



REPUBLIC OF THE UNION OF MYANMAR
COMMITTEE FOR QUALITY CONTROL OF
HIGH-RISE BUILDING CONSTRUCTION PROJECTS

**GUIDELINES FOR HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
(WATER SUPPLY AND SANITATION)**

23rd February, 2017

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
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GUIDELINES FOR HIGH - RISE BUILDING
CONSTRUCTION PROJECTS
(SANITAY)**

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Professional Engineer (PE) (Water Supply and Sanitation)

All designs on High-Rise Building(HRB) undertaken by a foreign firm/ company shall be duly endorsed/ countersigned by a Professional Engineer (PE) (Water Supply and Sanitation) when submitting HRB Project to CQHP.

To qualify for evaluating and endorsing designs by a foreign firm/company on Water Supply and Sanitation system for a (HRB), a PE (Water supply and Sanitation) must duly registered with CQHP for National Counterpart (NCP) and be of full validity as issued by Myanmar Engineer Council (MEC).

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE I
SITE INSPECTION**

1. General Requirements at Site (M)

- 1-1 Project Organization Chart
- 1-2 Water and Sanitation Drawings
- 1-3 Quality Control Facilities and Records
- 1-4 Work Schedule
- 1-5 Safety Provisions
- 1-6 Site Sanitation and Basic Health Care
- 1-7 Fire Protection (During Construction Period)

2. Inspection Check List

- 2-1 Preliminary Survey (M)
 - 2-1-1 Property Lines based on Certified Map
 - 2-1-2 Building Dimensions
 - 2-1-3 Building Layout
 - 2-1-4 Sources/ Sources of Water Supply
Storage Tank (Ground/Overhead) Layout,
Layout of Soil/ Waste Water Disposal System,
Water Treatment Plant Layout, Parameter / External drain ,
Waste Water Treatment Plant Layout,
Pipe Layout, Sewer and Manhole Layout
 - 2-1-5 Levels of Each Component
- 2-2 Building Survey (During Construction) (M)
 - 2-2-1 W.C Plan and Level
 - 2-2-2 Wet Area Plan and Level
- 2-3 Detail Checking (M)
 - 2-3-1 Cold Water Supply System
 - 2-3-2 Hot Water Supply System
 - 2-3-3 Soil, Waste and Vent Pipe System
 - 2-3-4 Fixture Installation
 - 2-3-5 Refuse Collection and Disposal System
 - 2-3-6 Deviation From Original Designs and Revision Designs

- M Mandatory**
- R Recommended**
- S Suggested**

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE II
GEOTECHNICAL INVESTIGATIONS RELATED TO SANITARY WORKS**

1. To provide bearing capacity of soil at site of construction, where required, for the design and construction of reservoirs, water treatment plant and waste water treatment plant. (M)
2. To provide information on the type of soil at site of construction, preferably with respect to the AASHTO soil classification.(R)
3. To provide result of Percolation Test where required. (R)

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE III
COLD AND HOT WATER SUPPLY**

1. Water Demand

- 1-1 Recommended water demand with respect to the inhabitants (Population Equivalent) is given in Table 1, Appendix.
- 1-2 Water requirement of a project shall be calculated with respect to the estimated Population Equivalent (PE).(M)

2. Sources of Water Supply

- 2-1 Where only one source is available, it shall have the capacity of meeting the water demand of the premises. (M)
- 2-2 Where two sources are available it is recommended that each shall have the capacity of meeting the demand of premises. (R)
- 2-3 Requirements for the utilization of ground water (M)
 - 2-3-1 Where groundwater is to be tapped by using tube wells, location of tube wells (tentative/permanent) should be indicated.
 - 2-3-2 The yield from the tube wells shall meet the demand of the project requirement, both in quantity and quality.
 - 2-3-3 Well logs, including the result of raw water quantity test shall be included in the submission.
 - 2-3-4 Following the water quality test, a proposed water treatment system, if required shall also be included in the submission.
 - 2-3-5 The space required for the water treatment plant shall be provided in the project area.
 - 2-3-6 In case where data on the utilization of ground water system cannot be submitted in time together with the proposed water supply and sanitation system of the project, a written pledge by the developer to meet the requirement of the project shall be submitted.
 - 2-3-7 However, allocation for the water treatment facilities shall be duly provided within the project premises.
 - 2-3-8 A raw water storage tank shall be duly included as a component of the proposed water treatment system.

3. Quality of Water (M)

- 3-1 Drinking-water quality used shall meet the Guideline given in National Drinking Water Quality. However, reference to updated WHO recommendations for drinking water quality is recommended.
- 3-2 Water treatment unit / plant shall be provided where the source of drinking-water quality does not meet the recommended level mentioned in para 3-1.

4. Water Distribution

- 4-1 Distribution systems
 - 4-1-1 Either a down feed distribution system or up feed distribution system may be used. (Figure 1, Appendix) (R)
- 4-2 Reservoirs
 - 4-2-1 A clear water reservoir shall be provided either at the ground level or basement floor. It shall be duly protected from potential sources of pollution. (M)
 - 4-2-2 For down feed system, a roof tank should also be provided with adequate water storage capacity to meet the 50% of one-day supply. (M)
 - 4-2-3 For up feed system, since no roof tank is provided, the ground tank shall have a capacity of both the ground tank and the roof tank, i.e. the minimum capacity of the ground tank shall be of 1-1/2 storage (1-day for ground tank + 1/2 day for roof tank).
 - 4-2-4 Where water treatment plant is not required, the storage capacity of the ground tank should be of a two-day supply (R), with the minimum of one-day supply. (M)
 - 4-2-5 Where a water treatment plant is required, raw water tank having minimum capacity of 50% of the one-day demand with a clear water tank having a minimum capacity of one-day demand shall be provided. (M)
 - 4-2-6 The guideline given for the capacity of reservoirs in para 4-2-1, 4-2-2, 4-2-3 does not include the volume of water required for fire fighting.
 - 4-2-7 Service tanks may also be used at intermediate level in the building if deemed necessary by the designer. (R)
 - 4-2-8 Water supply at all fixture units in the building shall be within the flow pressure between (0.5 and 2.0) bar at the highest point of a floor. (M)
 - 4-2-9 Pressure higher than 2.0 bar shall be used where necessary and appropriate. (M)
- 4-3 Pumps (M)
 - 4-3-1 Water pumps installed shall meet the designer's requirement.
 - 4-3-2 At least one stand-by pump shall be provided for duty pump/pumps.
 - 4-3-3 Characteristic curves for pumps installed showing the relationships between head, discharge, horse power, and efficiency shall be provided by the designer in the design calculations.
- 4-4 Pipe (R)
 - 4-4-1 Risers and transmission pipes should be made of D.I, C.I. or G.I.
 - 4-4-2 Cold water distribution pipes may be C.I, D.I, G.I, uP.V.C or PP-R.
 - 4-4-3 Hot water pipes may be of copper, steel or P-PR with suitable insulation, where required.

- 4-5 Fittings (M)
 - 4-5-1 Pipes & Fittings must be made of the same material.
- 4-6 Valves (R)
 - 4-6-1 Valves may be made of C.I, G.M or Brass.
- 4-7 Bib cocks, taps, faucets (R)
 - 4-7-1 Bib cocks, taps, faucets may be made of brass, stainless steel, NP or CP.

5. Hot Water Supply (R)

- 5-1 Individual hot water supply system is recommended. However central hot water supply system can also be used.

6. Specifications

- 6-1 Reservoir (R)
 - 6-1-1 Reservoir constructed of R.C.C should follow the ACI CODE.
 - 6-1-2 Reservoir constructed of prestressed steel panel, GRP, FRP, stainless steel panel or masonry should follow any internationally recognized standard or approved make.
 - 6-1-3 Where space is available storage tanks built under the floor slab must have at least 2 feet space around the perimeter of the tank to enable regular inspection and maintenance. It must have at least 3 feet vertical clear space between the ceiling and the cover slab (top) of the tank to enable regular inspection and maintenance.(M)
- 6-2 Cold water pipes and fittings (R)

Specifications for the following pipes and fittings of different materials should conform to any internationally recognized standard or approved make.

 - 6-2-1 Water pumps
 - 6-2-2 Cast iron pipes and fittings
 - 6-2-3 Ductile iron pipes and fittings
 - 6-2-4 Galvanized iron pipes and fittings
 - 6-2-5 Polyvinyl chloride pipes and fittings or unplasticized polyvinyl chloride pipes and fittings
 - 6-2-6 PP-R pipes and fittings
- 6-3 Hot water pipes and fittings (R)

Specifications for the following should conform to any internationally recognized standard or approved make:

 - 6-3-1 Copper pipes and fittings
 - 6-3-2 Steel pipes and fittings
 - 6-3-3 PP-R pipes and fittings
- 6-4 Water tank shall be water-proof both on the inside and outside of the tank.

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE IV
SANITATION**

Sanitation

1. Spent Water (R)

- 1-1 Spent water contribution should be based on water demand as given in para. 1-1, Guideline III. It is recommended that at least 90% of the water consumed will be discharged as spent water.
- 1-1-1 Spent water consists of soil and waste water. Table 1, Appendix (R)
- 1-1-1-1 Soil water is the spent water from WCs and urinals.
- 1-1-1-2 Waste water is the spent water from basins, kitchen sinks, showers and bath tubs.

2. Soil Water Treatment and Disposal (M)

- 2-1 Soil water shall be treated before being discharged into a water course or public drain or municipal sewer.
- 2-1-1 The effluent quality of the treated soil water shall conform to the following:

Items of Analysis		Sewer	Watercourse	Controlled Water course
		Units in milligram per litre or otherwise stated		
1	BOD (5 days at 20 °C)	300	50	20
2	COD	450	100	60
3	Total Suspended Solids	300	50	30

Note: BOD value refers to 5-day incubation period at 20 °C.

- 2-1-2 Any sewage treatment system meeting the requirement shown in para 2-1-1 can be used.
- 2-1-3 Soil and waste water may be treated separately before final disposal.
- 2-2 Soil water discharged into YCDC sewer , if allowed shall conform to the normal range generally specified for domestic soil water.(para 2-1-1)
- 2-3 A permit shall be obtained from authority concerned for the discharge of treated soil water.
- 2-4 Effluent of treated soil water shall be disinfected with chlorine or by any other approved method where required.
- 2-5 Where effluent is chlorinated, residual chlorine shall be between 0.1 and 0.2 mg/l.

3. Waste Water Disposal

- 3-1 Waste water from residences may be discharged directly after undergoing appropriate treatment followed by disinfection into public drain. (R)
- 3-2 However, waste water from kitchen sinks shall first be discharged into a grease trap before its disposal into public drain(M). Undergoing the same treatment as mentioned in para 3-1.
- 3-3 Waste water is prohibited from being discharged into YCDC sewer. However, if allowed the effluent quality shall conform to the normal range generally specified for domestic waste water.(para 2-1-1)
- 3-4 A permit shall be obtained from authority concerned before waste water is disposed into public drain. (M)
- 3-5 Recycling of grey water may be used for purposes other than domestics such as drinking, cooking, washing, bathing etc.....

4. Combined Soil and Waste Water Treatment and Disposal (M)

- 4-1 Combined soil and waste water shall be treated before being discharged into a water course or public drain.
- 4-2 The effluent quality shall conform to that given in para 2-1-1 and disinfected as given in para (2-4, 2-5).
- 4-3 The effluent of the combined treated soil and waste water is prohibited from being discharged into town sewer.
- 4-4 A permit shall be obtained from authority concerned , YCDC, for the discharged of the treated combined soil and waste water.

5. Soil and Waste Water Collection (M)

- 5-1 Horizontal collecting pipes placed in ceiling shall be securely supported by hangers and given a slope with self-cleansing velocity of 3.0 ft/sec.
- 5-2 Sewer laid in ground shall be placed in proper bedding and given a slope with self-cleansing velocity of 3.0 ft/sec.
- 5-3 Sewer shall be laid in straight line.
- 5-4 However, manholes shall be placed where there is either a change of direction or gradient of sewer.
- 5-5 Provision of ducts with adequate space.

6. Sewage Pumps (M)

- 6-1 Pumps used for pumping soil and waste water shall meet the designer's requirement.
- 6-2 At least one stand-by pump shall be provided for duty pump/ pumps installed.
- 6-3 Characteristic curves for the sewage pumps installed showing the relationships between head, discharged, horse power and efficiency shall be provided by the designer in the desing calculation.

7. Soil, Waste and Vent Pipe System (M)

- 7-1 Fully ventilated system shall be used. See also guide line VII para 2-1.

8. Fittings (M)

- 8-1 Pipes and fittings used shall be of the same material.

9. Sanitary Appliances (M)

- 9-1 All sanitary appliances used shall be of approved make.

10. Specifications

- 10-1 Specifications for the following should conform to any internationally recognized standard or approved make: (R)
 - 10-1-1 Cast iron pipes and fittings for soil, waste and vent piping system.
 - 10-1-2 PVC or uPVC pipes and fittings for soil, waste and vent piping system.
 - 10-1-3 Any other materials other than those given in para 10-1-1 and 10-1-2.
 - 10-1-4 Soil/Waste Water tank shall be water-proof both on the inside and outside of the tank.

11. Installation (R)

- 11-1 Installation of soil, waste and vent pipes shall referred to SINGAPORE CODE OF PRACTICE ON SANITARY PLUMBING AND DRAINAGE SYSTEM (1976 or any up dated version) or any other recognized code of practices.

12. Rain Water Collection and Disposal

- 12-1 Neither soil nor waste water shall be discharged into rain water down pipes. (M)
- 12-2 Rain water shall therefore be collected and disposed of in a separate system. (M)
- 12-3 Rain water can be directly discharged into road side drain. (S)
- 12-4 Rain water gutter shall have the capacity of collecting rain water runoff from roof area. (M)
- 12-5 Rain water gutter outlets shall be designed to ensure free discharge into down pipes. (M)
- 12-6 Rain water gutter outlets pipe shall have the capacity of conveying rain water runoff from the gutter through the gutter outlet to the roadside drain. (M)
- 12-7 Materials for rain water down pipe should be of C.I, D.I, G.I, PVC or uPVC ,or of any approved material. Fabrication with M.S or G.I sheet should not be used. (R)
- 12-8 An external perimeter drain, shall consist of the volume of rainwater, effluent of soil and waste water from treatment system. The minimum velocity used shall be 0.7m/s .

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE V
GARBAGE COLLECTION AND DISPOSAL**

Garbage Collection and Disposal

1. Solid wastes generated from the residential premises is classified as follows:

- 1-1 Garbage consists of wastes from preparation, cooking and serving of food, market wastes, waste from handling, storage and sale of produce.
- 1-2 Rubbish consists of combustible materials such as paper, cartons, boxes, wood and tree branches and non-combustible materials such as metals, tins cans, dirt, glass & crockery.

2. Garbage Collection System

- 2-1 Any of the following system is recommended for collection of garbage: (R)
 - 2-1-1 Chute System
 - 2-1-2 Service Lift Handling System
- 2-2 Chute System
 - 2-2-1 Free-standing chute may be used. The chutes are required to have smooth, non-absorbent and non-combustible surfaces and should be provided with close-fitting access hopper. (R)
 - 2-2-2 Not more than six dwellings/ apartments should share one hopper, in which case occupants shall have no more than 100 feet to walk to the point of access to the chute. (R)
 - 2-2-3 A container of adequate volume, placed at ground level for receiving garbage from the chute, shall be housed in an enclosure. (M)
 - 2-2-4 A compactor may be used where required. (S)
 - 2-2-5 For reducing the risk of blockage in the chute the diameter of the chute should not be less than 2 feet. (R)
- 2-3 Service Lift Handling System (Service Lift System) (R)
 - 2-3-1 Service lift may be provided for handling garbage generated from the premises.

3. Bin Center (M)

- 3-1 Adequate number of bins for a minimum of two-day storage garbage volume shall be provided at bin center which shall be easily accessible to the YCDC solid waste collection vehicle.

4. Garbage Unit Volume (R)

- 4-1 Residential (1.0 lb/ cap / day) at (4.7 - 5.0) lb / cft density
- 4-2 Restaurant (2.0 lb per meal) at (6.2) lb / cft density
- 4-3 Garbage generated from dwellings shall be collected and tied up securely in garbage sacks only before being disposed of into any collection system.

5. Ventilation and Washing (M)

- 5-1 Ventilation and washing facility shall be provided for chute, trash room and bin.

6. Disposal of Garbage (M)

- 6-1 Regular garbage collection service from the bin center of the premises for disposal shall be provided by authority concerned.

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE VI
DESIGN CONCEPTS AND CALCULATIONS**

1. Water Supply

- 1-1 Water demand estimate should be based on the water requirement given in Table-1 Appedix. (R)
- 1-2 If ground water is used as a source of supply, at least two tube wells shall be drilled with each meeting the daily demand of the premises. (M)
- 1-3 The pumping hours for each tube well should not exceed 12 hours a day. (R)
- 1-4 The distance between a tube well and the building should not be less than 50 feet. (R)
- 1-5 A tube well and soil water treatment plant shall be at least 50 feet apart. (M)
- 1-6 The vertical distance between the tip of the deepest pile or the bottom of the shallow foundation and the top of the aquifer from which ground water will be tapped shall not be less than 150 feet. (M)
There should be at least an adequate thickness of impervious layer between the aquifer from which the ground water is tapped and the tip of the deepest pile.
- 1-7 After compliance with para 1-4, 1-5 & 1-6 a final permit for the drilling of tube wells shall be duly obtained from the authority concerned.
- 1-8 If there is no space in the premises for drilling tube wells to comply with para 1-4 and 1.5 another source of water supply should be explored. (R)
- 1-9 When raw water is to be used for fire fighting ,a separate tank or compartment shall be constructed to store water for fire fighting. (M)
- 1-10 Drinking water not meeting the recommended guideline given in guideline IV para 3-1. shall be treated by a system deemed appropriate by the designer (M)
- 1-11 Clear water reservoir for domestic use should be divided into appropriate number of compartments to facilitate maintenance. (R)
- 1-12 When roof top water storage tank/tanks are used for distributing water, the tank/tanks should have a minimum capacity of not less than 50% of the daily requirement of the premises. (M)
- 1-13 Where several tanks are used to store water on roof level the minimum capacity of each tank should preferably be 1600 gallons. (R)
- 1-14 In case where the designer wishes to install a storage tank in each apartment, the capacity shall not be greater than 400 gallons. The water stored in such tank shall be used only in case when the normal supply is interrupted. (M)
- 1-15 A minimum pressure of 0.5 bar and a maximum of 2.0 bar shall be available at every highest fixture outlet. Pressure higher than 2.0 bar shall be used where necessary and appropriate. (M)
- 1-16 A pressure reducing valve shall be installed if the pressure in the main riser/ dropper or cold water supply line is greater than 5 bars. (M)
- 1-17 The system of using a pump and storage tank for each dwelling for individual water supply is not allowed. (M)
- 1-18 The installation of water meter for each dwelling is recommended. (R)

- 1-19 All design calculations shall be provided with graphs, charts, tables and nomographs used in the design. Justification for assumptions shall be clearly stated. If computer software is used, both input and output data shall be submitted and limitations of the program are to be duly stated. (M)
- 1-20 The following should be included in the conceptual design of proposed project for submission to CQHP.
- (a) Provision of water supply source/sources from YCDC water supply system, ground water, surface water or a combination of any two or more.
 - (b) Calculation of water demand. Sizing of raw water tank, clear water tank and roof tank.
 - (c) Provision of adequate space for (on-site) domestic water treatment system and the pumping machinery.
 - (d) Calculation of the Sewage (soil and waste water) volume .
 - (e) Provision of adequate space for sewage (soil and waste water) treatment system and the pumping machinery.
 - (f) A separate treatment system for soil and waste water can be used.
- 1-21 With regard to installation of water pumps, tanks, cold and hot water pipes SINGAPORE STANDARD CP 48, 1989 (or any updated version) is recommended. (R)

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE VII
DESIGN CONCEPTS AND CALCULATIONS**

2. Sanitation

- 2-1 Either a one-pipe system, a two-pipe system, a single-stack system, fully ventilated system or ventilated two pipe system installing.
(Figure -2 , Appendix) can be used for soil and waste pipe. (R)
- 2-2 Treatment System
 - 2-2-1 The system used for the on-site treatment of either soil water or a combination of soil and wast water to meet the recommended effluent quality as given in Guide line IV, para 2-1-1 shall be selected with due consideration to the environment of the premises. (R)
 - 2-2-2 Where space is available WWTP built under the floor slab must have at least 2 feet space around the perimeter of the tank to enable regular inspection and maintenance. It must have at least 3 feet vertical clear space between the ceiling and cover slab (top) of the tank to enable regular inspection and maintainance .Waste water treatment plant constructed in basement floor must be well ventilated.(M)
- 2-3 Rain Water Runoff (R)
 - 2-3-1 For the calculation of rain water runoff a average rainfall intensity of 3.0 inches per hour is suggested (Yangon Division).For other divisions authority concerned should be consulted.
 - 2-3-2 A conical outlet for gutter is preferable for drawing the runoff from the gutter. A box outlet may also be used. However, either should be of appropriate dimension.
 - 2-3-3 Flow in the vertical rain water pipe should not be more than 1/3 full.
- 2-4 Design Calculations (M)
 - 2-4-1 All design calculations must be provided with graphs, charts, tables and nomographs used in the design. Justification of assumptions shall be clearly stated. If computer software is used both input and output data should be submitted and limitations of the program are to be duly stated.
- 2-5 Installation (R)
 - 2-5-1 With regard to installation of pipes and pumps, SINGAPORE CODE OF PRACTICE ON SANTARY PLUMBING AND DRAINAGE SYSTEM, (1976 or any updated version) is recommended.

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE VIII
WATER, SANITATION AND PLUMBING-RELATED DRAWINGS**

1. Report (M)

- 1-1 A report must be prepared and submitted along with drawings. Designer must explain how the water supply system, sewerage system, fire fighting system, garbage collection and disposal system and storm water collection and disposal systems are planned.
- 1-2 Designer's assumptions, parameters and formulae must be used with justification.
- 1-3 Specification for materials and equipments must also be included.
- 1-4 Minimum size of drawing sheet is A3.
- 1-5 Symbols and abbreviations must be clearly indicated as shown in Table 2, Appendix Internationally recognized symbols and abbreviations can also be used.
- 1-6 Site plan must include all existing sewers, manholes, existing road side drains, natural drains and water lines within the municipal jurisdiction (eg. YCDC, MCDC)
- 1-7 Layout plan must include tentative locations of tube wells and water storage tanks for domestic tank & bin center. Only the approved water treatment plant, waste water treatment plant, pipe lines and drains shall be shown in the drawing.
- 1-8 Detailed drawings with suitable scale must be included where necessary. Isometric drawings shall be used.
- 1-9 Used table -3 for colouring of different piping systems.
- 1-10 Enlarged drawing of WC, wet area must be included. Plan of SWV, CW and HW must be shown in detail.
- 1-11 Symbols, Abbreviations and colour code for piping works can be used as per Table-2.

**COMMITTEE FOR QUALITY CONTROL OF HIGH-RISE BUILDING
CONSTRUCTION PROJECTS
GUIDELINE IX
OPERATION AND MAINTENANCE**

1. Operation

- 1-1 The contractor shall provide technical training in system operation and maintenance to the owner's staff members during the commissioning phase and prior to hand-over of the facilities. (M)

2. Maintenance (M)

- 2-1 The contractor provide maintenance manual to the owner's staff members during the commissioning phase.

3. General (R)

- 3-1 Operation instruction and maintenance manual should be provide in written text.
- 3-2 Operation instruction and maintenance manual should be prepared by experienced and competent representative of the contractor.
- 3.3 Completed pipe works should be painted as given in Table 3, Appendix, to facilitate maintenance.

APPENDIX

TABLE (1) - POPULATION EQUIVALENT

No.	Type of Premises/Establishment	Population Equivalent (recommended) PE
1.	Residential	5-6 per apartment
2.	Commercial: (includes entertainment/recreational centres, restaurants,cafeteria, theatres)	3-5 per 1000 square feet gross area
3.	Shopping Centre.	3-5 per 1000 square feet gross area
4.	Schools/Education Institutions: -Day schools/institutions -Fully residential -Partial residential	0.3 per student 1 per student 0.5 per student
5.	Hospitals	4 per bed
6.	Clinic	0.5 per patient
7.	Hotels (wit dining and laundry facilities) Hotels (without dinning & laundry)	4 per room 2.0 per room
8.	Market (wet type)	5-7 per 1000 square feet gross area
9.	Market (dry type)	3-5 per 1000 square feet gross area
10.	Beauty Saloon	0.5 per clinet

Note:

- 1 PE is equivalent to 40 gallons per capita per day (gpcd) or (180 lit/cap/day)
- 30% of water supply is generally taken as soil water.

APPENDIX

SYMBOLS	ABBREVIATION	DESCRIPTION	SYMBOLS	ABBREVIATION	DESCRIPTION
	CW	COLD WATER PIPE.		FCD	FLOOR CLEAN OUT
	V	AIR VENT PIPE		FD	FLOOR DRAIN
	S	SOIL PIPE		RD	ROOF DRAIN OR GARGOYLE DRAIN
	W	WASTE PIPE		VTR	VENT THROUGH ROOF
	IW	INFECTED WASTEWATER		MH	MANHOLE
	LW	LAUNDRY WASTEWATER		SMH	SANITARY MANHOLE
	F	FIRE PROTECTION PIPE		KWMH	KITCHEN WASTE MANHOLE
	HWS	HOT WATER SUPPLY PIPE		FDC	FIRE DEPARTMENT CONNECTION
	HWR	HOT WATER RETURN PIPE		P	PUMP
	SS	STEAM SUPPLY PIPE		H	HALON FIRE EXTINGUISHER
	SR	STEAM CONDENSE RETURN PIPE		BC	BALL COCK
	G	LPG GAS PIPE		HB	HOSE BIBB
	-	RISER UP		-	PLUG OR BLIND FLANGE
	-	RISER DOWN		SA	SHOCK ABSORBER
	-	RISER UP OR DOWN		LS	LEVEL SWITCH
	-	BRANCH-TOP CONNECTION		PG	PRESSURE GAUGE
	-	BRANCH-BOTTOM CONNECTION		FHC	FIRE HOUSE CABINET
	RPC	RUBBER PIPE CONNECTOR		SH	SHOWER
	FC	FLEXIBLE CONNECTOR		WC	WATER CLOSET
	-	EXPANSION JOINT		UR	URINAL
	STR	STRAINER		BD	BIDET
	GV	GATE VALVE		LAV	LAVATORY
	O S & Y GV	O S & Y GATE VALVE		SH	SHOWER HEAD
	BV	BUTTERFLY VALVE		BT	BATH TUB
	IND.BV	INDICATING BUTTERFLY VALVE		AC	AIR COMPRESSOR
	BAV	BALL VALVE		CWDF	COLD WATER DOWN FEED
	PRV	PRESSURE REDUCING VALVE		CWUF	COLD WATER UP FEED
	RV	PRESSURE RELIEF VALVE		GSP	GALVANIZED STEEL PIPE
	-	FLOAT MODULATING VALVE		PVC	POLYVINYL CHLORIDE
	PCV	PUMP CONTROL VALVE		PB	POLYBUTYLENE PIPE
	SCV	SPRING LOADED CHECK VALVE		PE	POLYETHYLENE PIPE
	CV	SWING CHECK VALVE		CI	CAST IRON PIPE
	ACV	ALARM CHECK VALVE		CWP	COLD WATER PUMP
	-	GLOBE VALVE		WWTP	WASTEWATER TREATMENT PLANT
	-	MOTOR OPERATED VALVE		DFP	DIESEL FIRE PUMP
	-	SOLENOID VALVE		JP	JOCKEY PUMP
	AAV	AUTOMATIC AIR VENT		RL	RAIN LEADER
	-	FOOT VALVE		A/C	ABOVE CEILING
	-	PENDENT SPRINKLER HEAD		B/F	BELOW FLOOR
	-	UPRIGHT SPRINKLER HEAD		F/A	FROM ABOVE
	WMT	WATER METER		F/B	FROM BELOW
	-	UNION		T/A	TO ABOVE
	CO	CLEAN OUT PLUG		T/B	TO BELOW
	-	LANDING VALVE		W/	WITH

TABLE -2 SYMBOLS & ABBREVIATIONS

APPENDIX

TABLE (3) - COLOUR SCHEME FOR PAINTING PIPE WORKS

Type of Pipes	Colour Names (to BS 4800)
1. Soil pipe	Blank
2. Waste pipe	Grey
3. Vent pipe	Yellow
4. Cold water pipe	Light Blue
5. Hot water pipe	Orange
6. Fire fighting pipe	Red
7. Rain water pipe	Dark Blue

* Rain water pipe should be painted only if it is located in the duct.

* Preferably pipes should be painted through out the entire length.

APPENDIX

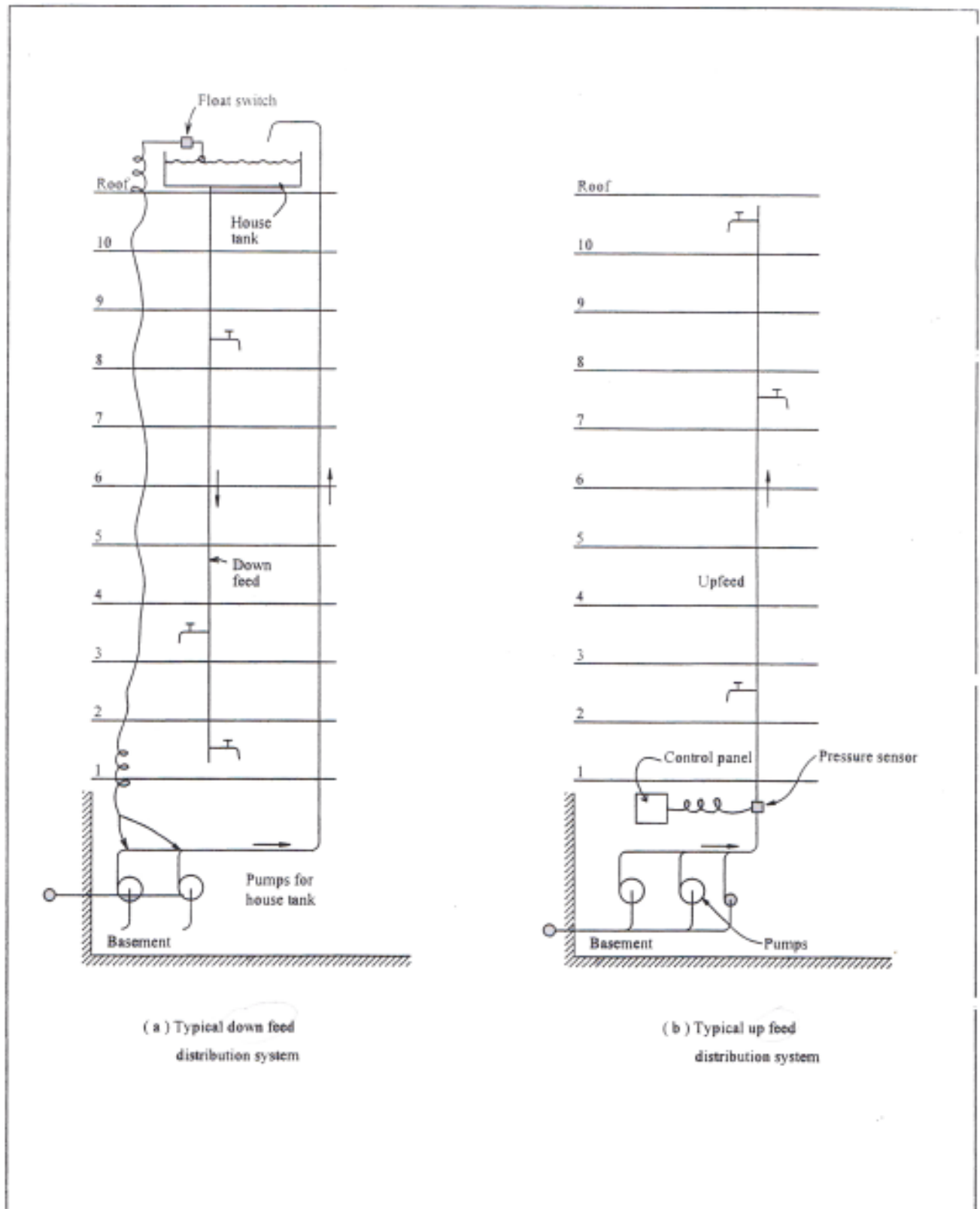


FIGURE.1 TYPICAL COLDWATRE DISTRIBUTION SYSTEM

APPENDIX

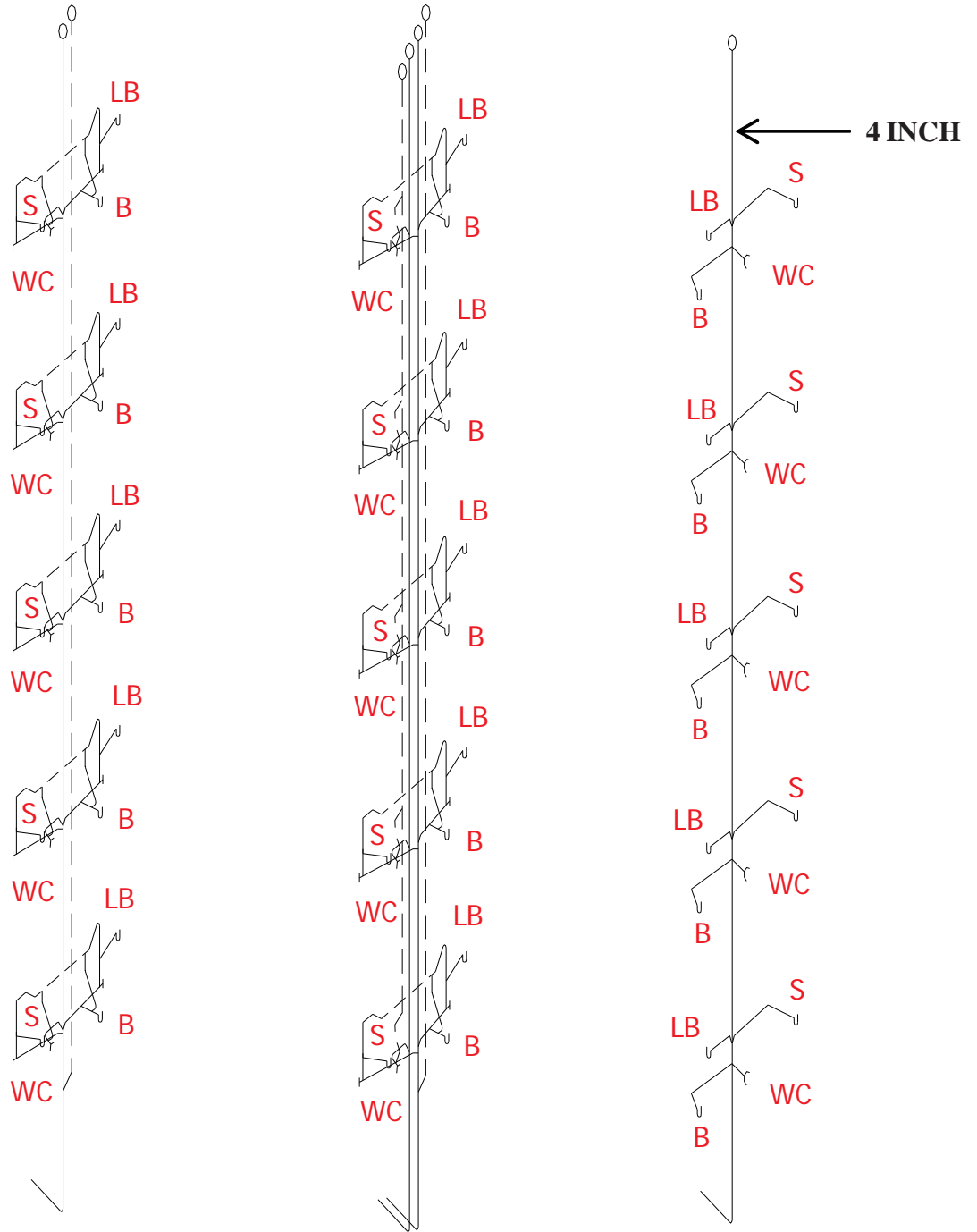


Figure 1 A. Typical one pipe system

Figure 1 B. Typical two pipe system

Figure 1 C. Typical single stack system

FIGURE.2 TYPICAL SOIL, WASTE & VENT PIPING SYSTEM