

TECHNICAL SPECIFICATIONS PLUMBING

GENERAL TECHNICAL SPECIFICATION FOR PLUMBING WORK

1.0 GENERAL:

- 1.1 The work shall be carried out in the accordance with the drawings and design as would be issued to the Contractor by the Design Consultant duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications etc. **not** bearing Design Consultant signature and stamp. Similarly the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Client's Representative in writing.
- 1.2 The work shall be executed and measured as per metric dimensions given in the Bill of Quantities, drawings etc.
- 1.3 The Contractor shall acquaint himself fully with the partial provisions for supports that may or may not be available in the structure and if are available then utilize them to the extent possible. In any case the Contractor shall provide all the supports regardless of provisions that they have been already made. Nothing extra shall be payable for situations where insert plates (for supports) are not available or are not useful.
- 1.4 Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.
- 1.5 The Contractor shall protect / handle the material carefully and if any damage occurs while handling by the Contractor then the sole responsibility shall be of the Contractor. Such damages shall be rectified/recovered by the Contractor at no extra cost whatsoever.
- 1.6 The Contractor shall, within twenty one (21) days of receipt of the Notice of Award for the Project, where applicable, complete the submission of shop drawings to the Client's Representative for approval by the Design Consultants in order to conform to the contract schedule.

1.7 MEASUREMENTS:

All measurements shall be taken in accordance with relevant IS codes, unless otherwise specified.

2.0 APPLICABLE CODES AND STANDARDS:

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended up to the date of submission of Tender. All equipment and material being supplied shall meet the requirements of BIS and other relevant standard and codes.

Plumbing Works:

Vitreous Chinaware	-	IS: 2556 - 1974 (Part - I)
	-	IS: 2556 - 1981 (Part - II)
	-	IS: 2556 - 2556 (Part - III)
Ball Valve	-	IS: 1703 - 1977
Cistern Brackets	-	IS: 775 - 1970
Toilet Seat Cover	-	IS: 2548 - 1983
Vitreous China Cistern	-	IS: 2326 - 1987
Sand Cast Iron Pipes and Fittings	-	IS: 1729 - 1979
Spun Cast Iron Pipes and Fittings	-	IS: 3989 - 1984
GI Pipes	-	IS: 1239 - 1979
Galvanizing for GI Pipes	-	IS: 4736 - 1986
Pipe Threads	-	IS: 554 - 1985
Milleable Iron Fittings	-	IS: 1879 - 1987
Cast Iron Sluice Valves	-	IS: 780 - 1984
Full Way Valves	-	IS: 778 - 1984
Brass Ferrule	-	IS: 2692 - 1978

Stone Ware Gully Trap	-	IS: 651 - 1980
RCC Pipes	-	IS: 458 - 1971
Cast Iron Class LA Pipes	-	IS: 1536 - 1989
Cast (Spun) Iron Fittings	-	IS: 1538 - 1976
Pig Lead	-	IS: 782 - 1966
Induction Motors	-	IS: 4691
Code for Measurements	-	IS: 1200
UPVC Pipes and Fittings	-	IS: 4984
Specification for Caulking Lead	-	IS: 782
Code of Practice for laying of concrete	-	IS: 783

3.0 QUALITY ASSURANCE AND QUALITY CONTROL:

- 3.1 The work shall conform to high standard of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.
- 3.2 At the site, the Contractor shall arrange the materials and their stacking/ storage in appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of material, assemblies etc. as directed by the Client's Representative. The test shall be conducted continuously and the result of tests maintained. In addition the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.
- 3.3 The Client's Representative shall be free to carry out such tests as may be decided by him at this sole direction, from time to time, in addition to those specified in this Document. The Contractor shall provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
- 3.4 The test shall be conducted at Standard Laboratory selected by Client's Representative. Contractor shall keep the necessary testing equipment such as hydraulic testing machine, smoke testing machine, gauges and other necessary equipment required.
- 3.5 The Client's Representative shall transport the samples to the laboratory.
- 3.6 Testing charges shall be borne by the Client's Representative.
- 3.7 Testing may be witnessed by the Contractor or his Authorised Representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

4.0 WATER SUPPLY:

4.1 SCOPE

- 4.1.1 Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the bill of quantities.
- 4.1.2 Without restricting to the generality of the foregoing, the water supply system shall include the following:-
- Pipe protection & painting.
 - Connections to all plumbing fixtures, tanks, pump etc.
 - Providing hot water pipe lines and supply point with isolation valves, wherever required.
 - Control valves, masonry chambers and other appurtenances.

- v. Connections to all plumbing fixtures, tanks and appliances.
- vi. Excavation and refilling of pipe trenches, wherever necessary.
- vii. Internal galvanized water supply piping inside the toilets shaft/plant room/terrace.
- viii. Testing all line and fixtures as specified.

4.2 GENERAL REQUIREMENTS:

- 4.2.1 All materials shall be new of the best quality and shall be furnished, delivered, erected, connected and finished in every detail conforming to specifications and subject to the approval of Client's Representative.
- 4.2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 4.2.3 Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.

As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes up to 64mm dia.

- 4.2.4 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc. and shall be selected and arranged so as to fit properly into the allocated building space.
- 4.2.4 Pipes shall be securely fixed to walls by suitable clamps at intervals specified.
- 4.2.6 Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance and repairs.
- 4.2.7 Connection between dissimilar materials.
- 4.2.8 All G.I. pipes jointing shall be with white lead and spun yarn.
- 4.2.9 Drawings illustrating block out and penetration of pipes in the wall/floor/slab.
- 4.2.10 UNIONS:

Contractor shall provide adequate no. of unions on all pipes to enable dismantling later and for servicing. Union shall be provided near each gunmetal valve.

INTERNAL WORKS (WATER) – MATERIAL:

4.3 ASTM - PVC PIPES & FITTINGS (Item no. 1 to 8)

4.3.1 SCOPE:

This specification covers the requirements for manufacture, supplying, lowering, laying, jointing, testing and commissioning of ASTM solvent welded PVC pipe with fittings for the conveyance & distribution system for above ground as well as below ground installation with required civil work.

4.3.2 CODES & STANDARDS:

The manufacturing, testing, supplying, jointing and testing at work sites of PVC pipes shall comply with all currently applicable statutes, regulations, standards and codes. In particular, the following standards, unless otherwise specified herein, shall be referred.

4.3.3 MATERIALS

ASTM D 1784	-	Specification for Poly Vinyl Chloride (PVC) Plastic Pipes, SCH 40 & SCH 80.
ASTM D 2466	-	Socket type Vinyl Chloride Plastic Pipe Fittings SCH 40

ASTM D 2467	-	Socket type Vinyl Chloride Plastic Pipe Fittings SCH 80
ASTM D 2464	-	Solvent Cement for Plastic Pipes & Fittings
ASTM D 2774	-	Underground installation of Thermo plastic Pipes

4.3.4 DESIGN

Design of uPVC pipes shall be according to ASTM D-1784 & fittings shall be made according to ASTM D-2467 (for Schedule 80). The pipe shall have socketed solvent welded fittings.

4.3.5 TRENCHING

- 4.3.6 The width of the trench at the crown of the pipe shall be not less than the outside diameter of pipe plus 300 mm to allow proper compaction of the side fills & at a 224 mm above the crown of the pipe. The trench width shall be as below :

NOMINAL PIPE SIZE (IN MM)	TRENCH WIDTH MIN. (IN MM)	TRENCH WIDTH MAX. (IN MM)
110	440	600
160	440	600
200	600	700
224	600	700
240	600	700
314	700	840
344	740	900
400	800	940
440	840	1000

- 4.3.7 The minimum trench depth shall be width plus outer diameter of pipe or 0.74 mtr. above crown of pipe whichever is more.
- 4.3.8 The trench shall be backfilled as soon as possible.
- 4.3.9 The excavated material shall be deposited at a sufficient distance away from the edge of the trench to avoid damage to the pipes through falling stones & debris.
- 4.3.10 Pipe shall be laid with a cover, measured from the top of the pipe to the surface of the ground of not less than 1.2 mtr. under roads
- 4.3.11 The pipe bedding shall be with a granular material & backfilling shall be performed in layer of 6 inch with each layer & shall be sufficiently compacted to 84% to 94% compaction.
- 4.3.12 A mechanical compaction shall be carried out for compacting sand & gravel backfill. Optionally manual compaction shall be carried out.
- 4.3.13 A trench shall be completely filled & backfilling shall be placed & spread in uniform layers to prevent any unfilled spaces or voids. Large rocks, stones, etc. shall be removed. Heavy tampers or rolling equipment shall be used for final backfilling only.

4.4 PIPE HANDLING & STORAGE :

- 4.4.1 The pipe shall not be pushed or dragged from the truck bed. Pallets for pipe shall be removed with a fork lift. Loose pipe can be rolled down on timber.
- 4.4.2 The pipe shall be stored in open ground which shall be dry & free from sharp objects.
- 4.4.3 The pipe shall be protected from the sun & shall be in area with proper ventilation.
- 4.4.4 If the pipe shall be stored in racks or it shall be supported throughout its length with the spacing not more than 3 feet.

4.5 LAYING & JOINTING :

- 4.5.1 Pipe shall be cut square with the special tool.

- 4.5.2 The inside & outside edges shall be cleaned from any burrs with file or deburring tool.
- 4.5.3 The surface shall be cleaned with a clean dry cloth.
- 4.5.4 With light pressure, pipe should go one third to one half of the way into the fitting socket.
- 4.5.4 Pipes & fittings that are too tight shall not be used. Use an applicator having size equal to one half the pipe diameter.
- 4.5.6 For jointing, full even layer of cement shall be provided on external surface of the pipe & medium layer of cement shall be provided to the inside of a fitting
- 4.5.7 Pipe & fittings shall be assembled & pipe shall give a quarter turn.
- 4.5.8 The piping (for sch. 40) shall be supported by the means of hangers having recommended spacing as below :

NOMINAL PIPE SIZE (MM)	TEMPERATURE IN DEG. C				
	14.4	26.6	37.7	48.8	60
14	4.4 MTR.	4.4 MTR.	4 MTR.	2.4 MTR.	2.4 MTR.
20	4 MTR.	4.4 MTR.	4 MTR.	2.4 MTR.	2.4 MTR.
24	4.4 MTR.	4 MTR.	4.4 MTR.	3 MTR.	2.4 MTR.
32	4.4 MTR.	4.4 MTR.	4 MTR.	3 MTR.	3 MTR.
40	6 MTR.	4.4 MTR.	4 MTR.	3.4 MTR.	3 MTR.
40	6 MTR.	4.4 MTR.	4 MTR.	3.4 MTR.	3 MTR.
63	6.4 MTR.	6 MTR.	4.4 MTR.	4 MTR.	3 MTR.
74	7 MTR.	7 MTR.	6 MTR.	4 MTR.	3.4 MTR.
100	7.4 MTR.	7 MTR.	6.4 MTR.	4.4 MTR.	4 MTR.
140	8.4 MTR.	8 MTR.	7.4 MTR.	4 MTR.	4.4 MTR.

- 4.5.9 The pipe joint setting & curing time shall be recommended as :

4.5.10 **SET TIME :**

Temperature	Pipe size	Pipe Size	Pipe Size
Range	14 mm to 32 mm	40 mm to 74 mm	100 & 140 mm
14.4-37.7 deg C	14 minute	30 minute	60 minute
4.4-14.4 deg C	60 minute	120 minute	240 minute

4.5.11 **CURE TIME :**

Temperature	Pipe size	Pipe Size	Pipe Size
Range	14 mm to 32 mm	40 mm to 74 mm	100 & 140 mm
14.4-37.7 deg C	6 hrs.	12 hrs.	24 hrs.
4.4-14.4 deg C	12 hrs.	24 hrs.	48 hrs.

- 4.5.12 To compensate the expansion & contraction, suitable means shall be provided by expansion loops with 90 deg elbows / bellows subject to the application for the above ground installation
- 4.5.13 For underground application, the compensation for expansion & contraction shall be done by anaking the pipe in trench.

4.6 TESTING :

- 4.6.1 The pipe shall be tested with water. Before testing, it shall be properly anchored.
- 4.6.2 Thrust blocks shall be provided at dead ends, at change in direction & at change in size.
- 4.6.3 The piping shall be slowly filled with water with velocity not exceeding 1ft./sec.
- 4.6.4 Vents shall be provided at high points & air shall be released before testing.
- 4.6.4 All valves & vents shall be kept open during testing to release the air.
- 4.6.6 The piping shall be tested for 124% of design working pressure for one hour maximum.
- 4.6.7 During testing, if any joint is leaking, it shall be cut & replaced.

4.7 CPVC PIPES & FITTINGS: (Item no. 9 to 14)

- i. The pipes and fittings chemically known as Chlorinated Poly Vinyl Chloride [CPVC] shall be produced in Copper Tube Size [CTS] from ½" to 2" with two different standard dimensional ratios – SDR 11 and SDR 13.4. The fittings shall be produced as per SDR 11. All the CPVC pipes and fittings in SDR 11 and SDR 13.4 shall be made from the identical CPVC compound having the same physical properties. Pipes and fittings shall be produced as per SDR 11 & shall meet the requirement of ASTM D 2846 whereas the pipes produced with SDR 13.4 shall meet the requirement derived from ASTM F 442, specific to CPVC in Iron Pipe Size [IPS] dimension, which also shall be applied to CPVC pipes in Copper Tube Size [CTS] dimension.

4.7.1. CUTTING AND JOINTING AND INSTALLATION OF CPVC PIPES & FITTINGS:

- i. CUTTING:

In order to make a proper and neat joint, the pipe length shall be measured accurately and make a small mark. Ensure that the pipe and fittings are size compatible. It shall be easily cut with a wheel type plastic pipe cutter or hacksaw blade. Cutting tubing as squarely as possible shall provide optimal bonding area within a joint.

- ii. DEBURRING / BEVELING:

Burrs and filings shall prevent proper contact between tube and fitting during assembly and should be removed from the outside and inside of the pipe. A pocket knife or file shall be used for this purpose. A slight bevel on the end of the tubing shall ease the entry of the tubing into the fitting socket.

- iii. FITTING PREPARATION:

Using a clean, dry rag, wipe dirt and moisture from the fitting sockets and tubing end. The tubing should make contact with the socket wall 1/3 to 2/3 of the way into the fitting socket.

- iv. SOLVENT CEMENTS APPLICATION:

Use only CPVC cement or an all – purpose cement conforming to ASTM -493 or joint failure may result. 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.

- v. ASSEMBLY:

Immediately insert the tubing into the fitting socket, rotate the tube ¼ to ½ turn while inserting. This motion will ensure an even distribution of cement within the joint. Properly align the fittings. Hold the assembly for approximately 10 seconds, allowing the joint to set-up.

- vi. SET AND CURE TIMES:

Solvent cement set and cure times are a function of pipe size, temperature and relative humidity. Curing time is shorter for drier environments, smaller sizes and higher temperatures. It requires 10 to 20 minutes for perfect joint.

- i. CEMENTING:

- Verify the cement is the same as the pipes and fittings being used.
- Check the temperature where the cementing will take place.

- Cement takes longer time to set up in cold weather. Be sure to allow extra time for curing. Do not try to speed up the cure by artificial means – this could cause porosity and blisters in the cement film.
- Solvents evaporate faster in warm weather. Work quickly to avoid the cement setting up before the joint is assembled. Keep the cement as cool as possible. Try to stay out of direct sunlight.
- Keep the lid on cements, cleaner and primers when not in use. Evaporation of the solvent will affect the cement.
- Stir or shake cement before using.
- Use ¾" dauber on small diameter pipes, 1 ½" dauber up through 3" pipe, and a natural bristle brush, swab or roller ½ the pipe diameter on pipes 4" and up.
- Do not mix cleaner or primer with cement.
- Do not use thickened or lumpy cement. It should be like the consistency of syrup or honey.
- Do not handle joints immediately after assembly.
- Do not allow dauber to dry out.
- Maximum temperature allowable for CPVC pipe is 180° F.
- All colored cements, primers and cleaners will have a permanent stain. There is no known cleaning agent.
- Use according to the step outline in ASTM D – 2846, joining of pipe and fittings.

4.7.2 TESTING

After laying and jointing, the pipes and fittings shall be inspected under working condition of pressure and flow. Any joint found leaking shall be redone and all leaking pipes removed and replaced without extra cost. Use of any compound or stop leak compound will not permit.

The pipes and fittings after they are laid shall be tested to hydraulic pressure of 1.4 times the working pressure or 7.4 Kg/Sq.cm whichever is more. The pipes shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The draw of taps and stop cocks shall then be closed and specified hydraulic pressure shall be applied gradually. Pressure gauge must be accurate and preferably should have been recalibrated before the test. The test pump having been stopped, the test pressure should be maintained without loss for at least two hours. The pipes and fittings shall be tested in sections as the work of laying proceeds, having the joints exposed for inspection during the testing.

4.7.3 MEASUREMENTS

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include pipe and fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions etc... Deductions for length of valves shall be made. Rate quoted shall be inclusive of all fittings, clamps, cutting holes chased and making good the same and all items mentioned in the specifications and Bill of Quantities.

EXTERNAL WORKS (WATER) MATERIALS:

4.8 G.I. PIPES (External BOQ Item no.1,2 &3)

- i. The pipes shall be galvanised mild steel threaded pipes conforming to the requirement of IS: 1239 Part-I for heavy grade upto 140mm dia and IS: 3489 for pipes above 140mm dia. They shall be of the dia (nominal bore) specified in the description of the item. Galvanising shall conform to IS: 4736.
- ii. The pipes shall be clearly finished, well galvanised in and out and free from cracks, surface flow, laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with axis of the tube.
- iii. All screw tubes shall have pipe threads conforming to the requirements of IS: 444-1944 (or revised).

4.8.1 G.I. FITTINGS

- i. All fittings shall be conforming to IS: 1239 Part II (or as revised). All fittings shall have manufacturer's trade mark stamped on it. Fittings in G.I. pipe lines shall include elbows, tees, bends, reducers, nipples, union, G.I. Clamps / Steel structural supports of approved design, nuts, bolts, washers, etc. All fittings shall be tested at manufacturer's works. Contractors may be required to produce certificate to this effect from the manufacturers.
- ii. The fittings shall have screw threads at the ends conforming to the requirements of IS: 444-1944 (or revised). Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.
- iii. Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks, or check valves and on straight runs as necessary at appropriate locations as required and/or directed by Client's Representative.

4.8.2 CUTTING AND JOINTING:

- i) The pipes and fittings shall be inspected at site before use to ascertain that they conform the specification given in para no. 4.4.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filled out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 444-1944 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in water tight joint.
- ii) The screw threads of pipes and fittings shall be protected from damage until they are fitted.
- iii) The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket. Care should be taken that all pipes and fitting are properly jointed so as to make the joints completely water tight and pipes are kept at all times free dust and dirt during the fixing. Burr from the joint shall be removed after laying. The open ends of the pipes shall be temporarily plugged to prevent access of water, solid or any other foreign matter.

4.8.3 INSTALLATION:

i) Trenches :

The galvanised iron pipes and fittings shall be laid in trenches. The widths and depths of the trenches for different diameters of the pipes shall be as in Table below:-

Dia of pipe	Width of trench	Depth of trench
14 mm to 40 mm	30 cm	60 cm
64 mm to 140 mm	44 cm	74 cm

At joints the trench width shall be widened where necessary. All G.I. / C.I. pipes below ground in trenches minimum cover over pipes shall be 60cm. Cover shall be measured from top of pipe to the surface of ground. The bed of the trench if in soft or made up earth, shall be well watered and rammed before laying the pipes and depressions if any shall be properly filled with earth and consolidated in 20cm layers.

If the trench bottom is extremely hard and rocky or loose stony soil, the trench shall be excavated at least 140mm below the trench grade. Rocks, Stone or other hard substances from the bottom of the trench brought back the required grade by filling with selected fine earth or sand and compacted so as to provide smooth bedding for the pipe. When excavation required blasting operation, it shall be ensured that no pipes have be stacked in the vicinity and completed pipe in the vicinity has already been covered before starting of blasting operations; this is necessary to prevent damage to the exposed pipe in the vicinity by falling stone as result of blasting.

After the excavation of the trench is completed, hollows shall be cut at the required position to receive the socket of the pipes and these hollows shall be of sufficient depth to ensure that the barrel of the pipes shall rest throughout their entire length on the solid ground and that sufficient spaces left for jointing the under side of the pipe joint. These socket holes shall be refilled with sand after jointing the pipe.

Roots of tree within distance of about 0.4 meter from the side of the pipe line shall be removed or killed.

The excavated materials shall be placed within 1 meter or half of the depth of the trench, whichever is greater, from the edge of the trench. The material excavated shall be separated and stacked so that in refilling they may be re-laid and completed the same order to satisfaction of the Client's Representative.

The filling shall be done in layers not exceeding 14mm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of the crow brass where rammers can not be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches.

Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and approved by Client's Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 14mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the instrument diversity of filled earth but on the discretion of Client's Representative the 94 proctor's compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Client's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

ii) Pipe Protection:

For underground G.I. pipes following treatment will be given:

Coat of hot bitumen R 84/24

- a) Wrapping of fiberglass tissue.
- b) Coat of hot bitumen R 84/24 over fiberglass tissue.

The pipes shall be laid on a layer of 7.4 cm sand and filled upto 14 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed.

iii) Jointing :

The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped around the screwed end of the pipes. The end shall then be screwed in the socket, tee etc with the pipe wrench. Care shall be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joints shall be removed after screwing. After laying, the ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

iv) Thrust Blocks :

In case of bigger pipes (80 mm dia and above), thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends as directed by the Client's Representative.

4.8.4 TESTING:

- ii. All external water supply pipes shall be tested by hydrostatic pressure of 1.4 times the working pressure or 7.4 Kg/Sq.cm whichever is more.
- iii. Pressure shall be maintained for a period of at least 180 minutes without any drop in the pressure after fixing

at site.

- iv. In addition to the sectional testing carried out during the construction. Contractor shall test the entire installation after connections to the hydro pneumatic system or pumping system. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to careless will has to be replaced by the Contractor.
- v. The initial back fill shall be placed evenly in a layer of about 100mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300mm of cover over the pipe.
- vi. The joint or coupling during the testing of mains shall be left exposed for inspection before cover-up, sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing. In this way if any error if workmanship will be found shall immediately corrected at a minimum cost.

4.8.5 MASONRY CHAMBER:

- i) All masonry chambers for stop cocks, sluice valves and meter etc. shall be built as per supplied drawings.
- ii) The excavation for chambers shall be done true to dimension and level indicated on plans or as directed by the Client's Representative.
- iii) Concrete shall be having cement concrete 1:2:4 (1 cement: 2 fine sand: 4 graded stone aggregate 40mm nominal size).
- iv) Brick shall be in 1st class bricks in cement mortar 1:4 (1 cement: 4 fine sand).
- v) Plastering not less than 12mm/14mm thick shall be done in cement mortar 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement for inside plaster and same for outside but with Rough plaster.

4.8.6 MEASUREMENTS:

All G.I pipes below ground shall be measured per linear meters (to the nearest cm) and shall be inclusive of all fittings e.g. coupling, tees, bends, elbows, unions, deduction for valves shall be made rate quoted shall be inclusive of all fittings, excavation, back filling and disposal of surplus earth, cutting holes and chase and making good all item mentioned in Bill of Quantities.

4.9 SANITARY FIXTURES & C.P. FITTINGS: (Internal BOQ-Item No. 20 to 42)

4.9.1 SCOPE

Work under this section shall consist of transportation, furnishing, installation, testing and commissioning and all labour as necessary as required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories as required by the drawings and specified hereinafter or given in the Bill of Quantities.

4.9.2 GENERAL REQUIREMENTS

- 4.9.2.1 All fixtures and fittings shall be fixed with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Bill of Quantities, specifications, drawings or not.
- 4.9.2.3 All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles or interior finish as per architectural design requirements. Wherever necessary the fittings shall be centered to dimensions and pattern desired.
- 4.9.2.4 Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Client's Representative.
- 4.9.2.5 All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shows on the drawings & in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, wall or ceiling surfaces shall be made good at Contractors cost.
- 4.9.2.6 All fixtures of the similar materials shall be by the same manufacturers.

- 4.9.2.7 All fitting shall be of the chromium plated materials.
- 4.9.2.8 Without restricting to the generally of the foregoing the sanitary fixtures shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the building.
- 4.9.2.9 Whether specifically mentioned or not all fixtures and appliances shall be provided with approved fixing devices, nuts, bolts, screws, and hangers as required. These supports shall have the necessary adjustment to allow for irregularities in the building area construction.
- 4.9.2.10 For the installation of the CP fittings, Teflon tape shall be used.

4.9.3 W.C.

- 4.9.3.1 Anglo indian / European W.C. of glazed vitreous china shall be wash down, single or double symphonic type, floor or wall mounted set, flushed by means of flush cock as specified in Bill of Quantities. Flush pipe / bend shall be connected to the W.C. by means of suitable rubber adopter. Wall hung W.C. shall be supported by C.I. floor mounted chair.
- 4.9.3.2 Each W.C. seat cover shall be so fixed that it remains absolutely stationary in vertical position without falling down on the W.C. Seat cover shall be of white solid plastic, elongated open front with heavy duty hinges. Exposed fixture trims shall be Chrome plated, and trims of similar function shall be by the same manufacturer.
- 4.9.3.3 Flush valves / flush cock shall be of the best approved quality procurable with C.P. flush pipe.
- 4.9.3.4 The flush pipe/bend shall be connected to the WC by means of a suitable rubber adopter.
- 4.9.3.5 Alternatively if flushing cistern to be used shall conform to the requirements of IS: 775-1971. High level cisterns shall be of cast iron unless otherwise specified. Low level cistern shall be of the same material as the water closet or as instructed by the Owner/Architect/ Consultant. The cisterns shall be mosquito proof & shall fulfill the requirements of the local Authority.
- 4.9.3.6 The levels of the WC should be checked by placing spirit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out. The fixing will have to be rectified / re-aligned.
- 4.9.3.7 Each WC shall be provided with CP Jet spray with required control valve & tubing
- 4.9.3.8 Also indian orrisa pan shall be executed as per the size & specifications given in BOQ if called for.

4.9.4 KITCHEN / PANTRY SINKS

- 4.9.4.1 Sinks shall be of stainless steel material as specified in the Bill of Quantities/Drawings.
- 4.9.4.2 Each sink shall be provided with R. S. brackets and clips and securely fixed. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 50 mm dia Chromium Plated waste with chain and plug or P.V.C. waste with Escutcheon plates. Fixing shall be done as directed by Client's Representative.
- 4.9.4.3 Supply fittings for sinks shall be mixing fittings or C.P. taps, angle cocks etc. all as specified in the Bill of Quantities/Drawings.

4.9.5 WASH BASINS

- 4.9.5.1 Wash basin shall be of white vitreous china of best quality manufactured by an approved firm and sizes as specified in the Bill of Quantities.
- 4.9.5.2 Wash basin shall be of wall mounted / under or over counter type & shall be supported on a pair of rolled steel brackets of approved design and shall be mounted on a countertop. So that rim and basin bowl is exposed from top.
- 4.9.5.3 Wash basin shall be provided with single lever mixer with chain (if called) and rubber plug, chromium plated

brass bottle trap of approved quality, design and make where hot water required. Single tap where hot water is not required.

4.9.5.5 Wash basin shall be fixed at proper location and height and truly horizontal as shown on drawing or as directed by Client's Representative.

4.9.5.6 The scope shall include flexible tubing from angle/stop cock to tap

4.9.6 SHOWER ROSE

4.9.6.1 100 MM DIA. CP shower rose with arm to be include for each bathing facilities with 15 mm water connections. It shall include all civil work required. However, the control/stop cocks to be measured & paid separately.

4.9.7 URINALS

Half stall wall hung urinals of glazed vitreous china shall be provided with 15mm dia, C.P. brass spreader, 32mm dia C.P. domical waste and C.P. cast brass bottle trap with pipe and wall flange and shall fixed to wall by one C.I. bracket and two C.I. clips as recommended by manufacturers complete as directed by the Client's Representative.

Urinals shall be flushed by means of "NO-TOUCH" infrared operated flush valves.

Waste pipes for urinals shall be any one of the given material as directed by the Client's Representative:

- a) G.I. Pipes
- b) Rigid PVC/High density polyethylene.

Waste pipes may be exposed on wall or concealed in chase as directed by the Client's Representative. Urinal partitions are not included

Alternatively, squatting pan type urinal shall be executed as per the specifications given in BOQ if called for.

4.9.8 MEASUREMENTS

4.9.8.1 Rate for providing and fixing of sanitary fixtures, hardwares, consumables, accessories shall include all items and operations stated in the respective specifications and Bill of Quantities, and nothing extra is payable.

4.9.8.2 Rate for CP fixtures shall be paid separately as per quantities executed as mentioned in BOQ

4.9.8.3 Rates for all items under specifications para above shall be inclusive of cutting holes and chases and making good the same, C.P. screws, nuts, bolts and any fixing arrangement required.

4.10 VALVES: (Internal BOQ-Item no.43 to 52)

4.10.1 BUTTERFLY VALVES:

All the isolation valve 40cm and above on the equipment and water lines, where specified or shown on drawings shall be wafer type butterfly valves. They shall be designed to fit without gaskets, the water tight seal being obtained by EPDM seat projection at the faces compressed between the flanges. The valves shall be supplied inclusive of M.S. pipe flanges and high tensile steel bolts of dimensions recommended by suppliers of valves. The valves shall comply with following specifications:

- a) Test Pressure : Body 24 Bar, Seat 16 Bar
- b) Valve Component : Material of Construction
 - i) Body : Cast Iron, Gr. FG 260, IS:210
 - ii) Disc : Nylon or Epoxy powder coated high duty iron, Gr, FG 260
 - iii) Stem : Stainless Steel or carbon steel IS: 1470, Part-II.

iv)	Seat	: EPDM
v)	Hand Lever	: Cast Iron (Mechanical Memory Stop)
vi)	Bearings	: PTFE or Nylon covered S.S. bush bearings at stem and pivot.
vii)	Primary Seal	: Reinforced PTEE slide bearings
viii)	Temperature	: 80 Degree C (max.)

4.10.2 INSTALLATION:

Valve shall be installed in a manner that allows future removal and service of the valve.

Packing and gasket shall not contain asbestos.

The valve shall be of the same size as the pipe to which they are installing.

Valve above 140mm diameter shall be self locking worm gear type water proof and protory lubricated.

Provide chain operators with chain cleats for all valves more than 2.4 meters above floor.

4.10.3 CONTROL (WHEEL) VALVE & NON RETURN VALVES:

All valves shall be provided as shown in the drawings conforming to IS 778 with its latest edition and in accordance with the following specifications.

Size	Construction	Ends
Up to 40 mm.	Gun metal	Screwed
64 mm and above	Gun metal/cast iron	flanged

Valves shall be of approved make. Valve shall be used and tested to 14 Kg. / Sq.cm. pressure. Wheel valve shall be sold wedge & non return valve shall be with single door design.

4.10.4 BALL VALVES (FLOAT VALVE):

The ball valve shall be of high pressure class and shall be confirm to IS: 1703 of sizes as specified. The nominal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball shall be of brass or gun metal as specified and the float shall be of polythene sheet. The minimum gauge of copper sheet used for making the float shall be 0.44mm for float upto 114mm dia and 0.44mm for float exceeding 114mm dia and shall be special in shape. The valve shall be constructed to permit replacing without console of the valve body from the valve line and the system shall not blow out under pressure. The jointing of the float shall be made by efficiently burnished, lapped and soldered seam or by bracing. Plastic float may also be used if specified. The body of ball valve when assembled in working conditions with the float immersed to not more than half of its volume shall remain closed against a test pressure of 10.4 Kg/Sq.cm. All ball valves shall be capable of withstanding a pressure of 14 Kg/Sq.cm.

The ball valve shall generally conform to IS specifications No. 1703-1962.

4.10.5 BALL VALVES:

The ball valve shall be of Brass or Gunmetal as specified conforming to IS: 1703. The ball valve shall be as given below:

High Pressure:

Indicated by the abbreviation 'HP' for use on mains having pressure. These shall remain closed at a test pressure of 10.4 Kg/Sq.cm.

SL. NO.	NOMINAL SIZE OF BALL VALVE					
	14 mm	20mm	24mm	32mm	40mm	40mm
1. Diameter of spherical float (mm)						

SL. NO.	NOMINAL SIZE OF BALL VALVE					
	14 mm	20mm	24mm	32mm	40mm	40mm
High Pressure	127	142	203	229	244	304
Low Pressure	114	127	178	203	203	244
Minimum weight of ball valve including back nut, body and piston (gms)	283	446	823	1149	1489	1842

The ball valves shall be of following nominal sizes 14mm, 20mm, 24mm, 32mm, 40mm and 40mm. The nominal size shall correspond with the nominal bore of the inlet shanks.

4.10.6 AIR VALVES:

Air valves shall be provided in all high points in the system to prevent air locks as shown on the drawings or directed by Client's Representatives.

4.10.7 HOSE BIB/TAP :

For garden, common green area, PVC 20 mm hose bibs/taps are to be provided for hose connection for irrigating green area. The locations shall be as shown in drawing or as directed by Client's Representative.

4.10.8 TESTING:

All valves shall be tested while installed in pipe by hydrostatic pressure of 1.4 time of the working pressure 7.4 Kg/Sq.cm which ever is more.

4.10.9 MEASUREMENTS:

All valves as mentioned in Bill of Quantities shall be measured by numbers and shall include all items mentioned in the Bill of Quantities.

4.11 CHLORINATION OF DOMESTIC WATER LINES:

4.11.1 After the completion of all the hot and cold water service piping, disinfect all the fresh water supply work and water reservoirs using a chlorine solution.

4.11.2 CHLORINATED SYSTEMS SHALL INCLUDE:

- i. Domestic fresh water tanks
- ii. Fire water tanks
- iii. All pipe work systems receiving suction from the above mentioned tanks apart from the fire systems.

4.11.3 Before handover of the system, submit to the consultant copies of the certification of performance and laboratory report (if required)

4.11.4 Under no circumstances the use of any portion of the fresh water system until it is properly disinfected, flushed and certified shall be permitted.

4.11.5 During the Chlorination work the Contractor shall take all necessary precautions to prevent site staff from drinking the system water. Such precautions shall include locking doors to 'wet' areas and providing warning signs in English and Hindi.

5.0 INTERNAL & EXTERNAL DRAINAGE (SOIL, WASTE, VENT) AND RAIN WATER PIPES : (Internal BOQ Item no. 15,16, 17,18, 19 & External BOQ Item no.8 to 16 & 18 to 20)

5.1 SCOPE:

5.1.1 Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes as required by the drawings, specified hereinafter and given in the Bill of Quantities.

5.1.2 Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:-

- i. UPVC vertical and horizontal soil waste and vent pipes, rainwater pipes and fittings, joints clamps and connections to fixtures.
- ii. Floor traps, floor drain clean out plugs, inlet fittings and rainwater roof drain, area/local drains, trench drain...
- iii. Waste pipes connections from all fixtures e.g. wash basins, sinks, kitchen equipment.
- iv. Testing of all pipes.
- v. Connection of main.

5.2 GENERAL REQUIREMENTS

- 5.2.1 All materials shall be new of the best quality conforming to specifications and subject to the approval of Client's Representative.
- 5.2.2 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 5.2.3 Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 5.2.4 Pipes shall be securely fixed to walls by suitable clamps at intervals specified.
- 5.2.5 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.
- 5.2.6 All works shall be executed as directed by Client's Representative.

5.3 UPVC PIPES AND FITTINGS (AGRICULTURE TYPE) : NOT APPLICABLE

5.4. SWR uPVC PIPES AND FITTINGS

- 5.4.1 Soil, waste, vent SWR Ring Fit pipes with socket and spigot. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. These pipes conform to Indian Standard IS:13592 - 1992 (reaffirmed 2002) and are designed to withstand continuous internal hydraulic pressure of 4 Kgf/cm so as to ensure life-long trouble free working. The pipes are provided with an integral rubber ring type socket at one end while the other end is kept plain, smooth and free from burrs. Rubber ring type socket ends provide easy push – fit type jointing. Simultaneously, allowance for thermal expansion can also be provided during installation.

5.4.2 FITTINGS:

Fittings shall conform to the corresponding Indian Standard 14735 . Contractor shall use pipes and fittings of matching specification.

Access door shall be secured air and water tight with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal.

5.4.3 JOINTING:

Rubber Seal Rings for Joints & Access Doors : Manufactured in accordance with IS : 5382 for 75 mm / 90 mm / 110 mm sizes. These are made out of natural rubber with a shore 'A' hardness pf 40 × 5. Provide superior resistance to biological attack. Special design of cross section ensures perfect sealing.

Lubricant: Available in 100 gms, 250 gms & 500 gms packing. Specially formulated for compatibility with rubber seal as well as PVC. Does not support the growth of bacteria or fungi.

5.5 PE PIPES & FITTINGS :

HDPE Pipe for internal drainage shall be of PE 63 grade PN 10 conforming to IS 14333 with butt welding joints with fittings with clamps at 2 mtr center to center on wall including testing of pipes, etc complete

Necessary connection to PVC / stoneware shall be included by the contractor.

Pipe shall be tested for joints for 1 hr. with atleast 1.5 mtr. water head.

Measurement shall be in length by running mtr. including fittings.

5.4.4 PIPE, HANGERS, SUPPORT, CLAMP, BRACKET, COWL ETC.:

Supports:

PE/UPVC pipes require supports at close intervals. Recommended support spacing for pipes is 1400 mm for pipes 50 mm dia and above. Pipes shall be aligned properly before fixing them on the wooden plugs with clamps. Even if the wooden plugs are fixed using a plumb line, pipe shall also be checked for its alignment before clamping, piping shall be properly supported on, or suspended from clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers and be responsible for their structural sufficiency. Pipe supports shall be primer coated with rust preventive paint.

Each soil/waste vertical downtakes shall be terminated at terrace level with cowl. Height of the cowl shall be 7 ft. from the terrace finished floor.

5.4.5 TESTING:

Before the system is put into use, it should be tested for leakages by air test, hydraulic test or smoke test.

5.6 TRAPS: (Internal BOQ Item no.19)

5.5.1 NAHANI TRAP OR FLOOR TRAPS:

Nahani traps or floor traps shall be cast iron/ PVC / PE, deep seal with an effective seal of 50 mm. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:3 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) mixed with water proof compound and extended to 40 mm below finished floor level. Contractor shall provide all necessary shuttering and cantering for the blocks. Size of the block shall be 30 x 30 cms of the required depth. The trap shall be installed at lowest point ensure no pending occurs at perimeters of the drain.

5.6 FLOOR TRAP INLET

Bath room traps and connections shall ensure free and silent flow of discharging water. PE/PVC P trap with hopper & jali to be provided as a floor drain. Hopper shall have multiple inlet connections connect waste form the sanitary fixture. Where specified, the Contractor shall provide a special type PE/PVC with multi floor trap, with one, two or three inlet sockets to receive the waste pipe & one outgoing connection to connect it soil/waste stack. Joint between waste and fitting shall be connected to a 'P' or 'S' trap with at least 50mm seal (Hopper and traps shall be paid for separately). Floor trap inlet fittings and the trap shall be set in cement concrete blocks

5.7 C.P./STAINLESS STEEL GRATINGS

Floor and Urinal traps shall be provided with 100-150mm square or round C.P./Stainless steel grating as approved by Client's Representative with rim, of approved design and shape. Minimum thickness shall be 4-5mm or as specified in the Bill of Quantities.

5.8 CLEANOUT PLUGS

Contractor shall provide PE/uPVC cleanout plugs in all horizontal run more than 15 meter length required one cleanout plugs shall be threaded and provided with key holes for opening. Cleanout plugs shall be fixed to the pipe by a seal ring / by solvent cement.

5.9 PIPE SLEEVES

Pipe sleeves 50mm larger diameter than pipes shall be provided wherever pipes pass through walls and slabs and annular space filled with fire proof materials like putty, fire seal etc. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burs removed before laying. Open ends of the pipe shall be closed as the pipe is installed to avoid entrance of foreign matters. Vertical sleeve shall finish 50mm above finish floor level.

5.10 RCC PIPES:

- 5.10.1 All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron) shall be centrifugally spun RCC pipes NP2 for general and NP3 where road crossing. Pipes shall be true and straight with uniform bore throughout. Cracked, wrapped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, prior to use on site, a certificate to that effect from the manufacturer.

The pipes shall be with or without reinforcement as required and of the class as specified. These shall conform to IS: 458 - 1971. The reinforced cement concrete pipes shall be manufactured by centrifugal (or spun) process.

All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. The external and internal surface of the pipes shall be smooth and hard. The pipes shall be free from defects resulting from imperfect grading of the aggregate mixing or moulding. The pipes shall be R.C.C. light duty, NP2 and NP3 type.

5.10.2 LAYING:

R.C.C. spun pipes shall be laid on cements concrete bed or cradles as specified and shown on the detailed drawings. The cradles may be pre-cast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Client's Representatives.

5.10.3 JOINTING (RIGID SPIGOT AND SOCKET JOINT):

Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skein of yarn shall be added and rammed home. Cement mortar with one part of cement and one part of sand and with minimum water content but on no account soft or sloppy, shall be carefully inserted, punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall then be finished off neatly outside the socket at an angle of 45 degree.

5.10.4 CURING:

The joint shall be cured for at least seven days.

5.10.5 CEMENT CONCRETE FOR PIPE SUPPORTS:

- a) Unless otherwise directed by the Client's Representative cement concrete for bed, all round or in haunches shall be laid as follows:

	Upto 1.5m depth (5')	Upto 3m depth (10')	Beyond 3m depth (10')
Pipes in open ground (no sub soil water)	all round (1:5:10)	in haunches (1:3:6)	all round (1:5:10)
RCC/C.I. pipes in sub soil water	all round (1:3:6)	in haunches (1:3:6)	in haunches (1:3:6)
RCC/C.I. pipes (in all conditions)	all round (1:3:6)	in haunches (1:3:6)	in haunches (1:3:6)
RCC/C.I pipes under road or building	all round (1:3:6)	all round (1:3:6)	all round (1:3:6)

- b) RCC pipes or CI pipes may be supported on brick masonry or pre-cast RCC or in situ cradles. Cradles shall be as shown on the drawings.
- c) Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

5.10.6 TESTING:

All lengths of the sewer and drain shall be fully tested for water tightness by means of water head maintained for

not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 meters head of water at the highest point of the section under test. The pipes shall be plugged preferably with standard drain plugs (with rubber rings) on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

Permissible drops in water head should be as per relevant standard

5.10.7 MEASUREMENT:

a) Excavation:

Measurement for excavation of pipes trenches shall be made per linear meter.

- b) Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm. The rate quoted shall be for a depth upto 1.5 meter or as given in the Bill of Quantities.

Payment for trenches more than 1.5 m in depth shall be made for extra depth as given in the Bill of Quantities and above the rate for depth upto 1.5 m.

c) RCC pipes shall be measured for the length of the pipe line per linear meter i.e.:

- i. Length between manholes shall be recorded from inside of one manhole to inside of other manhole.
- ii. Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

5.11 uPVC SOLID WALL PIPES FOR EXTERNAL SEWAGE (External BOQ Item no. 7 to 10)

- 5.11.1 This pipe & fittings PVC shall comply to IS 15328. These pipes & fittings shall be available from 110 to 315 mm with different stiffness classes.

- 5.11.2 Pipes having 110 dia shall have SN 8 while 160mm & above shall have SN 4 stiffness class.

- 5.11.3 The pipes shall be provided with proper sand bedding, encasing etc. as per actual site condition & manufacturer's recommendation.

- 5.11.4 Pipes are available with plain ends in 3 mtr. & 6 mtr. Length.

- 5.11.5 Jointing of the pipes shall be with fixed click ring & sealing ring. Joints are stable & water tight & can accommodate angular deflection & axial due to its design.

5.11.6 TESTING

- A.** All lengths of the sewer & drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of atleast 1.5 mtr. head of water. The test pressure shall, however, not exceed 6 mtr. head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both the sides. The upper end shall, however be connected to a pipe for filling with water & getting the required head poured at one time permit
- B.** The sewer lines shall be tested for straightness by (1) inserting a smooth ball 12 mm less than internal diameter of pipe. In the absence of obstruction such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe & emerge at the lower end. (2) Means of a mirror at one end & a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstructions will be apparent. (3) The contractor shall give a smoke test. A test register shall be maintained at site.

5.11.7 MEASUREMENT:

- A.** The pipes shall be measured for the length of the pipe line per linear meter i.e.:

- (i) Pipe trench with required excavation for the length
- (ii) Length between manholes shall be recorded from inside of one manhole to inside of other manhole

with bedding/encasing throughout its length.

(iii) Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

6.0 EXTERNAL CIVIL WORK FOR DRAINAGE SYSTEM

6.1 SCOPE:

- i. Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter or given in the Bill of Quantities.
- ii. Without restricting to the generality of the foregoing, the drainage system shall include:
Sewer lines including excavations, pipe lines, man holes, drop connections, underground storm water drains, including pipes, man holes, catch basins and open drains, thrust blocks.

6.2 GENERAL REQUIREMENTS:

All materials shall be new of the best quality conforming to specifications and subject to the approval of the Client's Representatives.

Drainage lines shall be laid to the required gradients and profiles.

All drainage work shall be done in accordance with the local municipal bye-laws.

Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other competent authority and also existing invert levels required to enter sanitary system.

Location of all manholes, catch basins, etc. shall be confirmed by the Client's Representatives before the actual execution of work at site.

All excavation, trenches etc shall be barricaded as per instruction of the Client's Representatives.

All works shall be executed as directed by the Client's Representatives.

6.3 TRENCHES FOR PIPE & DRAINS:

6.3.1 ALIGNMENT AND GRADE:

The drains are to be laid to alignment and gradients in continuous shown on the drawings but subject to such modifications, as shall be ordered by the Client's Representative from time to time to meet the requirements of the works. No deviations from the line, 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 Client's Representative.

6.3.2 OPENING OUT TRENCHES:

In excavating the trenches at the road metaling, pavement kerbing etc. are to be placed on one side and preserved for rein statement when the trench or other excavation shall be filled-up.

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's Representative. 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's Representative shall order to the contrary.

Trench to be excavated to alignment + depth required. Trench to be properly dressed and de-watered. Trench shall be kept free of water at all time. Discharge of water shall be into nearest drainage channel not on the road.

All under ground pipe to be laid open in trench. Pipes to be laid and maintained at required levels and grade during course of work. All joints to be aligned and complete.

Trench shall be of 450mm wide than pipe. Concrete anchors at change in direction for C.I. pipe shall be provided. Pipe shall be rest on cushion in the trench.

The Contractor shall scrub up and clear the surface over the trenches and other excavations of all stumps, roots and all other encumbrances affecting execution of the work and shall remove them from the site to the approval of the Client's Representative.

6.3.3 CONSTRUCTION ACROSS THE ROADS:

All the pipe line or drain crossing existing road, the road crossing shall be excavated at a time, the second half being commenced after the pipes have been laid in the first half and the trench refilled. Necessary safety measure for traffic as directed shall be adopted. All type of pipes, water mains, cables etc. met within the course of excavation shall be carefully protected and supported. Care shall be taken not to disturb the electrical and communication cable removal of which is necessary shall be arranged by the Client's Representative or the Contractor shall arrange to support and protect them during excavation.

6.3.4 EXCAVATION TO BE TAKEN TO PROPER DEPTH:

The trenches shall be excavated to such depth and width that the sewers pipe shall rest on cushion so that the inverts may be at the levels given on the section/plan. In bad ground the Client's Representative may order the Contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with such materials as decided by Client's Representative in writing.

6.3.5 REFILLING:

The filling shall be done in layers not exceeding 15mm in depth. Each layer shall be watered, rammed and consolidated. Ramming shall be done with iron rammers where possible and with blunt end of the crow brass where rammers can not be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches.

Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and approved by Client's Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the instrument diversity of filled earth but on the discretion of Client's Representative the 95 proctor's compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Client's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

6.3.6 CONTRACTOR SHALL RESTORE SETTLEMENT AND DAMAGES:

The Contractor shall at his own cost make good promptly during the whole period the works are in hand, any settlements that may occur in the surfaces or roads, beams, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations due to not using the method of compaction as given in clause 7.3.5 and he shall be liable for any accidents caused thereby.

He shall also at his own expense and charges, repair and make good any damage done to the building and other properties.

6.3.7 DISPOSAL OF SURPLUS SOIL:

The Contractor shall at his own cost and charge, dispose off from the site all surpluses excavated material not required to be used on the works.

- i. The width of excavated trench shall be as per table given below:

Excavation upto	Upto 100 mm Dia. Pipe	Upto 150 mm Dia. pipe
90 cms depth	33 cms	33 cms
90 - 150 cms depth	60 cms	60 cms
150 - 300 cms depth	75 cms	75 cms
300 - 500 cms depth	90 cms	100 cms

6.3.8 PROTECTION OF EXISTING SERVICES:

All pipes, water mains, cables etc encountered in the course of excavation shall be carefully protected and supported. In case of any damage caused the same shall be made good at no extra cost failing which necessary works will be carried out by the Clients Representative and contract charged to the Contractor.

6.3.9 CEMENT CONCRETE FOR PIPE SUPPORT

- Wherever specified or shown on the drawings, all pipes shall be supported in bed all round or in haunches. The thickness and mix of concrete shall be as given in the Bill of Quantities.
- Unless otherwise directed by the Consultant/ Client/ Architect, cement concrete of bed, all round or in haunches shall be laid as follows:

	Upto 1.5 m depth	Upto 3 m depth	Beyond 3 m depth
RCC, stoneware, PVC pipes in open ground (above sub soil water)	All round (1 : 5 : 10)	In haunches (1 : 5 : 10)	In haunches (1 : 5 : 10)
C.I.pipes in sub soil water	All round (1 : 3 : 6)	In haunches (1 : 3 : 6)	In haunches (1 : 3 : 6)
RCC or PVC or S.W. pipes in sub soil water	All round (1 : 3 : 6)	All round (1 : 3 : 6)	All round (1 : 3 : 6)
RCC or PVC or S.W. pipes under floors or building	All round (1 : 2 : 4)	All round (1 : 2 : 4)	All round 3. : 2 : 4)

- RCC pipes may be supported on brick masonry or precast RCC or in situ cradles. Cradles shall be as shown on the drawing.
- Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.
- Hand mixing on properly constructed platforms may be allowed for small quantities by the Consultant/ Client/ Architect. Rate for cement concrete shall be inclusive of all shuttering and centering at all depths and heights.
- Concrete work shall be of such thickness and mix as given in the Bill of quantities.
- All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during curing period.

6.4 SEWER MANHOLES WITH FRAME AND COVER: (External BOQ : Item no 20 to 25)
6.4.1 SCOPE

This specification covers the requirements for providing and constructing of Brick Masonry (for up to 3 mtr. depth) / RCC M 20 grade or 1:1½ :3 mix (for more than 3 mtr. depth) manholes with steps, frame, cover and vent shafts.

6.4.2 STANDARDS

The following standards/codes, unless otherwise specified herein, shall be referred. In all cases, the latest revision of the standards /codes shall be referred to.

IS : 210	Specification for gray iron castings
IS : 269	Specification for ordinary and low heat Portland cement
IS : 383	Specification for coarse and fine aggregates from natural sources for concrete
IS : 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
IS : 516	Methods of tests for strength of concrete

IS : 651	Specification for salt-glazed stoneware pipes and fittings
IS : 1077	Specification for common burnt clay building bricks
IS : 1726	Specification for cast iron manhole covers and frames
IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement
IS : 2116	Specification for sand for masonry mortars
IS : 3495	Methods of tests of burnt clay building bricks
IS : 5455	Specification for cast iron steps for manholes

6.4.3 CODES OF PRACTICE

IS : 456	Code of practice for plain and reinforced concrete
IS : 2212	Code of practice for brickwork
IS : 2250	Code of practice for preparation and use of masonry mortars
IS : 4111	Code of practice for ancillary structures in sewerage system part 1 manholes
IS : 4127	Code of practice for laying of glazed stoneware pipes

6.4.4 LOCATION

Manholes shall be constructed in accordance with the drawings at the locations indicated thereon.

6.4.5 CONSTRUCTION MANHOLES:

At every change of alignment, gradient or diameter of a drain, there shall be a manhole or inspection chamber. Bends and junctions in the drains shall be grouped together in manhole as far as possible. The maximum distance between manholes shall be according to NBC.

Manholes of different types and sizes as specified shall be constructed in the sewer line at such places and to such levels and dimensions as shown in the drawings or as directed by the Engineer-in-charge. The size specified shall indicate the inside dimensions between brick faces of the manholes.

Where the diameter of the drain is increased, the crown of the pipe shall be fixed at the same level and necessary slope given in the invert of the manhole chamber. In exceptional cases and where unavoidable, the crown of the branch sewer may be fixed at lower level but in such cases the peak flow level of the two sewers shall be kept the same.

Sewers of unequal sectional area shall not be jointed at the same invert in a manhole. The invert of the smaller sewer at its junction with main shall be at least 2/3 the diameter of the main above the invert of the main. The branch sewers shall deliver sewage in the manhole in the direction of main flow and the junction must be made with care so that flow in main is not impeded.

No drain from house fittings, e.g. gully trap or soil pipe, etc. to manhole shall normally exceed a length of 6 m unless it is unavoidable.

Manholes 90 x 80 cm are generally constructed within compound for house drainage only and near the buildings for house drainage. Manholes 1.2 m x 90 cm are generally constructed for main drainage work for depths less than 1.5 m.

Manhole 1.4 m x 90 cm is of the arched type and is generally constructed for main drainage works where depth is 1.50 m or more. The width of manholes shall be increased more than 90 cm on bends or junctions or pipes with diameter greater than 450 mm and that the benching width on either side of the channel is minimum 20 cm.

Manholes 1.4 m internal diameter are generally constructed for main drainage works where depth is 2.45 m or more as an alternative to manholes of arch type. The diameter shall be increased suitably, for pipes with diameter greater than 450 mm in the same manner as in the case of rectangular manholes.

Before deciding size of manholes, it shall be as specified in BOQ or as per Local Municipal Bye Laws. When manholes are constructed on foot path, these shall be provided with cover of medium duty casting and when built within the width of the road under vehicular traffic, these shall be provided with cover of heavy duty casting.

6.4.6 EXCAVATION

The excavation for manhole shall be true to dimensions and levels shown on the plans or as directed by the Engineer-in-charge.

6.4.7 BED CONCRETE

The manhole shall be built on a bed of foundation PCC 1 : 2 : 4 unless required by local authorities. The thickness of the bed concrete shall be 15 cm for manholes up to 4.5 m depth and 30 cm for depths beyond 4.5 m unless otherwise specified or directed by the Engineer-in-charge. In bad ground, special foundations as suitable shall be provided.

6.4.8 BRICK MASONRY / CEMENT CONCRETE WORK

(a) BRICK MASONRY

For depth up to 3 mtr, manhole shall be constructed with masonry wall, for more than 3 mtr. Depth, it shall be of M 20 grade as specified below:

The brick work shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4 coarse sand).

The brick work shall be with class 75 bricks in cement mortar 1:4 (1 cement: 4 coarse sand). The external joints of the brick masonry shall be finished smooth, and the joints of the pipes with the masonry shall be made perfectly leak proof. For arched type and circular manholes, brick masonry in arches and arching over the pipes shall be in cement mortar 1 : 3 (1 cement: 3 fine sand). In the case of manholes of circular type the excess shaft shall be corbelled inwardly on three sides at the top to reduce its size to the cover frame to be fitted.

The walls shall be built of one brick thickness for depths up to 4.25 m. below a depth of 4.25 mtr in ordinary subsoil the wall thickness shall be increased to one and half brick and at 9.75 m below ground two brick thick walls

(b) CEMENT CONCRETE WORK

The walls shall be built of M20 grade (1 cement : 1.5 coarse sand : 3 coarse aggregate having 20 mm nominal size) with 15 cm thickness for depth up to 4.5 m. Below a depth of 4.5 m in ordinary subsoil the wall thickness shall be increased to 30 cm

The thickness of the wall shall be take the total load coming over it including earth pressure & water pressure. The chamber shall be tested for water tightness.

The wall shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications. In case Local Authorities/Bye Laws specify richer specifications, the same shall be adopted.

For earth work excavation, bed concrete work, R.C.C. work and refilling of earth, respective specifications shall be followed.

6.4.9 PLASTER AND POINTING

In case of brick walls, the walls of the manholes shall be plastered inside with 20 mm thick cement plaster 1:2 (1 cement: 2 coarse sand) finished smooth. The plaster shall further be water proofed with addition of approved water proofing compound in a quantity as per manufacturer's specifications. In case Local Authorities/Bye Laws specify richer specifications, the same shall be adopted.

For earth work excavation, bed concrete brick work, plaster and pointing, R.C.C. work and refilling of earth, respective specifications shall be followed.

6.4.10 BENCHING

The channels and benching shall be done in cement concrete 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size) and rendered smooth with neat cement. The depth of channels and benching shall be as given in Table .

SIZE OF DRAIN ABOVE	TOP OF CHANNEL AT DEPTH OF BENCHING THE CENTER ABOVE AT SIDE WALLS	
	BED CONC.	BED CONC.
10 cm	15 cm	20 cm
15 cm	20 cm	30 cm
20 cm	25 cm	35 cm
25 cm	30 cm	40 cm
30 cm	35 cm	45 cm

6.4.11 FOOT RESTS

All manholes deeper than 0.8 m shall be provided with foot rests.

(a) Foot rest shall be CI type, each weighing 5.5 Kg, 1:2:4 coping.

(b) Alternatively MS foot rest shall be provided. These shall be embedded 20 cm deep in 20 x 20 x 10 cm blocks of cement concrete 1:2:4 (1 cement : 4 coarse sand : 4 graded stone aggregate 20 mm nominal size). The concrete block with M.S. foot rest placed in its center shall be cast in situ along with the RCC wall & finished smooth.

SIZE OF DRAIN MM	TOP OF CHANNEL AT THE CENTER ABOVE BED CONCRETE CM	DEPTH OF BENCHING AT SIDE WALLS ABOVE BED CONCRETE CM
100	15	20
150	20	30
200	25	35
250	30	40
300	35	45
350	40	50
400	45	55
450	50	60

(c) Foot rests which shall be of 20x20 Sq. M.S. bars.

(d) Foot rests shall be fixed 40 cm apart vertically and staggered laterally and shall project 10 cm beyond the surface of the wall. The top foot rest shall be 45 cm below the manhole cover.

(e) Foot rests shall be painted with coal tar, the portion embedded in the cement concrete block being painted with thick cement slurry before fixing.

6.4.12 MANHOLE COVERS AND FRAMES

The frame of manhole shall be firmly embedded to correct alignment and levels in R.C.C. slab or plain concrete as the case may be on the top of the masonry. After completion of the work, manhole covers shall be sealed by means of thick grease.

6.4.13 MEASUREMENTS

Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of RCC cover to the invert level of channel. The depth shall be measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

6.4.14 RATE

The rate shall include the cost of materials and labour involved in all the operations described above but exclude the cost of (i) excavation, (ii) refilling (iii) dewatering if required. These items shall be paid for separately under relevant items of work.

Payment for extra depths of manholes shall be made separately under relevant items of work.

6.4.15 DROP CONNECTION

In cases where branch pipe sewer enters the manhole of main pipe sewer at a higher level than the main sewer, a drop connection shall be provided. The work shall be carried out as per specifications and RCC pipes and special conforming to IS: 458 shall be of the same size as that of the branch pipe sewer.

For 150 and 250 mm main line, if the difference in level between the water line (peak flow level) and the invert level of the branch line is less than 60 cm, a drop connection may be provided within the manhole by giving suitable ramp. If the difference in level is more than 60 cm, the drop shall be provided externally.

The sewer main lines shall be designed with 0.8 full flow.

6.4.16 EXCAVATION

The excavation shall be done for the drop connection at the place where the branch line meets the manhole the excavation shall be carried up to the bed concrete of the manhole and to the full width of the branch line.

6.4.17 MEASUREMENTS

Drop connection shall be enumerated. The depths beyond 60 cm shall be measured in running metres correct to a cm under relevant items.

6.4.18 RATE

The rate shall include the cost of labour and materials involved in all the operations described above but excluding the cost of excavations and refilling.

6.4.19 TESTING

The interior of manholes shall be cleared of all debris after construction and before testing the same for water tightness by Contractor.

Water for testing of manholes along with pipeline shall be arranged by Contractor at his own cost.

7.0 R.C.C PRE CAST M.H.F.C. (External BOQ Item no. 33 & 34)

Manufacture, supply delivery at site of work and fixing on top of manhole precast RCC Frame & cover suitable to drainage M.H. and including cost of reinforcement M.S. Angles or Flat, curing, mold work etc.

7.1 GENERAL SPECIFICATION

R.C.C Precast manhole frame & cover shall be manufacture as per standard type design. Frame shall confirm to IS: 12592 part – II – 1991. Cover shall confirm to IS : 12592 part – I – 1988.

7.2 MATERIAL

Sand, cement, water, aggregates and reinforcement steel shall confirm to relevant I.S. specifications. Thickness of frame shall be 10 cm. Necessary reinforcement, M.S. angle or flat shall be placed as per design during the concreting work fabrication of R.C.C. M.H.F.C shall be carried out by mechanically vibrating process.

7.3 INSPECTION :

Inspection of materials will be carried out at work site by the Engineer who shall carry out inspection as soon as material is brought on work site. Inspection will be carried out normally within one week time. The supplier has to take care of the following points.

The manufacturer has to go in for one line stenciling for identifying size and class for proper separation.

The unloaded material has to be stacked in manageable batches with adequate inspection space like spreading the pieces etc. to permit proper inspection.

7.4 TRANSIT RISK

The contractor shall bring goods at his own risk or it should be covered against the transit risk at its own cost.

7.5 TEST CERTIFICATE

The contractor shall always provide manufacturer's test certificate in accordance with every batch/lot of goods so manufactured and supplied.

The supplier shall also produce in addition to manufacturer's test certificate as mentioned in above, the inspection certificate issued by Engineer for the same purpose.

7.6 FIXING

Precast R.C.C. frame shall be fixed on the top of manhole and properly embedded in cement concrete 1:1.5:3 in required quantity in such a way that the top of the cover when placed in position shall remain at the finished road level.

7.7 MEASUREMENT

The measurement shall be made on number basis subsequent to fixing the frame on top of manhole and placing the cover in the frame.

7.8 MARKING

Each manhole frame and cover shall have cast on them the following information.

- a) Manufacturer's name or trademark.
- b) Grade denoted by abbreviation such as HD, MD or LD.
- c) The word SWD or sewer to denote storm water drain or sewer respecting if desired.
- d) An identification name as required by purchaser.

8.0 HDPE TANK : (Internal BOQ Item no. 55)

8.1 SCOPE

The item pertains to provide HDPE overhead tank of capacity as specified in schedule of quantities including fixing, testing & commissioning

8.2 MATERIAL & FIXING

8.2.1 Water tank to be installed on terrace at the location shown in the drawing

8.2.2 Water tank shall be of HDPE in double layer construction.

8.2.3 Water tank shall be provided with inlet, outlet, drain, overflow & vent pipe connections.

8.2.4 Water tank shall be provided with manhole cover as per the manufacturer's standard .

8.2.5 The capacity shall be as per Bill of quantities

8.3 MODE OF MEASUREMENT

8.3.1 The measurement shall be for each unit of water tank installed.

8.4 MODE OF PAYMENT

8.4.1 The contract rate shall be for each unit of Water tank installed

9.0 SOLAR WATER HEATER (Internal BOQ Item no. 56)

9.1 DESIGN

Solar capacity :As mentioned in BOQ

Solar Collectors Temperature : 60° C

Collector Inclination : 24/32 degree

9.2 HEADER & RISER PIPE

Material : Copper

9.3 ABSORBER SHEET

Material : Copper

Absorber Coating : Black chrome

9.4 STORAGE TANK

Material: Stainless steel

Thickness:As per standard

Insulation: 100mm thick 100Kg/m3 density-LRB water proofing 22SWG Alum cladding

9.5 OUTER CLADDING

Material: Non-corrosive outer shell, providing high Quality of insulation for winter conditions.

Inter connecting pipes: Stainless steel 304

Insulation and Sheet: Thermal PU foam insulation

9.6 ELECTRICAL BACK-UP - Required

9.7 SACRIFICING ANODE

Material: Aluminium

Application: For avoiding hardness in water

9.8 PROTECTIONS

Thermostats, safety relief valve, etc. safety accessories required for complete installation

9.9 MOUNTING FRAME

Shall be of fresh MS structural sheet & painted with rust proof paint.

10.0 WATER COOLERS (Internal BOQ Item no. 57)

- 10.1 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.

10.2 MODE OF MEASUREMENT

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

11.0 REVERSE OSMOSIS SYSTEM (INTERNAL BOQ ITEM NO. 58)

11.1 SCOPE

Provide complete industrial-type packaged reverse osmosis (RO) water treatment system producing high purity water by removal of dissolved minerals, bacteria, particles and organic impurities. Designed for continuous automatic operation. The system shall include pre-filter, product storage tank and all devices necessary for fully operational system. RO system operation will be controlled by the water level in the product storage tank. RO shall generate the output water quality to meet the relevant drinking water standard

11.2 REVERSE OSMOSIS SYSTEM

- A. Packaged automatic reverse osmosis system mounted on steel frame, designed for project conditions. Equipment arranged on the frame to allow easy access for operating, maintenance and repair. Unit shall include reverse osmosis membrane, pressure vessels, pre-filtration system, high pressure pump and all required piping, wiring and controls for a fully operational system as per the raw water analysis report
- B. Raw water analysis to be carried out by the contractor
- C. All piping, valves, instrumentation, gauges shall be covered by contractor
- D. All booster pumps, back wash arrangement, consumables shall be supplied by contractor
- E. Mounting frame, storage tanks shall be part of contractor's scope
- F. All vessels shall be FRP
- G. Required electrification to execute the RO plant shall be covered by the contractor
- H. Output Capacity shall be as mentioned in BOQ

12.0 OIL & GREASE TRAP (Not Applicable)

The scope shall cover supply, installation testing & commissioning of SS 304 oil & grease trap in underground / above ground installation.

Scope shall cover all connections & civil work required for the installation including necessary accessories & hardware.

It shall be design for flow rate 2.5 ltr./sec. However, actual design to be submitted by contractor.

13.0 PERCOLATION WELL (External BOQ Item no. 26)

- A. The scope shall cover all material, construction labour & connection to the network.
- B. The construction shall be as per the drawing
- C. It shall be measured in no. of well constructed with all material

14.0 SOAK WELL / PIT (External BOQ Item no. 27)

- A. The scope shall cover all material, construction labour & connection to the network.
- B. The construction shall be as per the drawing
- C. It shall be measured in no. of well/pit constructed with all material

15.0 SEPTIC TANK (External BOQ Item no. 28)

- A. The scope shall cover all material, construction labour & connection to the network.
- B. The construction shall be as per the drawing
- C. It shall be measured in no. of tank constructed with all material

16.0 SEWAGE TREATMENT PLANT (External BOQ Item no. 29)

- 16.1 The plant shall be buried & shall be MBBR package type. However, Plant room/ Pre fab tanks can be above ground if approved by Client/Architect
- 16.2 The vendor shall include inlet collection tank & treated waste water tank with pump.
- 16.3 Vendor shall cover all electro-mechanical & civil components required for primary, secondary & tertiary processes with required electrification
- 16.4 Vendor shall include all interconnection piping, valves & instruments required for complete installation & monitoring operation.
- 16.5 All required civil, fabrication, painting work shall be covered.
- 16.6 Plant is capable to handle domestic sewage. Capacity of the plant is as mentioned in BOQ
- 16.7 Type of process shall be aerobic MBBR type.
- 16.8 For sludge handling, filter press or membrane bag filters shall be provided.
- 16.9 The vendor shall submit, dimensional GA drawing with power requirement & consumables requirement with design basis.
- 16.10 Treated waste water will be reused for irrigation & balance may be disposed to the nearest sewer/drain point/ soak wells. Accordingly the outlet parameters shall be achieved as per governing local pollution control board.
- 16.11 Vendor shall guarantee outlet parameters meeting as per local pollution control board.
- 16.12 The rate shall include 3 years of operation & maintenance contract including operator, consumables, spares, etc. if called in BOQ. The scope shall also include training to Client's representative.

17.0 CENTRIFUGAL PUMPS (External BOQ Item no. 30 & 31)

17.1 SCOPE:

This specification covers the supply, installation, testing & commissioning of Centrifugal type monobloc/ monoset pumps. The scope also includes suction & delivery piping upto Discharge Header with necessary pipe, fittings, etc. Each pump shall have isolation gate / ball valve & NRV at delivery side. The pipe shall be GI class B.

17.2 CODES AND STANDARDS:

The design and manufacture of the pump shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed.

17.3 DESIGN FEATURES:

17.3.1 The pump shall be capable of developing required total head at rated capacity.

17.3.2 Impeller shall be enclosed type and shall be dynamically balanced.

17.3.3 The pump shall have non overloading characteristics.

17.3.4 The pump shall have flooded suction – submersible type.

17.4 CONSTRUCTIONAL FEATURES:

17.4.1 The casing shall be of rigid construction and shall have central delivery pipe.

17.4.2 The casing shall be of Cast Iron.

17.4.3 The pump shall have very small length delivery pipe connections which will result in minimum friction loss in case of moonset pumps.

17.4.4 Impeller shall be of one piece and shall be of SS CF 8 M.

17.4.5 The shaft shall be of S.S. and its surface shall be properly finished.

17.4.6 Shaft sleeves shall be provided to protect shaft from any damage.

17.4.7 Bearing shall be ball or roller type.

17.4.8 Mechanical seal shall be provided to avoid any leakage.

17.5 TESTING:

17.5.1 Material test certificates for the various pump components shall be furnished

17.5.2 Hydrostatic test shall be carried out at 1.5 times the maximum discharge pressure.

17.6 DRAWINGS:

Following drawings shall be furnished by the vendor:

- 1) Overall dimensional drawing.
- 2) Cross-sectional drawings with Bill of Material and Material of Construction

17.7 TECHNICAL DATASHEET FOR CENTRIFUGAL PUMPS

SR. NO.	PARTICULAR	SPECIFICATIONS
1.0	Type	Centrifugal monoblock/ Monoset
2.0	Number of Units	As per BOQ
3.0	Design capacity of each pump	As per BOQ
4.0	Total head at design capacity	As per BOQ
5.0	Total duration of operation	As per BOQ
6.0	Speed	2900 RPM
7.0	Location	In Tank
8.0	FEATURE OF CONSTRUCTION	
8.1	Impeller	Enclosed
8.2	Shaft	Coupled

SR. NO.	PARTICULAR	SPECIFICATIONS
8.3	Drive Transmission	Direct
8.4	Seal	Mechanical
8.5	Mounting	Base plate
8.6	No. of stage	Single
8.7	Nozzle orientation A. Suction B. Discharge	Side suction Top discharge
8.8	Starter	DOL for upto 5 KW & Star / Delta for more than 5 KW rating
8.9	Flange drilling	As per BS 10, Table F, raised face with off center bolt holes
9.0	LIQUID DATA	
9.1	Liquid handled	Water
9.2	Specific gravity	1.0
9.3	Temperature	Ambient temp.
10.0	MATERIAL OF CONSTRUCTION	
10.1	Base plate	M.S. IS 226
10.2	Pump Casing	Cast Iron
10.3	Impeller	SS CF8 M
10.4	Shaft	S.S AISI 410
10.5	Wearing Ring	S.S AISI 410
10.6	Painting	Epoxy
10.7	Hardware in contact with water	Hot dipped galvanized
10.8	Companion flanges	As per mfg standard
11.0	ACCESSORIES & SERVICES REQUIRED	
11.1	Base Plate	YES
11.2	Foundation bolts	YES
11.3	Companion flanges	YES
11.4	Spare parts required	YES
11.5	Maintenance tools required	YES
12.0	MOTOR :	
12.1	Power Supply	230 / 415 Volts, 3 phase, 50 Hz. AC
12.2	Class of Insulation	Class B
12.3	Degree of Protection	IP 55
13.0	Delivery piping	GI, Class 'B'
14.0	Delivery valves & header valves	flanged valves Make : AUDCO / ZOLOTO / KSB / IVC For monoblock / end suction pump : Flanged Ball / Butterfly valve on suction & delivery side of each pump & Flanged Non Return Valve on delivery side of each pump & on header
15.0	Starter Panel	Required with pump interlocking with respect to tank levels.

SR. NO.	PARTICULAR	SPECIFICATIONS
		Also required Finolex / Polycab make cables up to starter panel.
16.0	Level Indicator	Required for 0-5mtr. Range and shall be panel mounted and interlocking with pump and over head tank.
17.0	Pressure Gauge	Required at delivery of each pump & on header. 0 –7 kg/sq.cm

17.8 WORKMANSHIP:

The pump shall be checked for proper alignment & performance test to check duty parameters & shall record the readings.

The contractor shall erect the panel at site in co-ordination with the supplier if required. He should check for loose ends on the part of the supplier and shall inform client and consultant for the same. Physical and continuity tests shall be carried out by contractor. Also the field tests carried out by the supplier shall be recorded by the contractor.

17.9 MODE OF MEASUREMENT:

Contractor shall be paid for one pump erection as per BOQ Quantities
Contractor shall be paid for one panel erection as per BOQ Quantities

18.0 LIST OF APPROVED MAKES**PLUMBING**

SR.NO.	ITEM	APPROVED MAKE
1	SWR PVC PIPE & FITTINGS	ASTRAL / SUPREME/ FINOLEX/ PRINCE/ASHIRVAD
2	uPVC SN4/8 SOLID WALL DRAINAGE PIPE & FITTINGS	SUPEREME / ASTARL/ ASHIRVAD
3	PVC / uPVC PIPES & FITTINGS	SUREME/PRINCE/ ASHIRVAD/ASTRAL/FINOLEX
4	HDPE PIPE & FITTINGS	ASTRAL / SUPREME/ FINOLEX/ PRINCE
5	STONEWARE PIPES	Hind Ceramic/ Orind/ Perfect/ Burn/EQ.
6	RCC PIPE	ALCOCK / PRANALI / EQ.
7	M.S/G.I. PIPES FOR WATER SUPPLY	TATA / JINDAL/ SWASTIK
8	CPVC PIPE & FITTINGS	ASTRAL / SUPREME/ASHIRVAD / PRINCE
9	GULLY TRAP	GIRCO / TIRUMALA / SONIA/ EQ. SUPREME/ASTRAL (FOR PVC) / PRINCE
10	SOLVENT CEMENT	SUPREME / KISSAN / FINOLEX
11	BALL VALVES	LEADER / ZOOTO / AUDCO / KBL
12	WHEEL VALVES	LEADER / ZOOTO/AUDCO / KBL
13	DCV / NRV	ADVANCE /ZOOTO/SPIREX/AUDCO /KBL
14	TAR	SHALIBIND / TIKIBOND-BS
15	SEWAGE PUMPS	MBH / KISHORE / KBL
16	WATER PUMPS	LUBI / WILLO / KBL
17	STARTER	SIEMENS / L&T
18	PRESSURE GAUGE	BELLS / H GURU
19	CP FITTINGS	JAQUAR / CERA / HINDWARE
20	SANITARY FIXTURES	CERA / JAQUAR / HINDWARE

SR.NO.	ITEM	APPROVED MAKE
21	FLOOR TRAPS	PRINCE / SUPREME/ASTRAL//EQUIVALENT
22	R.O.PLANT WITH COOLER	KENT / USHA / BLUE STAR
23	ELECTRIC GEYSER	SPHEREHOT / RACOLD
24	HOT WATER INSULATION	ARMAFLEX / EQUIVALENT
25	SOLAR HOT WATER SYSTEM	ELECTRA / BOSCH / EQ
26	PVC / HDPE OVERHEAD TANK	SINTEX / EQUIVALENT
27	SEWAGE TREATMENT PLANT	FLOWDYNAMICS / SHUBHAM / ALDEE / EQ.

- NOTE :
- (1) Equivalent makes shall be approved by PMC/Consultant before procurement
 - (2) Make & Model No. of Sanitary & CP Fixtures will be got approved/finalized by the Architect/Client before procurement.
 - (3) For items, make not provided shall be taken prior approval by Client/consultant