for an expansion cistern, expansion pipe and boiler feeder pipe

Indirect centralised hot water system



(Source: WSD, 2006. *Handbook on Plumbing Installation for Buildings*)

Hot water systems in HK



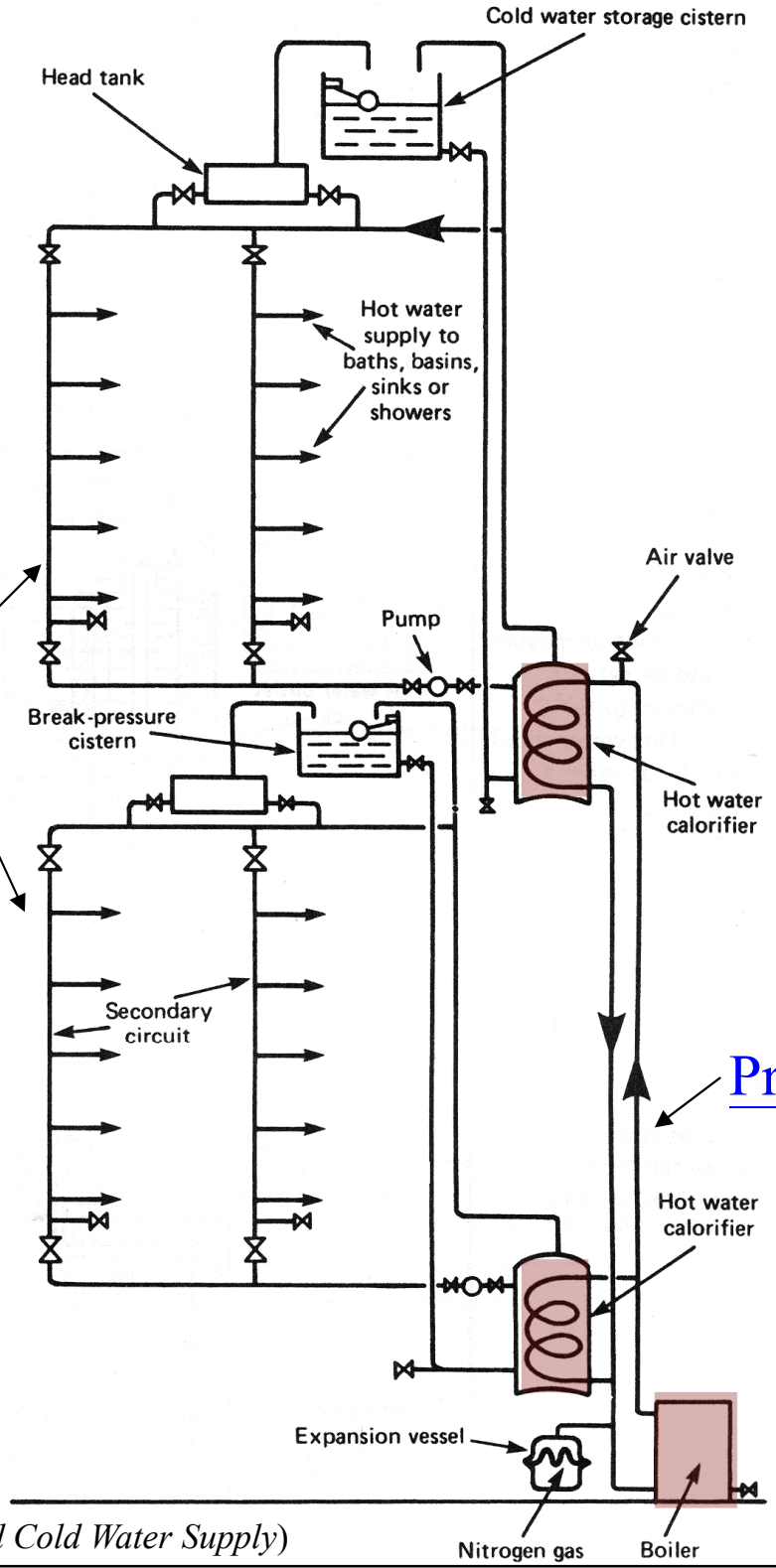
- Hot water systems for high-rise buildings
  - More economical to pressurise water in a sealed system
  - Proper zoning is required (e.g. 30 m)
  - Boiler & calorifiers to withstand water pressure
  - Sealed primary circuit saves on pipework and the expansion and feed tank
  - Expansion vessel takes up the expansion of water in the primary circuit
  - The pipes, calorifiers, head tanks & boiler must be well insulated

Upper zone

Secondary circuit

Lower zone

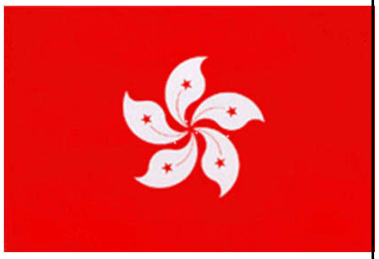
Sealed indirect hot water system for a highrise building



Boiler plant

(Source: Garrett, R. H., 2008. *Hot and Cold Water Supply*)

Hot water systems in HK



- Prevent dead legs in hot water systems
  - ‘Dead legs’ occur in hot water systems where water does not move for a period of time
    - Such as at night when hot water is not used and the contents of the pipes and appliances cools down
  - Water cooled to 20 to 45 ºC becomes more susceptible to bacteria growth, and overnight gives adequate time for possible bacteria to multiply
  - Two common approaches to avoid dead legs:
    - 1. Install a secondary return pipe
    - 2. Maintain the water temperature at all times

Water quality & management

- Water Safety Plan (WSP)
  - Developed by WSD in 2007 in accordance with WHO's recommendations
  - Launched an integrated Drinking Water Quality Management System (DWQMS) in 2017
    - Water quality policy
    - Principle of water quality management
    - Health-based targets
    - Water safety plans
    - Surveillance

(Source: https://www.wsd.gov.hk/en/core-businesses/water-quality/action-plan-for-enhancing-of-drinking-water-safety/water-safety-plans/)

Water quality & management

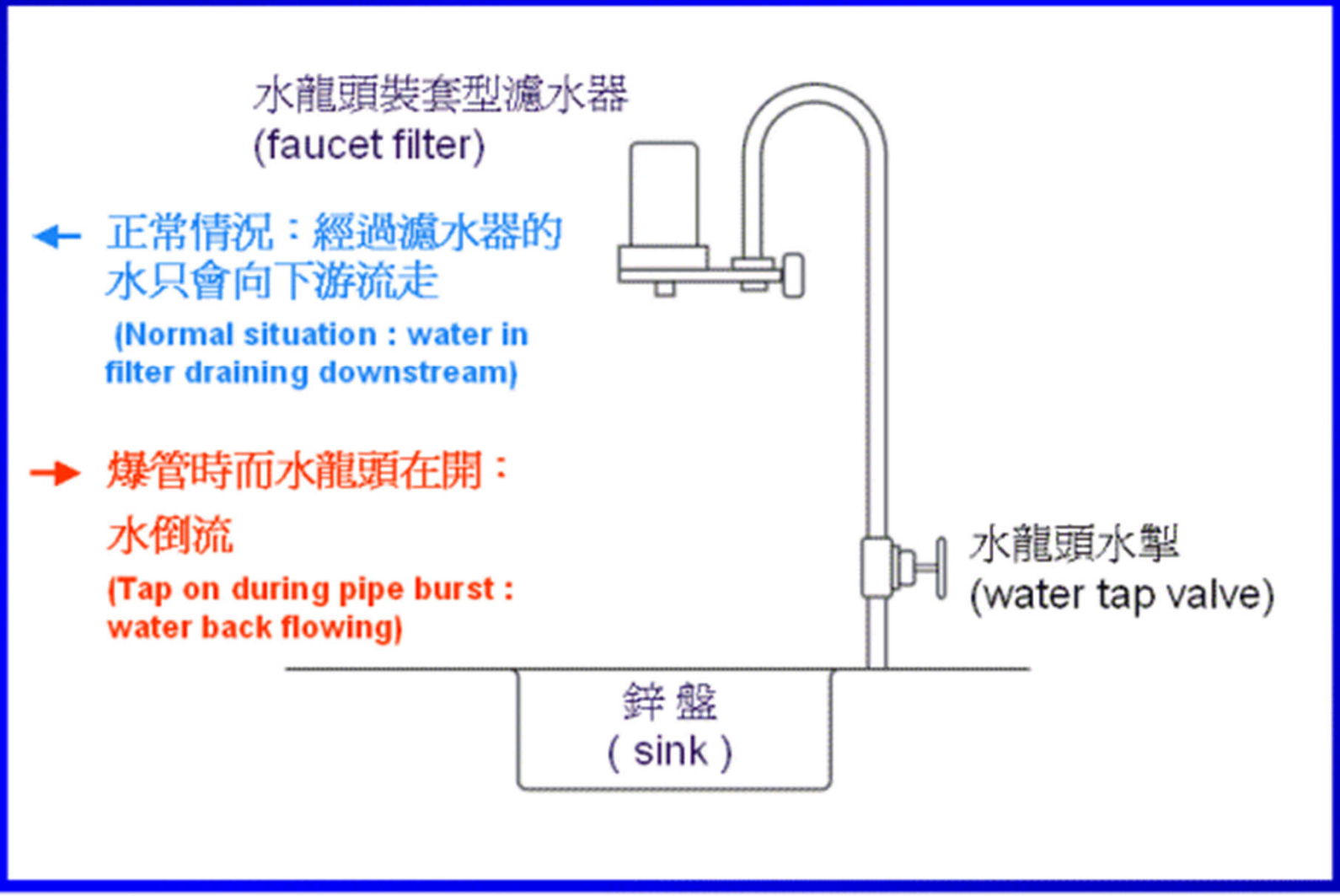
- Quality Water Supply Scheme for Buildings
  - https://www.wsd.gov.hk/en/core-businesses/water-quality/buildings/
  - To encourage building owners to maintain their plumbing systems properly
    - Fresh Water (Management System)
    - Fresh Water (Plus)
    - Flushing Water
  - There are 3 grades of certificates:
    - Blue Certificates: New application or renewal with < 3 years
    - Silver Certificates: Continuous participation 4-6 years
    - Gold Certificates: Continuous participation >= 6 years

(Source: https://www.wsd.gov.hk/en/core-businesses/water-quality/buildings/)

Water quality & management

- Treated water supplied by WSD at the connection points fully complies with the WHO guidelines for drinking water
- If the water is free from contamination within the plumbing system in a building, it is not necessary to use filter or purifier
- If a filter or purifier is used, it should be properly cleaned & maintained. Non-return valve may be needed to prevent back-flowing

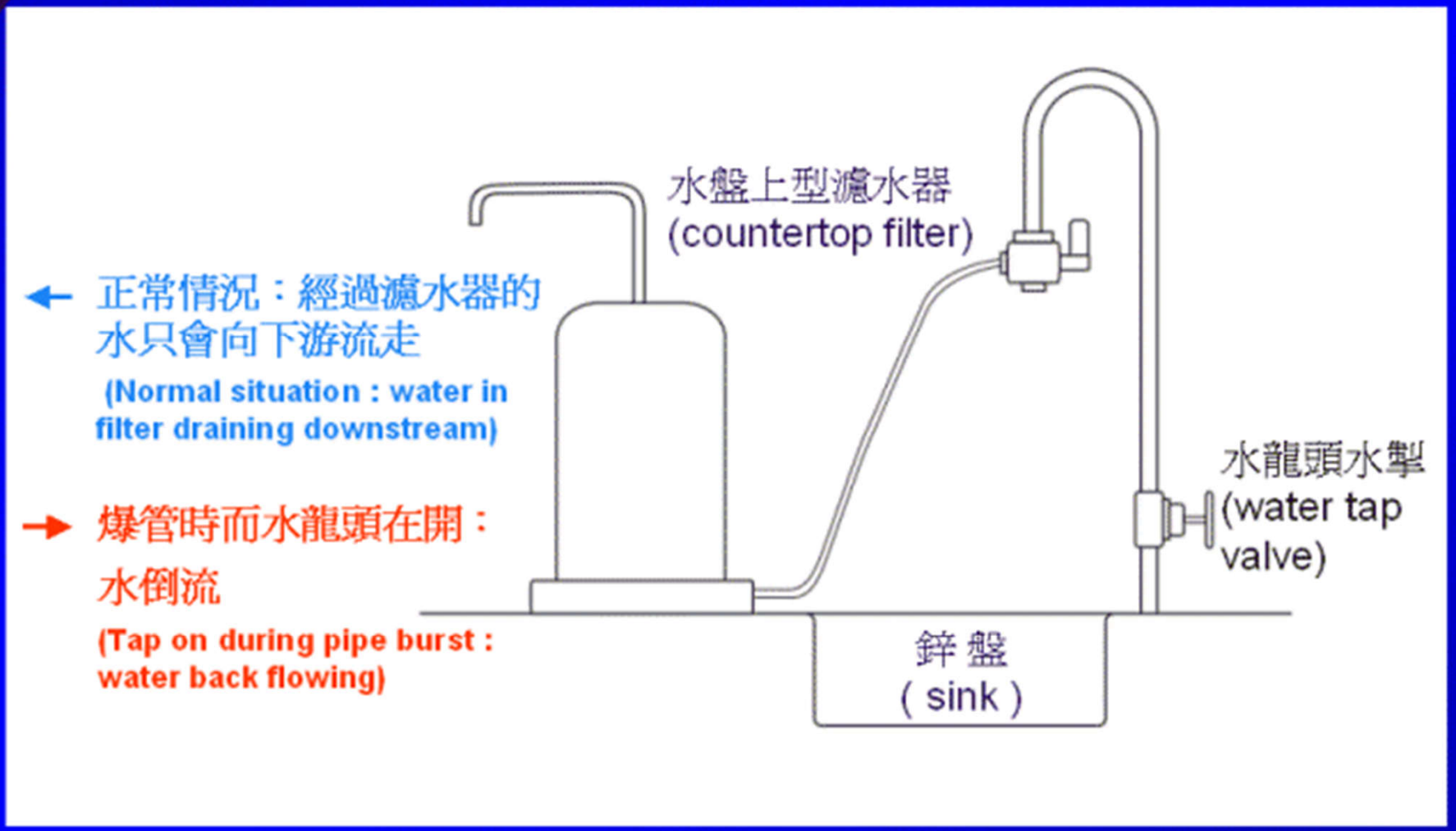
圖二：水龍頭裝套型濾水器
(Fig 2 : Faucet filter)



香港水務署

(Source: Water Supplies Department www.wsd.gov.hk)

圖三：水盤上型濾水器
(Fig 3 : Countertop filter)



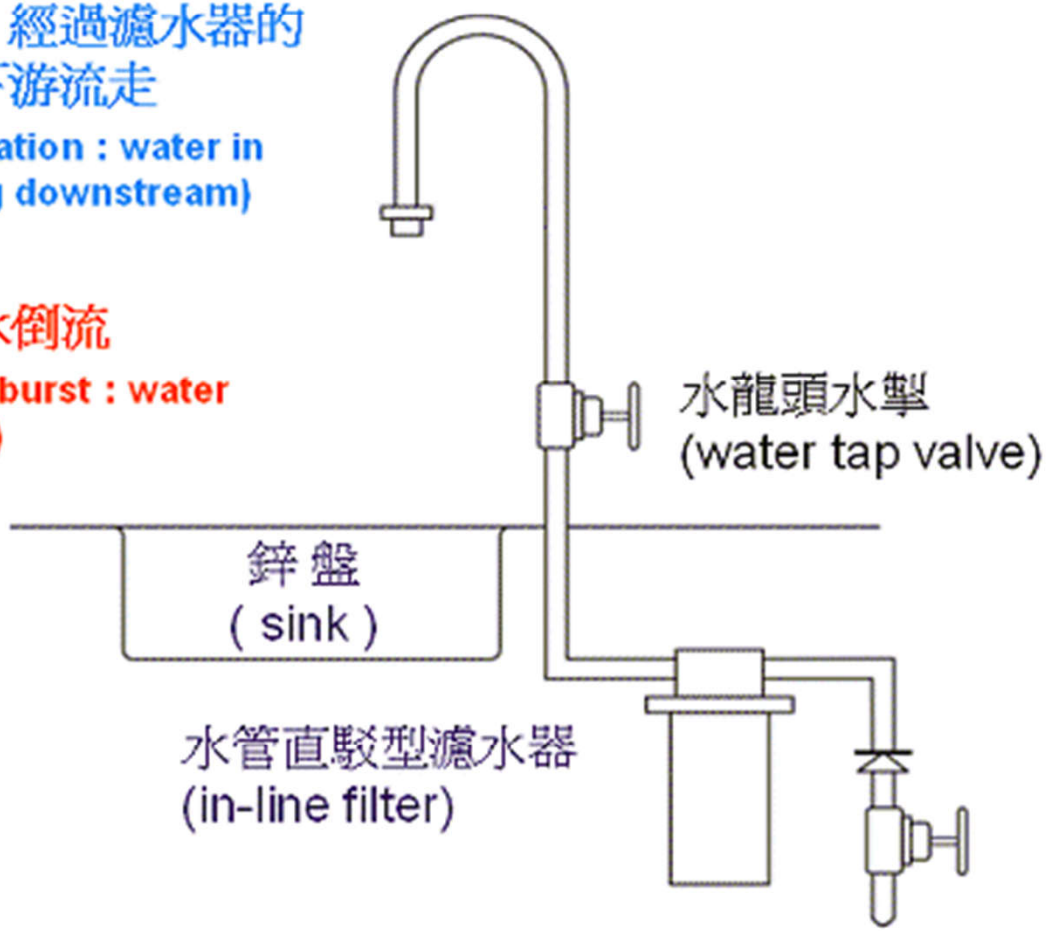
香港水務署

(Source: Water Supplies Department www.wsd.gov.hk)

圖六：水管直駁型濾水器
(Fig 6 : In-line filter)

← 正常情況：經過濾水器的水只會向下游流走
(Normal situation : water in filter draining downstream)

→ 爆管時：水倒流
(During pipe burst : water back flowing)



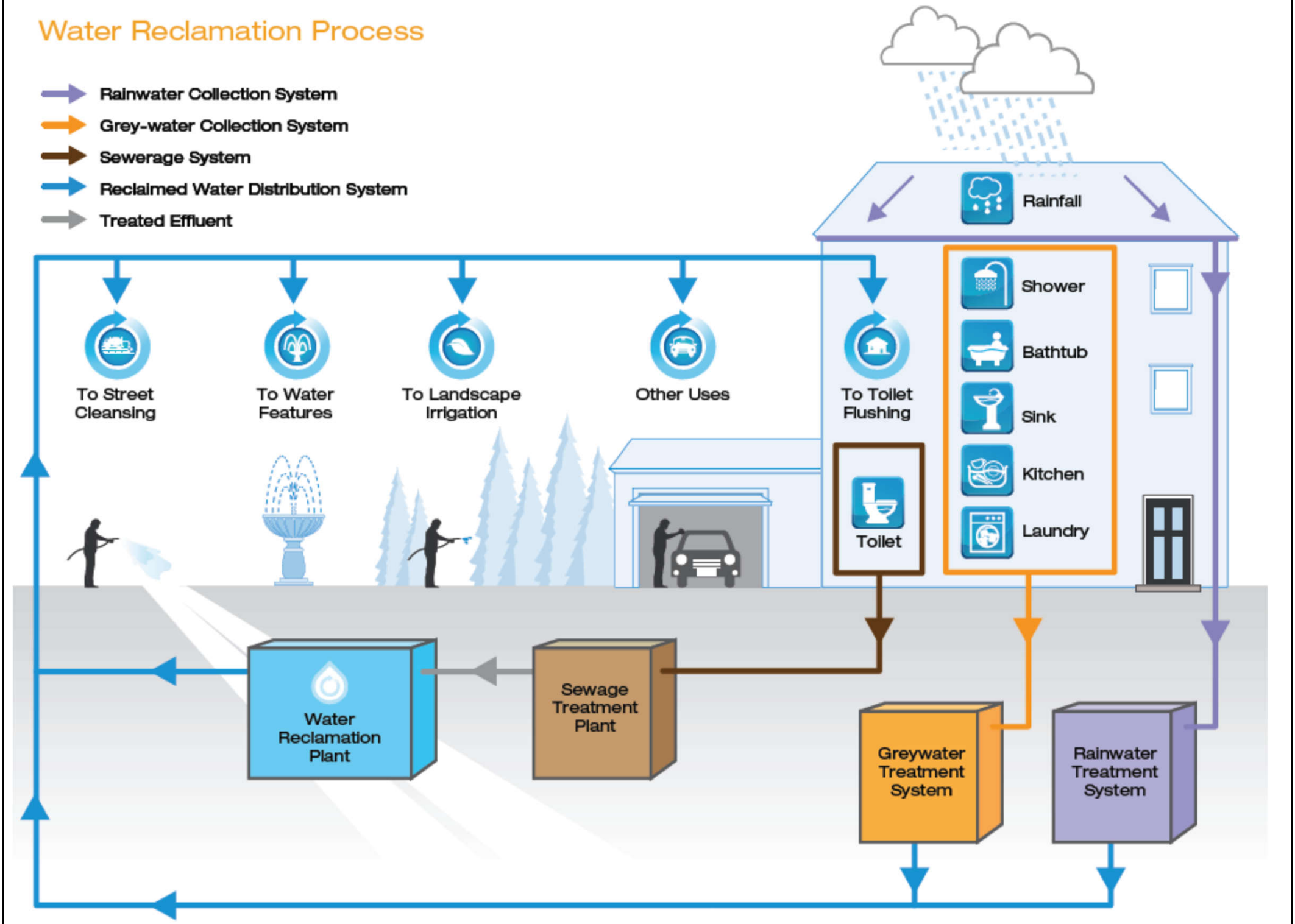
香港水務署

(Source: Water Supplies Department www.wsd.gov.hk)

Water quality & management

- Total Water Management (TWM) strategy
  - Water demand management
    - To enhance public education on water conservation
    - To promote use of water saving devices
    - To enhance water leakage control
    - To extend use of seawater for toilet flushing
  - Water supply management
    - To strengthen protection of water resources
    - To actively consider water reclamation (reuse of greywater & rainwater harvesting)
    - To develop the option of seawater desalination

(Source: https://www.wsd.gov.hk/en/core-businesses/total-water-management-strategy/)



(Source: Water Supplies Department www.wsd.gov.hk)

Water quality & management

- Development of new water supply sources
  - Seawater desalination
    - Using reverse osmosis (RO) technology
  - Reclaimed water
    - Primarily for non-potable uses
    - Convert the tertiary treated sewage effluent into reclaimed water for toilet flushing
  - Grey water reuse and rainwater harvesting
  - Stormwater management and harvesting

Water quality & management

- Promoting water conservation
  - Water Efficiency Labelling Scheme (WELS)
  - Automatic meter reading
  - Public education
  - Water use efficiency guidelines
  - Water loss management (reduce leakages)
  - Water intelligent network (WIN) (monitor water loss)
  - Underground asset (water mains) management
  - Expand the use of low grade water (e.g. seawater flushing)

(See also: https://www.waterconservation.gov.hk/)

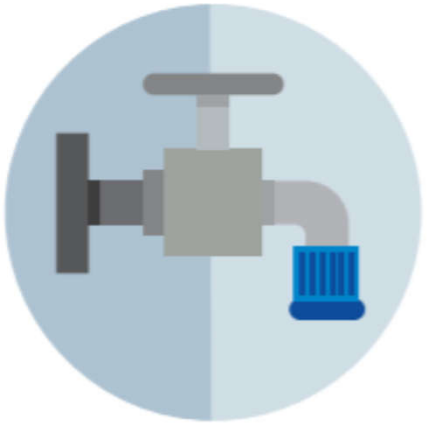
Voluntary Water Efficiency Labelling Scheme (WELS)

Showers for Bathing

Water Taps

Urinal Equipment

Washing Machines

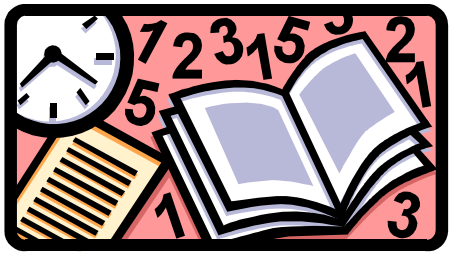


Flow Controllers

Water Closets

(Source: https://www.wsd.gov.hk/en/plumbing-engineering/water-efficiency-labelling-scheme/)

References



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