Section 6

Requirements for Ancillary Facilities
6.1 Introduction

This section defines the minimum requirements of ancillary facilities to be provided at the sewage treatment plants. These requirements are crucial in ensuring the workability and operability of the plants.

6.2 Water Supply and Wash Water

Water shall be supplied to each site from standpipes and taps, to provide for sanitary cleansing of plant areas, personal hygiene, safety, fire fighting, process use and for equipment cooling and/or sealing. Water shall be connected to potable supply that provides a minimum pressure of 20 m head across the site. A ring main system shall be provided for all treatment plants larger than 5000 PE.

Each sewage treatment plant or sludge treatment facility shall be provided with water tank of at least 445 litre storage capacities or one day water usage or whichever is higher.

Double backflow prevention shall be provided in all cases. This is to prevent contamination of any potable water service, including the incoming supply line.

The water supply system shall be sized to meet the following cases:

i) Fire fighting demand as instructed by the local regulations and any essential plant water demands.

ii) All potentially simultaneous process uses, equipment uses and a for plant cleansing.

All water supplies and its installation (piping, tanks, air conditioning drainpipes, gutters and etc.) must be totally isolated from all potential contact of electrical system by means of total enclosure or suitably located the electrical system above flood level.

Where required, wash water shall be equipped with booster pump and where possible, obtain from reclaimed water.

Drawings submitted for approval shall indicate locations of water tapping point and piping layout. Approval for water tapping should be obtained from water authority for permanent water supply before submitting inspection form. All related document, such as water bills and transfer of ownership, to be submitted before final inspection.

Table 6.1 tabulates the minimum number and location of stand pipe required in a sewage treatment plant. Typical drawing of stand pipe are shown in Figure 6.1
Table 6.1 Minimum Number of Recommended Water Stand Pipe and Location

<table>
<thead>
<tr>
<th>Class of STP</th>
<th>Population Equivalent</th>
<th>Minimum Numbers</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≤1000</td>
<td>1</td>
<td>Inlet Works</td>
</tr>
<tr>
<td>2</td>
<td>1001 – 5000</td>
<td>2</td>
<td>Inlet Works and Treatment Process Unit</td>
</tr>
<tr>
<td>3</td>
<td>5001 – 20 000</td>
<td>2</td>
<td>Inlet Works and Treatment Process Unit</td>
</tr>
<tr>
<td>4</td>
<td>&gt;20 000</td>
<td>4</td>
<td>Inlet Works, Secondary Screen Area, Treatment Process Units and Dewatering Facilities.</td>
</tr>
</tbody>
</table>

Figure 6.1 Standard Details for Stand Pipe

6.3 Mess Facilities and Ablutions

All treatment plants shall have a minimum of one sanitary set consisting of a toilet and wash basin. Washing facilities, toilets and showers shall be provided for operators at all Class 3 and Class 4 plants with PE
greater than 5000. Additionally, mess accommodation shall be provided at Class 4 treatment plants with PE greater than 20,000.

Guard house with water and power supply shall also be provided for plant more than 20,000 PE.

**Figure 6.2 Typical for Administration and Mess Facilities Building**
Minimum internal floor area of mess facilities are 400 meter$^2$. Approval from the Commission shall be sought if smaller floor area is to be provided. Typical arrangement of mess facilities is shown in Figure 6.2

### 6.4 Roads and Access

All-weather, surfaced roads shall be provided to permit access to all treatment plants. The roads must withstand a load of at least 15 tonnes. Such roads must also be constructed within the plant providing access to each process unit. The construction shall comply with Public Work Department requirement. Figure 6.3 and Figure 6.4 illustrate the typical section of road pavement and site road.

![Figure 6.3 Typical Details of Road Pavement](image1)

![40 THK. WEARING COURSE](image2)

![60 THK. PREMIX BINDER COURSE](image3)

![10 THK. SAND/QUARRY DUST](image4)

![300 THK. CRUSHER RUN](image5)

![50 THK SAND](image6)

![40 THK. WEARING COURSE](image7)

![60 THK. PREMIX BINDER COURSE](image8)

![250 THK. ROADBASE](image9)

![150 THK. SUB-BASE](image10)

![4000 GEOTEXTILE MEMBRANE APPROVED BY ENGINEERS](image11)

![ROAD KERB](image12)

![ROAD KERB](image13)

![FALL](image14)

![FALL](image15)

![ROAD KERB](image16)

![ROAD KERB](image17)
The on-site road shall be able to provide safe and convenient access for trucks or other machinery equipment used for maintenance purposes. The minimum width of the road shall be 4 meter. Where vehicles need to pass frequently or parking is required along the road, the minimum width shall be 6 m.

Corner of junction for perimeter internal road for tankers or trucks access shall have a minimum inside radius of 6 meter. Inside radius for perimeter road not intended for tankers or trucks access shall be not less than 4 m.

Cul-de-sac at the end of roads shall be provided with turning area reserve of not less than 9 m.

Where roads for maintenance vehicles or machineries are not required, concrete or hard surfaced walkways of at least 900 mm width shall be provided between each process unit. Concrete hardstanding area can be laid where storage bins are located. The use of steps shall be avoided, where possible.

Where the ingress or egress of the treatment plant is near a junction of a public road, an adequate acceleration and deceleration lane must be made available between the access road and the junction for vehicles to safely enter and leave the treatment plant.

Vehicular access shall be provided to all unit processes that require daily operation and maintenance.

### 6.5 Drainage

The area of the treatment plant shall be adequately drained and this shall be arranged to prevent surface water run-off from entering the process units.

Any cleaning or maintenance process wash water must be returned to the inlet works via a separate drainage system.

External drainage facilities must be provided for treatment plant along the slope area. Cut off drainage at the entrance must also be provided.

Treatment plant platform level shall be designed above flood level. If the treatment plant is located in a flood prone area, flap gate shall be provided to avoid back flow from the river/ main drain. The plant hydraulic must be designed properly to ensure the discharge head is adequate to open the flap valve at any circumstances.
The effluent discharge shall be directed to the main drain or river to avoid discharging effluent into a drain within the residential area. Discharge to a retention pond is not allowed unless prior approval has been granted.

The receiving drain/watercourse shall have sufficient capacity to accept the run-off from the plant as well as the effluent discharge from the treatment plant.

6.6 Fencing and Security

The boundary of a treatment plant, pumping station and/or sludge treatment facility shall be secured by 3.0 meter high fence. The perimeter fence shall have an entrance by double gates or sliding barrier to allow access of maintenance vehicles. The gates shall be secured by padlocks and shall comply with the requirements of the Commission. Where the treatment plant is situated in a building, access to the plant must be secured.

The fence shall be 2.4 meter solid wall with three strands of 0.6 meter high barbed wire. Typical details of the fence are given in Figure 6.5, 6.6, 6.7 and 6.8.

STP project proponent is required to provide adequate warning/safety and the Commission signboard before handing over the sewerage system to the Commission.
Figure 6.5 Typical Drawing of Brickwall Fencing and Gate
Figure 6.6  Brickwall Fencing

HEAVY SPLIT PINS
WIRE ATTACHED TO POST BY
3 STRANDS P.V.C. COATED BARBED
63 x 63 x 6mm M.S. ANGLE
45° WITH 3 STRANDS OF BARBED WIRE
AT 3.2m INTERVALS
230 x 230mm RC COLUMN
115mm THK BRICKWALL
PLASTERED ON BOTH SIDE
750 x 750 x 230mm FRONT VIEW OF BRICKWALL FENCING

NOTES:
1. ALL CONCRETE USED SHALL BE GRADE C25.
2. MINIMUM COVER TO REINFORCEMENT SHALL BE 25mm.
3. ALL BRICKS USED SHALL BE FIRST QUALITY CEMENT / SAND BRICKS.
4. BRICKWORK SHALL BE REINFORCED WITH EXPANDED METAL OR "EXMET" AT EVERY FOURTH COURSE COMMENCING TWO COURSES ABOVE GROUND BEAM LEVEL.
5. BRICKWORK WALLS SHALL BE ANCHORED TO CONCRETE FACES USING GALVANISED FISHTAIL ANCHORS TO LAP IN WITH THE BRICK REINFORCEMENT AT EVERY FOURTH COURSE AS PER SPECIFICATION.
6. MORTAR FOR BRICKWORK SHALL BE SET IN 1:1:5 CEMENT-LIME-SAND MORTAR.
7. PLASTERING AND RENDERING TO SURFACE OF BRICKWALL SHALL BE FINISHED TO A MINIMUM THICKNESS OF 20mm WITH 1:3 CEMENT-SAND MORTAR.
8. UPON COMPLETION OF WORK, THE WORKMANSHIPS TO BE COVERED WITH A LAYER OF ANTI-CRACKING FIBER TO PREVENT CRACKS FROM FORMING.
9. LINKS R6-150 4T12 B/W
10. SURFACE TO BE ROUGHENED
11. ALL EXPOSED WALL SHALL BE PAINTED WITH ONE UNDERCOAT OF APPROVED RESISTING PRIMER SEALER AND TWO COATS OF APPROVED WEATHER RESISTANT EMULSION PAINT.
12. TWO BANDS OF PAINT COLOUR WITH OVERALL HEIGHTS OF 400mm SHALL BE PAINTED ON EXTERIOR FACE OF THE WALL.
13. INTERIOR/EXTERIOR WALL COLOUR STANDARDS - DULUX TUNGSTEN (10412) OR EQUIVALENT.

FINISHED GRD. LEVEL
MIN. 900

SECTION A-A

SECTION B-B

SECTION C-C

TYPICAL RC COLUMN DETAIL

RC FOOTING
MIN. 900

TYPICAL CROSS SECTION OF BRICKWALL FENCING
**Figure 6.7 Precast Fencing**

1. All concrete used shall be Grade C25.
2. Minimum cover to reinforcement shall be 25mm.
3. Foundation as per the design of the Engineer-In-Charge.

**NOTES:**
- All exposed wall shall be painted with one undercoat of approved resisting primer sealer and two coats of approved weather resistant emulsion paint.
- Two bands of IWK's colour with overall heights of 400mm shall be painted on exterior face of the wall.
- Colour standards:
  - Interior/Exterior Wall: Blue (PANTONE 300C) or Equivalent
  - Green (PANTONE 354C) or Equivalent
  - Dulux Tungsten (10412) or Equivalent
  - Dulux Gloss Finish
  - Patience Factor Equivalent

**FINISHED GRD. LEVEL**

**FINISHED GRD. LEVEL**

**PAINTING**

**SECTION A-A**

**PRE-CAST CONCRETE WALL 75mm THICK**

**RC COLUMN**

**TYPICAL RC COLUMN DETAIL**

**TYPICAL CROSS SECTION OF PRE-CAST FENCING**

**FRONT VIEW OF PRE-CAST FENCING**

**A.) INTERIOR/EXTERIOR WALL**

**B.) BANDS - BLUE (PANTONE 300C) OR EQUIVALENT**

**- GREEN (PANTONE 354C) OR EQUIVALENT**

**- DULUX TUNGSTEN (10412) OR EQUIVALENT**

**- DULUX GLOSS FINISH**

**- PATIENT FACTOR EQUIVALENT**
Figure 6.8 Masonry Fencing

NOTE: 
1. FOUNDATION AS PER THE DESIGN OF THE ENGINEER-IN-CHARGE
2. CONCRETE BLOCKS USED MUST BE UNDER 390mmx190mmx190mm FULL BLOCK
3. CONCRETE MIX USED FOR GROUTING TO BE GRADE 20
4. CEMENT MORTAR USED FOR JOINTS TO BE 1:3 MIX

SECTION A-A

390mmx190mmx190mm BOND BEAM BLOCK

390mmx190mmx114mm FULL BLOCK

390mmx190mmx190mm BOND BEAM BLOCK

1 NO. HORIZONTAL REINFORCEMENT

HEAVY SPLIT PINS

ATTACHED TO POST BY

WIRE

ATTACHED TO POST BY

3 STRANDS P.V.C. COATED BARBED WIRE

PAINTING

1.) ALL EXPOSED WALL SHALL BE PAINTED WITH ONE UNDERCOAT OF APPROVED RESISTING PRIMER SEALER AND TWO COATS OF APPROVED WEATHER RESISTANT EMULSION PAINT.

2.) TWO BANDS OF IWK’S COLOUR WITH OVERALL HEIGHTS OF 400mm SHALL BE PAINTED ON EXTERIOR FACE OF THE WALL.

3.) COLOUR STANDARDS

A.) INTERIOR/EXTERIOR WALL

B.) BANDS - BLUE (PANTONE 300C) OR EQUIVALENT

GREEN (PANTONE 354C) OR EQUIVALENT

SIRIM CERTIFICATION SCHEME

63 x 63 x 6mm M.S. ANGLE

WITH 3 STRANDS OF BARBED WIRE

- DULUX TUNGSTEN (10412)

- DULUX GLOSS FINISH OR EQUIVALENT

- DULUX GLOSS FINISH OR EQUIVALENT
6.7 **Beautification Zone and Landscape**

Treatment plants shall be effectively and visually screened by a beautification zone within the treatment plant site of not less than 2 m wide, on which selected species of trees and shrubs can be planted. In congested or difficult locations, the Commission should be consulted on these requirements.

Premix or Paved area shall be provided at this zone for all class 1 treatment plants with loading equal or less than 1000 PE or where necessary.

6.8 **Stores and Workshops**

All Class 4 Treatment plants that exceed 20 000 PE and have a pump station within the premises shall be provided with an active store and workshop.

6.9 **Spares**

All mechanical units shall be provided with an adequate reserve supply of critical spare parts. A list of proposed spare parts should be forwarded for approval when detailed designs are submitted for verification and approval.

All parts recommended by the manufacturer to be provided with spares shall be so delivered at the stage of final inspection. Notwithstanding that, all parts with a life span of 3 years or less shall be provided with spares.

Typical spare parts requirements are provided in Table 6.2. Spare parts shall be obtained from the original manufacturer of the equipment and shall be packed and protected for storage to BS1133 requirement.

A set of special tools if required and specific to an equipment including lifting tackle and greasing equipment necessary for the maintenance, repair, testing and overhauled of the equipment shall be supplied together with the spares at the stage of final inspection.
### Table 6.2  Spare Part

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment</th>
<th>Spare Parts</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pumps:</td>
<td>Bearing</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>Raw Sewage Submersible Pumps.</td>
<td>o-ring</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>Grit Pumps.</td>
<td>oil seal</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>Feeding Pumps.</td>
<td>mechanical seal</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>RAS Pumps.</td>
<td>wear ring</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>Sludge Pumps.</td>
<td>Impeller (for 3 or more pump of similar model)</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>Effluent Pumps.</td>
<td>(see Pumps, Motors, Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>No. 1:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Motors (Electric):</td>
<td>Bearing</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o-ring</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oil seal</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mechanical seal</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drives</td>
<td>gear bearing</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>a)Direct Couple</td>
<td>chain</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>b)Chain</td>
<td>sprocket</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td>c)Belt</td>
<td>V-belt</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mechanically Raked Screens</td>
<td>Chain</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chain link</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gear sprocket (also see Motors, Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
<tr>
<td></td>
<td><strong>Total:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Diaphragm Pump</td>
<td>diaphragm</td>
<td>one set</td>
</tr>
<tr>
<td>6.</td>
<td>Progressive Cavity (Mono) Pump</td>
<td>rubber stator</td>
<td>one set</td>
</tr>
<tr>
<td>7.</td>
<td>Blowers</td>
<td>(see Motors, Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
<tr>
<td>8.</td>
<td>Aerator:</td>
<td>Diffusers</td>
<td>10% of total numbers</td>
</tr>
<tr>
<td></td>
<td>Diffused Air Mechanical (surface,</td>
<td></td>
<td>one set, whichever parts is relevant</td>
</tr>
<tr>
<td></td>
<td>brush)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Scraper</td>
<td>rotating collectors wheel (see Motors, Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
<tr>
<td>10.</td>
<td>Conveyor</td>
<td>(see Motors, Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
</tbody>
</table>
### Table 6.2 Spare Part (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment</th>
<th>Spare Parts</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.</td>
<td>Filter Press</td>
<td>oil seal for hydraulic pump</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td>membrane cloth</td>
<td>one pair out of every five pair of plates</td>
</tr>
<tr>
<td>12.</td>
<td>Belt Press</td>
<td>oil seal for hydraulic pump Belt</td>
<td>one set</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>one set if the STP has only one press</td>
</tr>
<tr>
<td>13.</td>
<td>Centrifuges (see Drives)</td>
<td>(see Drives)</td>
<td>one set, whichever parts is relevant</td>
</tr>
</tbody>
</table>

### 6.10 Yard Lighting

Effective yard and building lighting systems shall be incorporated within the treatment plant site in order to provide sufficient illumination for operation and maintenance schedules to be carried out during day and night periods. In addition, the entire treatment plant site shall have sufficient street lights and perimeter lights for various operations, safety and security reasons.

Compound lighting shall be provided at every 50 m interval for all manned and security plants. However, sufficient lighting is required at the strategic location such as entrance gate, inlet works and necessary areas. Refer to Table 6.3.

All lighting shall be accessible for maintenance / removal. Typical details of compound lighting are shown in Figure 6.9.

### Table 6.3 Numbers of Unit and Location of Compound Lighting

<table>
<thead>
<tr>
<th>Class of STP</th>
<th>Population Equivalent</th>
<th>Minimum Numbers of Unit</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>≤1 000</td>
<td>1</td>
<td>Inlet Works or Entrance</td>
</tr>
<tr>
<td>2</td>
<td>1001 – 5000</td>
<td>2</td>
<td>Inlet Works and Treatment Process Unit</td>
</tr>
<tr>
<td>3</td>
<td>5 001 – 20 000</td>
<td>4</td>
<td>Every Internal Corner of STP boundary and nearby to Inlet Works, Treatment Process Unit and Sludge Treatment</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 20 000</td>
<td>50 meter</td>
<td>Entrance, Inlet Works, Mess Building, Process Treatment Unit, Secondary Treatment Unit and Sludge Treatment</td>
</tr>
</tbody>
</table>
6.11 Sampling Facilities

Suitable sampling facilities shall be provided (preferably in the form of an open chamber) within the boundary of the STP to allow representative samples to be taken safely by one person. For treatment plants up to 20,000 PE, sufficient space shall be allowed for proper preparation of samples to be taken away to central laboratories for further testing and analysis. The sampling area shall contain sufficient bench space and storage space for samples. For treatment plants greater than 20,000 PE, the sampling area shall be provided in accordance with MS 1228. Access ladder shall be provided for sampling facilities where necessary. Internal surface area for sampling point shall be tiled with clear coloured tiles.

6.12 Auto Restart Facilities

All electrical equipment shall be fitted with auto restart facilities for quick re-operation in the event of failure of power facilities.
6.13 **Safety Facilities**

Safe access and walkways shall be provided at all process units and equipment (valves, penstocks, aeration tanks, etc.) that require service and maintenance. Safety handrails shall also be installed at walkways and other working areas with a fall greater than 2 m. Typical details of hand rail are shown in Figure 6.10

All chemical storage facilities shall be provided with a safety shower and eyewash as well as appropriate warning signs. Liquid chemical storage facilities shall be bund. Access to the area shall be restricted using lockable doors/gates.

Provision for fire detection, alarm and fire fighting equipment shall be complying with the latest requirements in the Uniform Building Bylaws, the Institute of Electrical Engineers (IEE) guidelines and other statutory requirements.

All tanks shall not exceed 1.2 m above ground.

Stair case and ladder exceeding 1.2 m shall be provided with handrail

All plants located adjacent to earth slopes shall be provided with proper slope protection structures. The slope protection design must be certified by Qualified Professional Engineer.

6.14 **Doors**

All external doors shall be of weather proof and suitable for out-door installation.

Door with sufficient width for the manoeuvre of equipment shall be provided at the building of pump station, blower room, etc. For opening more than 4 m wide or 5 m high, motorized roller shutter shall be provided complete with manual over-ride button, which enables it to be operated during power interruption.

6.15 **Fire Hydrant**

For treatment plants above 20 000PE, fire hydrant shall be provided complying with the requirements of Jabatan Bomba.
6.16 **Power Supply**

Power supply shall be provided to each plant from the approved source. Drawings submitted for approval shall indicate the locations of electrical power tapping point and schematic layout plan. Approval for power supply tapping should be obtained from relevant authority for permanent power supply before submitting inspection form. All related document, such as electrical bills, transfer of ownership: to be submitted before final inspection. Requirement of power shall be finalised prior to obtaining design approval.

Requirement of incoming permanent power supply shall be inline with Section 4 this Volume.

6.17 **Internal Sanitation (Toilet)**

All plants shall be provided with toilet. The toilet shall consist of water tap, water closet, shower and wash basin. The area for toilet shall comply with Uniform Building By Laws. Toilet to be located beside the control panel building. Toilets can also be located in the mess or office building.

6.18 **Lifting Requirement**

Safe lifting weight in unrestricted area is 16 kg. For heavier objects and/or very tight locations, provision of crane or access for truck mounted crane to be made.

Lifting requirements are as follows:

- Weight < 16 kg: Manual lifting
- 16 kg ≤ Weight ≤ 250 kg: A davit or ‘A’ frame shall be arranged to allow items lifted by using manual chain hoist to be projected on a 1.2 m truck tray and positioned at 2 m above road level. In the pump station, motorized hoist is required for lifting weight exceeding 100 kg.
- Weight > 250 kg: A gantry with motorised hoist shall be arranged to allow items to be projected on a 1.2 m truck tray and positioned at 2 m above road level truck tray.
Lifting equipment shall be subjected to DOSH approval standards and guidelines.

Safe Working Load with approved method of installation shall be rated and printed for all lifting facilities. Height and lifting method must be considered in the design for Safe Working Load of lifting facilities.

All portable motorised hoist shall be of 230 V operating voltage and fixed electrical hoist shall be of 415 V operating voltage.

All fixed 3 axis type gantry shall come with additional safety features such as travel stop limit switch, hoist over run limit switch, slow & fast speed mode and emergency stop (for all type of hoist).

All fixed type outdoor lifting facility futures shall comprise of hoist parking bay with shade. All fixed type lifting facility shall come with working platform and excess ladder.

Typical drawings of lifting davits and A-frame lifting facilities are shown in Figure 6.11 and Figure 6.12.

6.19 Ventilation

Ventilation is the process of letting in outside air into a space so that it mixes with the inside atmosphere to dilute contaminants and replenish oxygen. The purpose of ventilation in a sewage treatment plant is to provide a comfortable and safe working environment for all plant personnel.

Hence proper ventilation shall be provided as a mean of providing sufficient fresh air and reducing poisonous or explosive gases in enclosed or semi-enclosed spaces where access to human is allowed. Ventilation can be achieved naturally or mechanically:

- Natural ventilation uses the force of nature such as air currents, breezes, thermal gradients and pressure differences to move air in and out of the space.

- Mechanical ventilation uses fans and blowers to force air through space. It is also sometimes called forced ventilation.

Particular requirements are:

a) Ventilation shall be intrinsically safe with respect to explosive gases (such as methane) where such gases may be present.

b) Ventilation shall be designed to deal with the different densities of the various gases.
c) Ventilation fans shall be located outside the enclosed space to induce forced air into the plant. Intake locations shall be such that only fresh air is drawn into the system and not air recirculated from the exhaust.

d) Mechanical ventilation shall be used if the system is required to remove contaminants.

e) Ventilation exhaust shall be directed to a suitable location for discharge and it shall not be adjacent to the intake point.

f) Ventilation at rooms where heat generation may take place must be adequate to dissipate the heat generated to ensure a comfortable making ambient for the equipment and the operator.

g) Noise levels associated with operating fans and blowers, particularly in a confined space, shall conform to the requirements in Section 4 of this Guidelines and other stationary requirements.

h) Optimise recurring cost for operation, maintenance and replacement.

i) Regular testing and inspection of the equipment

j) Compliance with the suggested ventilation requirements. Table 6.4 presents some commonly used values for ventilation rates in typical enclosed spaces of a sewage treatment plant: -
### Table 6.4 Common ventilation rates

<table>
<thead>
<tr>
<th>Space</th>
<th>Minimum Ventilation Rate (Air Changes/hour, ac/hr)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet-Well</td>
<td>30 intermittent 12 continuous</td>
<td>Use 100% outside air. Step up to 24 ac/hr if hazardous gases are detected. Consider odour control, where warranted</td>
</tr>
<tr>
<td>Dry-Well</td>
<td>30 intermittent 12 continuous</td>
<td></td>
</tr>
<tr>
<td>Grit Removal/Screen Area</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Digester Gas Control Room</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Sludge Gas Compressor Room</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Enclosed Grit Loading Areas</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Enclosed Primary Sedimentation Tanks</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Scum Concentration Tank</td>
<td>30 intermittent 12 continuous</td>
<td>Same as wet well</td>
</tr>
<tr>
<td>Chlorine and Sulphur Dioxide Rooms</td>
<td>60 intermittent 12 continuous</td>
<td>Hazardous areas, toxic fumes, floor level exhaust required. Interlock fans with manual switches located at each entrance. Also interlock fans with chlorine and sulphur dioxide detection. Use 100% outside air</td>
</tr>
<tr>
<td>Filter/Dewatering Area</td>
<td>12 continuous</td>
<td>Consider odour control for exhaust air from dewatering area, where warranted</td>
</tr>
<tr>
<td>All other enclosed unit processes not mentioned elsewhere</td>
<td>30 intermittent 12 continuous</td>
<td>In particular at blower room, high tension room, low voltage room, switchboard and control panel rooms, where there are tendency of heat generation</td>
</tr>
</tbody>
</table>
k) An audible and visible warning shall be provided at all entry points. This shall automatically operate if the fan fails.

l) Where natural or forced ventilation is provided, it shall be installed in such a manner so as to avoid any ingress of water due to rain or other sources.

m) In areas with routine entry by personnel, the ventilation strategy shall emphasize adequate control of contaminants and the ventilation system shall be continuously operated.

6.20 Process Water

The designer is encouraged to provide recycle water facilities from the treated effluent. The recycle water can be utilised for cleaning and landscaping purposes.

6.21 Aesthetic

The structure of a treatment plant shall blend with the surrounding development to improve the aesthetic value of the area. Roof, structure wall or brickwall fancing can be designed with other than conventional finishing.

6.22 Close Turfing

Unpaved area within the STP reserve shall be turfed with close turfing. The type of grass must be “cow grass”. For slope area, turf must be pegged to avoid grass wash away during water run-off.

6.23 Standard Roofing and related requirement

Roof for control panel shall be of flat roof and shall be installed with water proving material on the final layer. The slope of flat roof shall be 1: 20 and gutter shall be provided.

However, for the aesthetic purpose Pitch type roof may be provided. The slope shall be 30 degree from horizontal. Suitable material for roof such as roof tile is recommended.

The design of roof shall be considered from the following:

i) Suitable material for roof (flat or slope) including colour

ii) Adequate air for ventilations

iii) Enough heights for lifting facilities
iv) Enough heights for access and headroom
v) Type of insulation
vi) Acoustic treatment where applicable

6.24 Painting

Painting shall include all plant and machinery inside buildings, including pipework, grating, handrailing, internal walls below ground level and all metal work including machinery.

The conduits and piping shall be appropriately named and labelled indicating flow directions and painted with the following colour codes for easy identification:

- Chlorine line - yellow with double green bands
- Compressed air line - green
- Fuel gas line - orange
- Potable water supply line - blue
- Raw sewage line - black
- Final effluent line - grey
- Sludge line - brown
- Non-potable water line - blue with double black bands
- Other disinfectant lines - yellow with double red bands
- Biogas line - yellow

The labels shall be stencilled on the piping in a contrasting colour with the colour coded bands, if any, located at appropriate and strategic points.

Colour codes selected for general equipment, building and others items in a sewage treatment plants shall be adhered to colour standards as detailed in Table 6.5. The types of paint and surface preparation used shall be as recommended by the paint manufacturer.
### Table 6.5  Painting System Index – Colour Standards

<table>
<thead>
<tr>
<th>Item</th>
<th>Colour</th>
<th>Equivalent Colour Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Equipment including motors (unless come with the original manufacturer approved colour code)</td>
<td>Dark Blue</td>
<td>Dulux Regal Blue 0013</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Mandarin Blue 0013</td>
</tr>
<tr>
<td>Penstocks/Valves/Manhole Covers</td>
<td>Black</td>
<td>Par Bituminous Black</td>
</tr>
<tr>
<td>Machinery Guards/Railings/Runways/Overhead Cranes/Lifting Davit</td>
<td>Yellow</td>
<td>Dulux Lemon 2024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Golden Yellow</td>
</tr>
<tr>
<td>Switchboards</td>
<td>Light Grey</td>
<td>Dulux Pewter 695</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Willow Grey 00A05</td>
</tr>
<tr>
<td>Fencing poles/Gates</td>
<td>Green</td>
<td>Dulux A365-13449</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Green 3666</td>
</tr>
<tr>
<td>Building and Walls – Exterior (Weathersheild)</td>
<td>Grey</td>
<td>Dulux BS 00A05-10235</td>
</tr>
<tr>
<td>Building and Walls - Interior</td>
<td>White</td>
<td></td>
</tr>
<tr>
<td>Fencewall – Interior and Exterior</td>
<td>Grey</td>
<td>Dulux BS 00A05-10235</td>
</tr>
<tr>
<td>Floors - Concrete Interior</td>
<td>Green</td>
<td>Leigh Green 3666</td>
</tr>
<tr>
<td>Building Stripes</td>
<td>Green</td>
<td>Dulux A910-13448</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Green 3666</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>Dulux A910-11482</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Blue 2686</td>
</tr>
<tr>
<td>Indah Water Logo (where applicable)</td>
<td>Indah Water Green</td>
<td>Dulux A365-13449</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Green 1006</td>
</tr>
<tr>
<td></td>
<td>Indah Water Blue</td>
<td>Dulux A365-11483</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Par Blue 1007</td>
</tr>
</tbody>
</table>

**Notes:**
The above painting requirements are not applicable to stainless steel, aluminium, galvanised metal surfaces except where necessary to comply with statutory health and safety requirement.
Figure 6.10  Typical Detail of Guard Rail

FLAT BASE
TUBULAR STANDARDS

TYPICAL RUN OF HANDRAIL AS VIEWED FROM WALKWAY SIDE

SIDE PALM BASE

TYPICAL RUN OF HANDRAIL AS VIEWED FROM WALKWAY SIDE

TRIANGULAR BASE

ROUND BASE
TUBULAR STANDARDS

DETAIL OF HOT DIPPED G.I. RAILING
Figure 6.11  Typical Detail of Lifting Davit

Figure 6.12  Typical Detail of A-Frame Lifting Facilities