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1. DEFINITIONS

- i. **“Authority”** Designated employees are authorized to conduct inspections and takes steps to administer and enforce these requirements in line with the regulation. The details of any construction which are not specifically dealt within this regulation shall be performed to the satisfaction of a designated employee, which authority shall be reasonably exercised by the designated employee. Designated employees are hereby authorized to determine whether equipment, techniques, conditions, circumstances and all other matters meet the standards and requirements of this regulation or are otherwise acceptable.
- ii. **“Act”** The Environment (Protection) Act - 1986, The Water (Prevention and Control of Pollution) Act – 1974.
- iii. **“Agreement”** means the application form along with general terms and conditions and other incidental documents signed and submitted by the Applicant for the connection of water supply at a specified location within building envelope and duly accepted by the Service Provider.
- iv. **“Applicant”** or **“Consumer”** means a Legal Entity (a company, partnership firm, LLP, Housing Society or Trust) or a proprietary concern or an individual, who has applied for water Connection for commercial / residential / institutional purpose.
- v. **“Application”** means request by an Applicant for Connection of water supply in the prescribed format / application form of the

Service Provider duly filled and signed by the Applicant.

- vi. **“Authorized Representative”** Refers to all officers, staff & Representatives of the GIFTCL, discharging functions under the general or specific authority of the GIFTCL.
- vii. **“Bill”** means bill of demand, issued by the Service Provider, on monthly basis or for such period as determined by the Service Provider, for Minimum Fixed Charges or charges for the actual consumption of water supply and such other incidental charges, taxes, cess, duties and levies payable by the Consumer.
- viii. **"Board"** means the Central Board or a State Board.
- ix. **“Code”** means The National Building Code of India-2005 or relevant Indian Standard adopted by this regulation or a subsequent and similar Code adopted by this Regulation.
- x. **“Connection”** means installation of combination of one or more pipelines, related fittings, valves, regulator, meter, etc. in Applicant’s Site in order to be able to supply water to the Applicant.
- xi. **“Consumer”** means the Applicant to whom the connection for water supply for commercial / residential / institutional purpose has been installed.
- xii. **“Domestic Connection”** means the connection used for Residential purposes.

“Non-Domestic connection” means the connection used for commercial, institutional, hospitals, public uses, horticulture and fire demand.

- xiii. **“Delayed Payment Charges”** means the charges as are payable by the Consumer as per rate given in the Tariff Card, for late payments of the Bill or such other demands raised by the Service Provider.
- xiv. **“Designated Employee”** The Manager of Development and Inspections of the Planning, Property and Development Department of the Gift City and any GIFTCL employee whom he or she has delegated authority to administer or enforce all or part of this regulation.
- xv. **“Developer”** A persons or organization procuring plots from the GIFTCL making necessary development and finally lease or sale flat to end user.
- xvi. **“Distribution”** means any of several mains, valves, service connections, hydrants or other appurtenances used for controlling and transporting water within building envelope.
- xvii. **“Drinking water”** is water used for domestic purposes, drinking, cooking and personal hygiene.
- xviii. **“Installation”** means the accessories and fittings on water line including motor, pump, apparatus, gadget, devices etc. installed / erected within a premise associated with a point of supply of a consumer and connected to GIFTCL’s water supply system;
- xix. **“Meter”** means the mechanical or electrical device which measures and registers the quantity of water consumption supplied to the Consumer.
- xx. **“Owner”** A person or the agent, servant or employee of a person who owns, manages or is in possession of land or a building to which this regulation applies. Who is in receipt of the whole or a part of any rents or profits, there from whether the rents and profits

are received on the person's own account, or as agent or trustee for another person.

- xxi. **“Person”** shall include any Company or body corporate or association or body of individuals, whether incorporated or not, or artificial juridical person;
- xxii. **“Potable Water”** means water suitable for drinking purpose.
- xxiii. **“Pollution”** means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health of animals or plants or of aquatic organisms.
- xxiv. **“Premises”** includes any land, building or structure;
- xxv. **“Prescribed”** means prescribed by rules made under Water Act by the Central Government or, as the case may be, the State Government;
- xxvi. **“Reconnection”** means, restart of the supply of water on fresh application submitted by the Applicant, after termination.
- xxvii. **“Regulations”** means regulations prescribed or as may be prescribed by the Commission under the Act;
- xxviii. **“Rules”** means the Rules prescribed or as may be prescribed under the Act; The Water (Prevention and Control of Pollution) Rules - 1975, 1956 (as amended up-to 24th Nov., 2011).

- xxix. **“Security Deposit”** means the amount of security (interest free) to be deposited by the Applicant, as per the Tariff Card, at the time of Application for Connection or Reconnection.
- xxx. **“Service / Services”** means supply of water by the Service Provider up to the Connection at the Applicant’s premises.
- xxxi. **“Service Provider”** means hereinafter referred as GIFTCL.
- xxxii. **“Site”** means the building, building envelope or property or establishment owned or occupied by the Applicant in the GIFT notified area.
- xxxiii. **“Street”** includes any way, road, lane square, court, alley, passage or open space, whether a thoroughfare or not, over which the public have a right of way and also the roadway and footway over any Public Bridge or Causeway;
- xxxiv. **“Tariff Card”** means a schedule, issued by the Service Provider, from time to time, in respect of the Security Deposit, Charges for New Water Connection, Water Charges, Delayed Payment Charges and such other charges to be paid by the Applicant/ Consumer to the Service Provider.
- xxxv. **“Termination”** means as defined in clause 10.1 of Water Connection Agreement.
- xxxvi. **“Water Demand”** means the water requirement during a given period.

2. GIFT WATER INFRASTRUCTURE

2.1 OVERALL WATER INFRASTRUCTURE IN GIFT

- GIFT City will provide treated water through pipeline from GIFT City's own WTP to building package level.
- GIFTCL do not permit borewell for any purpose. In underground tank provision of tanker water inlet should be provided by the developer for case of emergency/breakdown. Tanker water should be arranged by developer as per their requirement GIFTCL do not provide tanker water supply.

2.2 WATER DISTRIBUTION NETWORK

- Water distribution in GIFT city is underground.
- Utility tunnel is an underground passage developed by GIFTCL to house utility lines such as Water, electricity, AWCS pipe, ICT cables etc

2.3 SCOPE OF WATER DISTRIBUTION NETWORK FOR GIFTCL AND DEVELOPER

The demarcation of boundary of GIFTCL and Developer is as follows:

A) Developer's Scope

- The connection from the tap-off point near Utility tunnel/main water supply line to the underground water storage sump will be done by the developer. Minimum pressure provided near the tap-off will be 0.3 kg per sq.cm and size of the connection shall be 100 mm./150 mm./200 mm diameter. pipe.

- Design, laying and maintain the water supply distribution system inside the building should be done by the Developer. Also, the connection pipe from the valve chamber to the storage tank should be in developer scope.
- Developer will have to keep water collection sump having retention time, of 24 hours and fire water sump separately or as per latest standards / National Building Code, whichever is higher
- Developer will provide necessary arrangements for metering, if required at individual floor and main water collection sump to match the metering system of the GIFTCL.
- Tanker filling arrangement should be made by Developer for filling of sumps in case of pipe water supply in not available.
- Developer should provide proper cleaning arrangement for all water storage tanks.
- Developer has to provide tertiary treatment along with online monitoring system before main distribution within building. Installation arrangement shall be as per the principle's recommendations.
- Developer has to provide water sample analysis report every quarterly by MoEF approved Schedule II auditor / Laboratory, or as per the frequency suggested by GIFTCL's representative.
- Developer has to install all pipes, fittings, pumps, valves, meters, sensors etc. in a manner as to provide easy accessibility for repair & maintenance & shall not cause obstruction in shafts, passage, etc.
- Developer has to avoid impact due to high velocity of water rushing down the vertical stack, velocity reducing bend/PRV's should be added at immediate floor to reduce the possible impact.
- Developer should provide proper signage showing drinking water location, Irrigation water etc.

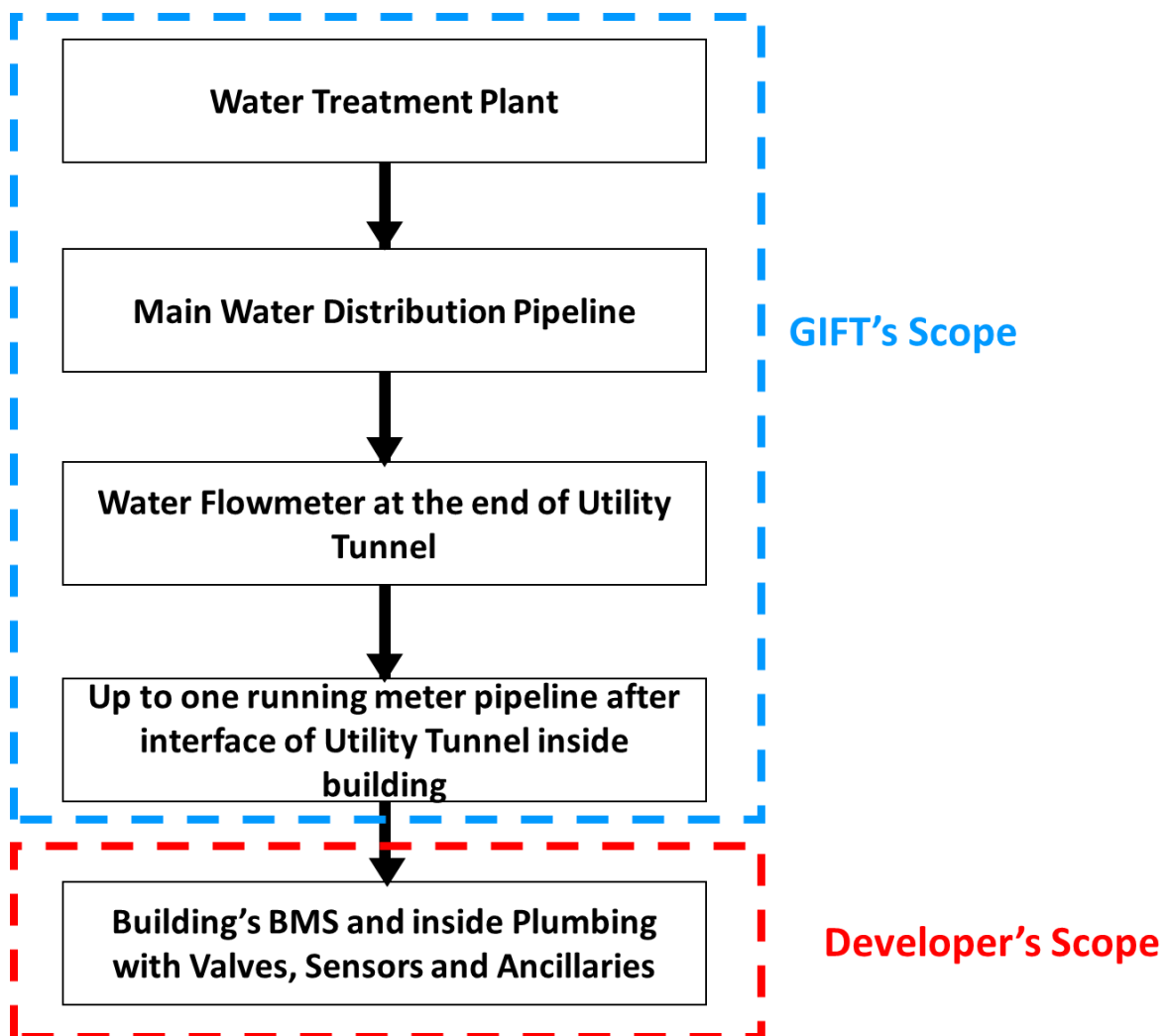
- Irrigation/Gardening water/STP treated water tap points should clearly mark “NOT FIT FOR DRINKING”.
- Developer has to provide interim arrangement for connection between flushing and treated water tank, as per the following –
 - At present GIFT is providing only domestic water. In future if access STP treated water will be available then it will be provided to developer at tunnel end and for that developer has to make necessary arrangement.
 - At present developer have to connect their flushing tank with domestic water pipeline having valve arrangement.
 - Tentative drawing for the arrangement with present and future scenarios is shown in Annexure – I.
- To ensure, “Any Tap Drinking Water” in the developer premises, the developer is responsible for providing online water quality monitoring sensors (as per GIFT’s standards, parameters such as pH, TSS/ Turbidity, TDS and Microflora measurement) in the building premises, after tertiary treatment, before supplying the water to any consumer of the building.
- Developer has to provide Motorized valve in water inlet from GIFT which should operate according to the level of UG Tank and control by developer's BMS. This should automatically open and close based on tank level and prevent any overflow from the tank. To control the same, tank shall be equipped with Ultrasonic/Radar Level transmitter, level switch (Hard wired with Motorized Inlet valve) and Mechanical protection (Overflow protection). The Procurement & Installation of Motorized butterfly Valve, Level Transmitter & Level Switch will be in Developers scope. Along with that the signals of the UG Tank Level transmitter, Level switch and Motorized

valve Open/Close feedback shall be connected to GIFTCL SCADA network through developers BMS for monitoring purpose only.

B) GIFTCL's Scope

- GIFTCL will lay pipeline with metering facility at end in utility tunnel.
- GIFTCL will not be responsible for any asset of network inside building; Developer will be solely responsible for O&M / repair works.
- Sampling location should be decided by GIFTCL's representative whom may change time to time.

The schematics for scope is shown below –



2.4 WATER DISTRIBUTION PHILOSOPHY

The General Terms and Conditions for Water Connection is shown in Annexure – II.

Validation / Submission of Documents / Drawings by Developer:

- GIFTCL will validate all drawing / documents based upon standards and specifications mentioned in Blue Book.
- Developer will submit soft and hard copy, dully stamped and signed by signatory authority by Developer with proper Letter of Transmittal.
- GIFTCL will review and wherever required all necessary comments should be incorporated by Developer.

Developer will only consider the approved documents / drawings by GIFTCL for further proceedings. Developer will consider the comment given by GIFTCL and shall resubmit the revised drawing / documents for approval with “Letter of Transmittal” as mentioned in above point till acceptance of final approval from GIFTCL.

3. WATER DISTRIBUTION NETWORK (INSTRUMENTATION AND CONTROL SYSTEM):

3.1 INTRODUCTION

The potable water shall be conveyed by pipeline from the WTP to the underground tanks of various packages/individual buildings.

3.4 I&C OPERATION PHILOSOPHY:

Complete operation & monitoring of the water distribution network system will be carried out from main PLC and SCADA located at WTP control room. The RIO panel is located near developers RMU room for local control and monitoring purpose and it communicate with main PLC through fiber optics cable.

All the online metering at each distribution line has been monitored at WTP control room. The WTP distribution network system shall have motorized control valve at each distribution end of building and this valve can be control in auto mode as per respective building UGT level status provided by BMS of that building. The motorized valve can also operate in manual mode from main PLC and SCADA system.

3.5 SCOPE OF INSTRUMENTATION & CONTROL WATER DISTRIBUTION NETWORK FOR GIFT & DEVELOPER

The demarcation of boundary of GIFT and Developer are as follows:

3.5.1 I&C GIFT'S SCOPE

- GIFT will lay pipeline with Motorized butterfly valve, Flow metering facility at end in utility tunnel.
- The WTP distribution network system shall have motorized control valve at each distribution end of utility tunnel and this valve can be control in auto mode as per respective building UGT level status provided by BMS of that building. The motorized valve can also operate in manual mode from main PLC and SCADA system.
- By default, all motorized valve in GIFT's scope should be in Open position all the time.

Motorized Butterfly Valve will stop in Auto mode:

- (i) If the set level reaches the high point of 90%, developers' valve shall be automatically closed, if this does not happen, GIFT's valve will change its positioned to close.
- (ii) For Maintenance purpose like Line removal, Valve problem or Power failure, but not limited to, then also GIFT's valve will be closed.
- (iii) If Signal failure occurs through developer's BMS then also GIFT's valve will be closed.
- Interfacing of main PLC with developers BMS System for Level sensors and motorized control valve monitoring at various buildings.
- When operated from Operator Station operator shall be able to call for various types of displays for all parameters as required on the screen and to perform normal start up, shutdown and emergency operations of the system/ equipment.
- GIFT will not be responsible for any asset of network inside building; Developer will be solely responsible for O&M / repair works.

3.5.2 I&C DEVELOPER'S SCOPE

- Developer has to provide Motorized valve in water inlet from GIFT which should operate according to the level of UG Tank and control by developer's BMS. This should automatically open and close based on tank level and prevent any overflow from the tank. To control the same, tank shall be equipped with Ultrasonic/Radar Level transmitter, level switch (Hard wired with Motorized Inlet valve) and Mechanical protection (Overflow protection).

- The UG Tank Level transmitter, Level switch and Motorized valve Open/Close feedback signal shall be connected to GIFTCL SCADA network for monitoring purpose only.
- Design, laying and maintain the water supply distribution system inside the building should be done by the Developer. Also, the connection pipe from the valve chamber to the storage tank should be in developer scope.
- Developer will have to keep water collection sump having retention time, of 24 hours and fire water sump separately or as per latest standards / National Building Code, whichever is higher
- Developer has to install all pipes, fittings, pumps, valves, meters, sensors etc. in a manner as to provide easy accessibility for repair & maintenance & shall not cause obstruction in shafts, passage, etc.
- The Developer has to install an Online Water Monitoring System for Domestic Water distribution. It is mandatory to install the system after the UV System or before supplying it to Internal Consumers to check the Water Quality Parameters. E.g., PH, TDS, TSS/Turbidity, hardness, and Microflora measurement.
- All the above-mentioned Water Quality Monitoring System Parameters (PH, TDS, TSS/Turbidity, hardness & Microflora Measurement) shall be connected to the GIFTCL SCADA network via the developer's BMS system.
- Water Quality Water Monitoring System Parameters (PH, TDS, TSS/Turbidity, Hardness, and Microflora Measurement) will provide Analog input (AI) signals to the developer's BMS. From Developer's BMS, they have to

transpose the signal and will have to provide as Analog output (AO) to the GIFTCL SCADA system for Monitoring purposes only.

Minimum Mandatory IO's required from Developer's BMS				
Sr No.	Signal Description	Signal in Developer's BMS	BMS	TO GIFT CITY
A	Meter/Instruments		From Developer's BMS, they have to transpose the signal and will have to provide as Analog output (AO) & DO (Digital Output) to the GIFTCL SCADA system for Monitoring purposes only.	
1	Level Indicating Transmitter - LIT	AI (Analog Input)		AO (Analog Output)
2	Level Switch (High and Low) - LS	Two DI (Digital Input) for Low & High		Two DO (Digital Output) for Low & High
3	pH Transmitter	AI (Analog Input)		AO (Analog Output)
4	Total suspended Solid - TSS	AI (Analog Input)		AO (Analog Output)
5	Total dissolved solid - TDS	AI (Analog Input)		AO (Analog Output)
6	Free residual chlorine - FRC	AI (Analog Input)		AO (Analog Output)
7	Any other Meter/Analyser	AI (Analog Input)		AO (Analog Output)
B	Motorised Butterfly Valves			
3	Valve open status	DI (Digital Input)		DO (Digital Output)
4	Valve Close status	DI (Digital Input)		DO (Digital Output)

- The Technical Specification of the Instruments/Meters/Analysers are placed as Annexure -IV.

4. PROCEDURE & QUALITY OF WATER SUPPLY

4.1 SUBMISSION OF APPLICATION

The GIFTCL shall be contacted for following application:

- a) To obtain a new water connection for water supply Reconnection
- b) Transfer of registered name
- c) Termination

The application for connection should be done in the prescribed format shown in Annexure – III.

DOCUMENTS TO BE SUBMITTED FOR VARIOUS STAGES

List of documents to be submitted at the subsequent stages (namely DP/CC/OC) for approval but not limited and may change on case to case basis which are as follows:

- Coordinated Building location along with GIFT Master Plan
- Water Schematic Diagram indicating all water pipeline network inside building including placement of tertiary system and online monitoring unit. Floor wise plan of Water distribution network
- Location of meter with details
- Location and details of water storage sump as per latest National Building Code
- Location and details of Fire water sump as per latest National Building Code / Fire Load / NFPA Regulation

- All drawing should be in proper readable scale and legend with revision number, reference drawing number if required as per following –

Sr. No.	Type of Pipe	Color
1	Domestic water supply	BLUE
2	Flushing water supply	CYAN
3	Domestic water riser	BLUE (With different line type)
4	Flushing water riser	CYAN (With different line type)
5	Hot water supply	RED
6	Hot water return	MAGENTA
7	Text	BLACK
8	LPG pipe	RED (With different line type)

- Related design calculation.
- Any changes/Modification in the design or concept should bring in notice to GIFTCL before executing on project.
- Before awarding final OC by GIFTCL, developer must ensure the water infrastructure checklist.

The checklist for all stages, but not limited to following, is as below –

Checklist for Various Stages for Developer	
DP	
Drawings for Space Arrangements	Assumptions
	Tank Location
	Internal Pipeline Routing
	Water Demand
	Water Storage Capacity
CC	
Drawings	Water Schematic
Submission of DBR	Assumptions
	Operational Water Philosophy
	Design Calculations of per capita demand including storage capacity
OC	

Presence of Tertiary Treatment	Specifically, UV
Installation of various sensors and valves	Level Switch
	Level Indicating Transmitter
	Motorized Valves
	Water Quality Monitoring Unit
Integration of Sensor with Developer's BMS and GIFT SCADA	Level Switch
	Level Indicating Transmitter
	Motorized Valves
	Water Quality Monitoring Unit

4.2 QUALITY OF WATER SUPPLY

GIFT City being a Global Financial Hub, Quality of water has been set by GIFTCL considering National / International water standards, which are as follows:

- IS (Indian Standard) 10500 for drinking water specification
- Central Public Health and Environmental Engineering Organization (CPHEEO) Standard – Water Manual

4.3 SAMPLING OF WATER AND DATA COLLECTION (MONITORING OF PERFORMANCE)

- GIFTCL holds the rights to reschedule and modify the frequency of sampling depending upon the requirements and site conditions.
- Concerned Authorities like CPCB, GPCB, and GIFTCL hold the right to inspect and supervise the sample, monitoring process and monitoring stations.

5. DEVELOPER'S INSTALLATIONS

Developer shall consider following guidelines for water distribution network within the building.

5.1 ESTIMATION OF WATER CONSUMPTION

- Developer of any building or block / amenities needs to submit water requirement with basis of calculation of water consumption for all type of usage (viz. drinking, Firefighting, flushing, cleaning, irrigation/landscape, swimming pool etc.) at the time of submission of Detailed plan as per standard norms and guidelines mentioned (Reference: CPHEEO water manual / NBC).The estimation of water requirement shall also include floating population/ visitors/ guests etc.
- GIFTCL will validate the water consumption for the development and usage of water submitted by Developer.
- Calculation for drinking water consumption as per connection form.

5.2 PEAK FACTOR

The following criteria should be used to assess the adequacy of the building / facilities water supply during high demand periods.

Maximum Demand & Fire flow in a Day

- In accordance with typical standards, the Developer water supply system should have the capability to meet a system demand condition equal to the occurrence of a maximum day demand condition concurrent with a fire flow occurrence.
- Additionally, the analysis of specific fire flow evaluations will be conducted assuming the largest booster pump if offline (i.e. Firm capacity of the pump station). This ensures the reliability of these systems to provide sufficient flow during emergency fire flow condition.

- For further system improvement analyses, pump station with only one booster pump, or without back-up power capability (either on site generator or adaptor for a plug-in generator), will not be considered to be reliable during fire flow analysis.

Developer shall consider the maximum day plus fire flow demand condition will consist of a single fire flow event.

Peak Hour Demand

- Peak hour demand will be considered as per latest prevailing CPHEEO standard.
- The tertiary treatment capacity should be capable of meeting maximum day demand/Peak demand.

Pumping Facility Capacity

Sufficient water system pumping capacity should be provided to meet greater of a fire flow concurrent with the maximum day demand or peak hour demand (unless peak hour is met with gravity storage), with the largest pump at the pump station in standby mode.

The fire pump should be UL/FM approved and the capacity should be as per the NFPA. The electric supply for the fire pumps should be considered as dead load whereas jockey pump should be considered as active load for electrical load calculation.

Water Storage Capacity

The total treated water storage and system peaking capacity requirements will be evaluated based on the following three components:

Operational Storage

- The tanks are normally refilled when demands drop below the baseline water production flow rate. The storage volume used to meet this peak demand period is called operational storage.
- All Developer should have sump, having retention time, of 24 hours and fire water sump separately or as per latest standards / National Building Code, whichever is higher with buffer storage to supply water to internal customers by considering this quantity as buffer stock.
- Developer shall make provision of tertiary treatment for their internal distribution.

Fire Storage

- Developer shall provide water inlet to fire tank and from fire tank overflow water would be available to other tanks as required.
- The overflow arrangement shall be provided in the fire water tank to domestic water tank in such manner that the water circulation in the fire water tank shall be maintained.
- Firefighting flow requirements are identified in NFPA. These requirements are based on flow (in liter/sec) for the building use type (i.e. Commercial, residential, school, industrial etc.), size of the building (Sq. feet area), and type of construction / material available (wood frame, metal, masonry etc.) After a fire flow requirement is established, it is multiplied by the required

firefighting duration to produce an estimate of total volume of fire water and flow required.

Emergency Storage

A reserve of stored water is also required to meet demand during period of supply emergency. An emergency is defined as an undesirable /unforeseen or unplanned event that may degrade the quality or quantity of potable water supplies available to serve customers. There are three types of emergency events for a typical utility there are:

- **Minor Emergency:** A fairly routine, normal, or localized event that affects few customers, such as pipeline break, malfunctioning of valve, hydrant break, or a brief power loss. Utilities shall be planned for minor emergencies and typically shall have staff and materials available to correct them.
- **Major emergency:** A disaster that affects an entire, and / or large, portion of a water system lowers the quality and quantity of water, or place the health and safety of contamination or major power grid outage. Water utilities infrequently experience major emergencies.
- **Natural Disaster:** A disaster caused by natural force or events that create water utility emergencies. Example includes earthquake, land slide, floods and other severe weather condition such as drought, etc.

However, determination of the volume of emergency storage is not considered in estimation of water standards hence Developer will consider the emergency storage including the diversity of the supply sources, redundancy and reliability of the facilities, and the anticipated length of the emergency outage. Developer has to describe the methodology of how emergency requirement can be meet.

5.3 PIPES / FITTINGS AND ACCESSORIES INSTALLATION

Developer shall opt any equipment / piping / fittings and accessories by considering following concern minimum criteria to be fulfilled:

5.3.1 CAST IRON PIPELINE

Excavation and Preparation of Trench

Excavation must be done by hand or machine. The trench shall be so dug that the pipe may be laid to the required gradient and at the required depth. When the pipeline is under a roadway a minimum cover of 1.0 m is recommended. The width of the trench at bottom shall be provided at position of sockets and flanges for joining. Depth of pits at such places shall be also sufficient to permit joints.

Handling of pipes

While unloading, pipes shall not be thrown down but may be carefully unloaded on inclined timber skids. Pipes shall not be dragged over other pipes and along concrete and similar pavements to avoid damage to pipes.

Detection of Cracks in Pipes

The pipes and fittings shall be inspected for defects and be rung with a light hammer, preferably while suspended, to detect cracks. Smearing the outside with chalk dust helps in the location of cracks. If doubt persists further confirmation may be obtained by pouring a little kerosene on the inside of the pipe at the suspected spot. If a crack is present the kerosene seeps through and shows on the outer surface. Any pipe found unsuitable after inspection before laying shall be rejected.

Lowering of Pipes and Fittings

All pipes, fittings, valves shall be carefully lowered into the trench by means of platform, ropes or other suitable tools and equipment to prevent damage to pipe materials and protective coatings and linings. Pipes shall be handled and lowered into trenches with the help of chain pulley blocks.

Cleaning of Pipes and Fittings

All lumps, blisters and excess coating material shall be removed from socket and spigot end of each pipe and outside of the spigot and inside of the socket shall be wire-brushed and wiped clean and dry and free from oil and grease before the pipe is laid.

After placing a length of pipe in the trench, the spigot end shall be centered in the socket and the pipe forced home and aligned to gradient. The pipe shall be secured in place with approved back fill material packed on both sides except at socket.

The socket end should face the upstream while laying the pipeline on level ground; when the pipeline run uphill, the socket ends should face the up gradient. When the pipes run beneath the heavy loads, suitable size of casing pipes or culverts may be provided to protect the casing of pipe. 1-10 pressure mains need anchorage at dead ends and bends as appreciable thrust occurs which tend to cause draw and even "blow out" joints. Where thrust is appreciable concrete blocks should be installed at all points where movement may occur. Anchorages are necessary to resist the tendency of the pipes to pull apart at bends or other points of unbalanced pressure, or when they are laid on steep gradients and the resistance of their joints to longitudinal or shear stresses is either exceeded or

inadequate. They are also used to restrain or direct the expansion and contraction of rigidly joined pipes under the influence of temperature changes. Anchor or thrust blocks shall be designed in accordance with I.S. 5330-1984.

Joints

Several types of joints such as rubber gasket joint known as Tyton joint, mechanical known as Screw Gland joint, and conventional joint known as Lead joint are used.

Categories of Joints

Following three categories depending upon their capacity for movement must be used by Developer to connect pipeline.

Rigid joints

Rigid joints, which are comprise of flanged, turned and bored joints. Flange (joints require perfect alignment and close fittings are frequently used where a longitudinal thrust must be taken such as at the valves and meters. The gaskets used between flanges of pipes shall be of compressed fiber board or natural or synthetic rubber.

Semi Rigid joints

Semi rigid joint is represented by the spigot and socket with caulked lead joint. A semi rigid joint allows partial movement due to vibration etc, the socketed end of the pipe should be kept against the flow of water and the spigot end of the other pipe is inserted into this socket. A twisted spun yarn is fled into this gap and it is adjusted by the yarning tool and is then caulked well. A rope

is then placed at the outer end of the socket and is made tight fit by applying wet clay, leaving two holes for the escape of the entrapped air inside. The rope is taken out and molten lead is poured into the annular space by means of a funnel. The clay is then removed, and the lead is caulked with a caulking tool. Lead wool may be used in wet conditions. Lead covered yarn is of great use in repair work, since the leaded yarn caulked into place will keep back water under very low pressure while the joint is being made.

Flexible joints

Flexible joints are used where rigidity is undesirable such as with filling of granular medium and when two sections cannot be welded. They comprise mainly mechanical and rubber ring joints or tyton joints which permit some degree of deflection at each joint and are therefore able to stand vibration and movement. In rubber jointing special type of rubber gaskets are used to connect cast iron pipe which are cast with a special type of spigot and socket in the groove, the spigot end being lubricated with grease and slipped into the socket by means of a jack used on the other end. The working conditions of absence of light, presence of water and relatively cool uniform temperature are all conducive to the preservation of rubber and consequently this type of joint is expected to last as long as the pipes. Hence, rubber jointing is to be preferred to lead jointing.

Testing

The pipes will be subjected to following tests for acceptance:

- IS 1536:2001 – Centrifugally cast-iron pressure pipes

- IS 1537:1976 – Vertically cast-iron pressure pipes
- IS 1538:1993 – Cast iron fitting for pressure pipes

5.3.2 STEEL PIPES

General

Steel pipes of smaller diameter can be made from solid bar sections by hot or cold drawing processes and these tubes are referred to as seamless. But the larger sizes are made by welding together the edges of suitably curved plates, the sockets being formed later in a press (IS:3589). The thickness of steel used is often controlled by the need to make the pipe stiff enough to keep its circular shape during storage, transportation and laying as also to prevent excessive deflection under the load of trench back filling, The thickness of a steel pipe is however always considerably less than the thickness of the corresponding vertically cast or spun iron pipe. Owing to the higher tensile strength of the steel, it is possible to make steel pipe of lower wall thickness and lower weight. Specials of all kinds can be fabricated without difficulty to suit the different site conditions. Due to their elasticity, steel pipes adopt themselves to changes in relative ground level without failure and hence are very suitable for laying in ground liable to subsidence. If the pipes are joined by a form of flexible joint, it provides an additional safeguard against failure. Steel pipes being flexible are best suited for high dynamic loading.

Protection against Corrosion

It must be borne in mind, however, that steel mains need protection from corrosion internally and externally, against internal corrosion, steel pipes are given epoxy lining or hot applied coal tar/asphalt lining or rich cement mortar lining at works or in the field by the centrifugal process. The outer coating

for underground pipeline may be in cement-sand guniting or hot applied coal-tar asphaltic enamel reinforced with fiberglass fabric yarn.

Laying and Jointing

Small size mild steel pipes have got threaded ends with one socket. They are lowered down in the trenches and laid to alignment and gradient. The jointing materials for this type of pipes are white lead and spun yarn. The white lead is applied on the threaded end with spun yarn and inserted into socket of another pipe. The pipe is then turned to tighten it. When these pipes are used in the construction of tube wells, the socketed ends after positioning without any jointing material are welded and lowered down. Lining and out coating is done by different methods to protect steel pipes. While laying, the pipes already stocked along the trenches are lowered down into the trenches with the help of chain pulley block. The formation of bed should be uniform. The pipes are laid true to the alignment and gradient before jointing. The ends of these pipes are butted against each other, welded and a coat of rich cement mortar is applied after welding. Steel pipes may be joined with flexible joints or by welding but lead or other filler joints, hot or cold, are not recommended. The welded joint is to be preferred. In areas prone to subsidence this joint is satisfactory but flexible joints must be provided to isolate valves and branches.

When welding is adopted, plain-ended pipes may be jointed by butt welds or sleeved pipes by means of fillet welds. For laying long straight lengths of pipelines, butt joint technique may be employed. The steel pipes used for water supply include hydraulic lap welded, electric fusion welded, submerged arc welded and spiral welded pipes. The latter are being made from steel strip. For laying of welded steel pipe I.S. 5822-1986 may be referred to.

For more details on different types of steel pipes used, reference may be made to the ISI codes.

For hydraulic testing of steel pipelines, shall be carried out as per IS:3589.

5.3.3 DUCTILE IRON PIPES

The pipes will be centrifugally cast (spun) Ductile Iron pipes for Water confirming to the IS 8329: 2000. The pipes used will be either with push on joints (Rubber Gasket Joints) or Flanged joints. The class of pipe to be used shall be of the class K-9.

The pipes shall be coated with bitumen as per appendix C and have factory provided cement mortar lining in the inside as per the provisions of Appendix B of the IS 8329: 2000.

The pipes will be supplied in standard length of 5.50- and 6.00-meters length with suitably rounded or chamfered ends. Each pipe of the push on joint variety will also be supplied with a rubber EPDM gasket.

The specials and gaskets should also be supplied by the manufacturer of the pipes. It should preferably be manufactured by the manufacturer of the pipes. In case they are not, it will be the responsibility of the manufacturer of the pipes to have them manufactured from a suitable manufacturer under its own supervision and have it tested at his/sub developer's premises as per the contract. The pipe manufacturer will however be responsible for the compatibility and quality of the products. The flanged joints will confirm to the Clause 6.2 of IS 8329-2000. The pipe supply will also include one rubber gaskets for each flange.

Inspection and Testing

The pipes will be subjected to following tests for acceptance:

Visual and dimensional check as per Clause 13 and 15 of IS 8329-2000

Mechanical Test as per Clause 10 of IS 8329-2000

Hydrostatic Test as per Clause 11 of IS 8329-2000

The test reports for the rubber gaskets shall be as per acceptance tests of the IS 5382-1985 and will be in accordance to Clause 3.8.

The sampling shall be as per the provisions of the IS 8329 -2000.

Marking

All pipes will be marked as per Clause 18 of IS 8329-2000 and show as below:

- Manufacturer name/ stamp
- Nominal diameter
- Class reference
- A white ring line showing length of insertion at spigot end

Specials for Ductile Iron Pipes

This section covers the general requirements for Ductile Iron (DI) fittings suitable for Tyton joints to be used with Ductile Iron pipes with flanged and Tyton jointing system.

Specials

The following types of DI fittings shall be manufactured and tested in accordance with IS: 9523-2000 or BS: EN 545.

- a. Flanged socket
- b. Flanged spigot
- c. Double socket bends (90° , 45° , $22\ 1/2^\circ$, and $11\ 1/4^\circ$)
- d. Double socket branch flanged tee
- e. All socket tee.
- f. Double socket taper.
- g. All flanged tee.
- h. All flanged taper.

All the DI fittings shall be supplied with one rubber ring for each socket. The rubber ring shall conform to IS: 12820-2004 and IS: 5382 -1985 as described in the preceding chapter. Flanged fittings shall be supplied with one rubber gasket per flange and the required number of nuts and bolts.

Lubricant for Ductile Iron Pipes and Specials

Specification

The lubricant has to have the following characteristics:

- a. Must have a paste like consistency and be ready for use
- b. Has to adhere to wet and dry surfaces of DI pipes and rubber rings

- c. To be applied in hot and cold weather; ambient temperature 0 - 50°C, temperature of exposed pipes up to 70°C
- d. Must be non toxic
- e. Must be water soluble
- f. Must not affect the properties of the drinking water carried in the pipes
- g. Must not have an objectionable odour
- h. Has to inhibit bacterial growth
- i. Must not be harmful to the skin
- j. Must have a shelf life not less than 2 years
- k. Acceptance tests shall be conducted in line with the provisions of the IS 9523-2000.

Packing for DI Specials

All the DI fittings shall be properly packed with jute cloth. Rubber rings shall be packed in polyethylene bags. Nuts, bolts etc. shall be supplied in separate jute bags.

Laying and jointing of DI pipes and fittings

Pipes should be lowered into the trench with tackle suitable for the weight of pipes. For smaller sizes, up to 200 mm nominal bore, the pipe may be lowered by the use of ropes but for heavier pipes suitable mechanical equipment have to be used.

All construction debris should be cleared from the inside of the pipe either before or just after a joint is made. This is done by passing a pull-through in the pipe, or by hand, depending on the size of the pipe. All persons should vacate any section of trench into which the pipe is being lowered.

On gradients of 1:15 or steeper, precautions should be taken to ensure that the spigot of the pipe being laid does not move into or out of the socket of the laid pipe during the jointing operations. As soon as the joint assembly has been completed, the pipe should be held firmly in position while the trench is back filled over the barrel of the pipe.

The designed anchorage shall be provided to resist the thrusts developed by internal pressure at bends, tees, etc. Where a pipeline crosses a watercourse, the design and method of construction should take into account the characteristics of the watercourse to ascertain the nature of bed, scour levels, maximum velocities, high flood levels, seasonal variation, etc. which affect the design and laying of pipeline.

The assembly of the pipes shall be made as recommended by the pipe manufacturer and using the suitable tools.

The socket and spigot ends of the pipes shall be brushed and cleaned. The chamfered surface and the end of the spigot end have to be coated with a suitable lubricant recommended by the manufacturer of the pipes. Oil, petroleum bound oils, grease or other material which may damage the rubber gasket shall not be used as lubricant. The rubber gasket shall be inserted into the cleaned groove of the socket. It has to be checked for correct positioning.

The two pipes shall be aligned properly in the pipe trench and the spigot end shall be pushed axially into the socket either manually or with a suitable tool specially designed for the assembly of pipes and as recommended by the manufacturer. The spigot has to be inserted up to the insertion mark on the pipe spigot. After insertion, the correct position of the socket has to be tested with a feeler blade.

Deflection of the pipes - if any- shall be made only after they have fully been assembled. The deflection shall not exceed 75 % of the values indicated by the pipe manufacturer.

Pillars for ductile iron pipes: In case of unstable subsoil or in case of ductile iron pipes laid above ground they shall be laid on pillars. Each pipe is supported at the plain end and behind the socket. One pillar shall support the socket end of one and the plain end of the other pipe. The pillars shall be of Cement Concrete and shall be founded on solid soil, not subject to erosion by wind or water. The foundation of the pillars has to be calculated according to the soil conditions.

The top of the pillar shall form two saddles for the pipe having the same radius as the pipe. The socket will be lying free between the two saddles. The pipes shall be laid on a coat of polyethylene of 2 mm thickness, put on mortar. It has to be ensured that the spigot end of the pipe is supported by the saddle and does not unduly compress the rubber ring in the lower part. Each pipe is fixed by one adjustable galvanized steel clamp, fixed to the pillar with anchor bolts. In case of vertical deviations the pipes shall be protected against uplift by additional reinforced clamps of mild steel.

5.3.4 BAR WRAPPED STEEL CYLINDER CONCRETE PRESSURE PIPES

General

Bar Wrapped Steel Cylinder Concrete Pressure Pipes (confirming to AWWA C 303 EN639 EN 641 or IS: 15155) are reported to be manufactured in India. Bar Wrapped Steel Cylinder Concrete Pressure Pipes are available in diameters of 250 mm to 1500 mm and higher diameter pipes can be designed for working pressures upto 25 kgs per sq. cm. Standard lengths are generally 5 to 6m. Longer length pipes can also be custom made.

Manufacture

Manufacture of Bar Wrapped Steel Cylinder Concrete Pressure Pipes begins with fabrication of a thin steel pipe cylinder. Thicker steel joint rings are welded at both ends. Each pipe is hydrostatically tested. A cement mortar lining is placed by centrifugal process inside the cylinder. The lining varies from 12mm to 25 mm. After the lining is cured by steam or water, mild steel rod is wrapped on the cylinder using moderate tension in the bar. The wrapping is to be done under controlled tension ensuring intimate contact with the cylinder. The cylinder and bar wrapping are covered with a cement slurry and a dense mortar coating that is rich in cement. The coating is cured by steam or water.

Joints

The standard joint consists of steel joint rings and a continuous solid rubber ring gasket. The field joint can be over lapping/sliding, butt welded or with confined rubber ring as per the clients requirement. In the case of welded & rubber

joints, the exterior joint recess is normally grouted and the internal joint space may or may not be filled with mortar. The AWWA C-303 provides for use of elastomeric sealing ring (rubber joint), and EN 641 provides both elastomeric sealing ring and steel end rings welded together on site. .At present the pipes available in India use steel end rings welded at site.

5.3.5 PLASTIC PIPES

General

Plastic pipes are produced by extrusion process followed by calibration to ensure maintenance of accurate internal diameter with smooth internal bores, These pipes generally come in lengths of 6 meters. A wide range of injection moulded fittings, including tees, elbows, reducers, caps, pipe saddles, inserts and threaded adapters for pipe sizes upto 200mm are available.

PVC Pipes

The chief advantages of PVC pipes are:

- Resistance corrosion
- Light Weight
- Toughness
- Rigidity
- Economical in lying, jointing and maintenance
- Ease of fabrication

The PVC pipes are much lighter than conventional pipe materials. Because of their lightweight PVC pipes are easy to handle, transport, and install. Solvent cementing technique for jointing PVC pipe lengths is cheaper, more efficient and

far simpler. PVC pipes do not become pitted or tuberculated and are unaffected by fungi and bacteria and are resistant to a wide range of chemicals. They are immune to galvanic and electrolytic attack, a problem frequently encountered in metal pipes, especially when buried in corrosive soils or near brackish waters. PVC pipes have elastic properties and their resistance to deformation resulting from earth movements is superior compared to conventional pipe materials especially AC. Thermal conductivity of PVC is very low compared to metals. Consequently water transported in these pipes remains at a more uniform temperature.

Rigid PVC pipes weigh only $1/5^{\text{th}}$ of conventional steel pipes of comparable sizes. PVC pipes are available in sizes of outer dia, 20, 25, 32, 50, 63, 75, 90, 110, 140, 160, 250, 280, and 315mm at working pressures of 2.5, 4, 6, 10 Kg/cm² as per IS 4985 - 1988.

Since deterioration and decomposition of plastics are accelerated by ultraviolet light and frequent changes in temperature which are particularly severe in India, it is not advisable to use PVC pipes above ground. The deterioration starts with discoloration, surface cracking and ultimately ends with brittleness, and the life of the pipe may be reduced to 15-20 years.

Precautions in Handling and Storage

Because of their lightweight, there may be a tendency for the PVC pipes to be thrown much more than their metal counterparts. This should be discouraged and reasonable care should be taken in handling and storage to prevent damage to the pipes. On no account should pipes be dragged along the ground. Pipes should be given adequate support at all times. These pipes should not be stacked in largeness, specially under warm temperature conditions, as the

bottom pipes may be distorted thus giving rise to difficulty in pipe alignment and jointing. For temporary storage in the field, where racks are not provided, care should be taken that the ground is level, and free from loose stones. Pipes stored thus should not exceed three layers and should be so stacked as to prevent movement. It is also recommended not to store one pipe inside another. It is advisable to follow the practices mentioned as per IS 7634 — Part II.

Laying and Jointing Procedure

The trench bed must be free from any rock projections. The trench bottom where it is rocky and uneven a layer of sand or alluvial earth equal to $1/3$ dia of pipe or 100mm whichever is less should be provided under the pipes.

The trench bottom should be carefully examined for the presence of hard objects such as flints, rock, projections or tree roots. In uniform, relatively soft fine grained soils found to be free of such objects and where the trench bottom can readily be brought to an even finish providing a uniform support for the pipes over their lengths, the pipes may normally be laid directly on the trench bottom. In other cases, the trench should be cut correspondingly deeper and the pipes lay on prepared under-bedding, which may be drawn from the excavated material if suitable.

As a rule, trenching should not be carried out too far ahead of pipe laying. The trench should be as narrow as practicable. This may be kept from 0.30m over the outside diameter of pipe and depth may be kept at 0.60 -1.0m depending upon traffic conditions. Pipe lengths are placed end to end along the trench. The glued spigot and socket jointing technique as mentioned later is adopted. The jointed

lengths are then lowered in the trench and when sufficient length has been laid, the trench is filled.

If trucks, lorries, or other heavy traffic will pass across the pipeline, concrete tiles 600 x 600mm of suitable thickness and reinforcement should be laid about 2m above the pipe to distribute the load. If the pipeline crosses a river, the pipe should be buried at least 2m below bed level to protect the pipe.

For bending, the cleaned pipe is filled with sand and compacted by tapping with wooden stick and pipe ends plugged. The pipe section is heated with flame and the portion bent as required. The bend is then cooled with water, the plug removed, the sand poured out and the pipe (bend) cooled again. Heating in hot air over hot oil bath, hot gas or other heating devices are also practiced. Joints may be heat welded, or flamed or with rubber gaskets or made with solvent cement. Threaded joints are also feasible but are not recommended. Jointing of PVC pipes can be made in following ways:

- i) Solvent cement
- ii) Rubber ring joint
- iii) Flanged joint
- iv) Threaded joint

For further details on laying & jointing of PVC pipes, reference can be made to IS 4985 — 2000, IS 7634 — Part 1-3. Socket and spigot joint: is usually preferred for all PVC pipes upto 150 mm in dia. The socket length should at least be one and half times the outer dia for sizes upto 100mm dia and equal to the outer dia for larger sizes.

For pipe installation, solvent: gluing is preferable to welding. The glued spigot socket connection has greater strength than can ever be achieved by welding. The surfaces to be glued are thoroughly scoured with dry cloth and preferably chamfered to 30° . If the pipes have become heavily contaminated by grease or oil, methylene cement is applied with a brush evenly to the outside surface of the spigot on one pipe and to the inside of the socket on the other. The spigot is then inserted immediately in the socket up to the shoulder and thereafter a quarter (90°) turn is given to evenly distribute the cement over the treated surface. The excess cement which is pushed out of the socket must be removed at once with a clean cloth. Jointing must be carried out in minimum possible time, time of making complete joint not being more than one minute. Joints should not be disturbed for at least 5 minutes. Half strength is attained in 30 minutes and full in 24 hours. Gluing should be avoided in rainy or foggy weather, as the color of glue will turn cloudy and milky as a result of water contamination.

Pre-Fabricated Connections

In laying, long lengths of pipe, prefabricated double socketed connections are frequently used to join successive pipe lengths of either the same or one size different. The socket in this case must be formed over a steel mandrel. A short length of pipe is flared at both ends and used as the socket connection. The mandrel used is sized such that the internal dia. of the flared socket matches the outer dia of the spigot to be connected. By proper sizing of the two ends of a connector, 'it is possible to achieve reduction (or expansion of pipe size across the connector.

Standard Threaded Connections

Normally PVC pipes should not be threaded. For the connections of PVC pipes to metal pipes, a piece of a special thick wall PVC connecting tube threaded at one end is used. The other end is connected to the normal PVC pipe by means of a glued spigot and socket joint. Before installation, the condition of the threads should be carefully examined for cracks and impurities.

Glue can be used for making joints leak proof, Yarn and other materials generally used with metal pipe and fittings should not be used. Generally, it is advisable to use PVC as the spigot portion of the joint.

Pressure Testing

The method which is commonly in use is filling the pipe with water, taking care to evacuate any entrapped air and slowly raising the system to appropriate test pressure.

After the specified test time has elapsed, usually one hour, a measured quantity of water is pumped into the line to bring it to the original test pressure, if there has been loss of pressure during the test. The pipe shall be judged to have passed the test satisfactorily if the quantity of water required to restore the test pressure of 30m for 24 hours does not exceed 1.5 litres per 10 mm of nominal bore for a length of 1 Km.

5.3.6 POLYETHYLENE PIPES

Rigid PVC and high-density polyethylene pipes have been used for water distribution systems mostly ranging from 15 -150mm dia and occasionally up to 350mm.

Among the recent developments is the use of High-Density Polyethylene pipes. These pipes are: not brittle and as such a hard at the time of loading and unloading etc. may not do any harm to it. HDPE pipes as per IS 4984 - 1995 can be joined with detachable joints and can be detached at the time of shifting the pipeline from one place to another. Though for all practical purposes HDPE pipes are rigid and tough, at the same time they are resilient and conform to the topography of land when laid over ground or in trenches. They are coilable, easily be bent in installation, eliminating the use of specials like bends, elbows etc., and thereby reducing fitting and installation costs. HDPE pipes are easy to carry and install. They are lighter in weight and can be carried to heights as on hills. They can withstand movement of heavy traffic. This would not cause damage to the pipes because of their flexural strength. HDPE has excellent free flowing properties. They have non-adherent surface which reject (not attract) any foreign materials which would impede the flow. HDPE pipes are anti-corrosive, have smooth inner surface so that there is less friction and pressure loss is comparatively less.

HDPE pipes can be joined by welding, for further details of PVC and HDPE pipes refer to:

- IS 7834 – 1987 Parts 1-8
- IS 8008 - 2003 Part-1-9
- IS 7634 – 2012 Part – 2
- IS 3395 – 1997
- IS 4984 - 1995

5.3.7 GI PIPES

These pipes are widely used for conveying raw water & distribution of treated water, where the requirement of water is less. Mostly medium quality GI pipes are used. These pipes are cheap, light in weight and easy to handle & transport & easy to join. Their sizes available from 15mm to 150mm.

These pipes are manufactured conforming to IS-1239 (pt-I) 1990. Generally screwed & socketed pipes are used.

G.I. Pipes, Fittings & Valves

- Fittings shall be malleable iron galvanized fittings, of approved make. All fittings shall have manufacturer's trade mark stamped on it. Fittings for G.I. pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes. Fittings shall be of I.S.: 1879 - (Part I to X) 2010.
- Pipes and fittings shall be jointed with screwed fittings care shall be taken to remove burr from the end of the pipe after cutting by a round file. Genuine red lead with grommet and a few strands of fine hemp shall be applied. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. G.I. pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other as shown on drawings.

Painting

- All pipes above ground shall be painted with one coat of red lead and two coats of

synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard color code specified by Architect.

- All pipes in chases and below floor shall be painted with two or more coats of anti-corrosive bitumen paint.

5.3.8 GENERAL GUIDELINE FOR LAYING AND JOINTING OF PIPES

Laying and jointing will be as per IS 12288. The pipes will be cleaned in the whole length with special care of the spigot and sockets on the inside/ outside to ensure that they are free from dirt and unwarranted projections. The whole of the pipes shall be placed in position singly and shall be laid true to profile and direction of slope indicated on longitudinal sections. The pipes shall be laid without deflection in a straight alignment between bends and between high and low points. Vertical and horizontal deflections between individual pipes need the approval of the Developer in Charge. In no case the deflection shall be more than 75 % of those recommended by the manufacturer.

Before pipes are jointed they shall be thoroughly cleaned of all earth lumps, stones, or any other objects that may have entered the interior of the pipes, particularly the spigot end and the socket including the groove for the rubber ring. The Developer shall not leave a gap for fittings and shall lay line in a continuous stretch.

Pipes and the related specials shall be laid according to the instructions of the manufacturers and using the tools recommended by them.

Cutting of pipes shall be reduced to a minimum required to conform with the drawings. Cutting has to be made with suitable tools and according to the recommendations of the manufacturer. The spigot end has to be chamfered again at the same angle as the original chamfered end. Cutting shall be perpendicular to the center line of the pipe. In case of ductile iron pipes the cut and chamfered end shall be painted with two coats of epoxy paint. If there is no mark for the insertion depth on the spigot ends of the (cut) pipe it shall be marked again according to the instructions of the manufacturer.

Before pipes are jointed, they shall be thoroughly cleaned of all earth lumps, stones, or any other objects that may have entered the interior of the pipes, particularly the spigot end and the socket including the groove for the rubber ring. End caps are removed only just before laying and jointing

All specials like bends, tees etc. and appurtenances like sluice or butterfly valves etc. shall be laid in synchronization with the pipes. The Developer has to ensure that the specials and accessories are ready in time to be installed together with the pipes.

At the end of each working day and whenever work is interrupted for any period of time, the free ends of laid pipes shall be protected against the entry of dirt or other foreign matter by means of approved plugs or end caps.

When pipe laying is not in progress, the open ends of installed pipe shall be closed by approved means to prevent entrance of trench water and dirt into the line.

No pipe shall be laid in wet trench conditions that preclude proper bedding, or when, in the opinion of the Developer in Charge, the trench conditions or the weather are unsuitable for proper installation.

The pipeline laid should be absolutely straight unless planned otherwise. The accuracy of alignment should be tested before starting refilling with the help of stretching a string between two ends of the straight stretch of pipes to rectify possible small kinks in laying.

5.4 VALVES

To isolate and drain pipe sections for test, installation, cleaning and repairs, a number of appurtenances or auxiliaries are generally installed in the line.

5.4.1 LINE VALVES

Main line valves are provided to stop and regulate the flow of water in the course of ordinary operations and in an emergency. There are many types of valves for use in pipeline, the choice of which depends on the duty. The spacing varies principally with the terrain traversed by the line, in urban areas with connections in the distribution system; main aim is to sectionalize the line in order to maintain reasonable service. In larger lines isolating valves are frequently installed at an intervals of 1 to 5 Km. The principle considerations in location of the valves are accessibility and proximity to special points such as branches, stream crossings etc. The spacing of valves is a function of economics and operating problems. Sections of the pipeline may have to be isolated to repair leaks. The volume of water which would have to be drained to waste would be a function of spacing of isolating valves.

These valves are usually placed at major summits of pressure conduits. Summits identify the sections of the line that can be drained by gravity, and pressures are least at these points permitting cheaper valves and easier operation. Gravity conduits are provided with valves at points strategic for the operation of supply points, at the two ends of sag pipes and wherever it is convenient to drain the given section.

Normally valves are sized slightly smaller than the pipe diameter and installed with a reducer on either side. In choosing the size; the cost of the valve should be weighed against the cost of head loss through it, although in certain circumstances it may be desirable to maintain the full pipe bore (to prevent erosion or blockage).

It is sometimes advisable to install small diameter bypass valves around large diameter inline valves to equalize pressures across the gate and thus facilitate opening.

5.4.2 SLUICE VALVES

Sluice valves or gate valves are the normal type of valves used for isolating or scouring. They seal well under high pressures and when fully open, offer little resistance to fluid flow. There are two types of spindles for raising the gate; a rising spindle which is attached to the gate and does not rotate with the hand wheel, and a non-rising spindle which is rotated in a screwed attachment in the gate. The rising spindle is easy to lubricate.

The gate may be parallel sided, or wedge shaped. The wedge gate seals best but may be damaged by grit. For low pressure, resilient or gunmetal scaling faces may be used for high pressure, stainless steel seals are preferred.

Sluice valves are not intended to be used for continuous throttling, as erosion of the seats and body cavitations may occur. If small flows are required the bypass, valve is more suitable for this duty.

Despite sluice valve's simplicity and positive action, they are sometimes troublesome to operate. They need a big force to unseat them against high unbalanced pressure and large valves take many minutes to turn open. or closed, for which power operated or manual operated actuators are also used. Some of these problems can be overcome by installing a valve with a smaller bore than the pipeline diameter.

In special situations variations of sluice valves suited to the needs are used; needle valves are preferred for fine control of flow, butterfly valves for ease of operation and cone valves for regulating the time of closure and controlling water hammer.

5.4.3 BUTTERFLY VALVES

Butterfly valves are used to regulate and stop the flow especially in large size conduits. They are sometimes cheaper than sluice valves for larger sizes and occupy less space. Butterfly valves with no sliding parts have the advantages of ease of operation, compact size, reduced chamber or valve house, improved closing and retarding characteristics.

These would involve slightly higher head loss than sluice valves and also are not suitable for continuous throttling. The sealing is sometimes not as effective as for sluice valves especially at high pressures. They also offer a fairly high resistance to flow even in fully open state, because the thickness of the disc obstructs the flow even when it is rotated to fully open position.

Butterfly valves as well as sluice valves are not suited for operation in partly open positions as the gates and seatings would erode rapidly. Both types require high torques to open them against high pressure, they often have geared hand wheels or power-driven actuators.

Butterfly Valves with loose sealing ring are sometimes not effective, especially at higher pressures. Butterfly valves with fixed liner can overcome this shortcoming, further the butterfly valves with fixed liner needs no frequent maintenance for replacement of sealing ring as in the case of butterfly valves with loose Sealing ring. The fixed liner design butterfly valves are now available in India suitable for working pressures up to 16 kgs sq cm. Presently there is no IS for the fixed liner Butterfly valves.

5.4.4 NON-RETURN VALVE

Non-return valve shall be as per IS 5312. The valves shall be suitable for mounting on horizontal pipeline. Valves shall be quick closing type with non-slam characteristics. Hydraulic passage and doors shall be designed to avoid cavitations. The pressure drop in the valve at design flow shall be limited to 0.3 mwc.

Valves shall be free from sharp projections, which are likely to get clogged with stringy materials. The internal parts shall be easily accessible for inspection through inspection hole.

Features of Construction

Valves shall be of swing check type. Valves shall be quick closing type with non-slam characteristics. In case of swing type, the non-slam characteristics shall be achieved by providing suitable combination of door and hydraulic passages without any external damping arrangement, or counterweights.

Flow direction shall be clearly embossed on the valve body. Valve flange faces shall be parallel to each other and shall be right angle to valve centreline. Flange back shall be machined, or spot faced for proper seating of bolt head and nut. Flanges shall be drilled as per BS 4504 (16 bar rating).

The internal parts shall be easily accessible for inspection through inspection hole. Valve body shall be designed for 1.5 times the rated pressure.

5.4.5 GLOBE VALVES

Globe valves have a circular seal connected axially to a vertical spindle and hand wheel. The seating is a ring perpendicular to the pipe axis. The flow changes direction through 90° twice thus resulting in high head losses. These valves are normally used in small bore pipe work and as taps, although a variation is used as a control valve.

5.4.6 NEEDLE AND CONE VALVES

Needle valves are more expensive than sluice and butterfly valves but are well suited for throttling flow. They have a gradual throttling action, as they close, whereas sluice valves and butterfly valves offer little flow resistance until practically shut and may suffer cavitation damage. Needle valves may be used with counterbalance 'weights, springs, or actuators to maintain constant pressure conditions either upstream or downstream of the valve or to maintain a constant flow. They are resistant to wear even at high flow velocities. The method of sealing is to push an axial needle or spear shaped cone into a seat. There is often a pilot needle which operates first to balance the heads before opening. The cone valve is a variation of the needle valve but the sealing cone rotates away from the pipe axis instead of being withdraw axially.

The needle and cone valves are not commonly used in water supply but are occasionally used as water hammer release valves when coupled to an electric or hydraulic actuator.

5.4.7 SCOUR VALVES

In pressure conduits, small gate off-take known as blow-off or scour valves are provided at low points above line valves situated in the line on a slope such that each section of the line between valves can be emptied and drained completely. They discharge into natural drainage channel or empty into a sump from which water can be pumped to waste.

The exact location of scour valves is frequently influenced by opportunities to dispose off the water. Where a main cross a stream or drainage structure, there will usually be a low point in the line, but if the main goes under the stream or drain, it cannot be completely drained into the channel. In such a situation it is better to locate a scour connection at the lowest point that will drain by gravity and provide for pumping out: the part below the drain pipeline

There should be no direct connection to sewers or polluted watercourses except through a specially designed trap Chamber or pit. For safety, two blow off valves are placed in series. The outlet into the channel should be above the high-water line. If the outlet must be below high water, a check valve must be placed to prevent back flow.

The size depends on local circumstances especially upon the time in which a given section of line is designed to be emptied and upon the resulting velocity of flow, Calculations are based upon orifice discharge under a filling head, equal to the difference in elevation of the water surface in the conduit and the

blow off less the friction head. Frequency of operation depends upon the quality of the water carried, especially on silt loads.

5.4.8 AIR VALVES

When a pipeline is filled, air could be trapped at peaks along the profile thereby increasing head losses and reducing the capacity of the pipeline. It is also undesirable to have air pockets in the pipe as they may cause water hammer pressure fluctuations during operation of the pipeline. Other problems due to air include corrosion, reduced pump efficiency, malfunctioning of valves or vibrations. Air valves are fitted to release the air automatically when a pipeline is being filled and also to permit air to enter the pipeline when it is being emptied. Additionally, air valves have also to release any entrained air, which might be accumulated at high points in the pipeline during normal operations.

Without air valves, vacuum may occur at peaks and the pipe could collapse or it may not be possible to drain the pipeline completely.

Air valves require care in selection and even more care in siting and it is good practice to plan the pipeline alignment to avoid air troubles altogether. A special study of the possible air problems is necessary at the design stage itself and provision should be made for suitable corrective measures rather than positioning arbitrary air valves at pipeline peaks.

Locations of air valves can be at both sides of gates at: summits, the downstream side of other gates and changes in grade to steeper slopes in sections of line not otherwise, protected by air valves,

The valve usually takes the, form of a rigid buoyant vulcanite or rubber-covered ball seated on a rubber or metal ring. The sealing element i.e., the ball is

slated against an opening at the top of the valve when the pipe is full and seals the opening. When the pressure inside the pipe falls below external pressure, the ball drops thereby permitting air to be drawn into the pipe. The valves are mainly available in two forms, either single-ball or double ball. The single ball type can have either a large orifice or a small orifice, the former being only suitable for emptying and filling of pipelines and latter for discharging small quantities of entrained air. Double air valves are available which can be classified as dual purpose with a large orifice and small orifice in one unit, with a common connection to the main. For large aqueduct pipelines, a triple orifice air valve is available with two large orifices and one small. For high pressures, stainless steel floats are used instead of the vulcanite-covered balls.

Special designs of air valves are also available which operate satisfactorily with high-velocity air discharges. If normal air valves are used under these conditions, there is a danger that the ball might be carried on to its seat by the air stream before the accumulated air has been fully released.

Air valves can be provided, with an integral, stop valve or alternatively and preferably, a standard sluice valve can be bolted to the inlet flange, which must be of adequate size for its duty. Regular maintenance checks on at least an annual basis should be carried out to ensure that the balls are free to move and that the seats do not leak. If an air valve is isolated for any reason in very cold weather, the body should be drained to prevent frost damage; a plug cock can be fitted at the base of the body for this purpose. Trapped chamber drainage is essential to prevent any possibility of stagnant or polluted water or air entering the pipeline.

Automatic air valves in urban streets present a serious contamination risk, since they must have air vents that could, in some circumstances, admit polluted surface water. Constructing an air valve chamber as watertight as possible and fitting a ball valve interceptor as an outlet to a storm water sewer is a practice to obviate this possibility. Using manually operated air valves in the streets, it being the routine duty of a turncock in the area to air the main, to minimize the risk of serious contamination, is yet another practice.

5.5 PUMPS

General

All the pumps shall be suitable for pumping Raw/Treated/ Flushing Water. The pumps shall be suitable for highest suction lift encountered. The pumps shall be suitable for satisfactory operational for the duty conditions, the head range stipulated as per standard and parallel operation at all water level conditions.

Pump Characteristic

Specific speed and discharge power characteristics of pump shall be suitable for starting the pump with closed sluice valve without drawing excess power. The pumps shall have stable characteristics over the entire range of working head.

Pump Construction

The pump shall be single stage double suction type. The casing of the pump used for raw water supply to tertiary treatment plant, shall be of SS. The casing of the pump used for treated water distribution, shall be of CI.

The casing shall be provided with priming funnel and air release vent, Tapping shall be provided for installing suction and delivery pressure gauges.

Each pump should be provided with combination gauge on suction side and suitable pressure gauge on delivery side.

Pump with mechanical seal is preferable. If other pump is used gland leakage shall be laid to the channel provided in the pump house by bleeding pipes which does not gets corrode.

Impellers

Impeller shall be double suction enclosed type, and balanced both statically and dynamically.

Renewable wearing rings shall be provided on both impeller and casing. SS impeller is preferable.

Pump Shaft

The shaft shall be of one-piece construction solid type and will be designed to take all types of loads such as torsion, tensile, bending and dynamic etc. The pump shaft shall be hard chrome plated steel or alloy steel (SS-preferable) as per manufacturer's standard. Sleeves shall be of stainless steel.

Pump Bearings

Pump bearings shall be of the antifriction type. The bearings shall be able to take normal thrust loads due to unbalanced hydraulic loads on the impellers plus the weight of all rotating parts of the pumps. Pump bearings shall be

designed with a minimum life of 40,000 hours. The bearings shall be grease lubricated for life and shall be maintenance free.

Flexible Coupling

The pump shaft shall be coupled to motor shaft through flexible coupling. The coupling shall comprise pin and rubber bushes. Each half shall be statically and dynamically balanced for transmission of the power without vibration and shall be keyed to respective shaft. The coupling halves shall have precise machined surfaces for facilitating alignment. Suitable guard for coupling shall be provided.

Base Plate (Base Frame)

The pump and motor shall be installed on common base plate, to accommodate both pump and motor. Suitable machined sole pieces shall be welded on top of base plate for mounting pump and motor. The base plate shall be constructed from steel channels. The base plate shall be fabricated and supplied by pump manufacturer only. The base plate shall be offered for inspection during factory test of pump. The pumping machinery contractor shall anchor base plate on such foundation with suitable foundation bolt and pipe sleeve with proper leveling and grouting. Required shims / wedges will be provided by the developer.

The leveling of pump motor shall be checked by dial gauge, feeler gauge and straight edge.

Fasteners

All pump fasteners shall be of SS.

Foundation Nuts and Bolts

S.S. foundation nuts and bolts shall be provided.

Protective Coating

The pumps shall be epoxy painted.

Pump Balance

All rotating parts shall be statically and dynamically balanced as per the relevant standards.

Submersible Pump

The materials of construction for submersible pumps shall be as follows:

S. No.	Component	Material
(i)	Impeller	Stainless Steel : ASTM A 743 CF8M
(ii)	Casing	Cast Iron to IS:210 Gr FG 200 with 1.5 to 2% Nickel
(iii)	Mechanical seal (Motor side and Pump side)	oil-lubricated with tungsten carbide or silicon-carbide faces
(iv)	Shaft	Stainless Steel : BS:970 Gr 316
(v)	Bush	Bronze IS 318 Gr. LT B2
(vi)	Guide rail pipe	Stainless Steel : BS:970 Gr 304
(vii)	Lifting Chain	Stainless Steel : AISI 316
(viii)	Fasteners and Foundation Bolts	Stainless Steel AISI 316

- Submersible pumps shall be of the totally submersible centrifugal or mixed flow type. The pumping unit shall be suitable for continuous operation, designed to meet the desired performance and capable of handling the pumped medium without undue wear and tear. The pump MOC shall be suitable for potable water application.
- A built-in cooling system must allow the motor to operate continuously at its rated output regardless of whether the electric motor is submerged or not.
- The motor shall be direct coupled to its pump and rated for continuous full load operation above or under water.
- The insulation rating of the motor shall be Class F. The motor shall have degree of protection IP 68.
- The cable termination shall be watertight and provided with a cable sleeve and strain relief.
- The motor shall have ball type bearings permanently greased and maintenance free.
- The pump and motor shall be separated by two mechanical face seals. The lower seal shall rotate in the water medium and the upper seal shall rotate in an oil bath medium.
- The pump shall have a non-overloading performance characteristic and its efficiency shall be high at the duty point and remain at a reasonably high level over the duty range of the pumping system.
- Rotating assemblies of pumps shall be statically and dynamically balanced and shall be designed so that the first critical speed of the pump and its drive is at least 50% greater than the maximum operating speed.
- The pump wear rings shall be easily replaceable.

Equipment Testing

Each major component of the pumping equipment shall be subjected to shop tests by the pump manufacturer and corresponding test reports / certificates shall be furnished by him along with supply documents of the pump.

Pumps testing

Each assembled pump shall be shop tested by the manufacturer to determine the following characteristics within the operating range as specified.

- Head capacity curve,
- Brake horse power curve,
- Efficiency curve,
- Total power consumed,
- Vibration, (bare pump on no load),
- Balancing (impeller and coupling only).

All the tests shall be conducted in accordance with the relevant I.S. / manufacturer's testing standards.

Each pump performance test shall be documented by obtaining concurrent readings showing motor voltage and amperage, pump suction Head and pump discharge Head. Such readings shall be documented for at least 5 pumping conditions. One test shall be at the shut off Head.

Test Certificates

In addition to the above tests, manufacturer will also conduct and furnish test certificates for the following:

- Hydrostatic test on casing,
- Material test certificates for major components certifying the grades of the materials used.
- Motor
- Base Frame
- Pump - Motor Coupling
- Foundation Bolts
- Pressure Gauges with cocks and tubes

5.5.1 GUIDELINE FOR INSTALLATION OF PUMPS

The procedure of installation depends upon whether the pump is to be mounted horizontal or vertical. Most pumps to be mounted horizontal are supplied by the manufacturers as a wholesome, fully assembled unit. However, pumps to be mounted vertically are supplied as sub-assemblies. For the installation of these pumps the proper sequence of assembly has to be clearly understood from the manufacturer's drawings.

The installation of a pump should proceed through, five stages in the following order:

- Preparing the foundation and locating the foundation bolts,
- Locating the pump on the foundation bolts, however resting on

leveling wedges, which permit not only easy leveling but also space for filling in the grout later on,

- Leveling,
- Grouting,
- Alignment

The foundation should be sufficiently substantial to absorb vibrations and to form a permanent, rigid support for the baseplate.

The capacity of the soil or of the supporting structure should be adequate to withstand the entire load of the foundation and the dynamic load of the machinery.

- constructional loads
- three times the weight of the pump
- two times the total weight of the motor
- weight of water in the column pipe
- half of the weight of the unsupported pipe connected to the pump flanges.

If the pumps are mounted on steel structures, the location of the pump should be nearest as possible to the main members (i.e. beams or walls). The sections of structural should have allowance for corrosion also.

A curb ring or sole plate with machined top should be used as a bearing surface for the support flange of a vertical wet pit pump. The mounting lace should be machined because the curb ring or sole plate is used to align the pump.

Pumps kept in storage for a long time should be thoroughly cleaned before

installation,

5.5.2 OPERATION OF THE PUMPS

Summarized below are a few points to be observed while operating the pumps.

- Dry running of the pumps should be avoided. Centrifugal pumps have to be primed before starting. Helical rotor pumps, although they are self-priming, being of the positive displacement type, need the rubber stator to be wetted before starting.
- Pumps should be operated only within the recommended range on the H-Q characteristics of the pump.
- Operation near to the shut off should be avoided, as in the operation near the shut off; there happens substantial recirculation within the pump, which causes overheating.
- Whether the delivery valve should be open or closed at the time of starting is to be decided by studying the power characteristics of the pump.
- Pumps of low and medium specific speeds draw more power as the flow increases. So, to minimize the load on the motor while starting, such pumps are started with the delivery valve closed. Conversely pumps of high specific speed draw more power at shut off; Such pumps should hence be started with the delivery valve open. While stopping, the position of the delivery valve should be same as at the time of starting.
- The delivery valve should be operated gradually to avoid surges.
- When pumps are to operate in parallel, the pumps should be started and stopped with a time lag between two pumps. The time lag should be adequate to let the pressure gauge stabilize,

- When the pumps are to operate in series, they should be started and stopped sequentially, but with the minimum time lag as possible. Any pump, next in sequence should be started immediately after the delivery valve of the previous pump is even partly opened.

Due care should be taken to keep the air vent of the pump next in sequence, open before starting that pump.

- The stuffing box should let a drip of leakage to ensure that no air is passing into the pump and that the packing is getting adequate water for cooling and lubrication. When the stuffing box is grease sealed, adequate re-fill of the grease should be maintained,
- The running of the duty pumps and of the standbys should be so scheduled that no pump remains idle for long period all pumps are in ready-to-run condition.
- If any undue vibration or noise is noticed, the pump should be stopped immediately and cause for vibration or noise be checked and rectified
- Bypass valves of all reflux valve, sluice valve and butterfly valve shall be kept in closed position during normal operation of the pumps.
- Frequent starting and stopping should be avoided as each start causes overloading of motor, starter, contactor and contacts. Though overloading lasts for a few seconds, it reduces life of the equipment.
- Voltage during operation of pump-motor set should be within +10% of rated voltage. Similarly, current should be below the rated current as per name plate on the motor.

5.5.3 MAINTENANCE OF PUMPS

Periodic inspection and test

The maintenance schedule should enlist items to be attended to at different periods, such as daily, semi- annually, annually, etc.

Daily observations and record

A logbook should be maintained to record the observations, which should cover the following items.

- timings when the pump was run during the previous 24 hours,
- at the time of observation, whether the leakage through the stuffing box is alright,
- bearing temperature/s,
- whether any undue noise or vibration,
- readings of pressure, voltage and current,
- water level in intake/pump
- flowmeter reading,
- motor winding and bearing temperature.
- water quality monitoring

Semiannual inspection

- free movement of the gland of the stuffing box,
- cleaning and oiling of the gland bolts,
- inspection of the packing and repacking, if necessary,
- alignment of the pump and the drive,

- Cleaning of oil lubricated bearings and replenishing fresh oil. If bearings are grease lubricated, the condition of the grease should be checked and replaced/replenished to correct quantity. An antifriction bearing should have its housing so packed with grease that the void spaces in the bearings and the housing be 1/3 to 1/2 filled with greases. A fully packed housing will cause the bearing to overheat and will result in reduced life of the bearing.
- Check vibration level, clean flow indicator, other instruments and appurtenances in the pump house.

Annual inspection

- Cleaning and examination of all bearings for flaws developed, if any,
- Examination of shaft sleeves for wear or scour.
- Checking clearances.
- Impeller hubs and vane tips should be checked for any pitting or erosion,
- End play of the bearing should be checked.
- All instruments and flow meters should be recalibrated.
- Pump should be tested to determine whether proper performance is being obtained. In the case of vertical turbine pump, the inspection can be biannual. Annual inspection is not advisable, because it involves disturbing the alignment and clearance.
- Check stuffing box, glands, lantern ring, mechanical seal and rectify if necessary.

5.5.4 SPACE REQUIREMENT AND LAYOUT PLANNING OF PUMP-ING SYSTEM

- Sufficient space should be available in the pump house to locate the pump, motor, valves, piping's, control panels and cable trays in a rational manner with easy access and with sufficient space around each equipment for the maintenance and repairs.

The minimum space between two adjoining pumps or motors should be 0.6 m for pumps up to 5HP and 1 m for pumps greater than 5HP.

Space for the control panels should be planned as per the Indian Electricity (IE) Rules. As per these:

- A clear space of not less than 915mm in width shall be provided in front of the switch board for easy movement of person in that corridor / area,
- In case of large panels, a draw out space for the circuit breakers may exceed 915mm. In such cases the recommendations of the manufacturers should be followed,
- If the switch board exceeds 760 mm in width, there shall be a passageway from either end of the switch board clear to a height of 1830 mm,
- A service bay should be provided in the station with such space that the largest equipment can be accommodated there for overhauling and repairs,
- A ramp or a loading and unloading bay should be provided. In large installations the floors should be so planned that all pipings and valves can be laid on the lower floor and the upper floor should permit free movement.
- In the case of vertical pumps with hollow shaft motors, the clearance

should be adequate to lift the motor clear off the face of the coupling and also carry the motor to the service bay without interference with any other apparatus. The clearance should also be adequate to dismantle and lift the largest column assembly.

- In the case of horizontal pumps (or vertical pumps with solid shaft motors) the head room should permit transport of the motor above the other apparatus with adequate clearance.
- The mounting level of the lifting tackle should be decided considering the above needs and the need of the head room. for the maintenance and repair of the lifting tackle itself.
- The traverse of the lifting tackle should cover all bays and all apparatus.
- The rated capacity of the lifting tackle should be adequate for the maximum weight to be handled at any time.

5.6 FACILITIES FOR MAINTENANCE AND REPAIRS

Consumables and Lubricants

Adequate stock of such items as gland packing, belts, lubricating oils, greases, insulation tape, sealing compound, emery paste etc. should be maintained.

Replacement Spares

To avoid downtime, a stock of fast-moving spares should be maintained. A set of recommended spares for two years of trouble-free operation should be ordered along with the pump.

Repair Workshop

The repair workshop should be equipped with:

- Tools such as bearing, pullers, clamps, pipe wrenches, etc.
- General-purpose machinery such as welding set, grinder, blower, drilling machine, etc.

6. OPERATION AND MAINTENANCE

6.1 List of Documents

The Developer has to provide but not limited to following documents for inspection as and when required by GIFTCL / GPCB / CPCB / MoEF's representative.

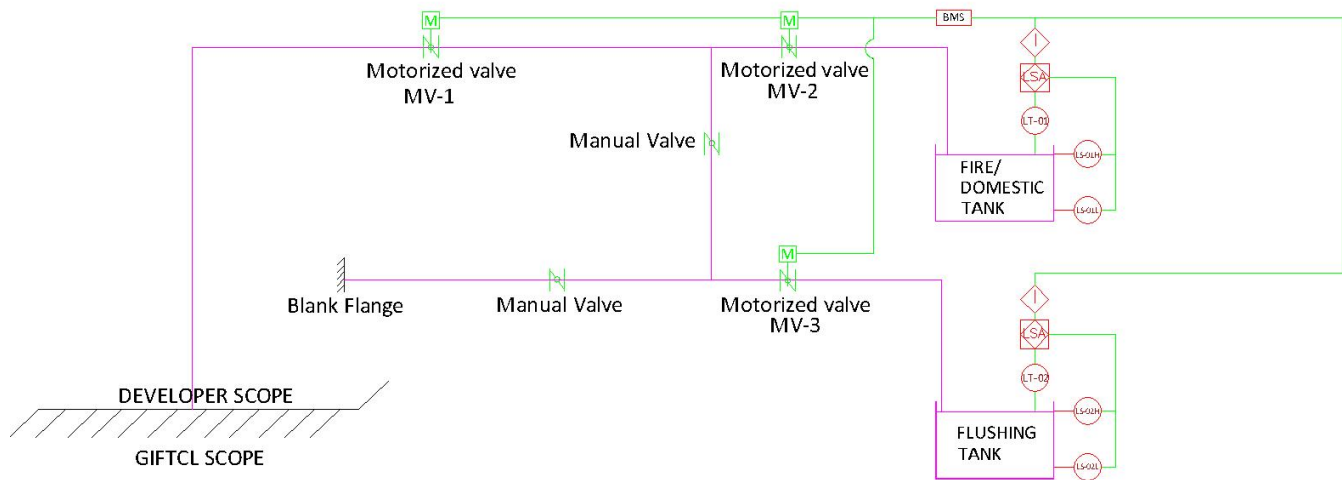
- Availability of Detailed plan / Drawings
- Operation and Maintenance Manual
- Schedule of Daily Operation
- Schedule of Inspection of Machinery
- Records of Quality of Water
- Water Analysis Report Methodology
- Records of Key Activity of O & M
- Staff position / Organogram / Hierarchy
- Inventory of Stores
- Maintenance records of Pump and Pumping Machinery
- Cleaning frequency of sumps and Methodology
- Water Quality Monitoring Report

6.2 O&M Guideline

- Operation and routine maintenance work shall include the day to day operation, inspection, performance logging, maintenance, servicing, periodic testing and calibration of the equipments.
- Any tools, equipment, testing instruments, consumable items and sundry materials required for the operation and routine maintenance work shall be provided by the Developer. Safety and protective equipment such as safety helmet, shoe, eye protectors, ear shields, etc. shall also be included.
- Uniform shall be provided for wearing by workers at all time while on duty and shall bear the Developer's company name. The cost of such provision shall be borne by the Developer.
- Remote Operation- Operation shall be carried out remotely using the designated remote-control software.
- Operation, Routine Maintenance, Preventive Maintenance & Break down maintenance shall be carried out.
- All necessary maintenance and operation staff experienced on both mechanical and electrical work such as engineers, foremen, operators, mechanics, helpers, etc., for effective maintenance and operation of all systems should be engaged.
- Provide sufficient personnel to operate a 24 hours per day, 7 days per week. Sufficient personnel shall remain on duty on the Premises at all times to immediately respond to emergency maintenance and repair work.
- Keep all records, logbooks, log sheets, maintenance job cards, etc., in neat order to the satisfaction of the GIFTCL's Representative. All records, logbooks and log sheets, charts, maintenance job cards, etc., shall become the property of the GIFTCL.

- Operate, control, maintain, replace and repair any part of equipment or material within the systems which may prove defective due to Developer's design, erection, operation, performance, or workmanship, or prove defective from any act or omission that may develop from use in the works or any section thereof. Defective is hereby defined to include, but not limited to operation or control system failures, Performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need of excessive maintenance, abnormal noise or vibration and similar unusual, unexpected and unsatisfactory conditions.
- Provide all spare parts for replacements made necessary due to wear and tear of equipment. Provide all consumable such as: refrigerants, oils, grease, filters, chemicals, etc., and all tools and maintenance equipment required for proper operation and complete maintenance of the Works.
- Provide all routine operational maintenance and full prevention maintenance as recommended by the equipment manufacturers to keep equipment and systems in proper operation condition.
- Allow for maintaining adequate stocks of all manufacturer's recommended spare parts and consumables as necessary to guarantee that all equipment and systems can be immediately repaired and properly maintained in satisfactory operation condition at all times.

ANNEXURE-I VALVE/ TANK ARRANGEMENT



1. Present scenario when there is only single line provided by GIFTCL:

Motorized Valve should automatically open & Close based on tank levels.

- i. If Domestic/Fire Tank level is above the high-level set point (i.e. 90% of the Tank level, then the Developer Motorized Valve (MV-2) should automatically operate and move to close position.
 - ii. If the Domestic/Fire Tank level goes below the low-level set point (i.e. 60% of the Tank level) then the Developer Motorized Valve (MV-2) should automatically operate and move to open position.
 - iii. If the Flushing Tank level is above the high-level set point (i.e. 90% of the Tank level, then the Developer Motorized Valve (MV-3) should automatically operate and move to close position.
 - iv. If the Flushing Tank level goes below the low-level set point (i.e. 60% of the Tank level) then the Developer Motorized Valve (MV-3) should automatically operate and move to open position
 - v. If Both the tank level (Domestic & Flushing) is above the high-level set point i.e. 90% of tank level, then only the Developer Motorized Valve (MV-1) should automatically operate and move to close position.
 - vi. If any of the Domestic/Fire Tank level goes below the low-level set point (i.e. 60% of the Tank level) then the Developer Motorized Valve (MV-1) automatically should operate and move to open position.
2. Later, when GIFTCL will provide individual line for domestic as well as flushing line:
 - i. If Flushing Tank level is above the high-level set point (i.e. 90% of the Tank level) then the Developer valve (MV-3) should automatically operate and move to close position.
 - ii. If Domestic/Fire Tank level is above the high-level set point (i.e. 90% of the Tank level, then the Developer Motorized Valve (MV-2) should automatically operate and move to close position.

- iii. If the Flushing Tank level goes below the low-level set point (i.e. 60% of the Tank level) then the Developer Motorized Valve (MV-3) should automatically operate and move to open position
- iv. If the Domestic/Fire Tank level goes below the low-level set point (i.e. 60% of the Tank level) then the Developer Motorized Valve (MV-2) should automatically operate and move to open position.

ANNEXURE - II GENERAL TERMS AND CONDITIONS

The following terms and conditions will apply and govern the water supply connection for supply of water to Domestic/ Non-Domestic Applicant of GIFTCL (hereinafter referred to as the “Service Provider”).

DEFINITIONS:

- (i) “**Agreement**” means the application form along with general terms and conditions and other incidental documents signed and submitted by the Applicant for the connection of water supply at a specified location within building envelope and duly accepted by the Service Provider.
- (ii) “**Applicant**” or “**Consumer**” means a Legal Entity (*a company, partnership firm, LLP, Housing Society or Trust*) or a proprietary concern or an individual, who has applied for water Connection for commercial / residential / institutional purpose.

- (iii) “**Application**” means request by an Applicant for Connection of water supply in the prescribed format / application form of the Service Provider duly filled and signed by the Applicant.
- (iv) “**Bill**” means bill of demand, issued by the Service Provider, on monthly basis or for such period as determined by the Service Provider, for Minimum Fixed Charges or charges for the actual consumption of water supply and such other incidental charges, taxes, cess, duties and levies payable by the Consumer.
- (v) “**Connection**” means installation of combination of one or more pipelines, related fittings, valves, regulator, meter, etc. in Applicant’s Site in order to be able to supply water to the Applicant.
- (vi) “**Consumer**” means the Applicant to whom the connection for water supply for commercial / residential / institutional purpose has been installed.
- (vii) “**Domestic Connection**” means the connection used for Residential purposes.

“**Non-Domestic connection**” means the connection used for commercial, institutional, hospitals, public uses, horticulture and fire demand.

- (viii) “**Delayed Payment Charges**” means the charges as are payable by the Consumer as per rate given in the Tariff Card, for late payments of the Bill or such other demands raised by the Service Provider.
- (ix) “**Distribution**” means any of several mains, valves, service connections, hydrants or other appurtenances used for controlling and transporting water within building envelope.
- (x) “**Meter**” means the mechanical or electrical device which measures and registers the quantity of water consumption supplied to the Consumer.
- (xi) “**Potable Water**” means water suitable for drinking purpose.

- (xii) “**Reconnection**” means, restart of the supply of water on fresh application submitted by the Applicant, after termination.
- (xiii) “**Security Deposit**” means the amount of security (*interest free*) to be deposited by the Applicant, as per the Tariff Card, at the time of Application for Connection or Reconnection.
- (xiv) “**Service / Services**” means supply of water by the Service Provider upto the Connection at the Applicant’s premises.
- (xv) “**Site**” means the building, building envelope or property or establishment owned or occupied by the Applicant in the GIFT notified area.
- (xvi) “**Tariff Card**” means a schedule, issued by the Service Provider, from time to time, in respect of the Security Deposit, Charges for New Water Connection, Water Charges, Delayed Payment Charges and such other charges to be paid by the Applicant/ Consumer to the Service Provider.

- (xvii) “**Termination**” means as defined in clause 10.1 of this Agreement.

2. SUPPLY OF WATER:

- 2.1 The supply of Water would be made, on the best effort basis by the Service Provider and the Service Provider shall at any time, be entitled to withdraw the supply of Water to the Applicant, without giving any notice.
- 2.2 By submission of this Application duly filled by the Applicant, shall be deemed to have unconditionally agreed to and accepted supply of water on the terms and conditions herein contained, and these terms and conditions shall constitute a binding Agreement between the Service Provider and the Applicant.

3. USE OF WATER:

- 3.1 Usage of the water shall be only for the purpose, as per the type of Connection requested for in the Application form at the Site and shall not permit/allow the water to be used for any other purpose.
- 3.2 Applicant shall have to obtain the specific prior written permission of the Service Provider for change in use and/or for installing any equipment and / or modification / alteration/ transfer of the Connection.
- 3.3 The Applicant shall not, re-supply or re-sale the water to any other Site or permit any other person or party to use the water.

4. CONNECTION OF WATER:

- 4.1 On submission of the Application and payment of the security deposit and charges as per the Tariff Card, the Service Provider or its representative will carry out a technical survey of the Site.
- 4.2 On completion of the technical survey, the Service Provider shall determine the location and manner of laying the pipeline and installation of the regulator, meter, and other equipment(s) for supplying the water as per the prevailing engineering norms and pressure regime in the Service Provider's pipeline network. The installation of such equipments shall be undertaken by the Service Provider or its authorized representative. If at the time of connection or subsequently any damage caused to the property / pipeline/

system of the Service Provider, it shall be repaired by the Applicant at his own cost as per the satisfaction of the Service Provider.

- 4.3 The water supply Connection will be provided subject to necessary approval and permissions being received along with the payments of the applicable charges, received from the Applicant as charges towards the cost of providing the connection as well as payment of connection charges & Security Deposit etc.

5. CHARGES/CONTRIBUTION:

- 5.1 The Connection for water supply shall be valid only after receipt of security deposit and completion of all formalities by the Applicant.
- 5.2 The water supply charges in various segments like Domestic/ Non-Domestic will be determined by the Service Provider. These charges shall be subject to revisions from time to time, without prior notice to the Applicant.
- 5.3 All cess, taxes, duties, assessments and any other levies imposed or to be imposed in future by any State or Central Government or any Statutory Authority in relation to the supply of water shall be passed on and be payable by the Applicant.
- 5.4 For any extension / modification, rectification / alteration of the pipeline / meter / regulator or any part of the Connection, the Applicant shall request the Service Provider by a written request. The request shall be considered by the Service Provider and subject to the technical feasibility and receipts of advance payment for the said charges are undertaken by the Service Provider. The charges for the same may be decided by the Service Provider. In no case, the Applicant shall have the right to modify / alter the Connection

without prior consent of the Service Provider. In the event if it is found that the Connection has been modified / altered / tampered in part or whole, the Service Provider at its sole discretion may discontinue the supply of Water and shall forfeit the Connection charges & Security Deposit. The decision of the Service Provider shall be final and binding upon the Applicant.

6. BILLING AND PAYMENT:

- 6.1 The quantity of Water supplied to the Applicant shall be measured through the meter(s) to be installed by the Service Provider. In the event of fault of the meter(s) to record correct consumption, the quantity of Water consumed by the Applicant shall be determined on the average consumption of last three months or on any other basis as determined by the Service Provider. The decision of the Service Provider as to the quantity of the Water supplied to the Applicant shall be final.
- 6.2 A Bill shall be sent on a monthly basis i.e. once in a month or as determined by the Service Provider at the prevailing water charges in the particular period. (The Bill will include all other taxes, cess, duties and levies) payable for the relevant period by the Applicant. The period and manner of billing can be changed at the discretion of the Service Provider. An amount of the Bill is required to be paid in full by the Applicant within the stipulated time frame as indicated in the Bill.
- 6.3 The Service Provider reserves its right to vary the period / frequency and manner of billing from time to time without prior notice to the Applicant. Every Bill issued by the Service Provider shall be paid in full or before its due date by the Applicant or else Service Provider has the right to stop the water supply without any prior notice to the Applicant.

- 6.4 In case of payment after due date, the Applicant shall have to pay delayed payment charge at rates specified by the Service Provider from time to time, as stated in the Tariff Card.
- 6.5 In case of dishonor of any cheque for any charges payable to the Service Provider, the Applicant shall without prejudice to the other rights of Service Provider hereunder or in law, be liable to pay to Service Provider such charges as decided by the service provider from time to time.
- 6.6 The Applicant shall bound to make payment of Bill in full on or before the due date even in the cases where the Applicant has lodged complaint or raised any dispute with respect to the water supply or otherwise. In case of any dispute or any discrepancy with respect to amount of Bill, the Applicant shall be required to lodge his complaint within 7 (seven) days after the payment is made. Service Provider reserves the right to stop Water supply without any prior notice in case of non-compliance with the above by the Consumer.
- 6.7 If the due date for payment of Bill is falling either on Sunday or holiday then the same shall be considered to be due on the previous working day of the holiday.
- 6.8 The Applicant shall at all times from the date of supply of water till the expiry or Termination of this Agreement will pay the Bill timely & regularly and maintain payment of Security Deposit to the Service Provider. The Service Provider would not pay any interest on the Security Deposit to the Applicant.
- 6.9 The Security Deposit shall be as per Tariff Card.

- 6.10 The Service Provider shall have the right to adjust any unpaid amount from Security Deposit, if the Applicant fails to pay any sum due and payable by the Applicant under this Agreement. The decision of the Service Provider shall be final and binding upon the Applicant.
- 6.11 Subject to no unpaid amount from the Applicant, the Security Deposit will be refunded to the Applicant after/ on Termination of the Agreement, or any such matter without any interest on this amount.
- 6.12 The Applicant shall be liable to pay the Minimum Fixed Charges per month, as prescribe in the Tariff Card, even if the Applicant has not consumed any amount of water or has consumed less than his monthly demand of water, during the period of billing month.

7. OBLIGATION OF THE APPLICANT:

- 7.1 Prior to the commencement of Water supply, the Applicant shall at its own cost obtain all necessary consents, approvals and permissions from all relevant authorities as may be required to obtain the Water Connection. It will be the sole responsibility of the Applicant to obtain all such “No Objection Certificates” (NOCs).
- 7.2 The Applicant has to make necessary provision for internal distribution for supply of water in the building, at its own cost, as per provision of GIFT DCR.
- 7.3 The distribution of the water supply and Operation & Maintenance after connection point within the building shall be the responsibility of the Applicant/ Developer.

- 7.4 The Applicant/ Developer shall provide the tertiary treatment (before distribution of potable water to all the potential customers/ consumers) including water quality monitoring units located in the building at appropriate location, so as to ensure that the drinking water quality is available at each tap.
- 7.5 To ensure this quality of water, the Applicant/Developer shall carry out adequate tests for drinking water quality, with the help of accredited testing laboratory, at different tap points to ensure the prescribed standards and submit the reports duly certified by the accredited laboratory, to GIFTCL. Or GIFTCL's representative may collect the water sample from any location in the developer's premises and developer is obliged to pay for the testing of the collected water sample.
- 7.6 GIFTCL shall have the right to take independent sampling at certain location to check the quality of water within the building.
- 7.7 The Applicant shall permit the Service Provider's authorized representative to access the Site for the purpose of laying pipelines and undertaking installation and also to alter or replace any pipeline, undertaken any inspection, installation of equipment if the Service Provider in its discretion determines the same to be necessary or expedient.
- 7.8 The Service Provider reserves the right to discontinue the Water supply in the event of any dispute between the Applicant and the Service Provider.
- 7.9 The Applicant shall take all adequate precautions and adopt all safety measures to safeguard pipeline, meter and other equipments installed by the Service Provider at the Applicant's premises for supply of Water. In case

the Applicant carries out any unauthorized repair, alteration, modification, directly or indirectly, in the pipeline, meter, equipments installed for the purpose of Water supply, the same shall be deemed to be breach of the contractual terms contained therein and in case of any accident, the Applicant shall be solely responsible for the same. Service Provider shall not take any responsibility on account of the same. Service Provider has the right to stop the Water supply immediately in such cases. In case of any damage or repair to the water meter then meter will be replaced by GIFTCL at Applicant's cost.

8 PROPERTY/OWNERSHIP:

- 8.1 Pipe fittings, meter and other materials used for the purpose of supply of Water up to and including the appliance valve shall be provided by the Service Provider and shall remain the property of the Service Provider and the Applicant shall remain the custodian of such properties. The manner and mode of supply of Water is at the absolute discretion of the Service Provider.
- 8.2 The Applicant shall permit the authorized representative of the Service Provider to enter upon the property/Site for the purpose of meter reading, inspection and maintenance checkups. The Applicant shall verify the identification of such authorized representative prior to permitting such persons access upon the property/Site. The Service Provider shall not be liable/responsible for the entry by any unidentified person or any imposter or person claiming to represent or act on behalf of the Service Provider.

- 8.3 The Applicant shall not tamper or interfere, nor permit any tampering or interference with the pipes, equipment and other installations provided for the purpose of supplying Water, Service Provider shall, without prejudice to its other rights, be entitled to disconnect the Connection without giving any prior notice and shall be entitled to recover suitable compensation for any damages caused by the Applicant.
- 8.4 The Applicant shall not adjust, clean, repair, replace or otherwise handle the Connection or any equipment thereof installed by the Service Provider. Any damage or breakdown in the Connection or its pipes, installations and equipment shall be immediately intimated by the Applicant to the Service Provider.

9. WATER SUPPLY BY THE SERVICE PROVIDER:

- 9.1 The Service Provider will endeavor to provide the Applicant with consistent and regular supply of Water.
- 9.2 GIFTCL will supply water from the Water Treatment Plant (WTP), for further internal distribution, at a specified location within the building envelope, as per Urban Design and Architectural Sheet (UDAS).
- 9.3 Water supply would be metered at the connection point provided in the building envelope.
- 9.4 The Service Provider reserves the right to revise per unit charges for water supply from time to time.
- 9.5 In case of any leakage or fault in Connection or any equipment thereof, the Service Provider, upon intimation by the Applicant, shall rectify the

leakage or fault. However, the Service Provider shall not be liable for any compensation or any damages, whatsoever.

10. TERMINATION:

10.1 Without prejudice to the other rights of the Service Provider in law otherwise, the Service Provider may at any time, immediately and without notice disconnect the Services and terminate the Agreement with the Applicant (“Termination”), if;

- (i) The Applicant fails to pay the Service Provider any sum due to the Service Provider under the terms and conditions and/or otherwise within 30 days from the due date of payment thereof.
- (ii) The Applicant fails to comply with any of its obligations and/or commits any breach of the covenant or conditions on his part to be observed, performed or fulfilled.
- (iii) The particulars as furnished by the Applicant in the Application are found to be false or incorrect.
- (iv) The Water is consumed by the Applicant for any other purpose.
- (v) The Applicant tampers/modifies/alters the Connection without the consent of the Service Provider.

10.2 The Applicant may, by written notice of one month to the Service Provider requests Termination of Water supply.

- (i) In such case, no charges/contributions paid by the Applicant to the Service Provider shall be refunded except the Security Deposit, without any interest, subject to settlement of all pending bills and dues by the Applicant.

10.3 In the event of Termination of the Water supply, without prejudice to the other rights of the Service Provider:

- (i) The Service Provider may remove all pipelines, installations and equipment installed by the Service Provider for the supply of Water.
- (ii) The Applicant shall be liable to pay the Service Provider all amounts due till that date of termination of this Agreement.

11. RECONNECTION:

11.1 If after Termination the Applicant applies for the restart of the supply of Water (“Reconnection”), all charges like Connection / commissioning (as determined by the Service Provider) shall be borne and paid by the Applicant and Applicant has to complete all formalities related to new Connection.

11.2 Reconnection of Water supply will be at the sole discretion of the Service Provider and the Service Provider may refuse the same, without assigning any reasons whatsoever.

12. TRANSFER OF THE CONNECTION:

12.1 The Service Provider permits transfer of the Water Connection from one name to another name in the event of transfer or assignment of the leasehold rights of the building. The transfer will be permitted subject to the payment of such charges as may be decided by the Service Provider, from time to time. The transfer of Water Connection from one name to another name is subject to submission of fresh application and necessary documents, as may

be required by the Service Provider and will be affected only upon full satisfaction by the Service Provider.

13. LIABILITY / INDEMNITY:

- 13.1 The Applicant shall not use the water for any illegal or unlawful purpose. In case of any offense under or violation of any law, statute or regulation by the Applicant, the Applicant alone shall be responsible and liable for the said offense or violation and the Applicant agrees to indemnify and keep indemnified the Service Provider from and against any loss, claim, action or proceeding that may be suffered or incurred by the Service Provider as a result of any such offense or violation by the Applicant.
- 13.2 The Applicant shall be liable for any loss or damage caused to pipes equipment or installations whether caused on account of negligence by the Applicant or its associates or agents or due to theft, sabotage or otherwise however.
- 13.3 The Applicant shall be deemed to be in exclusive possession and control of the water once it passes the meter outlet, and thereupon the Applicant shall be liable for any leakage, maintenance or for any damage caused to any person or property as a result thereof. Accordingly, the Applicant shall protect, indemnify and hold the Service Provider harmless against all claims, demands, actions, suits, proceedings, judgments and all liabilities, costs, expenses, damages or losses arising out of resulting from or incidental or in connection with the supply and usage of Water.
- 13.4 The indemnity provisions will be enforceable notwithstanding termination of Water supply.

13.5 The Service Provider will put in his best endeavor to cause minimum damage to garden, lawn, plants, decorations, tiles and any other decorative surface within the premises of the Applicant both on the ground and on the walls. Accordingly, the Applicant shall protect, indemnify, and hold the Service Provider harmless against all claims, demands, action, suits, proceedings, judgments and all liabilities costs, expenses, damages or losses arising out of resulting from or incidental to or connection with the supply of Water to the Applicant.

14. FORCE MAJURE

The Service Provider shall not be liable for any loss / damage, costs, charges or expenses whatsoever that may be caused to or occasioned by the Applicant or another person on account of failure to perform or for the delay in performing any provisions of this Agreement if the same is caused or results due to acts of God, War, Revolt, Fire, Tempest, Flood, Earthquake, Lighting, direct or indirect consequences of God (declared/undeclared) Sabotage, Hostilities, National emergencies, civil disturbances, commotion, embargo or any other law promulgation, regulation or ordinance whether Central or State or Municipal, breakage bursting or freezing of pipeline or occurrence of any event beyond the control of the Service Provider provided further that the Service Provider shall not be responsible and/or liable for any losses direct or consequential caused to the Applicant if the same is caused due to the reasons stated hereinabove.

15. AMENDMENT:

The Service Provider may at any time amend, add to or delete any or all these terms and conditions with immediate effect and in such case, the

amended terms and conditions shall be informed to the Applicant and shall be binding on the Applicant.

16. TERMS BINDING ON SUCCESSORS:

These terms and conditions shall be binding on the heirs, administrator, successor and assigns of the Applicant.

17. NOTICE:

Any notice to the Applicant will be sent to the address of the Applicant stated in its Application.

18. ARBITRATION:

All disputes arising out of this Agreement shall be referred to the sole arbitrator appointed by the MD/CEO of the Service Provider and the provisions of The Arbitration and Conciliation Act 1996 shall be applicable. The award of the Sole Arbitrator shall be final and binding on both the Service Provider and the Applicant. The seat of arbitration shall be at Gandhinagar. However, in case of any application or appeal to be preferred. The courts at Gandhinagar would only have the exclusive jurisdiction.

DECLARATION:

I confirm that I am authorized to make this Agreement with GIFTCL for supply of Water. I do hereby declare that I have read and understood the above terms and

conditions including the charges as applicable from time to time. I hereby accept the above stated terms and conditions in its entirety, irrevocably and unconditionally and accordingly put and subscribe my hand to these terms and conditions.

Name of the Applicant/Developer

Sign and seal of the Representative
of Applicant/Developer

Place:

Date:

Tariff Structure

A. Permanent Water Supply Connection Charges: Domestic /Non-Domestic Scheme.

1. Charges

I. New connection charges:

This one-time charge is in the form of connection charges which is fixed and non-refundable.

2. Cost Recovery

I. Recovery of connection charges includes cost of followings:

- 1) Electromagnetic Flowmeter
- 2) Motorized Butterfly valve
- 3) Pipeline (10m length)

- 4) Maintenance Charges
- 5) Meter Calibration Charges
- 6) GIFTCL management Charges

II. Cost recovered through DR charges includes followings:

- 1) Raw water intake and pumping arrangement
- 2) Transmission main pipeline and appurtenances
- 3) Treatment Plant
- 4) Distribution network up to motorized valve inside the tunnel.

III. Security Deposit (interest free)

Sr. No.	Consumer Category	Water (INR)
1	Domestic	3 months X Consumption Charges as applicable for full Water Demand
2	Non - Domestic	4 months X Consumption Charges as applicable for full Water Demand

IV. Consumption Tariff

Charges for FY 2023-24 i.e. from 1st April 2023 to 31st March 2024.

Sr. No.	Consumer Category	Water Charges* (INR/ KL)
1	Domestic	22
2	Non - Domestic	44

* Water charges will increase @ 10% every year starting from FY 2023-24 i.e. from 1st April 2023.

Charges for FY 2024-25 i.e. from 1st April 2024 to 31st March 2025.

Sr. No.	Consumer Category	Water Charges* (INR/ KL)
1	Domestic	24.20
2	Non - Domestic	48.40

* Water charges will increase @ 10% every year starting from FY 2023-24 i.e. from 1st April 2023.

V. Delay Payment Charges

Sr. No.	Consumer Category	Penalty
1	Domestic	18% interest per annum of the bill amount payment after due date
2	Non – Domestic	

B. Construction Water Supply Connection Charges: Domestic /Non-Domestic Scheme.

The Construction water requirement will be treated as per non-domestic charges/tariff.

1. Charges

I. New connection charges:

This one-time charge is in the form of connection charges which is fixed, non-refundable

2. Cost Recovery

I. Recovery of connection charges includes cost of followings:

- 1) valve
- 2) meter
- 3) strainer
- 4) chamber

5) Pipe

II. Cost recovered through DR charges includes followings:

- 1) Raw water pumping arrangement.
- 2) Distribution network up to sluice/ butterfly valve near developer premises.

VI. Security Deposit (interest free)

Sr. No.	Consumer Category	Water (INR)
1	Non - Domestic	4 months X Consumption Charges as applicable for full Water Demand

VII. Consumption Tariff

Charges for FY 2023-24 i.e. from 1st April 2023 to 31st March 2024.

Sr. No.	Consumer Category	Water Charges* (INR/ KL)
1	Non - Domestic	44

* Water charges will increase @ 10% every year starting from FY 2023-24 i.e. from 1st April 2023.

Charges for FY 2024-25 i.e. from 1st April 2024 to 31st March 2025.

Sr. No.	Consumer Category	Water Charges* (INR/ KL)
1	Non - Domestic	48.40

* Water charges will increase @ 10% every year starting from FY 2023-24 i.e. from 1st April 2023.

VIII. Delay Payment Charges

Sr. No.	Consumer Category	Penalty
1	Non – Domestic	18% interest per annum of the bill amount payment after due date

A. Permanent for Flushing Water^

IX. Minimum New Connection Charges (one-time charges)

X. Security Deposit (interest free)

XI. Consumption Tariff

XII. Delay Payment Charges

^The charges/ tariff for clause C.IX, C.X, C.XI & C.XII will be conveyed at later stages, whenever, the flushing water will be available for supply.

Note for Tariff Structure

- All the above rates/ charges/ tariff mentioned are exclusive of all taxes
- The billing will commence from the date of connection.
- The above tariff structure is subject to change from time to time by the Service Provider, without prior intimation to the developer.
- Penalty/ Cost recovery as per GIFT norms from developers for violation/ misuse of system.

ANNEXURE – III APPLICATION FORM FOR CONNECTION



Application Form

Gujarat International Finance Tec-City Company Limited

Applied for Utility:		<input type="checkbox"/> District Cooling System ડિસ્ટ્રિક્ટ કુલિંગ સિસ્ટમ	<input type="checkbox"/> Water પાણી	<input type="checkbox"/> Sewage સુએજ	<input type="checkbox"/> Solid Waste (AWCS) એડવેન્સ સી એસ
APPLICATION FOR:		<input type="checkbox"/> Permanent Connection કાયમી જોડાણ	<input type="checkbox"/> Temporary Connection સંચાલી જોડાણ	<input type="checkbox"/> Name Change નામ બદલી	<input type="checkbox"/> Demand Extension માંગનો વધારો
		<input type="checkbox"/> Demand Reduction માંગનો ઘટાડો	<input type="checkbox"/> Removal of Services સેવા બંદ કરવી		
Type of Premises / જગ્યાનો વર્ગ (પ્રકાર) :		For Office Use / ઓફિસ કામ માટે :		તાજેતરનો પાસપોર્ટ સાઈઝ ફોટો Latest Passport size Photo Sign Here / સહી	
<input type="checkbox"/> Domestic ઘરેલું		<input type="checkbox"/> Non-Domestic બિન ઘરેલું			
<input type="checkbox"/> Others – Please Specify અન્ય – વિગત સ્પષ્ટ જણાવો		Date તારીખ			
For Temporary Supply / સંચાલી જોડાણ હોય તો : Date of connection _____ to _____ સંચાલી તારીખ થી સુધી		Application No. અરજી નંબર			
In Case of Name change: Name of existing consumer નામ બદલી પડે : હાલના ગ્રાહકનું નામ		Consumer No. ગ્રાહક નંબર			
		SAP No. એસ એ પી નંબર			
		Applicable Tariff લાગુ પાત્ર			
<input type="checkbox"/> E-Bill confirmation / ઈ-બિલ પુષ્ટિ					

Details of Applicant supported by necessary evidences are furnished hereunder / અરજદારની વિગતો જરૂરી દસ્તાવેજ પુરાવા સહિત આ સાથે સામેલ છે:

Full Name of Applicant
અરજદારનું નામ

Applicant Type / અરજદારનો પ્રકાર						
<input type="checkbox"/> Public Ltd. પબ્લિક લી.	<input type="checkbox"/> Pvt. Ltd. પ્રાઇવેટ લી.	<input type="checkbox"/> Partnership ભાગીદારી	<input type="checkbox"/> Proprietary પ્રાઇવેટ	<input type="checkbox"/> Govt. Dept. સરકારી વિભાગ	<input type="checkbox"/> Reg. Trust રજીસ્ટર્ડ ટ્રસ્ટ	<input type="checkbox"/> Co-operative Society કો.ઓ. સોસાયટી
PAN No. :		GST No. :				
Occupancy Type: કબજાનો પ્રકાર		<input type="checkbox"/> Owner માલિક	<input type="checkbox"/> Joint Owner સહ માલિક	<input type="checkbox"/> Tenant ભાડુઆત	<input type="checkbox"/> Lease લીઝ	<input type="checkbox"/> Others અન્ય
Connection Address details / સંચાલીની જગ્યા અને વિગતો :						
Unit / Flat No.: એકમ / ફ્લેટ નં. :	Floor No.: ફ્લોર નં. :	Building Name: બિલ્ડિંગ નું નામ :				
Block No.: બ્લોક નં. :	Road No.: રોડ નં. :	Zone: ઝોન :	<input type="checkbox"/> DTA ડીટીએ	<input type="checkbox"/> SEZ એસઝીઝ	GIFT City, Gandhinagar - 382355 ગિફ્ટ સિટી, ગાંધીનગર - ૩૮૨૩૫૫	
E-mail: ઈ-મેલ :						
Mobile No.: મોબાઇલ નં. :			Landline Tel. No.: લેન્ડલાઇન ટે. નં. :			
Name and Designation of Authorized Person: અધિકૃત અધિકારીનું નામ અને પદ :						
Total Build up Area / કુલ વિસ્તાર બનાવો : _____ sq m / ચો.મી.			Total number of Occupants / કબજેદારનારની કુલ સંખ્યા :			
DCS Demand details / ડિસ્ટ્રિક્ટ કુલિંગ સિસ્ટમ માંગની વિગતો :						
Contract Demand / કરાર માંગ : _____ TR / ટી આર			Ultimate Demand / અંતિમ માંગ : _____ TR / ટી આર			
Water / Sewage / AWCS Demand details / પાણી / સુએજ / એડવેન્સ સી એસ માંગની વિગતો :						
Total Water Demand / કુલ પાણીની માંગ : _____ Liters/day / લિટર દિવસ દિવર						
Flushing / ફ્લશિંગ : _____ Liters/day		Domestic / સ્થાનિક : _____ Liters/day		Gardening / બાગીચા : _____ Liters/day		

Gujarat International Finance Tec-City Company Limited

EPS - Building no. 49A, Block 49, Zone 04, Gyan Marg, GIFT City, Gandhinagar – 382355

A) List of latest documents to be attached with new application

i) Identity Proof (self-attested) (anyone)

- ☐ Electoral Identity Card
 ☐ Passport
 ☐ Ration Card
☐ Driving License
 ☐ PAN Card
 ☐ Aadhar Card

ii) Proof of ownership or occupancy for which utility connection is required (anyone)

- ☐ Copy of registered sale deed or lease deed
☐ Letter of Allotment
☐ Ownership Certificate issued by GIFTUDA
☐ NOC from Developer (For Temporary connection only)
☐ Copy of Index (For Name Change)

iii) If the applicant is a company, trust, educational institute, government department etc. The application form shall be signed by a competent authority (e.g., Branch Manager, Principal, Executive Engineer, etc.) along with a relevant resolution authority letter of the institution concerned.

iv) In case of Public and/or Private Limited Company – The applicant shall furnish the Memorandum and Articles of Association and Certificate of Incorporation along with an authorization in the name of the applicant for signing the requisition form and agreement.

v) In case of a partnership firm – The applicant shall furnish the partnership deed and an authorization in the name of applicant for signing the requisition form and agreement.

vi) Clearly marked area of utilization on approved plan of GIFTUDA, jointly signed by building developer's authorized representative and Leaseholder's authorized representative.

vii) List of Directors with address & contact details on company's letter head (exempted for Government Institutions, PSU Banks).

viii) Copy of PAN and GST details of the applicant.

ix) Duly filled and signed installation test certificate is to be submitted before the release of connection. The installation test certificate is to be signed and sealed by the developer.

x) Buildup area certificate from GIFT UDA.

B) List of latest documents to be attached with application for Name Change

i) Submit the document mentioned at A i) & ii)

ii) No Objection Certificate from the registered consumer or authorized person of the premises shall be required for cases involving transfer of security deposit in the name of applicant.

iii) No Objection Certificate by Co-Owner, in case of joint Ownership.

iv) Copy of latest bill duly paid.

v) In case the existing consumer is deceased, death certificate is required.

vi) In case of change of name to legal heir, any of the following document shall be considered as acceptable proof of legal heir:

- ☐ Registered Will/deed
 ☐ Succession or legal heir certificate.
☐ Mutation in municipal/land records

vii) NOC from other legal heir(s) in case the connection is to be changed in the name of one of the legal heirs.

viii) If the applicant is company, submit the documents mentioned at A iii), iv), v), vi) & viii).

C) In case of application for contract demand alteration/conversion of service/change of consumer category, submit work completion certificate and installation test certificate from developer (A ix)).

D) Any Utility dues outstanding in GIFT City area of operation in consumer's name: Yes / No.

If 'Yes', provide Consumer No. _____

વિકટ સિટી ક્ષેત્રમાં અરજદારના નામે અન્ય સ્થળે કોઈપણ બીજા ચુકવવાનું બાકી છે : હા / ના જો 'હા' હોય તો ગ્રાહક નંબર આપો : _____

E) Any Utility dues outstanding for the premises for which connection applied for: Yes/No.

If 'Yes', provide Consumer No. _____

જે પરિસરમાં કનેક્શન માટે અરજ કરી છે તે પરિસર માટે કોઈપણ બિલ ચુકવવાનું બાકી છે : હા / ના . જો 'હા' હોય તો ગ્રાહક નંબર આપો : _____

F) Declaration / જાહેરનામું

I / We hereby declare that.

a) The information provided in this application is true to my knowledge.

b) I/We desire and agree with the utility supplier to avail connection for the above-mentioned purpose and of the demand provided in this application form for the period not less than 2 yrs. From the first day of the month next to date of commencement of connection by the supplier.

c) I/We have read the Supply Code issued by GIFT and agree to abide by the conditions mentioned therein.

d) I/We will deposit utility dues regularly as per the applicable tariff and any other charges.

e) I/We will own the responsibility of security and safety of the meter, its accessories, and the Installation thereafter.

હું / અમે આથી જાહેર કરીએ છીએ કે

એ) આ અરજમાં આપેલી માહિતી મારી જાણકારી મુજબ સાચી છે.

બી) હું/અમે વિકટ સિટી સાથે ઉચ્ચ અને સંપત્તિ ધરાવીએ છીએ કે ઉપરોક્ત નિર્દેશ વેલ્યુ માટે જ જોડાણ શરૂ કરવામાં આવે એ તારીખ પછીના મહિનાના પ્રથમ દિવસથી બે વર્ષથી ઓછા નહીં એવા સમયગાળા માટે આ અરજ ફોર્મમાં દર્શાવેલ માંગ પ્રમાણે હોય.

સી) હું / અમે વિકટ સિટીનો સપ્લાઈ કોડ વાંચેલ છે અને તેમાં ઉલ્લેખિત શરતો સાથે બાંધ્ય થવા સંમત છું/છીએ.

ડી) હું / અમે બિલના બાકી નાણાં નિયમિત રીતે લાગુ દર અને અન્ય ચાર્જિસ પ્રમાણે જમા કરાવીશું / કરાવીશું.

ઈ) હું / અમે મીટર, મોના એસેસરીઝ અને ઈન્સ્ટોલેશન પછીની સુરક્ષા અને તકેદારીની જવાબદારી લઈશું / લઈશું.

(Signature of the consumer or Authorized Signatory with Company Seal)

(ગ્રાહક અથવા અધિકૃત અધિકારીની સહી અને સીલકો)

Witness Name / સાક્ષીનું નામ

(Building Developer Authorized Person / બિલ્ડિંગના વિકાસકર્તા અધિકૃત અધિકારી)

Witness Signature / સાક્ષીની સહી

(Building Developer Authorized Person / બિલ્ડિંગના વિકાસકર્તા અધિકૃત અધિકારી)

*In case of thumb impression, name & signature of witness is necessary. In case the applicant is a Firm / Partnership / Ltd. Company, Power of attorney holder's signature must be supported by official seal.

Documents required at the time of submission of application**For New Connection:**

- 1) Building approval plan approved by GIFT UDA.
- 2) No Objection Certificate from GIFTCL
- 3) Certificate of Incorporation, Memorandum of Association of the applicant company or registration/ certificate of Partnership firm
- 4) List of Directors/ Partners with their contact details on the letter head of the Company/ Firm duly signed & certified by the Authorized Person.
- 5) Board Resolution/ Power of Attorney in favor of the Authorized Signatory

For Reconnection:

- 1) No Objection Certificate from GIFTCL
- 2) Copy of Last Paid Water Bill

For Transfer of Name:

- 1) No Objection Certificate from GIFTCL
- 2) Certificate of Incorporation, Memorandum of Association of the applicant company or registration/ certificate of Partnership firm;
- 3) List of Directors/ Partners with their contact details on the letter head of the Company/ Firm duly signed & certified by the Authorized Person.
- 4) Board Resolution/ Power of Attorney in favor of the Authorized Signatory
- 5) Payment proof of last Water Bill

ANNEXURE-IV

INSTRUMENT'S/ METER'S/ ANALYSER'S SPECIFICATION

Contents

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1. RADAR/ULTRASONIC LEVEL TRANSMITTER

RADAR/ ULTRASONIC Transmitter for Level Measurement	
Type	RADAR/ ULTRASONIC, Fully User Programmable
Type of Tx. (controller):	Remote Tx. Version
Mode of Operation	Level
Accuracy	+ 0.2% of measuring range
Repeatability	+ 0.25% of range
Outputs	4-20 mA DC HART analog output proportional to level
Programming Device	In-Built in controller or Hand-held
Local Digital Display :	Level in Engg. Units
Power	2-Wire (24V DC) / 4-Wire (230V AC, 50Hz)
Control Unit Protection:	IP-65 as a minimum
Proc. Temp. Compensation:	Required, Built-in temp. sensor in transducer
Meas. Range :	As per process
Transducer Protection :	IP-67/68
Blanking Dist. :	0-3-0.4m max.
Transducer Cable Length:	Min. 5m
Process Connection :	2" or 3" Flanged as per mfr. Std. Matching flange with required pipe / support structure shall also be provided

2. MAGNETIC FLOAT TYPE LEVEL SWITCH

	<u>GENERAL</u>	
1	Service:	Water
2	Weather protection class	IP 65 & above
3	Operating Temperature	Ambient, 50 °C Max.
4	Operating Pressure	As per process
5	Installation	Indoor / Outdoor
6	<u>FEATURES:</u>	-
7	Type	Magnetic float with guide tube
8	Accuracy	± 2 mm
9	Mounting	Direct
10	Switch Diff	Fixed Adjustable
11	Switch type	glass encapsulated hermetically sealed reed switch
12	No. of floats with stopper	single / multiple
13	Enclosure material:	Di Cast Al Epoxy coated aluminium Polyurethane Covered Aluminium
14	Float	316 SS PP Others
15	Guide tube	316 SS PP

16	Bolts & nuts	ASTM A 193 Gr.B7 / A194 Gr.2H
17	Gaskets	PTFE / OTHERS
18	Wetted parts	SS 316 /PP
19	Flange: SS 316 PP	SS 316/ PP
20	Instrument Process connection	flanged 3"or 4" ANSI class 150 RF Float size shall be suitable to process conditions and tank height. Accordingly, instrument flange size shall be selected
21	Cable entry	½ " NPT
22	<u>SWITCH DETAILS:</u>	-
23	Controller	Required for converting reed switch to POT Free Relay Output
24	No. and type of contacts	1 No SPDT, 1 No DPDT
25	Contact rating	5A@ 230 V AC 2A@24VDC
26	<u>ACCESSORIES:</u>	-
27	Still well for direct mounting	Required
28	Name plate	Removable – SS
29	Metal tag	SS

3. ON-LINE pH MEASUREMENT SYSTEM:

SPECIFICATIONS FOR pH ANALYZER		
A.	GENERAL	
1	Service	Water Application
2	Function	To measure & indicate the pH / Transmit
3	Operating Temperature	Ambient, 50 °C Max.
4	Operating Pressure	Atm. Max. 1 bar
5	Installation	Indoor / Outdoor
B.	Electrodes & Electrode Holder for Ph	
1	Type of Sensor	Differential Electrode Technique (Three Electrode), Digital type sensor
2	Measurement (Calibration) Range	0-14 pH
3	Temperature Compensation	Required, Automatic, In-built
4	Pre-amplifier	Integral or Remote as per mfr. Std.
5	Measuring Elements:	
a	Measuring Electrode Material	Glass
b	Reference System Type	Double Junction

	Electrolyte Material	Ag/AgCl with saturated KCL (Gelled Electrolyte)
	Ref. Junction / Diaphragm	Porous PTFE / Kynar / Equi. as per mfr. Std.
c	Soln. Ground Electrode	Required
	Material	Platinum / Titanium / Equi. as per Mfr. Std.
d	Sensor (Shaft) Body MOC	Ryton (PPS) / PP as per mfr. Std.
	Sensor (Shaft) Body Type	Refillable or Completely Sealed, Non- Refillable Type as per Mfr. Std.
6	Sensitivity	± 0.01 pH
7	Protection Class	IP-68
8	Cable Length Integral / after connector	Min. 10 Mtrs. or higher as per site condition
9	Process Connection (Mounting) Type	Suitable for pipe or immersion (open tank / sump) type mounting with mounting as under for both these applications
	For measurement on Pipe	Measurement of pH on pipeline shall be with flow through (Tee) assembly in SS304. Shall be with isolation valve & required piping up to disposal/drain
	For measurement on Open Tank / Sump	Measurement of pH at Open Tank / Sump shall be through suitable immersion mounting assembly.
10	Calibration Certificate	Required
11	Buffer Solution / Powder for Sensor Calibration	Buffer Solution / Powder of near about pH 4, pH 7 and pH 9 with NIST / DIN Std. traceability or equi. standards shall be provided in required quantity for periodic calibration of Sensor.
C.	TRANSMITTER	
1	Function	Transmit and Indicate
2	No. of Inputs	Single / Dual / Multiple (up to 8 channel)
3	Transmitter Type	Microprocessor based, User Programmable, 2-Wire or 4-Wire type as per mfr. Std.
4	Location	Field Mounting
5	pH Measurement:	
a	pH Measurement Range	0-14 pH, programmable
b	Accuracy	$\pm 0.25\%$ of Measuring Range or better
c	Resolution	0.01pH
d	Repeatability	$\pm 0.2\%$ of Measuring Range or better
6	Temp. Compensation	Automatic
7	Output Signal	4 -20 mA analog/ through suitable communication port – Profibus or Ethernet or Modbus with required connectivity with PLC
	Relay	Min. 2 potential free changeover contacts

8	Instrument Power Supply	100 to 240 VAC \pm 10%, 50 Hz \pm 5% or 24V DC as per mfr. Std.
9	Cable / Conduit Entry	1/2" NPT or M20 or equi. As per mfr. Std.
10	Local Indicator / Display	LCD / LED Display
11	Protection:	
a	Elec. Area Classification	Safe
b	Enclosure Type & Prot. Class	Weather Proof to IP-65 as a minimum
	MOC	Cast Alu. / Polycarbonate or equi. as per mfr. Std. suitable for withstanding harsh environment
12	Mounting	Wall mounting / Pipe mounting
13	Operating Temperature	0 to 55 °C
D.	Options / Accessories:	
1	Mounting Accessories	Required, Universal 2" Pipe and / or Wall Mounting Kit
2	Tag Plate	Required, SS 304
3	Cable Glands	Required, IP-65/66 as a min., Ni-Plated Brass / Polyamide
4	Plugs for addl. cable entries	Close up Plugs shall be provided for all unused cable entries, Ni-Plated Brass / Polyamide
5	Canopy for Analyzer / Transmitter To prevent from direct sun and rain	Required. MOC: FRP - min. 4mm thick / G.I. - min. 2mm thick

4. Online TSS METER

SPECIFICATIONS FOR TSS ANALYZER		
A.	GENERAL	
1	Service	Water Application
2	Function	To measure & indicate the Total Suspended Solid/ Transmit
3	Operating Temperature	Ambient, 50 °C Max.
4	Operating Pressure	Atm. Max. 1 bar
5	Installation	Indoor / Outdoor
B.	Electrodes & Electrode Holder	
1	Measuring Principle	Optical (Backscatter or infrared absorbance)
2	Measuring Range	0-1000 mg/l

3	Sensor Cable	Integral Cable or with watertight (IP-68) connector assembly with necessary cable
4	Measuring Elements:	
a	Measuring Electrode Probe / Shaft MOC	SS 304 / PVC equi. suitable as per mfr. Std.
	Optical Window	Scratch proof / resistant Glass or Sapphire or equiv. as per mfr. Std.
5	Protection Class	IP-68
6	Cable Length Integral / after connector	Min. 10m or higher as per site conditions.
7	Process Connection (Mounting) Type	Flow through assembly / sensor mounting assembly Sampling pump and pipe of required size and length upto instrument / sensor and sample drain pipe back up to sump. Assembly shall be in Black color only.
8	Mounting Accessories	Required
9	Calibration Certificate	Required
10	Sensor Calibration Kit	Required for on-site during O&M period for periodic calibration of Sensor as per manufacturer's recommendation.
c.	TRANSMITTER	
1	Function	Transmit and Indicate
2	No. of Inputs	Single / Dual / Multiple (upto 8)
3	Transmitter Type	Microprocessor based, User Programmable, 2-Wire or 4-Wire type as per mfr. Std.
4	Location	Field Mounting
5	TSS Measurement:	
a	TSS Measurement Range	As specified above for sensor
b	Accuracy	$\pm 2\%$ of measured value
c	Repeatability	$\pm 1\%$ of measured value
6	TSS Calibration	Semi-Automatic, 1 or 2-point calibration or as per mfr. Std. using reference / Manual adjustment to grab sample
7	Output Signal Analog outout	4 -20 mA analog / through suitable communication port - Profibus or Ethernet or Modbus with required connectivity with PLC.
	Relay	Min. 2 potential free changeover contacts
8	Instrument Power Supply	100 to 240 VAC $\pm 10\%$, 50 Hz $\pm 5\%$ or 24V DC as per mfr. Std.
9	Cable / Conduit Entry	1/2" NPT or M20 or equi. As per mfr. Std.
10	Local Indicator / Display	Backlit LCD Display

11	Scale Graduation / Measuring Units	Engg. Units
12	Data Safety	The Sensor / transmitter should store on board calibration data and diagnostic information
13	Security Access Code	Password protected
14	Protection:	
a	Elec. Area Classification	Safe
b	Enclosure Type & Protection Class	Weather Proof to IP-66/67 as a minimum
	MOC	Cast Alu. / Polycarbonate or equi. as per mfr. Std. suitable for withstanding harsh environment
	Paint	Chemical Resistant / Epoxy Coating
15	Mounting	Wall mounting / Pipe mounting
d.	Options / Accessories:	
1	Mounting Accessories	Mounting plate (min. 3 mm thick MSEP) for complete instrument,
2	Tag Plate	Required, SS 304
3	Cable Glands	Required, IP-65/66 as a min., Ni-Plated Brass / Polyamide
4	Plugs for addl. cable entries	Close up Plugs shall be provided for all unused cable entries, Ni-Plated Brass / Polyamide
5	Weather proof enclosure with glass cutout for Analyzer To prevent from dust and water	Required. MOC: G.I. - min. 2mm thick

5. ON-LINE TDS ANALYZER:

SPECIFICATIONS FOR CONDUCTIVITY ANALYZER		
A.	GENERAL	
1	Service	Water Application
2	Function	To measure & indicate the TDS / Transmit
3	Operating Temperature	Ambient, 50 °C Max.
4	Operating Pressure	Atm. Max. 1 bar
5	Installation	Indoor / Outdoor
B.	Electrodes & Electrode Holder	
1	Type of Sensor	Digital type sensor
	Sensor Cell constant	0.01 – 10 or lower as per process requirement

2	Measurement Range	0-20000 microsimen/cm or lower as per process requirement
3	Temperature Compensation	Required, Automatic, In-built
4	Accuracy	$\pm 2\%$ of reading
5	Sensitivity	$\pm 0.5\%$ of reading
7	Protection Class	IP-68
8	Cable Length Integral / after connector	Min. 10m length or higher as per site conditions.
9	Process Connection (Mounting) Type	Suitable for pipe or immersion (open tank / sump) type mounting with mounting as under for both this applications:
	- For measurement on Pipe	Measurement of TDS on pipeline shall be with flow through (Tee) assembly in SS304. Shall be with isolation valve & required piping up to disposal/drain
	- For measurement on Open Tank / Sump	Measurement of TDS at Open Tank / Sump shall be through suitable Immersion mounting assembly.
10	Calibration Certificate	Required
C. TRANSMITTER		
1	Function	Transmit and Indicate
2	No. of Inputs	Single / Dual / Multiple (up to 8 channel)
3	Transmitter Type	Microprocessor based, User Programmable, 2-Wire or 4-Wire type as per mfr. Std.
4	Location	Field Mounting
5	Output Signal Analog outout	4 -20 mA analog / through suitable communication port - Profibus or Ethernet or Modbus with required connectivity with PLC
	Relay	Min. 2 potential free changeover contacts
6	Instrument Power Supply	100 to 240 VAC $\pm 10\%$, 50 Hz $\pm 5\%$ or 24V DC as per mfr. Std.
7	Cable / Conduit Entry	1/2" NPT or M20 or equi. As per mfr. Std.
8	Local Indicator / Display	Backlit LCD Display
9 Protection:		
A	Elec. Area Classification	Safe
B	Enclosure Type & Prot. Class	Weather Proof to IP-65 as a minimum
	MOC	Cast Alu. / Polycarbonate or equi. As per mfr. Std. suitable for withstanding harsh environment
	Security	Password protection
10	Mounting	Wall mounting / Pipe mounting
D. Options / Accessories:		
1	Mounting Accessories	Required, Universal 2" Pipe and / or Wall Mounting Kit

2	Tag Plate	Required, SS 304
3	Cable Glands	Required, IP-65/66 as a min., Ni-Plated Brass / Polyamide
4	Plugs for addl. cable entries	Close up Plugs shall be provided for all unused cable entries, Ni-Plated Brass / Polyamide
5	Canopy for Analyzer / Transmitter To prevent from direct sun and rain	Required. MOC: FRP - min. 4mm thick / G.I. - min. 2mm thick

6. ON-LINE RESIDUAL CHLORINE MEASUREMENT

SPECIFICATIONS FOR FREE CHLORINE ANALYZER		
A.	GENERAL	
1	Service	Water Application
2	Function	To measure & indicate the FRC / Transmit
3	Operating Temperature	Ambient, 50 °C Max.
4	Operating Pressure	Atm. Max. 1 bar
5	Installation	Indoor / Outdoor
B.	Electrodes & Electrode Holder	
1	Type of Measurement	Amperometric / Potentiostatic with pH compensation as per application
2	Measurement (Calibration) Range	0 - 15 mg/l free residual chlorine
3	Sample Withdrawal As per application requirement	Peristaltic pump or suitable arrangement with necessary tubing / piping, Sample Inlet / Drain connection size as per mfr. Std. The withdrawn sample shall be suitably transferred back to immediate downstream or upstream process - shall not be drained / discharged in open. Pipe / Fitting associated or grouted with civil unit / structure shall be in GI / SS only.
4	pH sensor for Compensation	To be provided as per application
5	Cable Length Integral / after connector	Min. 10m length or higher as per site conditions.
C.	TRANSMITTER	
1	Transmitter Type	Microprocessor based, User Programmable, 2-Wire or 4-Wire type as per mfr. Std.
2	Location	Indoor Mounting / Outdoor mounting with canopy
3	Free Chlorine Measurement:	

a	Free Chlorine Measurement Range	0-5 mg/l, programmable (Normal measurement range shall be 0 - 2 mg/l)
b	Accuracy	± 5% of Measuring Range or better
c	Resolution	0.01 mg/l
7	Output Signal	4 -20 mA analog HART / through suitable communication port - Profibus or Ethernet or Modbus with required Connectivity with PLC
	Relay	Min.2 Potential Free changeover Contacts
5	Instrument Power Supply	100 to 240 VAC ± 10%, 50 Hz ± 5% or
		24V DC as per mfr. Std.
6	Cable / Conduit Entry	1/2" NPT or M20 or equi. As per mfr. Std.
7	Local Indicator / Display	LCD / LED Display
8	Protection:	
A	Elec. Area Classification	Safe
B	Enclosure Type & Protection Class	Weatherproof to IP-65 as a minimum or better
	MOC	ABS with Clear Polycarbonate Windows or equi. as per mfr. Std. suitable for withstanding harsh environment
9	Mounting	Wall mounting
D.	Options / Accessories:	
1	Mounting Accessories	Required, Universal 2" Pipe and / or Wall Mounting Kit
2	Tag Plate	Required, SS 304
3	Cable Glands	Required, IP-65/66 as a min., Ni-Plated Brass / Polyamide
4	Plugs for addl. cable entries	Close up Plugs shall be provided for all unused cable entries, Ni-Plated
		Brass / Polyamide
5	Canopy for Analyzer / Transmitter To prevent from direct sun and rain	Required. MOC: FRP - min. 4mm thick / G.I. - min. 2mm thick
6	Strainer Kit	Required, Self-cleaning strainer kit with required tubing & fittings for continuous operation without clogging, where applicable