

Chapter 11

TECHNICAL SPECIFICATION FOR FIRE PROTECTION AND PLUMBING WORKS

1.0.3 GENERAL REQUIREMENTS

1. Piping material shall be as per technical specifications.
2. Piping shall be given one primary coat of Red Oxide / Zinc Rich Primer paint (As per piping material requirement) and given two (2) coats of finish paints of approved shade after installed. Pipes shall be sloping towards drain points.
3. All equipment and valve connections etc. shall be through flanges / unions as required for mating connections.
4. All welding of piping is subject to approval of client.
5. Strainers shall be Y – type / Pot fabricated / Casted steel body designed to test pressure specified. These shall have removal stainless steel (SS316) screen with 1 mm perforation and a permanent magnet.
6. The drawings indicate schematically the size and location of pipes. Contractor shall prepare detailed working drawings showing sections, details of fittings, hanger & supports, location of isolating, drain valves etc.
7. Piping shall be properly supported or suspended from brackets, hangers, stand, clamps etc. as per site requirement. The supports shall be steel, prime coated with rust preventive paint and given two (2) coats of finish paints.
8. Extra supports shall be provided at the bends and at heavy fitting like valves etc. to avoid undue stress on pipes. Insulated pipe shall be supported in such a manner as not to put undue pressure on the insulation.
9. All fitting such as branches, reducers etc. shall have same dia. & thickness as the main pipe and its length shall be at least twice the pipe diameter.
10. Blank ends shall be formed with flanged joints with blank between flange pair.
11. Valves/capped connection shall be provided for all low points in piping system, necessary or required for draining all systems and also to permit repairs without interference with rest of the system.
12. During construction, open ends of pipes shall be temporarily closed with sheet metal caps to prevent debris from entering piping system.
13. Pipe sleeves of Galvanized Steel Pipe and 50 mm larger than OD of pipe shall be provided where pipes pass through walls, floor slab, beams etc.
14. Piping work shall be carried out with minimum disturbance to other works at site. A programme of work shall be chalked out in consultation with the Architect –in - charge.
15. Drain valves shall be provided at all low point in piping system and shall be minimum 25 mm size.

16. Pressure testing of pipe work, valves etc. shall be carried out at twice the working pressure of the particular system for a period of **24** hours as specified. All tools, labor, equipment, materials required shall be provided by contractor. Test reports shall be prepared for approval after testing has been carried out in presence of the Architect –in-charge. Test shall be repeated till the entire system/s is found satisfactory. After tests have been completed, the system shall be drained & flushed 3 to 4 times and cleaned of all dust, debris, foreign matter etc.
17. All pipes, supports, fittings etc. shall be given two coats of red oxide & then two (2) coats of finish paint in approved shade/color. All work of indication on piping, valves etc. shall be carried out by the contractor including proper labeling. Color coding and arrow marking.
18. Pressure gauges shall be not less than 100 mm dial, appropriate range and accuracy, complete with 100 mm needle valves as per system requirement and duly calibrated before installation.
19. Vibration Isolators shall be provided to eliminate vibration & stresses in various piping system & equipment.

2.0 TECHNICAL SPECIFICATION FOR FIRE FIGHTING WORKS

2.0.1 GENERAL REQUIREMENTS

The fire Protection system is designed and installed as per National Building Code (NBC) of India 2005, Part4 , Fire and Life safety and Detailed specifications. Hazard Classification as per NBC Educational Building has been classified, as Educational Building, Group-B (ii). Type of System Proposed, Overhead fire water tank and Booster pump at terrace floor level, Down comer, fire extinguishers.

Portable Extinguishers - Portable fire Extinguishers are provided at location mentioned in the tender drawings.

2.0.2 GENERAL

Upon Completion of installation the Contractor shall test the system and hand over the same in operating condition to the Client or other agencies as assigned by the Client. Necessary operating and maintenance manuals together with as-built drawings, all in Triplicate as hard copy and also on soft copy shall be submitted. The system shall be deemed to be taken over only upon submission of these documents and against the issuance of Completion Certificate from the Architect and also after obtaining all the safety certificates from the authorities. Final bill will be paid only after compliance of these requirement from Fire Department.

2.0.3 APPROVALS

After completion of Installation, necessary submission drawings shall be prepared by the Contractor and submitted to the relevant authorities. The scope of this tender includes the responsibility of obtaining the approval for the installation from the Fire Department and other relevant Departments and obtaining the required No Objection Certificate.

2.0.4 PIPING VALVES & ACCESSORIES

The scope of this section comprises the supply and laying of pipes, pipe fittings and valves and testing of all water piping required for the complete installation as shown on the drawings. All piping inclusive of fittings and valves shall follow the applicable Indian Standards.

2.0.4a PIPING

All Hydrant Pipes, Stand Pipes, Sprinkler Pipes, etc., shall be as per the Approved Make indicated elsewhere in this Specification conforming to relevant ISI Codes. Pipes upto 150 mm NB shall be as per IS 1239, Medium grade. Pipes of 200 mm NB and above shall be as per IS 3589, with 6.35 mm wall thickness.

Pipes up to and including 40 mm dia, shall have threaded joints using non - hardening lubricant as sealing material and / or by screwed flanges using 3 mm rubber gaskets, Pipe threads and flanges shall be as per BS 534 and BS 4504.

Pipes 50 mm and above in dia. shall have welded / flanged joints. All welding shall be done by qualified welders and shall strictly conform to Indian Standards code of procedure for manual metal arc welding of mild steel.

All fittings shall be of Mild Steel conforming to A 234 GR WPD Sch. 40. The Flanges shall be drilled as per relevant IS Standards. All Flanges, fittings and accessories shall be suitable for Grade 150 Pressure Rating unless otherwise specified.

All pipes and their steel supports shall be thoroughly cleaned and given one primary coat of red oxide paint before being installed.

Fittings shall be as per IS 1239 Part II of Pressure rating suitable for the piping system. Fittings used on welded piping shall be of weldable type.

Tee-off connections shall be through equal or reducing tees, otherwise ferrules welded to the main pipe shall be used. Drilling and tapping of the walls of the main pipe shall not be resorted to.

2.0.4b VALVES**SLUICE VALVE**

Non rising spindle sluice valve conforming to IS 780 with a rating of PN 1.6 shall be used for the system. These valves are provided at suitable locations, considering the need of isolation in case of maintenance and this shall be of TAC approved make.

G.M SLUICE VALVE

This shall be as per IS 778 with female threaded ends used for instrumentation / draining Arrangement and shall have ISI Mark.

C.I. NON RETURN VALVE

All C.I non return valve shall be “Dual Plate” Check Valves as per API 594. These check valves, without bypass shall be provided for the delivery lines of the pump sets and also for the interconnection of the fire hydrant and the sprinkler system. The makes shall be as specified elsewhere in this tender.

BUTTERFLY VALVE:

All isolation / shut-off valve shall be of Butterfly type wherever indicated in the Drawings. The Valves shall have cast iron body conforming to IS 210 GR FG 200 and suitable for ANSI 150 Grade flanges. The Valve stem shall be of Stainless Steel conforming to SS 410 / 316. The disk material shall be of Ductile Iron with Electro less Nickel Plating. The seat material shall be EPDM. All shut-off valves of 50 mm NB and above shall be Butterfly valves only.

BALL VALVE

All shut-off valves of size 40 mm NB and below shall be full bore type ball valves only conforming to BS 5351 and should be of 3 piece construction only. The body shall be of carbon steel as per ASIM A 216 - WCB. The end connectors shall also be of carbon steel as above. The ball and stem shall be stainless steel SS 304 / 316. The Valve seat, body gasket and stem packing shall be PTFE.

VALVE CHAMBER

Brick masonry chamber of size 1200 mm x 1200 mm x 1500 mm depth with 600 mm x 600 mm Cast Iron manhole cover shall be provided for the sluice valve that are proposed for the underground fire hydrant lines.

Flanges shall be of approved make. The supply of flanges shall also include supply of bolts and nuts and suitable asbestos / fibre rubber insertion gaskets (minimum 3 mm thick).

Strainers shall be of approved make, equal “Y” type or pot strainers, with Cast / MS fabricated bodies. Strainers shall have bronze screen with 3 mm perforations. Screen shall be removable and replaceable without disconnection of the main pipes. All strainers shall be provided with equal size isolation valves, so that the strainer may be cleaned without draining the system. All “Y” type strainers wherever specified shall be MS fabricated type only.

All pipe supports shall be mild steel, thoroughly cleaned and given on primary coat of red oxide paint before being installed.

2.0.4c ACCESSORIES**AIR VESSEL**

The air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter-acting pressure, surges, whenever the pumping sets come into operation. Air vessel shall conform to IS:3844. It shall be normally half full of water, when the system is in normal operation. Air vessel shall be fabricated with 8 mm thick M.S. plate with dished ends and suitable supporting legs. It shall be provided with one 100 mm dia flanged connection from pump, one 25 mm drain with valve, one water level gauge and 25 mm sockets for pressure switches. The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5 times the shut-off.

2.0.5 EXTERNAL STAND POST & HYDRANT ASSEMBLY**2.0.5a STAND POST**

MS Stand Post with MS heavy grade pipe for seating the yard hydrant valve 80 mm dia. x 1500 mm long.

2.0.5b SINGLE HEADED HYDRANT VALVE

Gun Metal oblique type hydrant valve of single outlet with necessary hose coupling adaptor of 63 mm size, instantaneous spring lock arrangement and blank cap conforming to IS 5290.

2.0.5c HOSE WITH COUPLING

Controlled percolation / RRL Hose conforming to IS 8423 of 63 mm dia. x 15 RMT long shall be provided with suitable fire hose delivery coupling of instantaneous spring lock arrangement comprising of male and female half and rubber cup washer as per IS 903.

2.0.5d GUN METAL BRANCH PIPE WITH NOZZLE

Gun metal short branch pipe shall be of 63 mm dia. female instantaneous inlet, male threaded outlet complete with hexagonal nozzle of 19 mm dia. heavy quality as per IS 903 shall be provided.

2.0.5e HOSE CABINET

MS Hose Cabinet to accommodate two nos. of Hose Pipes with coupling and 1 No. branch pipe shall be provided for each yard hydrant valve. This cabinet shall be glass fronted with hinged door and lock. The cabinet is spray painted to scarlet red colour. The size of the cabinet shall be 750 mm x 600 mm x 250 mm.

2.0.5f FIRE BRIGADE CONNECTION

Fire brigade connection shall be provided to the reservoir comprising of four instantaneous pattern 63 mm dia. inlets with four nos. built-in non-return valve including cap with chair and 150 mm dia. sluice valve. The manifold shall be mounted in a MS cabinet with glass fronted door.

2.0.6 INTERNAL HYDRANT ASSEMBLY**2.0.6a SINGLE HEADED HYDRANT VALVE**

Gun Metal oblique type hydrant valve of single outlet with necessary hose coupling adapter of 63 mm size, instantaneous spring lock arrangement and blank cap conforming to IS 5290.

2.0.6b HOSE WITH COUPLING

Controlled percolation / RRL Hose conforming to IS 8423 of 63 mm dia x 15 RMT long shall be provided with suitable fire hose delivery coupling of instantaneous spring lock arrangement comprising of male and female half and rubber cup washer as per IS 903.

2.0.6c GUN METAL BRANCH PIPE WITH NOZZLE

Gun metal short branch pipe shall be of 63 mm dia. female instantaneous inlet, male threaded outlet complete with hexagonal nozzle of 19 mm dia. heavy quality as per IS 903 shall be provided.

2.0.6d HOSE REEL

Hose Reel of swing type with 19 mm dia. and 36 RMT long hose and hand controlled nozzle of 6.35 mm dia. shall be provided on a drum with suitable bracket for fixing on the wall.

2.0.6e HOSE REEL CABINET

MS Hose cabinet of size to suit the location shown in drawing for the fire escape hydrant and the hose reel assembly and shall be flush with the wall. These cabinets shall be of glass fronted with hinged door and lock. The cabinet is spray painted to scarlet red colour.

2.0.7 PUMPS**2.0.7a PUMPS & CONTROLLERS**

Complete fire pump system, including pump motor, auxiliary components, controllers, and interconnecting power and control wiring.

For rating, Model No. total dynamic head and electrical characteristics of pumps, refer to schedule on drawings and BOQ.

Motor: Shall be of suitable rating as specified and shall be TEFC squirrel cage induction type with class B insulation.

The following accessories shall be included with the pump unit :

1. Eccentric Suction Reducer

2. Discharge Tee
3. Test Header with Valves and Caps
4. Casing Relief Valve
5. Overflow Cone
6. Suction and discharge gauges
7. Coupling Guard
8. Vibration Isolator

Pump and driver shall be mounted on a common base plate of either Cast Iron or fabricated steel and direct connected through a flexible coupling. The pump shall have Bronze impellers mounted on to SS Shafts.

Provide name and capacity plate with pump.

Prior to shipment, the pump and motor for this project shall be thoroughly shop tested as a complete unit by the pump manufacturer. This shall include a hydrostatic test to twice the working pressure, but in no case to less than 1724 KPA (250 psig). A certified characteristic curve showing the pump performance based upon the results of the shop test shall be furnished to the purchaser. The test data shall include a plot of motor speed Vs pump capacity over the entire range from shut-off to beyond 150 % of design capacity.

2.0.8 ELECTRICAL INSTALLATIONS

SCOPE

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of Motor Control Centre (MCC), wiring and earthing of all air-conditioning equipment, components and accessories.

GENERAL

Work shall be carried out in accordance with the accompanying specifications and shall comply with the latest relevant Indian Standards and Electricity Rules and Regulations.

All motor control centres shall be CPRI approved and shall be suitable for operation on 3 phase/single phase 415/230 volts, 50 cycles power supply system.

CONSTRUCTIONAL FEATURES

The Motor Control Centre (MCC) electrical panels shall be sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be 3b construction. The control panel shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors with Neoprene gasket. Control panel shall be suitable for the climatic conditions as specified in Specifications. Steel sheets used in the construction of Control panel shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to relevant BIS Codes.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of Control panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum clearance of 275 mm shall be provided between the floor of control panel and the lowest unit.

The control panel shall be of adequate size with a provision of 25% spare space to accommodate possible future breakers. Breakers shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Motor Control Centre in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram mounted on inside of door shutter protected with Hylam sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

WIRING SYSTEM

All L T power cabling between MCC and motors shall be carried out with 1100 volts grade PVC insulated, overall PVC sheathed aluminium conductor armoured cables, Cables shall be sized by applying proper derating factor. All control wiring shall be carried out by using PVC insulated copper conductor wires in conduits. Minimum size of control wiring shall be 1.5 sq mm. Minimum size of conductor for power wiring shall be 4 sq. mm 1100 volts grade PVC insulated copper conductor wires in conduit.

CIRCUIT COMPARTMENT

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the “ON” position. Safety interlocks shall be provided to prevent the breaker from being drawn-out when the breaker is in ‘ON’ position. The door shall not form an integral part of the draw-out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

INSTRUMENT ACCOMMODATION

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control MCBs. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar ‘ON’ lamps shall be provided on all outgoing feeders.

BUS BAR CONNECTIONS

Bus bar and interconnections shall be of high conductivity electrolytic aluminium complying with requirement of grade E91E of IS:5082-1981 and shall be of rectangular cross section suitable for carrying the rated full load current and short circuit current without overheating of phase and neutral bus bar and shall be extendable on either side. Bus bar and interconnections shall be insulated with heat shrinkable sleeve and shall be colour coded and shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bar shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area shall be added to the bus bar to compensate for the holes. All connections between bus bar and breaker shall be through solid aluminium strips of proper size to carry full rated current as per approved for construction shop drawing and insulated with insulating sleeves. Bus bar shall be rated for current density of 1.0 amps/mm² cross section area.

TEMPERATURE - RISE LIMIT

Unless otherwise specified, in the case of external surface of enclosures of bus bar trunking system which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per relevant IS Codes.

CABLE COMPARTMENTS

Cable compartment of adequate size shall be provided in the control panel for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables as per approved for construction shop drawing.

MOULDED CASE CIRCUIT BREAKER (MCCB)

All MCCB's shall be motor duty and Current Limiting type, and comprise of Quick Make - break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCB's shall be capable of defined Variable overload adjustment. All MCCB's rated 200 Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall override all other commands. MCCB shall employ maintenance free double break contact system to minimise the let thru' energies and capable of achieving discrimination upto full short circuit capacity of downstream MCCB. The manufacturer shall provide both discrimination tables and let thru energy curves.

The breaking capacity of MCCB's shall be asked for in the schedule of quantities. The breaking capacities specified will be ICU=ICS i.e type-2. Co-ordination as per relevant IS and IEC Codes.

The MCCB's shall be provided with rotary handle operating mechanism. The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts.

MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with relevant IS Codes and shall be quick make and break type for 230/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint

(Powder coating). The shade of colour of panel inside/outside shall be as per relevant BIS code.

LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel door and covered with transparent plastic sheet.

METERS

1. All voltmeters and indicating lamps shall be through MCB's.
2. Meters and indicating instruments shall be plug type.
3. All CT's connection for meters shall be through Test Terminal Block (TTB).
4. CT ratio and burdens shall be as specified on the Single line diagram.

CURRENT TRANSFORMERS

Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondaries for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

SELECTOR SWITCH

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

STARTERS

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta Starters shall be fully automatic.

CONTACTOR

Contactors shall be built into a high strength thermoplastic body and shall be provided with an arc shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta and Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E".

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 220/415 \pm 10% volts AC, 50 cycles AC supply.

THERMAL OVERLOAD RELAY

Thermal over load relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing as well as on overloading. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual-reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5° C to +55°C.

All overload relays shall be of three element, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be directly connected for motors up to 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacity. Heater circuit contactors may not be provided with overload relays.

TIME DELAY RELAYS

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

INDICATING LAMP AND METERING

All meters and indicating lamps shall be in accordance with IS:1248 and IS-1258. The meters shall be flush mounted type. The indicating lamp shall be of low wattage . Each MCC and control panel shall be provided with voltmeter 0-500 volts with three way and off selector switch, CT operated ammeter of suitable range with three nos. CTS of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 MCB. Other indicating lamps shall be backed up with fuses as called for in Schedule of Quantities.

TOGGLE SWITCH

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS Codes and shall be of 5 amps rating.

PUSH BUTTON STATIONS

Push button stations shall be provided for manual starting and stopping of motors / equipment. Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

CABLES

M.V. Cables shall be PVC insulated XLPE aluminium conductor and armoured cables conforming to IS Codes. Cables shall be armoured and suitable for laying in trenches, ducts, and on cable trays as required. M.V. Cables shall be termite resistant. Cable glands shall be

double compression glands. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

CABLE LAYING

Cable shall be laid in accordance with IS code of Practice. Cables shall be laid on 14 gage factory fabricated perforated galvanized sheet steel cable trays, and cable drops / risers shall be fixed to ladder type cable trays factory fabricated out of galvanized steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running on a cable tray, one dia spacing shall be provided between cables to minimise the loss in current carrying capacity.

Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks/tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable.

EARTHING

Earthing shall be provided in accordance with relevant BIS Codes and shall be copper strips /wires .The main panel shall be connected to main earthing system of the power supply. All single phase metal clad switches and control panels be earthed with minimum 3 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with 2 numbers distinct and independent copper wires / tapes as follows:

- | | | |
|----|---|--------------------------------------|
| 1. | Motor upto and including
10 HP rating. | 2 Nos. 3 mm dia copper
wires. |
| 2. | Motor 12.5 HP to 40 HP capacity | 2 Nos. 4 mm dia copper wires |
| 3. | Motor 50 to 75 HP capacity. | 2 Nos. 6 mm dia copper |
| 4. | Motor above 75 HP. | 2 Nos. 25 mm x 3 mm
copper tapes. |

All switches shall be earthed with two numbers distinct and independent copper wires' tapes as follows:

- | | | |
|----|--|--------------------------------------|
| 1. | 3 phase switches
and control panels upto
60 amps rating. | 2 Nos. 3 mm dia copper
wires. |
| 2. | 3 phase switches, and
control panels 63 amps to
100 amps rating. | 2 Nos. 4 mm dia copper
wires. |
| 3. | 3 phase switches and control
panels 125 amps to
200 amps rating. | 2 Nos. 6 mm dia copper
wires. |
| 4. | 3 phase switches, control
panels, bus ducts, above | 2 Nos. 3 mm x 25 mm
copper tapes. |

200 amps rating.

The earthing connections shall be tapped off from the main earthing of electrical installation. The overlapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be riveted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance, and properly tinned.

2.0.9 COMMISSIONING GUARANTEE

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Client / Architect or any inspecting authority. At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Three copies of all test results shall be submitted to the Architect in A4 size sheet paper within two weeks after completion of the tests.

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS codes and test report furnished by a qualified and authorised person. The entire electrical installation shall be gotten approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Project Manager. Testing of the panels shall be as per relevant BIS Codes

Pump factory test data.

Shop drawings for the installation of the pump sets, including foundation details.

Upon completion of the installation, as-built drawings for the entire system shall be prepared and submitted along with 4 sets of operating manuals for the systems.

2.0.10 PRE COMMISSIONING

1. Check all hydrant valves by opening and closing : any valve found to be open shall be closed.
2. Check all the piping under hydro test.
3. Check that all suction and delivery connections are properly made for all pump sets.
4. Check rotation of each motor after decoupling and correct the same if required.
5. Test runs each pump set.
6. All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

2.0.11 FINAL ACCEPTANCE TEST

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Client/ Architect.

2.0.12 MODE OF MEASUREMENT

Unless otherwise specified measurements for piping for the project shall be on the basis of centre line measurements described herewith.

Shall be measured in units of length along the centre line of installed pipes including all pipe fittings, flanges (with gaskets and nuts and bolts for jointing) unions, bends, elbows, tees, concentric and / or eccentric reducers, inspection pieces, expansion loops etc., The above accessories shall be measured as part of piping length along the centre line of installed pipes and no special rates for these accessories shall be permitted.

The quoted unit rates for centre line linear measurements of piping shall include all wastage allowance, pipe supports including hangers, MS Channel, wooden haunches, nuts and check nuts, vibration isolator suspension where specified or required, and any other item required to complete the piping installation as per the specification. None of these items will be separately measure NOR paid for. However, all valves (gate / globe / check / balancing / butterfly / ball etc.,) strainers, orifice plates, thermometers, pressure gages shall be separately measured and paid as per their individual unit rates.

2.0.13 LIST OF RECOMMENDED MANUFACTURERS MAKE-FIRE FIGHTING

1.	Pumps	-	Kirloskar/Mather& Platt/Grundfoss
2.	Motors	-	Kirloskar/ABB/Seimens
3.	MS Pipes	-	Jindal/Tata
4.	Butterfly valves	-	Audco / Intervalve/KSB
5.	Check valve	-	Advance/Intervalve/Normax
6.	Non-Return Valve / Foot valve	-	Normax /Advance/Intervalve
7.	Ball valve	-	Leader/RB /itap
8.	Hydrant Valve, Branch Pipe	-	NewAge / Winco
9.	RRL Hose	-	NewAge / Chataria/Arihant
10.	Hose Box	-	Fabricated
11.	Coating & Wrapping	-	IWL
12.	Cable	-	Polycab/Universal
13.	Cable Tray	-	Profab/Hitech
14.	Paint	-	Berger/ICI
15.	Fire Extinguishers	-	Minimax/Ceasefire/Gilpro
16.	Pipe Clamps & Supports	-	Hitech/Equivalent
17.	Air Release Valve	-	Zoloto/OR/ Arco

18.	Y' Strainer	-	Emerald/Zoloto
19.	Welding Rods	-	Cosmos /Esab /Super Bond (S)
20.	Fasteners	-	Fisher / Hilti
21.	MCB	-	Siemens/LT/Scheider
22.	Panels	-	Approved manufacturer by Architect

3.0 TECHNICAL SPECIFICATION FOR PLUMBING WORKS

3.0.1 GENERAL REQUIREMENTS

This specification covers the requirements of supply, installation, testing and commissioning of Water Supply and Sewerage system for the proposed Building. Scope of work generally includes Supply, fixing, testing and commissioning of the following:

1. Internal Sanitary Fixtures.
2. Internal and External Water Supply system.
3. Puddle flange inserts for underground sump and Overhead tank.
4. Internal and External Drainage system.

The General character and the scope of work to be carried out under this section is illustrated in the drawings and specifications attached herewith. The contractor shall carry out and complete the said work under this contract in every respect in conformity with the rules and regulations of the local authority. The Contractor shall furnish all labour, materials, appliances, tools and equipment necessary for the work for plumbing services installation including testing and commissioning as specified herein, and as per the relevant Bureau of Indian Standards (BIS), British Standards codes and as shown on the drawings. This also includes any material, appliances and equipment not specifically mentioned herein or noted on the drawings as being furnished or installed which are necessary and customary to make a complete installation properly connected and in working order.

Carryout all incidental works connected with plumbing services installation, such as excavation in trenches and backfilling. Cutting and chasing in concrete or brick and making good, cutting / drilling holes through walls, floors, and grouting for embedding of fixing of fixtures / equipment and so forth.

Furnish and install complete workable, plumbing services installation as shown on the drawings and described in this specification and as per the latest Bureau of Indian Standards (BIS), British Standards (BS) specifications including all that which is reasonably inferred to all the buildings, internally and externally.

Complete installation of the sewerage and sewerage appurtenances internally as well as around the building.

Complete installation of all sanitary and plumbing fixtures in all the floors of the building including basement floor.

Co-operation with other trades in putting the installation in place. Any work done without regard or consultation with other trades, shall be removed by the contractor without additional cost to the Client, to permit proper installation of all other work, as desired by the Architect.

Repair all damage done to the premises as a result of this installation and remove all debris left by those engaged for this installation to the satisfaction of Architect.

Cleaning of all plumbing and sanitary fixtures, testing and proving the satisfactory performance of all fixtures at the time the buildings are handed over to the Client.

It is the responsibility of the contractor to take care of all the fixtures fitted until the time of handing over to the Client.

Painting of all concealed and exposed pipes as specified.

Wrapping and coating of all underground GI pipes.

Assume full responsibility for getting the entire installation duly approved by the authorities concerned and for all expenses in connection with the same. Assume responsibility for obtaining and delivering to the Client certificate of final inspection and approval by the concerned authorities.

All work performed by the contractor shall be through licensed plumbing supervisor possessing a valid plumbing contractor's license employing Engineers, Technicians, Foremen, Plumbers, Masons, Helpers, etc., as required.

REGULATIONS AND STANDARDS

The installation shall conform in all respects to the following standards in general:

IS 651 - 1992	: Specification for Salt Glazed stoneware pipes and fittings (Fifth revision)
IS 7558 - 1974	: Code of practice for domestic hot water installation
IS 5329 - 1983	: Code of practice for sanitary pipe work above ground for buildings.
IS 12251 - 1987	: Code of practice for drainage of building basements
Is 2064 - 1973	: Code of practice for selection, installation and maintenance of sanitary appliances
IS 1200 (Part 1)	: Method of measurement of building earthwork
IS 1200 (Part 16)	: Method of measurement of laying of water and sewer lines including appurtenant
IS 1200 (Part 19)	: Method of measurement of Water supply, plumbing and drains.
IS 783 - 1959	: Code of practice for laying of concrete pipes
IS 13592 - 1992	: Specification for unplasticized PVC pipes for soil and waste discharge system inside building including ventilation and rainwater.
IS 2527 - 1984	: Code of practice for fixing rainwater gutters and down pipes

	for roof drainage.
IS 2685 - 1971	: Code of practice for selection, installation and maintenance of sluice valves.
IS 6784 - 1984	: Method of performance testing of water meters (Domestic type).
IS 458 - 1988	: Specification for pre cast concrete pipes (with/without reinforcement)
IS 2692 - 1989	: Specification of ferrules for water services
IS 12701 - 1989	: Specification for rotational moulded polyethylene water storage tanks.
IS 771 (Part 3 to 6)	: Specific requirements for urinals.
IS 2548 (Part 1&2)	: Specification for plastic seats and covers for water closets.
IS 3004 - 1979	: Specification for plug cocks for water supply purposes.
IS 1711 - 1984	: Specification for self closing taps for water supply
IS 1703 - 1977	: Specification for ball valves (Horizontal plunger type) including floats for water supply purposes.
IS 4038 - 1979	: Specification for foot valves for water works purposes.
IS 1172 - 1983	: Code of basic requirements for water supply, drainage & sanitation (revised).
IS 1239 – 1990 (Part I)	: Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1239 - 1992 (Part II)	: Specifications for mild steel tube, tubular and other steel pipe fittings.
IS 1726 - 1991	: Code for cast iron manhole frame and cover (third revision).
IS 1742 - 1983	: Code of practice for building drainage. (Second revision)
IS 2064 - 1973	: Code of practice for selection, installation and maintenance of sanitary appliances.
IS 2065 - 1983	: Code of practice for water supply to buildings.
IS 4111 - 1986	: Code of practice for Ancillary structures in sewerage system
IS 4127 - 1983	: Code of Practice for laying glazed stoneware pipe.
BS 4515	: Specification for unplasticized PVC pipe fittings.
IS 4985 - 1988	: Specification for unplasticized PVC pipes for portable water supplies (second revision)
IS 732 & IS 2274 - 1963	: Indian Standard code of practice for electrical wiring & installation.

IS 780 - 1984	: Specification for sluice valves for water works purposes.
ASTM-D2846	: CPVC Hot and cold water distribution
ASTM - F493	: CPVC Solvent cement specifications
ASTM - F402	: Handling cement solvents
ASTM - F442	: CPVC Plastic pipe (SDR-PR)
ASTM - F437	: Threaded CPVC fittings Schedule 80
ASTM - F438	: CPVC Schedule 40 CPVC fittings
ASTM - F439	: CPVC Schedule 80 CPVC fittings
ASTM - F441	: CPVC Schedule 40 & 80 pipe
ASTM-D1784	: CPVC Compounds
ISO - 727	: Dimensions of CPVC sockets

National building Code for Water Supply, drainage and Sanitation Part IX Plumbing services section 1 & 2.

The installation shall also be in conformity with the by laws and requirements of the local authority in so far as these become applicable to the installation. Wherever this specification calls for, a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards.

Wherever drawings and specifications require something that may conflict with the regulations, the regulations shall govern. This shall be referred to the Architect for arbitration.

EXECUTION OF WORK

The work shall be carried out in conformity with the water supply and sanitary drawings and within the requirements of Architect, HVAC, Electrical, and other specialized services drawings.

The contractor shall co-operate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up or progress of the construction programme. Any work done without regard (or) consultation with other trades, shall be removed and rectified by the contractor without additional cost to the Client.

The contractor shall furnish and install a complete working, plumbing services installation as per approved drawings and as per the latest BIS codes of practice.

Execution of work by the contractor includes complete installation of internal & external water supply system, sewerage and sewerage appurtenances internally as well as around the building, controllers, valves and power control wiring for controller etc. complete installation of all sanitary and plumbing fixtures. It is the responsibility of the contractor to protect all the installed fixtures and fittings until the time of handing over to the CLIENT.

The Contractor shall set out the drainage, soil, waste and water pipe lines and other fittings and fixtures in accordance with the Drawings and instructions of the Architect. The contractor shall be responsible for the correctness of the above and any incorrectness shall be rectified at his own cost. He will be responsible for taking levels at site before setting out and putting them on record without extra charge.

The contractor shall provide at all times during the progress of the works and during maintenance period proper facilities and necessary attendance for inspection or measurement of the works by the Architect or their representatives.

FEES, PERMITS AND NOTICES

Contractor shall comply with all bye-laws and regulations of local and other statutory authorities having jurisdiction over the works and shall be responsible for the payment of all fees and other charges and giving and receiving of all necessary notices. Contractor shall keep the Architect timely informed about regulations and requirements of statutory authorities and shall obtain the final certificates of inspection and approval from the authorities.

SHOP DRAWINGS

The contractor shall submit to the CLIENT four copies of the shop drawings. Shop drawings shall be submitted as follows. Drawings showing any change in layout in the contract drawings. Floor plans, Enlarged toilet details, schematic showing water supply and sanitary installation works. Manufacturer's or Contractor's fabrication drawings for any materials or equipment. The contractor shall submit four copies of catalogues, manufacturer's drawings, equipment characteristic data or performance charts as required by the CLIENT.

AS BUILT DRAWINGS

On completion of works, the Contractor shall submit one complete set of original tracings and two prints of "As built" drawings to the CLIENT. He shall also submit all drawings / information in AutoCAD latest version. These drawings shall have the following information: Exact run and sizes of all piping on all floors and vertical stacks. Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall. Run of all water supply lines with diameters, location of control valves, access panels. Location of all mechanical equipment with layout and piping connections. Contractor shall provide four sets of product catalogues, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

All "Warranty Cards" given by the manufacturers shall be handed over to the Architect. Four sets of Operation and maintenance manuals in the desired format shall be handed over to the Client.

MATERIALS

Materials shall be of approved make and quality specified. They shall conform to the respective Bureau of Indian Standards, British Standards Specifications and supported by Manufacturing Certificate / test certificate.

Samples of all materials shall be as per the first choice of the list of approved brand manufacture, the sample of which shall be approved by the Architect before placing the order.

In any case of non-availability of materials in metric sizes, the nearest size of FPS units shall be provided with prior approval of the Architect at no extra cost to the Client. Colour code shall be used to identify pipe material. The CONTRACTOR shall be able to identify on request all random piping prior to any field installation.

As far as possible materials bearing I.S. certification marks shall be used with the approval of the Architect.

Unless otherwise specified and expressly approved in writing by the Architect, materials of makes and specifications mentioned in this document/BOQ shall be used.

The CONTRACTOR shall furnish two (2) copies of certificates for piping for –

Dimensions and Hydrostatic test

Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Architect.

If directed, materials shall be tested in an approved testing laboratory and the contractor shall produce the test certificate in original to the Architect and the entire charges for original as well as repeated tests shall be borne by the Contractor. If required by the Architect, the Contractor shall arrange to test portions of the work at his own cost in order to prove their soundness and efficiency. If after any such test the work or portions of work is found in the opinion of the RE (Architect), to be defective or unsound, the Contractor shall pull down and re-do the same at his own cost. Defective materials shall be removed from site.

It shall be obligatory for the Contractor to furnish certificates if demanded by the Architect from manufactures or materials suppliers, that the work has been carried out by using their material and installed / fixed as per their recommendations

CEMENT

Cement required, for the plumbing work shall be -supplied to the Contractor through the Civil Contractors. However, the contractor will have to make his own arrangement to lift the cement from the go-down to the site. Cost of cement issued will be recovered from contractor.

Cement shall be stored in weather proof shed with raised wooden plank flooring to prevent deterioration by dampness or intrusion by foreign matter.

SAND

Sand shall be clean, shells, free from silt, clay, loam, shells, vegetable matter and be as approved by the Architect.

COARSE AGGREGATE

Shall be angular, tough, and sharp and well graded stone metal, Basalt from approved source.

BRICKS

Bricks shall be local best quality obtainable and shall be table moulded. Well burnt, but not over burnt and shall be free from cracks, chips, flaws, and stones. It shall not absorb water

more than 20% of its own weight when dry. The crushing strength of bricks shall not be less than 35 kg./sq.cm.

CEMENT CONCRETE

P.C.C shall be of the proportion specified in the particular item in the schedule of quantities. Sand and Metal shall be measured in suitable measuring boxes and correct quantity of cement shall be added. The materials shall be mixed dry on a clean platform. Clean water is then added, and mixed thoroughly. It shall be prepared in such quantity as can be readily used up. P.C.C which has partially set shall under no circumstances be used and shall be removed away from the site.

REINFORCED STEEL

Reinforced steel shall be ribbed torsteel. Steel required for plumbing work shall be supplied to the Contractor Free of Cost' through Civil Contractor. However the Contractor shall make his own arrangements to lift the steel from the go-down to the site.

CONTRACTOR RATES

The rates quoted by the contractor shall be inclusive of cost of materials, accessories, labour, supervision, erection, tools, tackles, plant, scaffolding, pipe hangers, supports, clamps, brackets, service connection, transport to site, storing at site, taxes, octroi and levies, breakage, wastage and all such expenses as may be necessary and required for complete installation of all the items of work as described in the specifications, drawings and to the satisfaction of the Architect.

The rates quoted are for all heights and depths as required for the work.

All rates quoted shall be for complete items inclusive of all the required accessories, fixtures and fixing arrangements, nuts, bolts, hangers, supports etc. are part of the particular item except where specifically mentioned otherwise.

All rates quoted are inclusive of making holes and chases in walls and floors and making good the same with cement mortar/concrete of appropriate mix and strength as directed by the Architect. Contractor shall provide necessary holes, sleeves, and puddle flanges, recesses parallel in the concrete and masonry work as the work proceeds.

The quoted rates shall be inclusive of cost incurred in testing, erection and commissioning of works and materials.

The contractor shall have full responsibility for all required liaison work including getting the sanction letter from the concerned authority for getting the service connections. The statutory charges will be paid by the Client.

The contractor shall furnish the Architect with voucher on request to prove that the materials are as specified and to indicate the rates at which the materials are purchased in order to work out the rate analysis for the non-tendered items, which he may be called upon to carryout.

PIPE HANGERS, SUPPORTS, CLAMPS, BRACKETS ETC.

GENERAL:

Provided proper solid angle iron/channel section, supports for all pipes complete with clamps. Wherever comes, provided wooden guide to support pipe on the angle iron hangers/supports. For attachment in concrete, use Hi-Tech fasteners or anchor plug type inserts of equipment. Provide hangers within 900 mm of all changes in direction of pipes. A minimum of three hangers per expansion band wherever shown in drawing.

Provided all additional structural steel angles, channels of the members whether specifically shown or not but are required for proper support.

Where necessary additional hangers to be provided to arrest water hammers or hydraulic resonance with proper rubber padding.

Space hangers as noted below, except on all soil pipes which shall have a hanger of multiple fittings.

Sufficient hangers shall be provided to maintain proper slope without sagging. In case of angle suspended line, the following is suggested.

Standard sizes of Hanger rods

Sl.No	Pipe Sizes	Hanger Rod Dia.
1	20 through 50 mm	6 mm
2	65 through 125 mm	10 mm
3	150 and above	15 mm

Standard spacing of supports for pipes.

Sl.No	Pipe size	Spacing of supports
1	12 to 40 mm	1.0 m apart
2	50 and above	1.5 m apart or as per IS

Provide floor stands, wall brackets of masonry pillars etc. for all lines running near the floor or near walls for those lines which cannot be properly supported or suspended from the walls or floors. Pipe lines near concrete or masonry walls may be hung also by hangers carried from wall brackets at a higher level than pipes. Hanging of any pipe from another pipe is prohibited.

Band type hangers shall be provided. Hot water piping is to be provided with suspended supports as far as possible. Note that straphangers are not permitted and clamps should be of removable type.

All vertical pipes shall be fixed by M.S. galvanised Clamps truly vertical.

Inclined pipes running along ceiling shall be fixed on M.S adjustable hangers of special design as directed. Pipes shall be laid to uniform slope and the hangers adjusted to the proper levels so that the pipes fully rest on them.

Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels, flats as per detailed drawing or as directed. Contractor shall provide all nuts, bolts,

welding and paint the clamps with two coats of zinc chromate primer and two coats of approved enamel paint. Wooden saddles shall be provided free of cost.

Slotted angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls and bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiselling will be allowed. The spacing of supports horizontally shall not exceed 1.8 M.

Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and for making good with cement concrete 1:2:4 as directed by the Architect.

CORE CUTTING

Wherever required to run the water supply pipes and sanitary pipes in RCC slabs/ beams/retaining walls/masonry walls, the core cutting shall be done by the contractor at his own cost using core-cutting machine. Manual breaking of holes in the RCC structure shall be not allowed. Contractor to mark the positions of core cutting at site and get the approval from the Architect before cutting the holes.

INSERTS AND SLEEVES

Layout work in advance of placing of concrete slabs or construction of walls, furnish and set inserts and sleeves necessary to complete the work. Cost of cutting or patching made necessary as a result of this operation shall be at no expense to the Client Opening shall be as per structural Engineers approval.

CLEANOUT PLUGS

Cleanout plugs at the head of horizontal pipes under the floor, ceiling level, on floor and vertical pipes on wall/pipe shaft, cleanout on paved area including CI frame and cover shall be provided as per the standard drawings and as per the instructions of the Architect. The cost of supply and installation of cleanout plug, CI frame, cover etc. shall not be paid separately and the same shall be measured as part of the piping item.

Internal toilet floor and wall cleanouts shall be fitted with brass cleanout cover and screwed cap. The cost of supply and installation of brass items for floor and wall cleanout shall be paid as per the bill of quantities.

SITE FACILITIES

An open area shall be made on the plot to enable the contractor to put up the site office and store at his own cost.

Water and Power supply will be provided by CLIENT at one point during the construction period and the necessary distribution shall be done by the contractor to the required point at his own cost. Based upon the consumption he will be charged for the same.

SITE CLEARANCE AND CLEANUP

The contractor shall, from time to time clear away all the debris and excess materials accumulated at site.

After the equipment and appliances have been installed and commissioned, contractor shall clear-up the same and remove all plaster, paint stains, stickers and other foreign matter of discolouration leaving the same in a ready to use condition.

On completion of all the works, contractor shall demolish all the temporary structures, remove all surplus material on written permission of the Architect, and leave the site in a room clean condition.

CUTTING AND MAKING GOOD

Structural member shall not be chased or cut without the written permission of the Architect.

Any tiles or finished surfaces or floors damaged by the contractor while doing his work shall be made good with new tiles or other finishing material as approved by the Architect at his own cost.

In case the plumbing contractor fails to get the work done to the satisfaction of the Architect, the same shall be repaired by other agencies and debit the cost of such repair to the plumbing contractor.

RECOVERY OF COST OF MATERIALS DAMAGED BY THE CONTRACTOR, ISSUED FREE OF COST TO THEM

If any materials issued to the contractor at free of cost by the CLIENT, is damaged or pilfered. The cost of the same shall be recovered from the contractor on the basis of actual cost to the Client, which shall include basic cost of material and all freight and transportation, excise duty, sales tax, octroi, import duty etc. The derivation of the actual cost given by the Client shall be final and binding on the contractor.

BRAND NAME / MAKE OF MATERIAL

For the entire plumbing and sanitary system Contractor are required to offer only the 'Brand' makes / as indicated in the specification of to ensure fair evaluation of proposal. It is to be noted by the contractor that materials / equipment, for which brand / make has not been specified, the contractor shall use only reputed makes. The contractor shall submit a list of such brands / makes to the Architect along with his offer for approval.

GUARANTEE

The contractor shall guarantee for the materials, equipments and accessories supplied by him against the manufacturing defects, malfunctioning or under capacity, functioning and workmanship of first class quality corresponding to standard engineering practice. Any defective materials / workmanship shall be rejected, the contractor has to rectify / replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the Client.

The warranty period shall be valid for a period of one year from the date of commissioning and handing over.

3.0.2 SANITARY FIXTURES & INSTALLATIONS

supply and fixing of all sanitary fixtures like sanitary ware, CP fittings, bath room accessories, wall flanges, valves and all related to bath room, kitchen utility fittings (CP and sanitary fittings).

Supply and fixing small accessory piping and any specialties furnished for fixtures such as waste connector, WC connector, pvc connection pipe, connecting nipple, screws, clamps, white cement wall flanges, washers, sealant and other accessories of this type as required.

The client will issue the CP fittings or sanitary fittings when required by the contractor. It is the contractor responsibility to install the fittings received from the client in a good condition otherwise contractor shall pay for the entire fittings cost. (Including transportation charges, all taxes, and other accessories).

Scope of installation to be performed by the contractor is outlined below:

The contractor shall hydrostatically test all the sanitary appliances and CP fittings installation including accessories and specialties.

Contractor shall supply all Jointing material as required for all joints. Like screws, washers, sealants, Installation tools, tackles, drilling machine as required to complete the work.

Tile Sanitary fixtures and fittings shall be installed at the correct aligned position as shown on the drawings and as directed by the Architect, and shall fully meet with the aesthetic and symmetrical requirements as required by the Client

All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per Project Engineer requirements. Wherever necessary the fittings shall be centered to dimensions pattern as called for.

Fixture shall be installed by skilled plumber with appropriate tools according to the best trade practice. Manufacturer's instruction shall be followed for the installation of fixtures. Fixtures in all toilets shall be standard height, mounting as called for on the drawings. Fixtures shall be mounted rigid, plumb and true to alignment

All fixtures shall be fixed firmly to the floor / wall with accessories supplied by the manufacturer. Use chrome plated brass cap nuts for fixation screws.

All ferrous accessories used for the installation of sanitary fixtures shall have anti-rust treatment given at the factory. Provide chrome plated brass escutcheon plates on chrome fittings fixed on the wall. Refer to schedules on drawings for roughing in details.

Mount fixtures at the following heights above FFL, unless otherwise dictated by selection.

Water closet 390 mm to top of bowl rim.

Bidet 390mm to top of bowl rim.

Urinal 550mm to top of bowl rim.

Washbasin 790 mm to top of bowl rim.

Flush valves 650 mm above top of bowl rim.

Refer to interior Architect documents for details of toilet and bathroom accessories. These are part of the finishing works

Care shall be taken in fixing all approved chromium plated (CP) fixtures and accessories so as not to leave any tool marks or damages on the finish. All such fixtures shall be tightened with fixed spanners. Use of 'Stiltson' type pipe wrenches with toothed jaws shall not be allowed.

All fixtures shall be thoroughly tested after connecting the drainage and water supply system. All fixtures shall be thoroughly finished and any leakage in piping valves and waste fittings corrected to the complete satisfaction of the Architect.

Upon completion of the work, all labels, stickers, plaster, etc. shall be removed from the fixtures and all fixtures shall be cleaned with soap and water so as to present a neat and clean toilet.

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Nothing in this specification shall construe to relieve the CONTRACTOR of his responsibility. The material supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

Following standards and codes are made part of this specification.

IS 10446 – 1983- Glossary of terms relating to water supply and sanitation.

IS 11208 – 1985- Guidelines for registration of Plumbers

IS 2082 -1993- Water Heaters

IS 1701 – 1960- Specification for mixing valves for ablutionary and domestic Purposes.

IS 1711 – 1970- Specification for self closing taps

IS 2963 – 1979- Specification for copper alloy waste fittings for wash basins and sinks.

IS 3004 - 1979- Specification for plug cocks for water supply purposes.

IS 3311 – 1979- Specification for waste plug and its accessories for sinks and wash basins.

IS 775 – 1970- Specifications for CI brackets and supports for wash basins and sinks.

781 – 1977- Specifications cast copper alloy screw – down bib taps and stop valves for water supply.

IS 9758 – 1981- Specification for flush valves and fittings for water closets and urinals.

IS 9763 - 2000- Plastic Bib Taps, pillar taps, angle valves and stop valves for hot and cold water services.

IS 13983 – 1994- Stainless steel sinks for domestic purposes – Specification

SP – 35- Hand book of water supply and drainage (with special emphasis on plumbing)

IS 1700 – 1973- Specification for drinking fountains

SP 7 – 1983- National building code of India (Part IX – Plumbing services)

IS 2064 – 1993- Code of Practice for selection, installation and maintenance of Sanitary appliances (First Revision)

IS 774 – 1984- Specification for – flushing cistern for water closets and urinals (Other than plastic cistern)

IS 2326 – 1987- Specification for automatic flushing cisterns for urinals.

IS 2548 - part 1- Specification for plastic seats and covers for water closets (Part 1 Thermo-set seats and covers)

IS 2548 - part 1- Specification for plastic seats and covers for water closets (Part 2 Thermoplastic seats and covers)

IS 3489 – 1985- Specification for enameled steel bath tub

IS 6411 – 1985- Specification for gel coated glass fiber reinforced polyester resin bath tub

IS 7231 – 1984- Specification for plastic flushing cistern for water- closets and urinals.

IS 9110 – 1979- Hand Operated Angers for Cleaning Water Closet & Pipes

IS 1795 - 1982- Specifications for Pillar taps for water supply purposes.

IS 2556 - 1994- Specifications for the Vitreous Sanitary Appliances

Part 1 - part 14- (Vitreous china) (Part 1 general requirements)

IS 5961 - 1970- Specification for cast iron gratings for drainage purposes.

EUROPEAN TYPE WATER CLOSET

The closet shall be white or colored as per BOQ and made of vitreous China and shall be of the best quality manufactured by an approved firm, and fixed by approved means. It shall have 100 mm dia 'P' or 'S' trap depending on the location of water closets and soil stacks with effective seal. Each closet shall be provided with the following accessories:

1. Double flapped heavy urea formaldehyde seat cover of approved make quality and color with rubber buffers and C.P. brass bar and screws fixed to the pan.
2. 32mm dia C.P flush valve set/ Cistern.
3. 15mm C.P health faucet with angle valve.
4. Cast-iron chair or cantilever bracket for wall hung type with C.P bolt & nut.

The quoted rate is inclusive of, receiving of items, installation and testing as per the specifications and instructions of the Architect.

MODE OF MEASUREMENT

European Water Closets shall be measured per number and the quoted rate shall include: fixing of,

1. W.C pan, trap with brackets/bolts and CP flush pipe, CP brass flush valve set.
2. Plastic seat cover.
3. Jointing and fixing material.
4. C.I chair / cantilever bracket.
5. Fixing the WC as per the drawing.
6. Testing as specified, if any.

INDIAN WATER CLOSET

Indian Water Closet white or color Orissa pan type with porcelain 'P' or 'S' trap shall be provided with cistern with all the required accessories etc., Indian Water Closet and trap shall be set in plain cement concrete 1:4 and flush with the floor. The quoted rate shall include installation and testing as per the specifications and instructions of the Architect. The scope of work included in the fixing of 32mm PVC flush pipes, high level cistern, PVC inlet connection and brass strip cock. The Indian type water closet shall be treated as a single item and no extra spares and labour should be paid.

MODE OF MEASUREMENT

Indian Water Closets shall be measured per number and the quoted rate shall include: fixing of

1. W.C. pan with 'P' or 'S' trap, cistern, PVC inlet pipe, CP brass stopcock and fixing materials.
2. Setting the closets in Plain cement concrete including the cost of cement concrete.

WASH BASINS

They shall be white or colored as per BOQ and of vitreous China with best quality manufactured by an approved firm and size as specified. Oval / circular wash basin shall be supported on a RC counter with necessary steel reinforcement and rectangular wash basins with or without pedestals shall be supported by a pair of CI brackets of approved design. The wash basin shall be circular or oval shape below or above counter or rectangular with or without pedestal type as specified in Schedule of Quantities.

Each washbasin shall be fitted with 1 No. CP brass pillar cock, 15mm CP brass angular stop cock, 8mm PVC inlet pipe, 32mm CP waste half threaded coupling, 40mm dia PVC waste pipe.

The quoted rate is inclusive of complete fixing of supporting brackets, installation and testing as per the specifications and instructions of the Architect.

MODE OF MEASUREMENT

Washbasins shall be measured per number and the quoted rate shall include:

1. Above said items.
2. Necessary fixtures.
3. Fixing in position and
4. Testing where necessary / specified.

SHOWER UNIT

The shower unit shall be brass chromium plated wall mounted exposed type hot and cold water mixer unit with CP spout. The shower unit shall be fitted with an overhead shower set comprising of shower arm, rose, wall flange etc., for complete installation of shower unit as per manufacture/RE (Architect) instructions.

MODE OF MEASUREMENT

All the items above shall be measured in numbers only and the quoted rate shall be per number, which shall include: fixing of

1. Above said items.
2. Necessary fixtures.
3. Fixing in position and
4. Testing where necessary/specified.

SINKS

They shall be Stainless steel of best quality and shall be supported on necessary brackets. Each sink shall be provided with 40 mm CP waste coupling, 40mm waste pipe, wall flanges, connection pipe, angle valve, long nose bibcock etc. including all the fixing materials.

Each sink shall be provided with 40mm CP waste coupling & 40mm PVC waste pipe.

The quoted rate is inclusive of complete fixing of supporting brackets, installation and testing as per the specifications and instructions of the RE (Architect).

MODE OF MEASUREMENT

Sinks shall be measured in numbers including all items stated above and shall include fixing in position.

URINAL

Urinal shall white or colored as per Schedule of Quantities. The urinal shall be large flat back type fixed with hanger and brackets. This includes fixing of partition in position and fixing of the followings,

- 40 mm dia. C.P waste coupling with dome grating.
- 32 mm dia. C.P bottle trap.
- C.P urinal spreader & C.P flush pipe.

15mm dia CP brass angular stop cock with wall flange

- Auto flush system with sensor, solenoid valve, gate valve, conduit and wiring complete. (If this system is specified in BOQ)

The quoted rate is inclusive of complete fixing of supporting brackets, installation and testing as per the specifications and instructions of the RE (Architect).

MODE OF MEASUREMENT

Urinal shall be measured in numbers and the quoted rate shall include. Fixing of

1. 15mm CP brass urinal flush valve set complete with control cock/15mm CP push cock/15mm Cp angular cock with wall flange and 300mm long connecting pipe with nut, CP urinal spreader, CP waste coupling and dome grating.
2. 40mm CP brass bottle trap of casted type/32mm PVC waste pipe.
3. Jointing and fixing material
4. Fixing of the brackets.

In case of Auto Flush systems including wiring, fixing of solenoid valves, non-return valves, conduiting and other electrical related works etc., shall also included in the unit rate.

TOILET ACCESSORIES**MIRROR**

Mirrors shall be of the best quality and of approved make, 6.0 mm thick with copper backing fixed to 8mm thick commercial plywood fixed to the back of the mirror and encased with teakwood frame. The mirror shall be fixed to wall with stainless steel mirror head screws.

TOWEL RAIL

Towel rail shall be of C.P. with reinforced bends and circular flanges. The size of the rail shall be as specified. The bracket shall be fixed by means of stainless steel screws to wooden / plastic cleats firmly embedded in the wall.

TOILET PAPER HOLDER

Toilet paper holder shall be of chromium plated.

TOWEL RING, SOAP TRAY, CLOTH STAND ETC.

These shall be of CP specified in the Schedule of quantities. These shall be fixed by means of stainless steel screws to wooden / plastic cleats firmly embedded in the wall.

ELECTRIC HAND DRIER

The electric hand drier shall be twin blower type interpreted with timer range 0 to 3 minutes. The drier shall be fully automatic. The power requirement shall be 230V, 1PH, 50Hz 1700 watts. The drier shall be wall-mounted type.

SOAP DISPENSER

The Soap dispenser shall be wall mounted type tough ABS plastic with soap pouch and pump system as per list of recommended makes. The capacity of dispenser shall be 500 ml

BOTTLE TRAPS

Bottle trap (for wash basins, sinks, urinals etc..) shall be deep seal (minimum 60mm water seal) cast brass bottle, heavy chromium plated. All bottle traps shall be provided with suitable cleaning eye, extension piece, flare nuts all chromium plated. Bottle traps shall be of approved make and design. Traps for washbasins, and for urinal and sinks shall be 32mm.

MODE OF MEASUREMENT

All the items above shall be measured in numbers only and the quoted rate shall be per number, which shall include:

1. Fixing of respective materials.
2. Necessary fixtures.

3. Fixing in position, wiring, conduiting and
4. Testing where necessary / specified.

WATER COOLERS

Water coolers specified shall be exterior stainless steel construction. They should have PUF insulation to reduce the effective electrical power consumption. The water cooler should be capable of supplying water to the drinking standards as enumerated in Indian Standard 10500 – 1980. The cooler to be installed in plumbing with the floor level and should consist of rubber mounted adjustable jack bolts to suit parallelism of the floor. The compressor is to rugged and dependable and hermetically sealed for any leakage. Surge drums in the refrigerant circuit should be well enough to prevent leakage in the compressor unit. The cooling and loading capacities should be sufficient as per the bill of quantities. The nominal cooling capacities through a drop of temperature should conform to IS 11475.

MODE OF MEASUREMENT

Electric water coolers shall be measured in numbers and should include all the items as mentioned above.

WATER HEATER:

These shall be of best approved make and type and capacity as per Bill of materials. They shall be mounted on the wall/left with necessary bolts of approved make. They shall have an internal tank made of 99% pure copper, 8 mm PVC inlet pipe, 12 mm lead/copper pipe outlet, 15 mm non-return valve. These shall be measured per number and the rate quoted shall include. Fixing of

1. Water heater with all built-in electrical accessories like pilot lamp, thermostat, standard length of cable and 3 pin 15A plug.
2. PVC inlet lead outlet pipe and non-return valve.
3. Fixing accessories like bolts and nuts etc.,

MODE OF MEASUREMENT

Water heater shall be measured in numbers only and the quoted rate shall be per number, which shall include: fixing of

1. Above said item
2. Necessary fixtures.
3. Fixing in position.
4. Testing where necessary / specified.

MOCK UP AND TRIAL ASSEMBLY

The installation of the sanitary fixtures and shall be as per the shop drawings approved by the Client.

The Contractor shall assemble on trial basis at least one set of each type of sanitary fixture and fittings in order to determine precisely the required supply and disposal "connections. Relevant instructions from manufacturer shall be followed as applicable. This trial, assembly shall be developed to facilitate determining the location of punctures, holes, holding devices etc, which will be required for final installation In position of all sanitary fixtures and fittings. The above assembly shall be subject to final approval by the Client.

The fixtures in the trial assembly can be reused for final installation without any additional payments for fixing or dismantling of the fixtures.

3.0.3 INTERNAL & EXTERNAL WATER SUPPLY SYSTEM

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install internal and external water supply pipes, pipes, fittings, valves and specialties, construction of valve chambers as indicated on the drawings and specifications.

Without restricting to the generality of the foregoing works, the scope of the work shall include Supply, Installation and testing of all Piping works like cold Water, hot water, piping and related valves, specialties and accessories for internal and external water supply.

The Contractor shall carryout and complete the said work under this contract in every respect in conformity with the rules and regulations of the local Authority. The Contractor shall furnish all labour, supply and install all new materials, appliances, equipment necessary for the complete installation and testing of the internal and external water supply system, as per the relevant BIS codes. This also includes any material, appliance, equipment not specifically mentioned herein or noted in the drawings but which are necessary and customary to make a complete installation as shown on the drawings or described herein, properly connected and in working condition. However, this specification does not relieve the contractor for the correctness of the system.

The contractor shall include all implied/allied items in their offer. Nothing extra will be paid whatsoever for incidental or contingent work.

The contractor must get acquainted with the proposed site for the works and study specifications and conditions carefully before tendering. The work shall be executed as per programme approved by the Project Engineer. If part of site is not available for any reason or there is some unavoidable delay in supply of materials stipulated by the Client, the programme of construction shall be modified accordingly and the contractor shall have no claim for any extras or compensation on this account.

Three sets of all manuals for the water supply system shall be submitted to the CLIENT. This shall include instruction and maintenance manuals.

It is the responsibility of the Contractor to train the Client's personnel in the operation and maintenance of the system.

Supply, Installation, testing and commissioning of the complete water supply system shall be as per the specifications and drawings and as per the instructions of the RE (Architect).

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Nothing in this specification shall construe to relieve the CONTRACTOR of his responsibility. The material supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

Following codes and standards are made part of this specifications.

IS 10446 - 1983	Glossary of terms relating to water supply and sanitation.
IS 11208 - 1985	Guidelines for registration of Plumbers
IS 7558 - 1974	Code of practice for domestic hot water installations
SP 7 - 1983	National Building Code of India (Part IX- Plumbing services)

IS 2692 - 1989	Specification for Ferrules For Water Services.
IS 1239 (Part-I)-1990	Mild steel tubular and other wrought steel pipes and fittings
IS 1239	Mild steel tubular and other wrought steel pipes and fittings (Part-II) –1990
IS 779 - 1978	Specifications for Water Meters Domestic Type
IS 2104 – 1981	Specification for water meter boxes (Domestic type)
IS 2401 - 1973	Code of practice for selection, installation, and maintenance of domestic water meters.
IS 7413 - 1981	Insulation Material
IS 2065 – 1983	Code of practice for Water Supply In Buildings (Second Revision)
IS 778 - 1984	Specifications for copper alloy Gate, Globe And Check Valves for water supply purposes.
IS 1703 - 1977	Specification for ball valves (horizontal plunger type) including floats for water supply purposes.
IS 3004 - 1979	Specification for plug cocks for water supply purposes.
IS 3950 – 1979	Specifications for surface boxes for sluice valves.
IS 9338 - 1984	Specification for cast iron screw-down stop valves and stop and check valves for water works.
IS 4346 - 1982	Specification for washers for use with fittings for water services.
IS 5219 - Part 1	Specification for cast copper alloy traps
IS 5312 - part 1	Specification for swing check type reflux (Non-return) valve for water works purposes single door pattern
IS 13049 - 1919	Diaphragm type (plastic body) float operated valve for cold water services – specification.
IS 13114 - 1991	Forged brass gate, globe and check valves for water works purposes – specification.
IS 14399 - part 1	Hot press moulded thermosetting glass fiber reinforced polyester (GRP) resin sectional water storage tanks.
IS 310 - 1965	Code of Practice for Water Supply

SP - 35 Hand books of water supply and drainage (with special emphasis on plumbing)

IS 1172 – 1983 Code of Basic Requirement for Water Supply, Drainage & Sanitation
(Third Revision)

IS 12183 Code of practice for Plumbing in Multi-Storey Buildings (Part 1 water supply
(Part I) - 1987

IS 1200 – 1992 Method of Measurement Of Building And Civil Engg. Works.
(Part 1 earth work)

IS 2379 - 1963 Specification of color code for the identification of pipes.

SP 7 - 1983 National building code of India (Part IX – Plumbing services)

IS 2401 - 1973 Code of practice for selection, Installation and maintenance of domestic water meters.

IS 780 - 1984 Specification for Sluice valves for water works purposes (50 to 300mm size)
(Sixth Revision)

WATER SUPPLY

Main source of water is from bore wells. The underground water tank comprises domestic water storage, firewater storage. Access manholes are provided for maintenance purposes. Air vents with mosquito proof mesh is provided to prevent the entry of insects.

CPVC PIPES AND FITTINGS FOR WATER CONNECTIONS

CPVC pipes and fittings shall be used for cold water services above and below ground applications. All internal and external piping shall be of CPVC SDR 13.5 up to 50 mm and above 50 mm shall be CPVC SCH 40.

LAYING AND FIXING

Visually inspect pipe ends before making the joint. Use of chamfering tool will help identify any cracks, as it will catch on to any crack.

Pipe may be cut quickly and efficiently by several methods. Wheel type plastic tubing cutters are preferred. Ratchet type cutters or fine tooth saws are another option. However, when using the ratchet cutter, be certain to score the exterior wall by rotating the cutter blade in a circular motion around the pipe. Do this before applying significant downward pressure to finalize the cut. This step leads to a square cut. In addition, make sure ratchet blades are sharp. Cutting tubing as squarely as possible provides optimal bonding area within a joint.

Burrs and fittings can prevent proper contact between the tube and fittings during assembly, and should be removed from the outside and inside of the tube. A chamfering tool is preferred, but a pocketknife or files are also suitable for this purpose.

A primer is required with two-step solvent cement; it is important to use the proper applicator. A dauber or natural bristle paint brush approximately half the size of the tubing end and the fitting socket. Solvent cement must be applied when the pipe surface is tacky from primer. Do not allow primer to puddle inside the fitting or finished assembly.

Use CPVC cement or all-purpose cement conforming to ASTM F-493 otherwise joint failure may result.

When using solvents be certain of proper ventilation.

When making a joint, apply a heavy, even coat of cement to the pipe end. Use the same applicator without additional cement to apply a thin coat inside the fitting socket. Too much cement can cause clogged water ways. Do not allow excess cement to puddle in the fitting and pipe assembly. This could result in a weakening of the pipe wall and possible pipe failure when the system is pressurised.

Rotate pipe one quarter to one half turn while inserting in into the fitting socket. Once the pipe end is sealed, hold it in place for five to ten seconds to allow the joint set.

When making a transition connection to metal threads, use a special transition fitting or CPVC male threaded adapter whenever possible. Do not over torque plastic threaded connections. Hand tight plus one half turn should be adequate.

When female threaded transitions are required, use only the type manufactured with brass-threaded inserts.

Use care when selecting threaded sealants.

Teflon tape is always compatible with CPVC. If you prefer paste, use only those sealants specially approved for use with CPVC. Paste based on horse hair, widely used with galvanized iron is not recommended with CPVC. Included in the installation section is a list of known incompatible sealants.

Hang or strap CPVC systems loosely to allow for thermal expansion. Do not use metal straps with sharp edges that might damage the tubing.

When connecting gas water heater, CPVC tubing should not be located within 50 cm of the flue. For water heaters lacking reliable temperature control, this distance may be increased upto 1m. A metal nipple or flexible appliance connector should be utilized. These measure climates the potential for damage to plastic piping that might result from excessive radiant heat from the flue.

Use of a brass / CPVC transition adapter when connecting CPVC to a water heater will help facilitate water heater replacement in the future.

Pressure test CPVC systems in accordance with local code requirements.

An alternative method is the use of ratchet cutter. Although this option is quick and easy, this method should be used only if you are willing to be diligent in regularly sharpening your cutting blades. If poorly sharpened blades are used, it is possible that the downward pressure from cutting will cause cracking of the pipe end. When using the ratchet cutter be certain to score the exterior wall by rotating the cutter blade in a circular motion around the pipe. Do this before applying significant downward pressure on the pipe. As a precaution in cold weather, we recommended you use your hands to grip the area of the pipe to be cut for 5 to 10 seconds. Lastly, when cutting pipe in extremely cold weather we recommended you choose alternative methods of cutting.

Safe handling of solvents:

When using solvent cements, primers, and cleaners there are some basic safety measures all users should keep in mind.

Avoid prolonged breathing of solvent vapors. When pipe and fittings are being joined in enclosed areas, the use of ventilating devices are advised.

Keep cements, primers and cleaners away from all sources of ignition, heat, sparks and open flame.

Keep containers of cements, primers and cleaners tightly closed except when product is being used.

Dispose of all rags used with solvents in a proper outdoor waste receptacle.

Avoid eye and skin contact. In case of eye contact, flush with plenty of water for 15 minutes and call a physician.

All exposed cPVC pipes and fittings shall be supported on MS pipe supports, hangers, ‘U’ clamps, and bolts etc., as shown on the detailed drawings and as per the RE (Architect) instructions. All the pipe supports shall be hot dip galvanised as per the Indian standard specifications. All the pipe supports shall be painted with two coats of enamel paint over a coat of zinc chromate primer. The colour of the paint shall be approved by the RE (Architect).

For internal work all pipes and fittings shall be fixed truly vertical and horizontal, either by means of standard pattern holder bat clamps keeping the pipes 1/2” (12mm) clear of the wall everywhere or concealed as directed.

For external work pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for working. The pipes laid underground, the cover on top of pipe shall be not less than 600mm for metal pipes and shall not be less than 900mm for plastic pipes from the finished ground level and a minimum horizontal distance of 600mm shall be maintained between other services lines. Backfilling of trenches shall be as explained elsewhere in the specifications.

TESTING

Before any pipes are painted or covered / buried, they shall be tested to a hydrostatic pressure of one and half times the working pressure. Pressure shall be maintained for at least eight hours without an appreciable drop in pressure. In addition to the sectional testing of water supply pipes, the contractor shall test the whole installation to the entire satisfaction of the RE (Architect). He shall rectify any leakages, failure of fittings or valves.

RECTIFICATION

Any leakage noticed shall be promptly attended by the contractor. If required the pipes and fittings shall be replaced to achieve an absolutely watertight system at his own cost.

DISINFECTION OF THE PIPE NETWORK

The contractor to disinfect the entire water distribution network including the storage tanks at his own cost. The disinfection shall be done by using residual chlorine of 0.2 ppm for a period of 2 (two) hours. The entire chlorinated pipe network is to be flushed out with fresh water before the water supply system is put into operation for domestic usage.

MODE OF MEASUREMENT

CPVC pipes above ground shall be measured along the centre line of the pipes and fittings. The quoted rate for respective item shall be per Rmt and shall include the following:

1. Cost of respective pipes and specials.
2. Laying, fixing and jointing with standard pipe clamps available for different sizes inside the wall chase and fixed on MS angle iron brackets and GI U clamps for pipes in ducts as shown on the drawing.
3. Cutting holes and chases in walls, floors, etc. and making good the same.
4. All supporting arrangements, brackets, etc.

Testing and making good the defects, if any. Pipes below ground shall be measured as stated elsewhere in the specifications.

3.0.4 VALVE & CONTROLS

GENERAL

This section deals with different type of valves like butterfly valves, gate valves, ball valves, check valves, and Strainers and pressure gauges. The contractor shall refer to the approved make of materials specified in the document & relevant drawings.

Valves shall be provided on branch pipe connections to mains and at connection to equipment where indicated. All valves are to be located for easy access. All valves shall be supported wherever necessary with MS brackets. Valves shall comply with IS 780 (Class I) for C.I sluice valves and IS 778 for G.M valves and tested.

Pressure gauges shall have outer diameter not less than 115mm with 10mm BSP full thread, brass body siphon and gauge cock of size 10mm. Dial gauges shall have adequate response for the pressures encountered within the specified (Range 0-15Kg/sq.cm).

GATE VALVE

The primary function of a gate valve is for starting and stopping of flow. It has a disc actuated by a stem screw and hand wheel, moves up and down at right angles to the path of flow of fluid and seats against two faces to shut off flow. As the disc of the gate valve presents a flat surface to the direction of flow, this valve is only for starting and shutting the flow in the pipe.

These valves are of GM make. Supplying, fixing and testing shall correspond to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

All globe and check valves shall have working parts suitable for hot and cold water, as required. Valves shall be tagged with permanent label under hand wheel indicating type or duty.

All valves should have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same. Gate valves shall be of the size as specified in the BOQ.

Also the following standard corresponds to their manufacture.

Design	-	API602/BS5352
Face to Face/End to End	-	ANSI B 16.10
Flange Dimension	-	ANSI B 16.5
Butt Weld Ends	-	ANSI B 16.25
Pressure/Temperature Ratings	-	ANSI B 16.34
Testing	-	API 598

BALL VALVE

The ball valve shall be of high pressure type and shall be of sizes as specified in the BOQ. The normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed. Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for a float exceeding 115mm dia. The body of the high pressure ball valve when assembled in working condition with the float immersed to not more than half of its diameter shall remain closed against a test pressure of 3.5kg/sqcm.

The ball valve shall generally conform to IS specification No.1703: 1977. The weight of ball cock and the size of the ball cock shall be as per IS specification.

FOOT VALVES

Foot valves are provided with cast iron body with brass disc and strainer of approved quality as specified in BOQ. The foot valve shall be of spring loaded or flapper type depending on the requirement. The valves should be tested physically for free operation before being mounted or assembled to the pipeline.

BUTTERFLY VALVES

Butterfly valves shall be slim seal, short wafer type with standard finish. The valves shall be suitable for mounting between flanges drilled to ANSI 125. The valve body shall be cast iron. The disc shall consist of disc pivot and driving stem shall be in one piece centrally located. The disc shall move in bearings on both ends with 'O' ring to prevent leakage. The seat shall be moulded with black nitrile rubber or nylon and shall line the whole body. The spindle shall be AISI 41 steel. The valve shall be suitable for a working pressure of 16.5 kg/sq.cm and shall be complete with flow control lever and notches, factory machined companion flanges and bolts and nuts. These valves conform to BS 5155 with electrosteel nickel coated SG Iron (N) and seat material EPDM3.

Also the following standard corresponds to their manufacture

Design	-	API609 / BS5155
Face to Face/End to End	-	ANSI B 16.10
Flange Dimension	-	ANSI B 16.5
Butt Weld Ends	-	ANSI B 16.25
Pressure/Temperature Ratings	-	ANSI B 16.34
Seating	-	moulded in situ resilient lining of black Nitrile rubber
Body	-	Heavy duty CI to IS210 Gr FG220 & BS 1452 Lining of black nitrile rubber.
Disk	-	Nylon coated SG iron of IS1865 / SF415 /
127BS2729 Gr. 420 / 12		
Shaft	-	Shafts are to be made of SS AISI 431 Only, flanged valves to be used with Flanges drilled to BS10 table F; valves shall be capable of being locked in open position. Hand wheel shall be with Worm and worm wheel operated for Smooth opening and closing. Key rod with MS Coated extended spindle to be provided wherever the valves are not approachable from the ground surface.

CHECK VALVES

Check valves / Non-Slam Non-return valves are designed to prevent reversal of flow. These are also called Non-return valves or reflux valves to avoid reversal of flow. Check valves shall be Dual Plate check valves with CI body, Aluminium bronze plate SS 316 hinge pins and springs and Buna-N seals to ANSI series 125. They can also conform to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

Also the following standard corresponds to their manufacture

Design	-	BS1873 / IS 5312 Part I
Face to Face/End to End	-	ANSI B 16.10
Flange Dimension	-	ANSI B 16.5
Butt Weld Ends	-	ANSI B 16.25
Pressure/Temperature Ratings	-	ANSI B 16.34

STRAINERS

"Y" strainers up to 50mm shall be of gunmetal and above 50mm shall be of cast iron body. Strainers shall incorporate a removable bronze screen with 3.175 mm (1/8") perforations and a permanent magnet. Strainers shall be provided with flanges at both inlet and outlet. They shall be designed to enable blowing out of accumulated dirt and facilitate removal and replacement of the screen without disconnection of the main pipe.

All strainers shall be provided with equal size isolating “Slim Seal” butterfly valves of approved brands as shown in drawings so that the strainer may be cleaned without draining the system

FLANGES AND UNIONS

Sufficient number of flanges and unions shall be provided as required to facilitate maintenance work after the piping is installed. Mild steel flanges shall be used for pipes. The flanges shall be connected to the pipeline by screwing or welding depending on the requirement. The flanges shall conform to the relevant ASTM standard for the particular material used for its manufacture. The flanges shall also conform to IS 5211.

BRASS BIB COCK AND STOP COCK

A bibcock is a draw off tap with a horizontal inlet and free outlet and stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipeline for controlling or stopping the flow. They shall be of specified size and shall be screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle, which operates it. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anticlockwise direction.

The bibcock and stopcock shall be polished bright (Chrome plated). The minimum finished weights of bib tap (cock) and stop tap (cock) as given in the IS specification are reproduced in the table:

Minimum finished weight

Size Mm	Bib tap Kg.	Stop tap Kg.
8	0.25	0.25
10	0.30	0.35
15	0.40	0.40
20	0.75	0.75

WATER METER

The water meter and stop cock shall be fixed in position by connection pipes, with GI nuts and socket etc,. The stopcock shall be fixed near the inlet of the water meter.

The paper disc inserted in the ripples of the water meter shall be removed and the meter installed exactly horizontal or vertical as per the flow direction indicated on the body of the water meter. Care shall be taken while installation, the seal of the meter shall not be disturbed. To protect the water meter from the external forces, a valve chamber of 600mm x 900mm x 600mm depth with medium duty cast iron frame and cover shall be provided. The cost of excavation to chamber, plastering necessary cement concrete shall be included in the unit rate.

AUTOMATIC LIQUID LEVEL CONTROLLER

The supply installation testing and commissioning of electronic Automatic Level Controller to monitor both sump and overhead tank simultaneously shall be included in the scope of Building automation system (BAS). Depending on preset levels both in sump / overhead tank, the pump / starter switches ON/OFF automatically

INSTALLATION OF VALVES

Valves should be installed in true tolerance of +/-5mm with respect to the center line of the pipe. Where threaded joints are encountered the threads should be initially sealed with PVC tape to avoid leakage due to improper tightening and leakage from threading.

Proper care has to be taken in welded installation so that the centerline of valve should not deviate from the pipe causing uneven load on the pipe and further stress during its operation. The welding should be done only after proper inspection of the joint by the RE (Architect) in the tacked position of the joint.

Before putting the line in operative mode the valves should be checked for free and easy operation of the hand wheel. Any burrs or foreign materials should be removed by flushing before final operation so that no choking in the valves should occur which might damage the valve seal.

CONSTRUCTION OF VALVE CHAMBER

Valve chamber shall be of internal size 600mm x 600mm up to a depth of 900mm shall be constructed. Bed concrete shall be in 1:4:8 cement concrete 150 mm thick for valve chambers. Brickwork shall be with best quality table moulded bricks in 1:6 cement mortar as per specification for brick masonry. The thickness of masonry shall be as specified in the ISI codebook.

Internal walls shall be plastered smooth with 15mm thick cement mortar 1:3 using water proofing material and external walls shall be plastered rough with sponge finish. The inspection chamber shall be fitted with heavy duty cast iron frame and cover. The weight of the cover and frame shall be as specified in the IS code. The cost of excavation and backfilling shall also be included in the scope of work.

P.C.C PIPE SUPPORTS.

Constructing P.C.C. pipe supports using P.C.C 1:2:4. The concrete surface shall be plastered smooth using 1:6 cement mortar including all the necessary metal insertions for pipe anchorage. The size of the support shall be as per the detailed drawing/ B.O.M. The maximum spacing of the supports shall be 2.5mtrs.

Mode of Measurements

Valves shall be measured in number only and the cost shall include:

1. Cost of valves and jointing materials.
2. Fixing and jointing with necessary bolts, nuts, rubber inserting, etc.

Testing and making good the defects if any.

WATER HAMMER ARRESTORS

The effective fluid hammer which result in breaking of pipeline caused due to series of hydraulic shock should be arrested by means of a water hammer arrestor. The arrestor shall be capable of withstanding pressures upto 500 P.S.I. and temperatures in the range of –415F to 2120F (-540 C to +1000C). It shall be maintenance free with a companion flange to suit in the pipeline. The following materials are used for its manufacture

Barrel	-	Type 'K' hard drawn copper.
Cap	-	Standard wrought copper fittings attached to Barrel with 95-5 solder.
Piston & Thread Adaptor	-	Machined of free turning brass.
Seals	-	"O" rings shall be of Parker spec. EP-5778-80
Seal Lubricant	-	Dow-corning silicone compound #111, FF & DAListed for use in potable water system or Nickel plated for seawater application.

PRESSURE REDUCING VALVE

Pressure reducing valves are provided to keep the pressure in the line below a given value within the reasonable limits in the downstream side of the pipeline when the pressure builds up beyond the design value. Pressure reducing valves shall be of high pressured type of specified sizes. The valves should be suitable for mounting between flanges and threading connections also. The valve body shall be of bronze / SS as specified. The valve shall be of spring loaded, direct operation, metallic diaphragm type, as required for the particular usage. The pressure reducing valves should be manufactured in conformance with ASA -150, 300, 600, 800, 900 and 1500, or to BS10- table –D, E, F, H or DIN- ND-16 & ND-40.

3.0.5 STORAGE TANK & RESERVOIR INSERTS

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install the reservoir inserts such as inlet, outlet, overflow, drain, ladder, manhole frame and cover including all other materials required to complete the work as indicated on the drawings and specifications.

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Nothing in this specification shall construed to relieve the CONTRACTOR of his responsibility. The material supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

Following are the standards and codes are made part of this specifications.

IS 2062 – 1992	Structural steel for general purposes
IS 226	Galvanization of structural steel
IS 816 and 823	Welding of structural steel

PUDDLE FLANGES FOR RESERVOIR (INSERTS)

Inlets, outlets, interconnection sleeves and drain outlets for the reservoir shall be made through mild steel bath galvanised puddle flanges obtained from reputed manufacturers and to be inserted at suitable levels as indicated on the drawings. The Contractor shall be responsible for placing the inserts at required level well in advance and before making the final shuttering layout for casting the walls. All the overhead water tank terraces shall be provided with efficient rainwater disposal system. The necessary sleeve in the tank wall shall be provided for running the level controller wires/probes.

The plate used for fabricating the puddle flanges shall be MS 6mm thick with fillet welding. The length of the puddle flanges shall be minimum 600mm unless otherwise specified.

Puddle flanges shall have threaded ends upto 80mm dia and flanged ends above 80mm dia. All puddle flanges shall be hot-dip galvanised after fabrication.

All the underground water tanks shall be fitted with heavy duty CI manhole frame and cover. The overhead water tanks are provided with light duty CI manhole frame and cover.

The tanks are provided with aluminium step ladder for efficient maintenance of the water tanks.

Adequate number of vent pipes of minimum 100mm dia with mosquito proof mesh shall be provided above the overflow level at regular intervals as per the detailed drawings and as per the instructions of the RE (Architect).

MANHOLE COVERS

The manhole covers shall be of medium duty/light duty type (cast iron) with double seal, locking arrangement and lifting hooks manufactured as per IS-1726. The shape of the cover to be as per the drawings.

ALUMINIUM STEP LADDER

For effective maintenance of the reservoir portable Aluminium step ladder to suit the depth of the tank shall be provided with necessary hooks and fixing accessories.

3.0.6 INTERNAL SEWAGE SYSTEM

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install soil, waste, vent and rain water pipes as indicated in the specifications and as per the instructions of the RE (Architect).

Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater piping system shall include the following: -

1. Vertical and Horizontal Soil, waste, vent, rain water pipes and fittings, joints, clamps and connections to fixtures.
2. Connection of all pipes to sewer lines as shown on the drawings.
3. Floor and urinal traps, cleanout plugs and inlet fittings.
4. Testing of all pipe lines and all accessories as per Bureau of Indian Standards

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Nothing in this specifications shall construed to relieve the CONTRACTOR of his responsibility. The material supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

Following are the standards and codes are made part of this specifications.

IS 10446 - 1983 Glossary of terms relating to water supply and sanitation.

IS 11208 - 1985 Guidelines for registration of Plumbers

IS 5382 - 1985 Specification for rubber sealing rings for gas mains, water mains and sewers.

SP - 35 Hand book of water supply and drainage (with special emphasis on plumbing)

IS 1172 - 1983 Code of Basic Requirement For Water Supply, Drainage & Sanitation
(Third Revision)

IS 1200 - 1992 Method of Measurement Of Building And Civil Engg. Works.
(Part 1 earth work)

IS 2379 - 1963 Specification of colour code for the identification of pipes.

SP 7 - 1983 National building code of India (Part IX – Plumbing services)

IS 1742 - 1983 Code Of Practice For Building Drainage (Second Revision)

IS 301 - 1971 Code of practice for Building Drainage

IS 12251 - 1987 Code Of Practice For Drainage In Basement

BS 5572 - 1978 (Amendment No.2) Sanitary pipe Works

BS 4660 - 1973 (Amendment No.1) PVC Underground Drain Pipes & Fittings.

IS 5329 – 1983 Code of practice for sanitary pipe work above ground for buildings
First Revision)

IS 2527 - 1984 Code of practice for fixing rain water gutters and down take pipes for roof drainage. (First Revision)

IS 5961 - 1970 Specification for cast iron gratings for drainage purposes.

IS 2527 - 1984 Code of practice for fixing rain water gutters and down take pipes for roof drainage. (First Revision)

IS 1626 (Part 1) Specification for asbestos cement building pipes and pipe fittings, gutter and gutter fittings, and roof fittings

GENERAL REQUIREMENTS

Materials shall be of the approved make and quality specified. They shall conform to the respective Bureau of Indian Standards, British Standards Specifications, supported by Manufacturing Certificate and any other specification referred to herein.

Pipes and fittings shall be fixed truly vertical, horizontal or on slopes as required in neat manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, and in suspended ceilings.

Pipes shall be fixed securely to walls and ceilings by suitable pipe supports at intervals specified.

Access door for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

POLYVINYL CHLORIDE (PVC) PIPES AND FITTINGS

PVC (SWR) class pipes and fittings of dia 75mm OD, 90mm OD, 110mm OD and 160mm OD of Type A for use in rain water and ventilation and of Type B for soil and waste discharging system and conforming to IS 13592: 1992, shall be used. The pipes shall be supplied in nominal lengths of 2,3,4 or 6 meters, tolerance on specified lengths shall be +/- 10mm. Any physical test requirements shall be as per IS 13592-1992.

Rain water pipes higher than 160mm OD in diameter shall conform to IS 4985-1988. The pipes used for rainwater disposal system shall not be less than 4kg/cm² and fittings shall be of injection moulded PVC conforming to IS 7634 (Part1) - 1975.

HANDLING

Because of their lightweight, there may be a tendency for the PVC pipes to be thrown much more. Reasonable care should be taken in handling and storage to prevent damage to the pipes. Contractor should hold the fullest responsibility in this case. On no account the pipes should be dragged on the ground. Pipes should be given adequate supports at all times.

LAYING

The PVC pipes shall be laid under the floors below slab or on walls either buried or exposed as the case may be, as per the specifications and instructions of the RE (Architect). The minimum thickness of fittings shall be of 3.2 mm. The fittings shall be of injection-moulded type with solvent cement joint or rubber ring joint. The pipes and fittings shall be capable of withstanding sun's rays. PVC pipes laid below slab or suspended in ceiling shall be supported by angle brackets / MS supports as detailed in the drawings and as per the instruction of the RE (Architect). The cost of drilling holes in RCC slab, floor, RCC/masonry retaining wall with the core cutting machine and making good the same with approved quality cement concrete etc. is at its own cost. If the pipes laid above the floor level (sunken level), it should be rigidly fixed with PCC bedding and levelled at every 1 metre intervals.

JOINTING

The jointing of pipes to fittings shall be done as per the manufacturers instructions / recommendations and as per the RE (Architect) instruction.

The PVC pipes and fittings shall be joined with Solvent Cement and jointing shall be carried out as follows:

1. Cut the spigot end of the pipe square.
2. All burrs from the internal and external surfaces should be removed.
3. The spigot should be marked with a pencil line and a distance equivalent to the socket depth. Clean the surface within the marked area.
4. Apply uniform coat of solvent cement on the external surface to the pipe and a lighter coat on the internal surface of the fitting.
5. Insert the pipe end into the socket of the fitting and push it in upto the mark.

Remove the excess solvent cement and hold the joint firmly in position for 30 seconds to dry. Gluing should be avoided in a rainy or foggy weather.

The other method of jointing shall be by rubber rings. The material of rubber ring should conform to IS 5382-1969. The ring is housed in groove formed in a plastic or metallic housing. The rubber is compressed and makes a seal between the pipe and housing. Lubricating paste should be applied before compressing the rubber. Where natural rubber rings are used, mineral oil or petrol or grease should be used.

TESTING

PVC pipes and fittings shall be tested in accordance with IS 13592 - 1992. The openings of the pipes shall be sealed for the section to be tested. The water pressure of 0.5Mpa (50m of H₂O or 5.0 kg/cm²) shall be maintained for a minimum period of 15 minutes and there should be no leakage at any joint. The RE (Architect) shall examine carefully all the joints for leakage. The cost of equipments and accessories required for testing the system shall be supplied by the contractor at his own cost.

RIGID PVC PRESSURE PIPES AND FITTINGS

The PVC pressure pipes and fittings shall be used for conveying wastewater from washbasins, kitchen sinks, urinals, floor drain connecting to washing machines and condensate drain etc.

The pipes shall be 10 Kg/cm². PVC pipes and fittings shall be jointed with solvent cement. Fittings shall be of injection moulded PVC conforming to IS 7634 (Part1) - 1975.

LAYING AND FIXING

The pipe laying and jointing shall be done in accordance with IS 7634 (Part 3) – 1975. Pipes shall be cut to size and chamfered well. Burrs if any shall be removed. Pipes and fittings shall be jointed using solvent cement or rubber ring joints. The pipes and fittings shall be jointed accurately without any stress to achieve leak proof joints. The cost of drilling holes in RCC slab, floor, RCC/masonry retaining wall with the core cutting machine and making good the same with approved quality cement concrete etc., to the satisfaction of the RE (Architect) shall be included in the quoted rate. Separate rate for core cutting shall not be paid to the contractor.

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 the test pressure. The test shall be done in accordance with IS 2065 – 1983 – code of practice for water supply in buildings. The test pressure shall be 5 kg/cm² or the maximum working pressure plus 50%, whichever is greater. The pressure shall be maintained for at least 4 hours. The RE (Architect) shall examine carefully all the joints for leakage. The cost of equipments and accessories required for testing the system shall be supplied by the contractor at his won cost.

MODE OF MEASUREMENT PVC PIPES

PVC Pipes shall be measured along the centreline of the pipeline including the specials in running meter (Rm.) between:

1. Chambers: Shall be recorded from the inside of one chamber to inside of another chamber.
2. Gully trap and Chamber: Shall be recorded between socket pipe near gully trap and inside of chamber.

The quoted rate shall include the following:

1. The cost of pipes, specials and other jointing materials.
2. Laying, jointing and curing.
3. Testing and making good the defects, if any.

PVC FLOOR TRAPS

The PVC floor trap shall be of multi-inlet and one single outlet type. The floor trap shall be deep seal type with an effective seal of minimum 50mm. The waste from sanitary fixtures shall be directly discharged to the floor trap. Jointing of the waste pipe to the floor trap shall be done as per manufacturer's instructions. The height riser fitting shall be made use of, wherever the floor drain is located in deep-sunk floors or is suspended from the ceiling. The floor trap shall be of reputed make and preferably of the same make as of the pipes used.

The floor trap shall be provided with 150 x 150mm square cast chrome plated or stainless steel grating with rim of approved design. Minimum thickness of the grating shall be 4 to 5mm.

The urinal trap shall be provided with 150 x 150mm square cast chrome plated or stainless steel sealed cover with rim of approved design. Minimum thickness of the cover shall be 4 to 5mm.

The cost of removing and refixing of tiles and making good as per the instructions of the RE (Architect) for fixing the grating floor trap and urinal cover shall not be paid separately.

The AHU floor drains shall be fitted with chrome plated funnel shaped grating.

ROOF DRAIN

The supply and installation of PVC roof drain and grating with water proofing flashing around the drain shall conform to the requirements of local codes and or British standard specifications whichever is applicable. The cost of supply and installation of roof drain shall be measured as part of the rain water pipe.

3.0.7 EXTERNAL SEWAGE SYSTEM

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install the external sewer pipes, construction of manholes and inspection chambers as indicated on the drawings and specifications.

External sewerage system consisting of construction of gully trap, inspection chambers, and manholes, laying of sewer pipes, earth work and backfilling as specified in the drawings and bill of quantities.

Testing of all pipe lines and all accessories as per Bureau of Indian Standards.

The General character and the scope of work to be carried out under this section is illustrated in the drawings and specifications attached herewith. The contractor shall carry out and complete the said work under this contract in every respect in conformity with the rules and regulations of the local authority. The Contractor shall furnish all labour, materials, appliances, tools and equipment necessary for the external sewerage services installation including testing and commissioning as specified herein, and as per the relevant Bureau of Indian Standards (BIS), British Standards codes. This also includes any material, appliances and equipment not specifically mentioned herein or noted on the drawings as being furnished or installed which are necessary and customary to make a complete installation properly connected and in working order.

Carryout all incidental works connected with external drainage services installation such as excavation of trenches and backfilling.

Furnish and install complete workable external drainage services installation as shown on the drawings and described in this specification and as per the latest Bureau of Indian Standards (BIS), British Standards (BS) specifications.

Complete installation of the external sewerage and sewerage appurtenances within the site boundary.

Co-operation with other trades in putting the installation in place. Any work done without regard or consultation with other trades, shall be removed by the contractor without additional cost to the Client, to permit proper installation of all other work, as desired by the RE (Architect).

Repair all damage done to the premises as a result of this installation and remove all debris left by those engaged for this installation to the satisfaction of RE (Architect).

It is the responsibility of the contractor to take care of all the installed materials until the time of handing over to the Client.

Assume full responsibility for getting the entire installation duly approved by the authorities concerned and for all expenses in connection with the same. Assume responsibility for

obtaining and delivering to the Client certificate of final inspection and approval by the concerned authorities.

CODES AND STANDARDS

Unless specifically mentioned otherwise, all the applicable codes and standards published by the Bureau of Indian Standards and their subsequent revision shall govern in respect of design, workmanship, quality and properties of materials and method of testing.

Nothing in this specification shall be construed to relieve the CONTRACTOR of his responsibility. The material supplied shall comply with the latest applicable Indian and / or British Standards. Other National Standards are acceptable, if they are established to be equal or superior.

Following are the standards and codes are made part of this specifications.

IS 10446 - 1983	Glossary of terms relating to water supply and sanitation.
IS 11208 - 1985	Guidelines for registration of Plumbers
SP - 35	Hand book of water supply and drainage (with special emphasis on plumbing)
IS 1172 -1983	Code of Basic Requirement for Water Supply, Drainage & Sanitation (Third Revision)
IS 1200 - 1992 (Part 1 earth work)	Method of Measurement Of Building And Civil Engg. Works.
SP 7 - 1983	National building code of India (Part IX – Plumbing services)
IS 4111 (Part 1) 1986	Code of practice for Ancillary Structure In Sewerage System
IS 301 - 1971	Code of practice for Building Drainage
IS 651 1992	Specification for salt- glazed stoneware pipes and fittings.
IS 1726 -1991	CI Manhole Covers and Frame
BS 5572 -1978	(Amendment No.2) Sanitary pipe Works
IS 4127 - 1983	Specification for testing of stone ware pipes and fittings.

POLYVINYL CHLORIDE (PVC) PIPES AND FITTINGS

PVC (SWR) class pipes and fittings of dia 75mm OD, 90mm OD, 110mm OD and 160mm OD of Type A for use in rain water and ventilation and of Type B for soil and waste discharging system and conforming to IS 13592: 1992, shall be used. The pipes shall be supplied in nominal lengths of 2, 3, and 4 or 6 meters, tolerance on specified lengths shall be +/-10mm. Any physical test requirements shall be as per IS13592-1992.

All soil, waste and siphonage pipes and fittings used as vertical external pipes with in the shafts shall be PVC SWR grade socket and spigot type pipes confirming to relevant IS or its subsequent revisions .

All pipes being used on exposed surface shall be UV protected with a UV inhibitor built in during Molding / extrusion in case of PVC pipes

All such pipes shall use only rubber ring joints

No pasted joints shall be permitted on external piping

All external pipes shall be mounted on special sliding brackets of galvanised MS grouted to the duct wall, with the pipes being held to it using GI “U clamps”. These brackets shall provide for a least 50mm clear working space behind the pipes

MANHOLE AND INSPECTION CHAMBERS

Inspection chambers of Internal size 600mm x 600mm up to a depth of 1.2m and manholes of varying sizes as per IS 4111 shall be constructed beyond 1.2m (depth of the sewer line from the Formation Ground level).1

LOCATION AND SIZES

The size indicated in the drawings shall be the internal size of chamber. Unless otherwise specified, the clear internal diameter of the manhole shall be 1.2mtrs. for depth upto 2.3mtrs. and the diameter of the manhole shall be 1.5mtrs. for larger depth upto 9mtrs. The inspection chambers are provided at all changes of direction of drains and where branch drain meets the main drain. Chambers shall be of such size as to allow necessary examination and clearance of drains. The minimum internal sizes shall be taken as per detailed drawings; standards specified and local byelaws if any. In the absence of local byelaws, the requirements stipulated in IS 4111 (Part I) Code of Practice for Ancillary Structures on Sewerage System shall be followed. The work shall be done strictly as per standard drawings and the following specifications: Depth of manhole shall be the clear vertical depth between the manhole cover to the outgoing invert of the main drain channel.

BED CONCRETE

Bed concrete shall be in 1:4:8 cement concrete and the thickness of bed concrete shall be as tabulated below.

Sl.No	Depth of manhole/Inspection chambers	Thickness of bed concrete
1	Inspection Chambers upto 1.2 m depth	150mm
2	Manholes upto 1.65m depth	225mm
3	Manholes from 2.3m and above	300mm

BRICK MASONRY

Brickwork shall be with best quality table moulded bricks in 1:6 cement mortars as per specification for brick masonry. The thickness of masonry shall be as specified in the ISI specifications as per the table below.

Sl.No	Depth of manhole/Inspection chambers	Thickness of brick masonry
1	Inspection Chambers upto 1.2 m depth	230mm
2	Manholes upto 2.25m depth	230/345mm

3	Manholes from 3.0m to 5.0m.	230/345/460mm
3	Manholes from 5.0m to 9.0m.	230/345/460/575mm

PLASTER

Inside walls of chambers / manholes shall be plastered with 15mm thick cement plaster 1:3 mixed with waterproofing material and finished smooth with a floating coat of neat cement. External walls shall be plastered in CM 1:3 and sponge finished.

BENCHING

Sloping surfaces having slope in transverse direction constructed on either side of channels at the base of manholes or inspection chamber for the purpose of confining the flow of sewage, avoiding the accumulation of deposits and providing a safe working platform. Channels and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement. The following sizes of channels for the benching shall be adopted:

Size of Drain	Depth at Centre	Depth at sides
100 mm	150 mm	250 mm
150 mm	200 mm	300 mm

CHAMBER / MANHOLE COVERS

Manhole frame and cover shall be of heavy duty cast iron or fiber reinforced cement concrete as per bill of quantities with lifting hooks as per IS 1726 - 1974 and as per the details given in the drawings and fixed on CI frame or cement concrete embedded in concrete. Covers placed on the frames shall be airtight. The weight of frame and cover shall be as per bill of quantities.

STEPS

PVC Steps shall be provided in all manholes and inspection chambers over 800mm depth and shall preferably be of cast iron and of suitable dimensions. These shall steps may be staggered in two vertical runs, which may be 300mm apart horizontally and vertically and shall project minimum 100mm beyond the finished surface of the manhole wall. The top step shall be 450mm below the manhole cover and the lowest not more than 300mm above benching. Foot rest shall be painted with coal tar, the portion embedded in masonry on cement concrete block being painted with thick cement slurry before fixing.

DROP CONNECTIONS

In case the difference in invert levels between the main drain and the branch line requires a drop more than 600 mm, a drop connection should be provided with PVC or cast iron or stoneware four way junctions, fixed at right angles to the drop pipe at the level where the branch pipe enters the manhole. Access for cleaning the bend with cast iron frame and cover should be provided at finished ground level. The necessary concrete encasement and reinforcement, required for the drop connection are included in the quoted rates.

GULLY TRAP CHAMBERS

Stoneware gully traps of specified size shall be provided as per IS 651. It shall be fixed on 150mm thick and 700mm square 1:4:8 cement concrete bedding and the gully outlet shall be jointed similarly to the jointing of stoneware pipes. A brick masonry chamber 300 x 300 mm (internally) shall be constructed in 1/2 brick masonry with 1:6 cement mortar and the spaces

between the trap and the wall shall be filled up with 1:3:6 concrete and the upper portion of the chamber shall be finished with neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating and the bottom of the chamber shall not be less than 230 mm. In addition to 150mmx150mm CI grating, the chamber shall have a CI frame and cover (300mm x 300 mm). The cover and frame shall be placed on top of the brick masonry.

GREASE TRAP CHAMBERS

Design Considerations

Design considerations are broadly based from the spacing building line. The size of grease trap are as follows:

LOCATION AND SIZES

The location and sizes are shown on the drawings. The work shall be done strictly as per standard drawings and the following specifications:

Max Hourly Discharge In litres	Minimum Internal Dimensions		Minimum Spacing of Baffles & Weir				
	Width	Length	Depth Below Crest of Weir	Inlet to Baffle no.1	Inlet to Baffle no.2	Baffle No.2 To Weir	Weir Outlet
500	600	1870	700	200	1200	150	200
750	600	1870	1000	200	1200	150	200
1000	700	2660	600	300	1640	300	300
1500	700	3020	600	300	2000	300	300
2000	1000	3020	780	300	2000	300	300
3000	1250	3820	1050	300	2500	300	600
4150	1350	4020	1150	300	2700	300	600
5000	1450	4020	1250	300	2900	300	600

BED CONCRETE

Bed concrete shall be in 1:4:8 cement concrete 225 mm thick as shown in the drawing and specifications.

BRICK MASONRY

Brickwork shall be with best quality table moulded bricks in 1:5 cement mortar as per specification for brick masonry.

PLASTER

Inside walls of manholes shall be plastered with 15mm thick cement plaster 1:3 mixed with waterproofing compound and finished smooth with a floating coat of neat cement. External walls shall be plastered in CM 1:3 and sponge finished.

GREASE RACKING ARM

Grease collected at the upper portion of the chamber shall be removed using raking arm made of galvanised MS with length and breadth as shown on the drawing.

COVERS

Covers and baffle slab should be as per the detail drawings.

MODE OF MEASUREMENT

Manholes, inspection chambers, Grease trap chambers, ventilating columns shall be measured in numbers and the rate quoted shall also be per number only. The quoted rate shall include the cost of all the following items:

1. Bed concrete.
2. Brick work.
3. Plastering.
4. Grease racking arm.
5. Concrete to embed the grease trap.
6. RCC top slab and Chamber cover with baffle slab
7. Providing holes and embedding pipes for all connections.
8. Excavation, refilling, necessary dewatering and disposing off extra material to a place as directed by RE (Architect).

UNDERGROUND TRENCHES**ALIGNMENT AND GRADE**

Drains are to be laid to correct alignment & grade shown in the drawings but subject to such modifications as necessary to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express direction in writing of the RE (Architect). The pipe shall be laid to slope with the socket and spigot ends on higher and lower side respectively

OPENING OUT TRENCHES

In excavating the trenches, the road metalling, pavement kerbing, etc., are to be placed on one side and preserved for reinstatement and the trench or other excavation shall be filled up and laid back to original condition at no extra cost. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Client. The contractor shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under them unless the Client orders the contrary. The contractor shall scrub and clear the surface over the trenches and other excavations of all stumps, roots and other encumbrances affecting execution of work and shall remove the same from the site as per the directions of the RE (Architect).

EXCAVATION TO BE TAKEN TO PROPER DEPTH

Trenches shall be excavated in all conditions of soil and to such a depth that the sewers shall rest as described in the several clauses relating thereto and so that the inverts may be at the levels given on the section. In bad ground, the RE (Architect) may order the contractor to excavate the trench to a greater depth than shown on the drawings and to fill up the excavation to the level of the sewer with concrete, sand, gravel, or other materials. For such works the contractor shall be paid extra at the rates laid down for such works in the schedule, if the extra work was ordered by the RE (Architect) in writing. But if the contractor should excavate the trench to a greater depth than is required without a specific order to that effect in writing of the RE (Architect), the extra depth shall have to be filled up with concrete at the contractors own cost to the requirements and satisfaction of the RE (Architect).

TRANSFERRING LEVELS TO TRENCH BOTTOM FROM SITE RAILS BY USING BONING ROD

Excavation of trench shall be proceeded to the correct depth less 75mm by fixing actual depths to be excavated true to the specified gradient. Spot levels shall be fixed at every 3mtrs. Spacing in the trench prior to the last 75mm depth excavation using boning rod and the bottom of the trench trimmed to correct gradient and level.

REFILLING

After the sewer or other work has been laid and proved to be water-tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this so that no damage is caused to the sewer and other permanent works. Filling in the trenches upto 50 cms. Above the crown of the sewer shall consist of the finest selected materials placed carefully and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in 15 cms. layers with material taken from the excavation, each layer being watered and consolidated.

BACK FILLING OF TRENCH

For the purpose of back filling, the depth of the trench shall be considered as divided into the following three zones from the bottom of the trench of its top, for the purpose of refill materials to be used.

ZONE A: - From the bottom level of the trench to the centre line of the pipe.

ZONE B: - From the centre line of the pipe to a level 30 cm above the top of the pipe.

ZONE C: - From a level 30 cm above the top of the pipe to the top of the trench.

BACKFILL MATERIALS

All backfill materials shall be free from cinders, ashes, slag, refuse, rubbish, vegetable or organic materials, lumpy or frozen materials boulder, rocks or stone or other materials which in the opinion of the RE (Architect), is unsuitable for deleterious. Excavated earth, which shall pass through a sieve of aperture size 20mm can be used for filling in zones A & B. However, material containing stones upto 20mm as their greatest dimension may be used in zone C only unless otherwise specified by the RE (Architect). Where excavated material considered by the is RE (Architect) not suitable for back filling, clean river sand shall be used for the same.

BACK FILL SAND

River sand used for back fill shall be natural sand graded from fine to coarse. The total weight of clay in it shall not exceed 10 percent. All material shall pass through a sieve of aperture of size 20mm (IS-2405-1980) and not more than 5 percent shall remain on IS sieve of aperture size 6.30mm.

BACK-FILL GRAVEL

Gravel used for back fill shall be natural gravel and having durable particles graded from fine to coarse in a reasonably uniform combination with no boulders or stone larger than 50mm in

size. It shall not contain excessive amount of loam and clay and not more than 15 percent shall remain on a sieve of aperture size 75 micron.

Back filling in zone A shall be done by hand with fine excavated material or river sand, fine gravel or other approved materials placed in layers of 8cm and compacted by tamping. The back filling material shall be deposited in the trench for its full width on each side of the pipe, fittings and appurtenances simultaneously.

Back-filling in zone B using fine excavated material shall be done by hand or approved mechanical methods using the fine excavated material special care being taken to tamping and to avoid injuring or moving the pipe. If excavated material is not suitable the type of back-fill material to be prescribed by the RE (Architect) to suite individual locations.

Back filling in zone C shall be done by hand or approved mechanical methods and well compacted. Excavated earth having stones of size not exceeding 20mm can be used for zone C. If the excavated earth unsuitable for back fills the filling material shall be specified by RE (Architect).

BACKFILL WITH EXCAVATED MATERIALS

Where the excavation is made through permanent pavements, curbs, paved footpaths, or where such structures are undercut by the excavation, the entire back fill to the sub-grade of the structures shall be made with sand or cement concrete in accordance with Para 5.7 The method of place and consolidating the back fill material shall be prescribed by the RE (Architect).

CONCRETE SLABS OVER PIPES

When pipes are laid under roads and pavements subjected to heavy traffic loads the trenches may be covered with reinforced concrete slabs of suitable dimension, supported on edges to relieve the load on pipes to the adjoining earth.

SITE CLEANING ON COMPLETION OF WORK

All surplus pipes and fittings, valves, etc., and all tools and temporary structures shall be removed from the site as directed by the RE (Architect). All dirt, rubbish and excess earth from the excavation shall be removed and transported and disposed at a suitable place as directed by RE (Architect) and the construction site left clean to the satisfaction of the RE (Architect).

CONTRACTOR SHALL RESTORE SETTLEMENT AND DAMAGES

The Contractor shall at his own cost make good promptly, during the whole period that the works are in hand, any settlement that may occur on the surfaces of roads, beams, footpaths, gardens, open spaces, etc. whether public or private caused by his trenches or his other excavations and he shall be liable for any accidents caused thereby. He also shall, at his own expense and charge, repair and make good any damage done to the buildings and other properties.

DISPOSAL OF SURPLUS

The Contractor shall at his own cost dispose within the site or as directed all surplus excavated materials not required to be used in the work.

TIMBERING

The Contractor shall at all times support efficiently and effectively the sides of trenches and other excavations by finest selected timbering, piling, sheeting material, etc. The trenches shall be close timbered in loose or sandy strata and below the surface of the sub-soil table. All timbering, sheeting and piling with their wallings and supports shall be of adequate dimensions and strength and fully braced and strutted so that there is no risk of collapse or subsidence of the walls of the trench. The Contractor shall be held accountable and responsible for the adequacy of all timbering, bracing, sheeting and piling used and for all damages to persons and property resulting from the improper quality, strength, placing, maintenance, or removing of the same.

REMOVAL OF WATER

The Contractor shall at all times during the progress of work keep the trenches and excavations free from water which shall be disposed off by him in a manner as will neither cause injury to public health nor to public or private property, to the work completed or in progress, to the surface of any roads or streets and cause any interference with the use of the same.

TRENCH WIDTH

The width of excavated trenches shall be as per the table given below:

Width at bottom

Excavation upto:	Upto 100mm dia pipe	Upto 150mm dia pipe	Upto 300mm dia pipe
900 mm depth	500 mm	550 mm	600 mm
900 to 1500 mm depth	650 mm	700 mm	850 mm
1500 to 3000 mm depth	900 mm	950 mm	1100 mm
3000 to 5000 mm depth	1100 mm	1150 mm	1300 mm

PROTECTION OF EXISTING SERVICES

All pipes, water mains, cables, etc. met with during the course of excavation shall be carefully protected and supported.

ROAD CROSSINGS

All pipelines laid below roads shall be taken through suitable underground trenches. The size of trenches shall be as per drawings.

CONSTRUCTION ACROSS ROADS

All works across roads shall be carried out as per the directions of the Client.

MODE OF MEASUREMENT

Measurement for excavation of pipes trenches shall be made per linear meter under the respective category of soil classification encountered at site.

All types of soil like soft soil, hard soil, soft rock and disintegrated rock requires chiselling. Hard rock requiring blasting

3.0.8 PUMPS & MECHANICAL EQUIPMENTS

This specification covers the design requirements, materials, and features of construction, inspection and testing and commissioning of Horizontal Centrifugal Pumps for lifting the water from underground sump to overhead tank.

Also the scope of work included with supply and installation of interconnecting piping works including all the related valves, specialties and all other accessories.

The pump set offered shall be generally horizontal centrifugal pump, single stage or multistage or mono-bloc pump to satisfy the duty conditions stipulated in the bill of quantities.

The pumps shall be selected having their maximum efficiency at average operating conditions. The maximum speed at which a pump shall run is determined by the net positive head available at the pump, the quantity of liquid being pumped and the total head.

Following standards and codes are made part of this specification.

IS 8418 - 1977	Specifications for horizontal centrifugal pumps.
IS 8034 - 1976	Specifications for submersible pumpset for clear, cold, fresh water (First revision).
IS 5120	for handling water.
IS 5600 - 1970	for pumping storm water and sewage.
IS 325 - 1961	Specification for three phase induction motors.

SCOPE OF SUPPLY AND ERECTION

The CONTRACTOR shall supply, install, test and commission all pumps and accessories, interconnecting material like pressure gauges & accessories, specialties and other items as required.

Contractor to provide flanged metal/rubber bellows at the suction and delivery side of pumps that are assumed to be a part of the equipments.

Scope of erection to be performed by the CONTRACTOR is outlined below:

The CONTRACTOR shall unload from carriers at plant site, handle, and check, receive, transport, store, erect and test all materials furnished by him and others in accordance with this specification and General Conditions of Contract. The CLIENT shall be informed of any loss of damage within seven days of receipt of material.

The CONTRACTOR shall also install small accessory piping and any specialties furnished for equipment such as built-in bypass and other equipments of this type.

The CONTRACTOR's scope under this includes the following:

Jointing material as required for all screwed joints. Fasteners (bolts, nuts, studs washers etc.) and gaskets is required for all flanged joints.

Erection tools, tackles drilling machines, chasing machines as required.

TESTS AND INSPECTION

A standard hydrostatic test shall be conducted on the pump casing with water at 1.5 times the maximum discharge head or twice the rated discharge head, whichever is higher. While arriving at the above pressure, the maximum suction head shall be taken into account. (Maximum discharge head = Shut off head + maximum suction head). The hydrostatic tests on the casing shall be conducted for a minimum duration of 30 minutes.

PERFORMANCE TEST

Standard Running Test

The pumps shall be tested as per IS 5120, at rated speed at SUB-Contractor's works to measure capacity, total head, efficiency and power. The negative tolerance on efficiency shall be limited to 2.5% (not 5 % as indicated in IS 5120. These tests shall form the basis for acceptance of pumps except for vibration and noise. The pumps shall be tested over the range covering from shut-off head to the maximum flow. The duration of the test shall be minimum one hour. Minimum five readings approximately equidistant shall be taken for plotting the performance curves.

NPSH Tests

NPSH tests shall be conducted with water as the medium.

MECHANICAL BALANCING

In addition to static balancing, impeller and balancing drum shall be balanced dynamically at or near the operating speed.

FIELD TESTING

After installation, the pumps shall be subjected to testing at site also. If the field performance is found not to meet the requirements regarding vibration and noise as specified, the equipment shall be rectified or replaced by the CONTRACTOR, at no extra cost to the CLIENT.

CONTRACT DRAWINGS

The contractor to submit preliminary outline dimensional drawing of pump and motor including suction and discharge connections and the foundation details required for the pump to be installed along with the Bids

Performance curves (capacity vs. total head, efficiency, NPSH and KW requirement) ranging from zero to maximum capacity.

Pump Catalogues.

PAINTING

All metal surfaces shall be painted with two coats of enamel paint over a coat of approved oxide primer. However the components of the pumps shall not be painted before inspection.

GASKETS, SEALS AND PACKINGS

The gaskets, seals and packing are used in special purpose pumps shall be suitably chosen so as to withstand the effect of liquid being pumped.

Clear cold fresh water Mechanical seal or cotton yard (lubricated) seal.

ACCESSORIES

Essential for pumpset used for pumping water.

Oil lubricator with oil level indicator if the pump is lubricated.

Grease cup for grease lubricated bearings.

Flanged ball valve/Gate valve on suction side if there is positive suction.

Flanged ball valve/Gate valve on delivery side.

Flanged horizontal/vertical check valve on delivery side.

Pressure relief valve.

Pressure gauge (for delivery pipe) and vacuum gauge (for suction pipe) with copper tubing and winch cock.

Priming funnel with separate or integral air cock.

Float switches or automatic level operated control switch.

Base plate.

Foundation bolts and nuts.

FOR WATER PUMPSET

In case of more than one duty point, the performance range is to be indicated and the prime mover should be of sufficient power to take the entire load in this range. Head (restrictions) shall be indicated in the nameplates to avoid overloading of the prime mover.

For working in parallel pumps should be with stable head capacity characteristics.

Arrangement for cooling of bearings where required.

Balancing water leakage connection should be provided in case of multistage pumps with balancing discs.

Thrust bearing of adequate size.

PUMP TEST

Pump tests are made to determine the following:

The discharge against the specified head when running at the rated speed under specified suction lift or head.

The power absorbed by the pump at the pump shaft (BP) under the above specified conditions and Efficiency of the pump under the above specified conditions.

The pump has to be tested at manufacturers works and a test certificate furnished before supply and tested at site after installation as per procedure as per clause 13 of 5120 – 1968.

PUMP INSTALLATION

INSTALLATION

Certain precautions must be observed in both planning a pump installation and erection

Piping: Both the suction and discharge lines should be independently supported so as no strains will be thrown on the casing such strains may cause distortions and rubbing.

The suction line should be as short and straight as possible. Any elbows should have large radii. For pumps operation with suction lifts no valves other than a foot –valve should be placed in it. Generally, the diameter is made one or two sizes larger than the pump flange size. All these precautions insure the maximum available suction head on the pump. When an oversize line is used an eccentric reducer, which is horizontal at top, is placed between it and the pump flange size.

It is very important to have the suction line airtight and to avoid high spots at which dissolved gases or air might separate out and destroy the vacuum. After piping is installed and the pump is running all joints should be inspected with a flame, as air leakage will draw the flame to the opening. The same method can be used to determine leakage through the packing box; the eccentric reducer is used at the suction flange to avoid high spot at which the air might collect. The inlet end of the suction line i.e., submergence should be 1 to 2 mtrs. Below the minimum water level of the sump (not less than 1 mtr.) to prevent air from being drawn into the pipe with the water.

It is desirable to have a long length of straight piping between the elbow and suction flange as possible to even out the flow of the water as it enters the pump. The pump should be placed to secure the greatest possible suction head and yet to be available for inspection and repair work.

A non-return valve and isolation valve are usually placed in the discharge line. The isolation valve is used to regulate the flow and the non-return valve prevents backflow into the pump, which might cause it to operate like a turbine and perhaps be damaged on account of over speed. The non-return valve is placed between the isolation valve and the pump so that it may be inspected or removed without emptying the discharge line.

FOUNDATION

The foundation should be heavy to reduce vibrations and should be rigid to avoid any twisting or misalignment. A space of 2 to 4 cm is allowed between the base plate and top of the foundation, which is filled with grouting to secure a uniform load distribution. Alternatively, rubber cork anti-vibration pad shall also be placed.

When the grouting had dried the base plate should be drawn down evenly to avoid springing it. After this has been done the shaft is finally aligned both radically and axially with the

driver by means of shims or wedges so that it turns freely. If the shaft is not properly aligned there will be vibration and excessive wear on the bearings, packing and wearing rings.

PUMP OPERATION:

TRAIL OPERATION

The operation of centrifugal pump is quite simple and safe. There are relatively few valves and the pump will not be damaged even if the discharge valve is closed for short periods of time.

STARTING

The pump must be primed before it will deliver any fluid. Failure to prime the pump may cause the wearing, rings, and rub and seize or the shaft may be scored at the packing boxes. During starting it is wise to have the vent cock in the casing open slightly to remove any dissolved air in the water.

It is best to have the discharge valve set so that the least load is thrown on the driver when the pump is started. The valve should be opened gradually to avoid throwing a large sudden load on the driver and to prevent a sudden surge in the discharge line. The discharge valve should be fully open when starting mixed flow or propeller pumps because the brake horsepower will then be a minimum.

RUNNING

When the unit is running it requires very little attention beyond occasionally checking to see that the journal and thrust bearings are running cool and have a sufficient supply of oil. The packing is adjusted to permit a slight leakage to cool and lubricate it, and the water is flowing to the water seal of the suction gland to prevent air from leaking in.

SHUTTING DOWN

When shutting down, the discharge valve should be in the same position as when starting up by closing the discharge valve gradually so that less power is dropped from the line and any sudden pressure surges in the pipe system are avoided.

INSPECTION AND MAINTENANCE

Manufacturer supply instruction manuals, which give directions for the operation and maintenance of each pump.

The wearing ring clearance should be checked as they will increase with time and thus cause a decrease in efficiency. The frequency of the inspection will depend upon the liquid handled. If the liquid contains gritty materials or is corrosive, inspection may be made monthly, but if clear water is pumped it may be sufficient to check them annually. A general rule is to replace the rings when the clearance has increased 100 percent above the original.

The packing should be replaced after it becomes hard and tends to score the shaft. When the packing is being replaced the finish of the shaft sleeves should be examined for smoothness. It is essential that the lantern ring shall be placed directly under the water inlet when putting in the new packing to insure a circulation of the water and a satisfactory seal. The packing should be gradually compressed with the pump running. It should not be compressed too much as local heating of the shaft and consequent misalignment will result. A slight leakage will insure proper lubrication and cooling.

If the base is not too rigid the shaft alignment should be checked occasionally when the pump is at a temperature corresponding to running conditions. This must be done with the packing removed. At the same time the clearance of the journal bearings should be checked for wear.

The oil should be changed as required and at that time inspected for the presence of water. If water appears in the oil the pump casing should be examined to find the leak.

GUARANTEE OF PERFORMANCE OF PUMPS:

The pumps shall be guaranteed by the manufacturer/supplier against defects in material and workmanship under normal use and service for a period of at least one year from the date of dispatch.

TOLERANCE

A tolerance of ± 2.5 percent shall be permissible on discharge. However, for small discharge up to 9000 litres per minute, a tolerance of ± 2.5 percent or +24 litres per minute whichever is higher is allowed. While the negative tolerance 2.5 percent is maintained.

The pump efficiency shall be not less than the specified value by more than 2.5 percent. This tolerance may be raised to 5 percent in case the prime mover does not get overloaded.

GENERAL REQUIREMENTS

The specified range shall lie on the stable portion of the head characteristic curve. This is applicable in case of parallel operations of pumps only.

SUCTION AND DELIVERY ENDS

The size of the suction end of a double suction pump should preferably be one size larger than that of the delivery. This is to offset the increased loss in the suction. Typical practices of piping used are:

80/65m, 100/80m, 125/100m, 150/125m, 200/150m and 250/200m etc.,

For a high-pressure pump, a reflux valve shall be connected on the delivery side and a pressure relief valve installed in pumping main outside pump house. Need for surge control devices verified.

FLUID PASSAGES

All the liquid passages in the casing and the impeller which are inaccessible to machining shall be finished to smooth surface as far as possible.

DRAINAGE PLUGS

Tapped drain holes with plugs shall be provided for draining the fluid that may drip from the sealing arrangement. The sealing arrangement shall be sufficiently deep to provide for sufficient quantity of packing to prevent leakage of air.

LANTERN RING

In case, where a lantern ring is used in a stuffing box, it shall be sandwiched between rows of packings and shall be easily removable.

CASING

Casing shall be of robust construction and tested to withstand 1.5 times the shut-off pressure or twice the rated pressure whichever is higher.

IMPELLER

The impeller shall be properly balanced along with any other un-machined rotating parts on proper balancing equipment so as not to cause any vibrations.

SHAFT

The shaft shall be finished to close tolerance at the impeller coupling, pulley and bearing diameters. The impeller, pulley and shaft sleeves shall be firmly secured to the shaft by keys or nuts on both.

SHAFT COUPLINGS

Shaft couplings, where provided, shall be properly aligned and firmly secured to the shaft by keys or nuts on both.

The size of the shaft shall be calculated on the basis of the maximum combined shear stress. This shall not exceed 30 % of the elastic limit in tension or 18% of the ultimate tensile strength.

The next higher standard size of shaft in accordance with the relevant standard shall be chosen.

The design of the shaft shall also be taken into consideration the critical speed of the shaft, which shall differ from the actual working speed by at least ten percent on either side.

BEARINGS

The bearings should be designed for a minimum life of 20,000 hours. The bearing housings are designed in such a manner that no liquid being pumped should enter the housing.

The bearing may be ball, roller or sleeve bearings. In the latter case, some sort of thrust bearings is necessary. If sleeve bearings are used, they are to be machined for close running fit. The bearings shall be so designed as to take up the necessary radial load as well as the net hydraulic axial thrust. Bearings shall be lubricated properly.

Where there is a possibility of fluid entering the bearing the pump shall be provided with suitable preventive arrangements for example deflectors.

STUFFING BOXES

The stuffing boxes shall be extra deep and provided with a cooling water jacket if so required. In addition, provision for tapping off the leakage liquid shall also be made. The packing materials employed shall be suitable for withstanding special conditions such as temperature, corrosion due to the fluid being handled etc. Wherever possible, suitable mechanical seals may be used.

BASE PLATES

The base plates which accommodate the pump and the prime mover, when provided shall be rigid so that alignment is not affected under normal working conditions.

PRIME MOVER

The prime mover shall be of a such capacity to provide, under working site conditions a power which is more than maximum power required by the pump at any point in the specified range should be a specific margin be required by the customer in the power of the prime mover, he should go advise the manufacturer for obtaining the proper recommendations.

NAMEPLATE

Every pump shall have a nameplate indicating:

Name and address of the pump manufacturer. Type, size and serial number of the pump and Speed, total head, capacity and corresponding pump input for the duty point.

For corrosive liquids the material of the nameplate shall suitable to withstand the corrosive atmosphere.

3.0.9 LIST OF RECOMMENDED MANUFACTURERS MAKES - PLUMBING

1.	Vitreous China Sanitary ware	-	Hindware/Kholar/Rocca
2.	WC connectors	-	Prince /Supreme
3.	Stainless Steel Sink	-	Hindware/Parryware/Diamond
4.	Urinal Flush System	-	Hindware/Parryware/Jaguar
5.	Hand Drier	-	Kimberlay/Jaguar
6.	CP fixtures	-	Hindware/Kholar/Rocca/Jaquar
7.	Floor Drain Fixture, Rain Water Outlets & Channel Gratings	-	Aco/Neer
8.	Shower Channel / PP – car parking channel	-	Aco/Neer
9.	C.P. Grating for Floor Trap	-	Chilly/GMGR
10.	Cast Iron Pipes & Fittings Manhole covers and frames	-	Neco/Kaplansh
11.	GI / M.S Pipes	-	Jindal/Tata
12.	GI pipes fittings	-	Jindal/Tata
13.	Copper Pipes & Fitting	-	Rajco/Mandhev
14.	UPVC Pipe	-	Astral/Supreme/Prince
15.	CPVC pipes	-	Astral/Ashirwad
16.	RCC Pipe	-	Local & Approved
17.	Stoneware Pipes, Gully Traps	-	JABALPUR/Rajura
18.	Butterfly Valve Audco/Advance/Leader/Lehry	-	

19.	Check Valve – WaferType	-	Advance/Danfoss/Lehry
20.	Pressure Reducing Valve	-	RB/Zoloto/Leader
21.	Ball valves	-	RB/Zoloto/Leader
22.	Solenoid Valve	-	Avcon/Danfoss/Lehry
23.	Air Release Valve	-	Fouress/Arco/OR/Zoloto
24.	Ball Float Valve	-	Zoloto/Lehry/Equivalent
25.	Y Strainer	-	Emerald /Zoloto
26.	Hydropneumatic System	-	ITT/KSB/Dharani
27.	Storm Water Drainage		
28.	Sump Pumps(Submersible)	-	ITT/KSB/Dharani
29.	Sewage Handling Pumps (Submersible)	-	ITT/KSB/Dharani
30.	Transfer Pumps	-	ITT/KSB/Dharani
31.	Self-Priming Pumps	-	ITT/KSB/Dharani
32.	Pressure Gauge	-	H Guru/Mahaveer/Equivalent
33.	Water Meter (Mechanical Type Magnetic driven)	-	Aquamet/Zenner/Equivalent
34.	Water Meter (Electronic Type) Aquamet/Zenner/Forbes/Equivalent	-	
35.	Paints	-	Asian Paints/Berger
36.	MH / Water Tank Plastic Steps	-	KGM/Patel/Pranali Industries
37.	Insulation for Hot Water Pipes	-	Armaflex/Klex/Eurobatex
38.	Solar Hot water Generator	-	Bosch/Tisun/Equivalent Standard
	Products Mfg		
39.	Fastner	-	Hilti/Fischer
40.	Fire Sealant	-	Birla 3 M/Hilti /Promat
41.	Level Switch controls panels	-	Lehry / Equivalent

4.0 GENERAL REQUIREMENTS – SEPTIC TANK

Any septic tank constructed or installed in the city shall meet the following minimum specifications:

A. The tank shall have an inside depth of at least five feet, with a liquid depth of at least four feet.

B. The length of the tank shall not exceed three times the width, and shall have a liquid capacity of not less than nine hundred sixty gallons.

- C. The tank shall have at least two compartments, and a manhole of adequate size shall be installed in each compartment.
- D. The inlet and outlet of the tank shall have a vertical four-inch tee extending two feet below and six inches above the liquid level of the tank.
- E. The tank shall be watertight, and shall be constructed of concrete, concrete block, brick or tile.
- F. The top of the tank shall be constructed of reinforced concrete, at least four inches thick.
- G. When the tank is constructed of concrete, the walls and bottom shall be at least six inches thick and shall be adequately reinforced with steel or other approved material.
- H. The concrete used for the tanks shall contain one part cement, two parts sharp sand and four parts crushed rock or gravel.
- I. Where brick, concrete block or tile is used in the construction of the tank, the inside shall be plastered with portland cement mortar, composed of one part cement and three parts sand.
- J. The side walls of the tank shall be adequately reinforced with steel or other approved material so as to withstand any inside or outside pressure.