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

23rd February, 2017
<table>
<thead>
<tr>
<th>Sr.</th>
<th>Subject</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Professional Engineer (PE) (Water Supply and Sanitation)</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Guideline I Site Inspection</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Guideline II Geotechnical Investigations Related to Sanitary Works</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Guideline III Cold and Hot Water Supply</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Guideline IV Sanitation</td>
<td>7</td>
</tr>
<tr>
<td>6.</td>
<td>Guideline V Garbage Collection and Disposal</td>
<td>9</td>
</tr>
<tr>
<td>7.</td>
<td>Guideline VI Design Concepts and Calculations (Water supply)</td>
<td>11</td>
</tr>
<tr>
<td>8.</td>
<td>Guideline VII Design Concepts and Calculations (Sanitation)</td>
<td>13</td>
</tr>
<tr>
<td>9.</td>
<td>Guideline VIII Water, Sanitation and Plumbing-Related Drawings</td>
<td>14</td>
</tr>
<tr>
<td>10.</td>
<td>Guideline IX Operation and Maintenance</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td><strong>Appendixes</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Table 1 Population Equivalent</td>
<td>16</td>
</tr>
<tr>
<td>5.</td>
<td>Table 2 Symbols and Abbreviations</td>
<td>17</td>
</tr>
<tr>
<td>6.</td>
<td>Table 3 Colour scheme for painting pipe works</td>
<td>18</td>
</tr>
<tr>
<td>7.</td>
<td>Figure 1 Typical Cold Water Distribution System</td>
<td>19</td>
</tr>
<tr>
<td>8.</td>
<td>Figure 2 Typical Soil, Waste &amp; Vent Piping System</td>
<td>20</td>
</tr>
</tbody>
</table>
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
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 AASHO 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.
Sanitation

1. Spent Water (R)

1-1 Spent water contribution should be based on water demand as given in para.
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:

<table>
<thead>
<tr>
<th>Items of Analysis</th>
<th>Sewer</th>
<th>Watercourse</th>
<th>Controlled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Units in milligram per litre or</td>
<td>otherwise stated</td>
<td></td>
</tr>
<tr>
<td>1 BOD (5 days at 20℃)</td>
<td>300</td>
<td>50</td>
<td>20</td>
</tr>
<tr>
<td>2 COD</td>
<td>450</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>3 Total Suspended Solids</td>
<td>300</td>
<td>50</td>
<td>30</td>
</tr>
</tbody>
</table>

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

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 design 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, GI, PVC or uPVC, or of any approved material. Fabrication with M.S or GI 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.
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.
1. Water Supply

1-1 Water demand estimate should be based on the water requirement given in Table-1 Appendix. (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)
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 maintenance. 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 (e.g. 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

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

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

#### TABLE 2 SYMBOLS & ABBREVIATIONS

<table>
<thead>
<tr>
<th>SYMBOLS</th>
<th>ABBREVIATION</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>CW</td>
<td>COLD WATER PIPE</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>AIR VENT PIPE</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>SOIL PIPE</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>WASTE PIPE</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>INFECTED WASTEWATER</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>LAUNDRY WASTEWATER</td>
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<td>F</td>
<td>FIRE PROTECTION PIPE</td>
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<td>HWS</td>
<td>HOT WATER SUPPLY PIPE</td>
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<td>HWR</td>
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<td>SS</td>
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</tr>
<tr>
<td>SR</td>
<td>STEAM CONDENSE RETURN PIPE</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>LPG, GAS PIPE</td>
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</tr>
<tr>
<td>R</td>
<td>RISER UP</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>RISER DOWN</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>RISER UP OR DOWN</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>BRANCH-TOP CONNECTION</td>
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</tr>
<tr>
<td>B</td>
<td>BRANCH-BOTTOM CONNECTION</td>
<td></td>
</tr>
<tr>
<td>RPC</td>
<td>RUBBER PIPE CONNECTOR</td>
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</tr>
<tr>
<td>FC</td>
<td>FLEXIBLE CONNECTOR</td>
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</tr>
<tr>
<td>E</td>
<td>EXPANSION JOINT</td>
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</tr>
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<td>STRAINER</td>
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<td>H</td>
<td>GATE VALVE</td>
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<tr>
<td>O/S &amp; Y</td>
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<tr>
<td>BV</td>
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<td>IND.BV</td>
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<tr>
<td>BAV</td>
<td>BALL VALVE</td>
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</tr>
<tr>
<td>P</td>
<td>PRESSURE REDUCING VALVE</td>
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</tr>
<tr>
<td>RV</td>
<td>PRESSURE RELIEF VALVE</td>
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</tr>
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<td>FCD</td>
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</tr>
<tr>
<td>FD</td>
<td>FLOOR DRAIN</td>
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</tr>
<tr>
<td>MG</td>
<td>ROOF DRAIN OR CANGY DRAIN</td>
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</tr>
<tr>
<td>VTR</td>
<td>VENT THROUGH ROOF</td>
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<tr>
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<tr>
<td>KRMH</td>
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<tr>
<td>FDC</td>
<td>FIRE DEPARTMENT CONNECTION</td>
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</tr>
<tr>
<td>P</td>
<td>PUMP</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>HALON FIRE EXTINGUISH</td>
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<tr>
<td>RC</td>
<td>BALL COCK</td>
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<tr>
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<td>SHOWER</td>
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<td>WATER CLOSET</td>
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<tr>
<td>LH</td>
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<td>LAVATORY</td>
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<td>BATH TUB</td>
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</tr>
<tr>
<td>AC</td>
<td>AIR COMPRESSOR</td>
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<td>POLYVINYL CHLORIDE</td>
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<td>PB</td>
<td>POLYBUTYLENE PIPE</td>
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<tr>
<td>FE</td>
<td>POLYETHYLENE PIPE</td>
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</tr>
<tr>
<td>CI</td>
<td>CAST IRON PIPE</td>
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<td>COLD WATER PUMP</td>
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<td>DFP</td>
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<tr>
<td>JP</td>
<td>JOCKEY PUMP</td>
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<tr>
<td>RL</td>
<td>RAIN LEADER</td>
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<tr>
<td>A/C</td>
<td>ABOVE CEILING</td>
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<tr>
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<tr>
<td>F/A</td>
<td>FROM ABOVE</td>
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<tr>
<td>F/B</td>
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<td>T/A</td>
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<tr>
<td>T/B</td>
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<td></td>
</tr>
<tr>
<td>W/</td>
<td>WITH</td>
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</table>
### APPENDIX

**TABLE (3) - COLOUR SCHEME FOR PAINTING PIPE WORKS**

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

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

* Preferably pipes should be painted through out the entirely length.
APPENDIX

FIGURE 1 TYPICAL COLD WATER DISTRIBUTION SYSTEM
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