Specification For Plumbing Work

MATERIALS AND WORKMANSHIP

INTRODUCTION:
This part of the Specification sets out the general standards of materials to be supplied 1and the workmanship required to be ensured by the Contractor and mention of any specific material or Plant does not necessarily imply that such is included in the Works. All component parts of the Works shall, unless otherwise specified, comply with the provisions of this part or be subject to the approval of the Engineer. The names of the manufacturers of materials and equipment proposed for incorporation in the Works together with performance, capacities, certified test reports and other significant information shall be furnished by the Contractor.

COMPLIANCE WITH STANDARDS :

Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to 'B.S.') issued by the British Standards Institution of 2, Park Street, London W.I., or to an Indian Standard Specification (I.S.) issued by the Buereau of India Standards, (earlier known as Indian Standard Institution), Manak Bhavan, 9 Bhadur Shah Zafar Marg, New Delhi 110 002, American Society for Testing and Materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American National Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or to any other equivalent standard it shall be to the latest revision of that standard at the tender opening date.

The Contractor may propose at no extra cost to the Employer, the use of any relevant authoritative internationally recognized Reference Standard, including Indian Standard.
All details, materials and equipment supplied and workmanship performed shall comply with these standards. If Contractors offer equipment to other standards, the equipment / material should be equal or superior to those specified and full details of the difference shall be supplied.
In the event of conflict between this specification and the codes for equipment, provisions of this specification shall govern.

MATERIALS – GENERAL
All materials used in the works shall conform to the specifications attached herewith and latest relevant I.S. Specifications.

As far as possible materials bearing I.S. certification marks or makes approved by Consultant / Architect/Engineer-in-charge shall be used with the approval of the Engineer-In-Charge.

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

Samples of all materials including all mechanical items shall be got approved before placing order and the approved samples shall be deposited with Construction Manager.

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

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

Cement: Cement, required, for the plumbing work shall be supplied to the Contractor through the Civil Contractors. However, the contractor will have to make his own arrangement to lift the cement from the godown to the site. Cost of cement issued will be recovered from contractor. Cement shall be stored in weather proof shed with raised wooden plank flooring to prevent deterioration by dampness or intrusion by foreign matter. Storing of cement and quality of cement shall be as specified in relevant clauses of I.S.Codes

Sand: Sand shall be clean, shells, free from silt, clay, loam, shells, vegetable matter and be as approved by the Construction Manager. Sand used shall conform to relevant codes of I.S.

Coarse Aggregate: Shall be angular, tough, sharp and well graded stone metal, Basalt from approved source. Coarse aggregate shall conform to relevant codes of I.S.

Cement Concrete Block/ Bricks: Bricks shall be local best quality obtainable and shall be as specified in relevant clauses of IS and shall be approved by Engineer-in-charge..

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

Reinforced Steel: Reinforced steel shall be ribbed torsteel. The steel shall be as per relevant IS specifications and as mentioned elsewhere in Civil Detailed specification.

M.S. Brackets/Hangers: All M.S. Brackets/Hangers for supports of C.I./G.I./P.V.C./H.D.P.E. pipes shall be fabricated out of Mild Steel sections such as channels, angles, tees, flats etc. as per drawings or as suitable as per I.S. Code. The welding shall show evenness of ripples or waves and well formed beeds with good fusion along the edges of welds. There should be no unfilled cavities, small pockets of slags or burned metal air or gas pockets.

M.S. Brackets/Hangers shall be thoroughly cleaned by wire brush to make the surface clear from any rust before application of paint. The Brackets/Hanger shall be fixed .to the ceiling either by hooking or by Anchor dash fasteners as directed by the Construction Manager. In case the Brackets cannot be fixed by above methods, due to site, condition, they shall be grouted with the permission and as directed by the Construction Manager.

Sturdy hangers, brackets and saddles of approved design shall be installed to support all pipe lengths, which are not embedded, over their entire run. The hangers and brackets shall be of adjustable heights and primer coated with Zinc Chromate primer. Clamps, collars and saddles to hold pipes shall be provided with nuts, bolts and suitable gaskets. The brackets and hangers shall be designed to carry t he weight of pipes safely and without excessive deflections.

All pipes and fittings shall be supported near every joint change of direction, or to a maximum of 3M run of pipe, unless otherwise specified. Where called for, pipe hangers shall also be supplied with proper sound and vibration dampening devices to minimize noticeable noise and vibration transmission.

Details of piping supports both for horizontal and vertical pipes are shown in the relevant drawings and shall be strictly followed by the Contractor

WORKMANSHIP – GENERAL

Workmanship and general finish shall be of first class quality and in accordance with best workshop practice.

All similar items of the Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items. Machining fits on renewable parts shall be accurate and to specified tolerances so that replacements made to may be readily installed.

All equipment shall operate without excessive vibration and with minimum noise. All revolving parts shall be truly balanced both statically and dynamically so that when running at normal speeds at any load up to the maximum there shall be no vibration due to lack of balance.

All parts which can be worn or damaged by dust shall be totally enclosed in dust proof housings.

All materials incorporated in the work shall be most suitable for duty concerned, free from imperfections, selected for long life and minimum maintenance.

All necessary accessories required for satisfactory and safe operation of the Plant shall be supplied by the Contractor unless it is specifically excluded from his scope.

All valves shall be closing on clockwise rotation of the hand wheel. The effort required to close / open under all operating conditions shall be limited to 7 kg. The direction of opening / closing shall be cast on the hand wheel.

All flanges shall be drilled in accordance with requirements of IS : 1538.

All flanges shall be full or spot faces on the back side. The flange thickness shall be uniform throughout.

Flange outside periphery shall be concentric with the bore. Flanges shall be finished smooth on periphery also.

Castings and fabricated materials shall be finished smooth all over.

GENERAL:

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.

The work shall be executed and measured as per metric dimensions given in the Bill of Quantities, drawings etc.

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.

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.

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.

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.

MEASUREMENTS:

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

QUALITY ASSURANCE AND QUALITY CONTROL:

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

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

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.

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.

The Client's Representative shall transport the samples to the laboratory

Testing charges shall be borne by the Client's Representative.

Testing may be witnessed by the Contractor or his Authorized Representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

4.0 SCOPE

Work under this section consists of furnishing all labor, 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.

5.0 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 upto 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

CPVC Pipes and Fittings - ASTM – D2846

G.I./M.S. Pipe - IS : 1239 & IS : 3589

Stone Ware Gully Trap - IS: 651 – 1980

Composite pipe - IS: 15450

Solvent Cement - ASTM - 493

S.W.R. Ring Fit Pipe & Fittings - IS: 4985 - 2000

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 pipes - IS: 783

SANITARY FIXTURES & C.P. FITTINGS:

SCOPE

Work under this section shall consist of transportation, furnishing, installation, testing and commissioning and all labor 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.

GENERAL REQUIREMENTS

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.

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.

Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per directions of Client's Representative.

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.

All fixtures of the similar materials shall be by the same manufacturers.

All fitting shall be of the chromium plated materials.

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.

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.

For the installation of the CP fittings, Teflon tape shall be used.

EUROPEAN W.C.

European W.C. of glazed vitreous china shall be wash down, single or double symphonic type, wall mounted set, flushed by means of flush tank (low flow 3 / 6 LPF) 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.

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.

The flush pipe/bend shall be connected to the WC by means of a suitable rubber adopter.

Flushing cistern to be used shall conform to the requirements of IS: 774-1971. 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.

The levels of the WC should be checked by placing sprit 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.

KITCHEN / PANTRY SINKS

Sinks shall be of stainless steel material as specified in the Bill of Quantities/Drawings.

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 40 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.

Supply fittings for sinks shall be mixing fittings or C.P. taps, angle cocks etc. all as specified in the Bill of Quantities/Drawings.

URINALS

1.0 Materials

The lipped type urinal shall be flat back or corner type as specified in the item and shall conform to I.S. 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge.

2.0 Workmanship:

The urinals shall be fixed in position by using wooden plugs and screws and shall be at a height 60 cms. from the floor level to the top of the lip or urinal, unless otherwise directed. The wooden plugs shall be 50 mm. x 50 mm. at base lapping to 38 mm. x 38 mm. at top and 50 mm. in length shall be fixed in wall in cement mortar 1 : 3 (1 cement : 3 coarse sand). The urinal shall be connected to 50MM mm. dia. PVC waste pipe which shall discharge in the channel or floor / Nahni trap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

3.0 Mode of measurements & payment:
The rate includes cost of all labour, materials, tools and plants etc. required for satisfactory completion of this item.
The rate shall be for a unit of one number.

WASH BASINS
Wash basin shall be of vitreous china of best quality manufactured by an approved firm and sizes as specified in the Bill of Quantities.

Wash basin shall be of under counter drop in 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.

Wash basin shall be provided with single lever mixer with chain 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.

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

BATH TUB
Material for bath tub shall be polymarble / acrylic of size 1670 x 76 x 375 with all other accessories to be provided

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

HOSE BIB'S
Hose Bib of Chromium Plate tap is draw off tap with horizontal inlet and free outlet knurling on outer face to fix the hose pipe. Hose bib shall be of specified size and shall be of screw down type and shall conform to IS: 781-1984. The closing device shall work by means of a disc carrying a renewable non-metallic washer which shuts against the water pressure on a seating at right angle to the axis of the threaded spindle which operate it. The handle shall be either crutch or butterfly type securely

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

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.

INTERNAL / EXTERNAL WATER SUPPLY WORKS
Work under this section consists of furnishing all labor, materials and appliances necessary and required to install and commission the water supply systems.
The work shall include but not limited to the following:
a) Water distribution system to all parts of the building including supporting.
b) Valve chambers and other ancillary items.
c) Connections to all plumbing fixtures, tank, pumps, etc.
d) Chasing of walls for pipes, making holes in walls/floors, making good the opening. e)

PIPING MATERIALS
7.1.1 The Upvc pipe of specified diameter with 6 Kg/Sq.cm. working pressure shall conform to I.S. 4985:2000.

Fittings:
Fittings shall be of the same make as that of pipes, injection moulded and shall confirm to Indian Standard. The specials and fitting shall be confirms to IS: 14735-99 & fittings dimension as per DIN 19534 shall be of best quality. the pipe shall be provided with bends, junctions, inspection doors, offests, cowl, access pieces/plugs etc. jointing with Solvent cement (lubricant) with O-Ring joints including cutting holes in walls and making good the same. The 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.

Lubricant:
Lubricant is available in 100 gms, 250 gms & 500 gms packing. It is Specially formulated for compatibility with rubber seal as well as PVC. It does not support the growth of bacteria or fungi. Solvent joints shall be used as per manufacturers recommendations.

Workmanship:
The P.V.C. Pipes of specified diameter shall be fixed as directed. At joints the trench width shall be widened wherever necessary. The work of excavation & refilling shall be in the scope of the Contractor and shall be done true to line & gradient.

The pipes shall be laid on a layer of 10 cm sand & filled upto 10 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.

The pipes shall be laid and jointed on a layer of 7.5 cms sand and filled up to 15 cms above the pipes when laid in soil containing sulphates & chlorides. In case of sandy soil not containing sulphates and chlorides provision of layer of sand is not required. The remaining portion of the trench shall then be back filled with excavated earth. The surplus earth shall be disposed off as directed.

In case of bigger diameter (65mm & above) pipes where the pressure is very high, thrust blocks of cement concrete 1:2:4 shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground & spreading it over a sufficient area.

Jointing the pipes:
The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions / recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:-

The pipes and sockets shall be accurately cut. Clean the outside of the pipes spigot end and the inside of the ceiling groove of the fitting. Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Since solvent cement is aggressive to P.V.C., care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm to make the pipe fully fitted to the fitting.

The horizontal pipes on the wall shall be fixed with M.S. fabricated clamps with necessary provisions to take care the expansion and contraction in PVC pipes. The spacing of the clamps shall be at the intervals of 1.5 mtr to 2 mtr. Depends on the requirement of the supporting arrangements.
If manufacture recommends its own methods of jointing, the same shall be adopted after necessary approval from the Engineer-in-charge.

Repairs:
While temporary or emergency repairs may be made to the damaged pipes, permanent repairs should be made by replacement of the damaged section. If any split or chip out occurs in the wall of the pipe, a short piece of pipe of sufficient length to cover the damaged portion of the pipe is cut. The sleeve is cut longitudinally and heated sufficiently to soften it so that it may be slipped over the damaged hard pipe.

Testing
PVC pipes and fittings shall be tested for 1.5 times the maximum working pressure. The openings of the pipes shall be sealed for the section to be tested. The water pressure shall be maintained for maximum of one hour. The engineer shall examine carefully all the joints for leakage.

3.0 Mode of measurement :
Payment includes supply, lowering, laying, jointing and testing shall be made on running meter basis. The length of pipes laid include all fittings and the rate shall include all supplies and works mentioned in above including excavation backfilling, concrete, removal surplus earth etc. complete.

INSULATION

All the Hot Water supply & Hot Water return pipe shall be insulated in the manner specified hereinafter.

Insulating material shall be rigid performed sections of mineral/rock wool with a "K" value of not more than 0.036 W/MK at 100 Deg. C mean temperature and of density 140 Kg/Cu.m

No insulation shall be applied until the pipe is satisfactorily pressure tested.
Pipes shall be insulated with rigid performed pipe sections of the following thickness:

Pipe Diameter (mm)	Thickness (Mineral Wool) mm
80-150	50

Pipe insulation shall be applied as follows OR AS SPECIFIED IN BOQ:
a) Pipe shall be thoroughly cleaned with wire brush and rendered free from all rust and grease and applied with two coats of anti-rust paint.

b) Pipes in Shaft:

i) Fix rigid performed sections of insulation with adhesive between all points (transverse and circumferential).
ii) The insulation shall be tied with GI chicken wire mesh.
iii) The insulation shall be provided with 24 gauge aluminum cladding screwed at the joints with cadmium coated self tapping screws. Joints shall be overlapped minimum 12mm wide.

c) Pipes exposed to weather:
i) Same as (b) (i) to (ii)

ii) Provide polythene based hessian (500 gauges) overlapping 100mm on all joints (transverse and circumferential) and stitched at the joints.

iii) The hessian shall be covered with 15mm x 20mm hexagonal chicken wire mesh.

iv) Over the wire mesh the surface shall be covered with two layers of tarfelt grade-II and type-II with bitumen between layer overlapping 100mm on all joints (transverse & circumferential).

v) Over the second layer of tarfelt final coat of hot bitumen not less than 6mm thick shall be applied.

vi) Over the final layer of tarfelt and hot bitumen coat aluminum cladding shall be provided with 24 gauge aluminum shut screwed at the joints with cadmium coated self-tapings screws. Joints shall be overlapped minimum 25mm wide.

Connection of Distribution Branch with Main:
Materials: Pipes & fittings shall be as specified under general requirements.
Preliminary work:
A pit of suitable dimensions shall be dug at the point where the connection is to be made with the main & earth removed upto 15cm below the main. The flow of water in the water main shall also be disconnected by closing the sluice valves on the mains.

Making Connections:
For cutting & jointing specifications stated earlier shall be applied. The main shall be cut, water if any collected in the pit bailed out and ends of the pipe threaded. The connection of distribution pipe shall then be made by fixing allowable CPVC fittings of the required size OR connecting pieces etc.

Testing of Joints:
Joints shall be tested under working condition as specified above.
The portion of the pipe in the pit shall be protected against corrosion as specified earlier. Pit shall be filled with earth in level with original ground surface, watered, rammed & the area dressed.

Measurements
The work of making connections shall be counted in numbers

Rate
The rate shall include the cost of labor & materials involved in all the operation described above

Fittings
General - Brass or gunmetal fittings shall be heavy quality, of approved manufacturer & pattern with screwed or flanged ends as specified. The fittings shall in all respects comply with the Indian Standard Specifications No:IS:778 & IS:781. The standard size of brass or gunmetal fittings shall be designated by the nominal bore of the pipe outlet to which the fittings are to be attached.

All cast fittings shall be round & free from blow holes. Both internal & external surfaces shall be clean, smooth & free from sand etc. Burning, plugging, stopping or patching of the casting shall not be permissible. The bonnet, spindles & other parts shall be truly machined so that when assembled the parts shall be axial, parallel & cylindrical with surface smoothly finished.

The fittings shall be thoroughly examined & cleaned of all foreign matter before being fixed. The fittings shall be fixed in the line in a workmanlike manner. The joints between fittings & pipes shall be made leak proof. The joints & fittings shall be leak proof when tested to a pressure of 7 Kg/Sq.Cm as described under the title ‘testing of joints. & the defective fittings & joints shall be replaced or redone.

Brass Bib Cock & Stop Cock:

a) Bib cocks (bib tap) and stop cocks (stop tap) shall be of specified size & shall be of screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the threaded spindle that operates it. The handle shall be either crutch or butterfly type securely fixed to the spindle.

1. Valve shall be of the loose leather seated pattern. The cocks (taps) shall open in anti-clockwise directions.

b) The bib cock & stop cock shall be polished bright. The minimum finished weights of the bib tap (cock) & stop tap (cock) given in the IS specifications are reproduced below:

SIZE (mm)	MINIMUM FINISHED BIB TAP (Kg)	WEIGHT STOP TAP (Kg)
8	0.25	0.25
10	0.30	0.35
15	0.40	0.40
20	0.75	0.75

When the bib cocks or stop cocks are required to be chromium plated, the chromium plating shall be conforming to IS: 1068. The chromium shall never be deposition brass unless coating of nickel is interposed. In case these are required to be nickel plated, the plating shall be of first quality with a good thick deposit of silvery whiteness capable of taking high polish that will not easily tarnish for scale. In finish & appearance, the plated articles, when inspected shall be free from plating defects such as blisters, pits, roughness. Unplated areas shall not be stained or discoloured. Before a plate is plated the washer plate shall be removed from the fittings. The gland packing shall be protected from the plating solution.

Gun Metal Bib Cock & Stop Cock:
These shall be of gunmetal screw down pattern of the size as specified. So far as the general requirements of material are concerned, these shall be similar to those as described above. The weight of these shall be the same as for brass bib cocks.

Brass Full Way Valve:
Full way valve shall be of brass fitted with a cast iron wheel & shall be of gate type, opening full way of the size as specified.

The valve shall be of best quality as approved by the Engineer-in-charge & shall have the following approximate weight with a tolerance of 5%..

Mm	Flanged ends Kg.	Screwed ends Kg.
15	1.021	0.567
20	1.503	0.680
25	2.465	1.077
32	3.232	1.559
40	4.082	2.268
50	6.691	3.232
65	10.149	6.804
75	13.381	8.845

Gun Metal Full Way Valve:
These shall be of gun metal fitted with wheel & shall be of gate type opening full way & of the size upto 50 mm. These shall generally conform to IS.778 & their approximate weights shall be as specified earlier.

Check Valves (Non return valves)
Check valves of 40mm and smaller size shall be gunmetal conventional swing/lift check valve type used in all water services. Check valves larger than 40 mm shall be Bronze wafer/Dual plate check valve type used in all water services. The valves shall be supplied inclusive of M.S. Pipe flanges and high tensile steel bolts of dimension recommended by suppliers of valves.

Ball Valves
These shall be of brass fitted with handle upto 50 mm dia. These shall generally conform to latest revision of ASTM A105 & their approximate weights shall be as specified in the code

CONTROL VALVES:
The design and manufacture of the valves shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall relieve the vendor of this responsibility. Valves shall be confirming to IS 778 PN 1.0 (Class 1).All valves shall be tested while installed in pipe by hydrostatic pressure of 1.5 time of the working pressure 7.5 Kg/Sq.cm which ever is more.

8.0 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 1.5 times the working pressure or 7.5 Kg/Sq.cm which ever 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.

9.0 MEASUREMENTS
The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include CPVC 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.

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

10.0 SOLAR SYSTEM
The scope shall cover design, supply, installation, testing, painting & commissioning of Solar Water Heating system (direct heating) with all required equipments, mechanical, electrical & civil work, foundation, piping, instrumentation, etc. to complete the job. The system will be installed at terrace.

The system capacity is 4000 LPD. The battery limit under this tender shall cover all the work upto terrace hot water ring main connection.

1.0 TECHNICAL DATASHEET:

SR. NO	DESCRIPTION	DETAILS TO BE PROVIDED BY VENDOR
1.0	Collector Type	
2.0	Absorber	
3.0	Absorber Area	
4.0	Absorber Material	
5.0	Absorber Coating	
6.0	Total Absorptance	
7.0	Heat Collected	
8.0	Absorber Cover	
9.0	Heating	
10.0	Effective Outlet Temperature	
11.0	Stagnation Temperature	
12.0	Min. Ambient Temperature	
13.0	Inner Tank	
14.0	Max. Pressure	
15.0	Scaling Protection	
16.0	Tank Insulation	
17.0	Outer Tank	
18.0	Electric Backup	
19.0	International Certificates	
20.0	Indian Certifications	
21.0	Life Span	

10.0 RO PLANT

Material:
The proposed Water Treatment Plant based on **Reverse Osmosis (R.O.) Technology** is designed to produce product Water at the flow rate of 25 L.P.H.

END WATER QUALITY :

Total Dissolved Solid : Less Than equal to 100 ppm
PH : 6.5 – 7.0

PLANT OPERATING CONDITION:

Sr. No.	Parameter	
1.	Feed Flow Rate	40 lph
2.	Product Flow Rate	25 lph
3.	Operating Pressure	15-16 kg/cm2
4.	Recovery	70%

TREATMENT SCHEME :

Sr. No.	***Description***
1.	*Raw water storage Tank*
2.	Raw Water Pump
3.	Dual Media Filter
4.	Sp. Anti Scalent Dosing System
5.	Micron Cartridge Filter (5 micron)
6.	High Pressure Pump
7.	R.O. Module
8.	UV Unit
10.	RO Product Water Storage Tank

SCOPE OF SUPPLY FOR RO SYSTEM

Sr. No.	Item / Component	Qty.
1.	Raw water Storage tank	Client scope
2.	**Raw water pump**	Two No.
3.	Dual Media Filter consists of --- - FRP Pressure vessel with manual multi-port valve. - Initial charge of media. - Frontal PVC pipe work with necessary fittings.	One No.
4.	Special Anti-Scalent Dosing System includes- - Dosing pump & Dosing Tank	One No.
5.	Micron Cartridge Filter (5 Micron) incorporating - Micron Cartridge Filter - Micron Cartridge Housing	One No.
6.	High Pressure Pump with Motor (1no. working + 1no.stand by)	SET.
7.	R.O. Module incorporating - R.O. Membrane: M/s Hydranautics - R.O. Pressure Pipes [M.O.C. : FRP] - R.O. Skid with Control panel along with instruments. - High pressure interconnecting piping. - Interconnecting Piping.	One Lot.
8.	U V Unit	One No.
9.	Product water storage tank	One No
	INSTRUMENTATION	
1.	Conductivity Indicator	One No.
2.	Flow Indicator	Two Nos.
3.	Low pressure Switch / High Pressure Switch	One No. each
4.	Pressure Gauges.	One Lot.
5.	PLC Based Control Panel	One No.
6.	Dry Run Protector for Raw water tank	One No.

DRAWINGS:

The following drawings shall be submitted by vendors along with their offer:

Flow Diagram & general arrangement drawing

Technical Catalogues

Cross-sectional drawings with Bill of Material and Material of Construction

11.0 END SUCTION TYPE MONOSET TYPE PUMP

Material:
The design and manufacture of the pump shall be complied with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The pump shall be horizontal end suction, centrifugal monoblock type. The pump base frame shall be fabricated and should be very rigid. The base frame shall accommodate both the pump and the motor. The pump shall be suitable for automatic operation. The pump shall be provided with a name plate indicating delivery head, capacity and RPM. The motor shall be TEF type.
The material of construction of pump shall be as under:

i. Casing : Cast Iron, IS:210, Gr 20
ii. Impeller : Cast Iron
iii. Base frame : Fabricated M.S

STARTER PANEL:
It shall be fully automatic star – delta starter with micro controller based technology include user friendly programming, modular concept, Electronic over load protection, In built over voltage, under voltage & dry run protection, automatic on-off facility (optional), Water level controller, all protection limits shall be programmable as per requirememnts, single contrl & display unit technology.

INSPECTION AND TESTING:
The pump shall be offered for visual inspection before dispatch. Material test certificates for the various pump components shall be furnished for purchaser's approval. Hydrostatic test shall be carried out at 1.5 times the maximum discharge pressure. All the tests shall be witnessed by purchaser.

TECHNICAL DATASHEET FOR MONOBLOCK TYPE PUMPS

SR. NO.	PARTICULAR	SPECIFICATIONS
1.0	Type	End suction, monoblock type
2.0	Number of Units	As per Bill of Quantities
3.0	Design capacity of each pump	As per BOQ
4.0	Speed	2900 RPM
5.0	Location	As per drawing
8.0	**FEATURE OF CONSTRUCTION**	
8.1	Impeller	Enclosed
8.2	Shaft	Coupled
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	As per BOQ
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	Filtered Water
9.2	Specific gravity	1.0
9.3	Temperature	Ambient temp.
10.0	**MATERIAL OF CONSTRUCTION**	

SR. NO.	PARTICULAR	SPECIFICATIONS
10.1	Base plate	M.S. IS 226
10.2	Pump Casing	Cast Iron
10.3	Impeller	Cast Iron
10.4	Shaft	S.S AISI 410 (M)
10.5	Wearing Ring	S.S AISI 410 (M)
10.6	Painting	Epoxy
10.7	Hardware in contact with water	Hot dipped galvanized
10.8	Companion flanges	M.S., BS 10, Table F
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	As per BOQ
12.2	Class of Insulation	Class B
12.3	Degree of Protection	IP 55
13.0	Delivery piping	As per BOQ
14.0	Delivery valves & header valves	As per BOQ
15.0	Starter Panel	Required with pump interlocking with respect to tank levels. Also required Finolex / Polycab make cables upto starter panel.
16.0	Level Indicator	In built in starter panel
17.0	Pressure Guage	Required at delivery of each pump. 0 –7 kg/sq.cm for domestic 0 –10 kg/sq.cm for domestic

PART B: DRAINAGE WORK

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

GENERAL REQUIREMENTS

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

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

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.

Pipes shall be securely fixed to walls by suitable clamps at intervals specified.

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

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

2.0 PIPES & FITTINGS
1.0 Material

The pipes and fittings shall be of best quality as approved by the Engineer-in-charge. The pipe shall be of best quality manufactured from stone-ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close even texture, shall be smooth and perfectly glazed. The pipe shall be capable to withstand pressure of 1.5 mm. lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The pipes and fittings shall give a sharp clear note cringing sound when struck with a light hammer. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 1 mm. around the pipe.

The pipes shall generally conform to "Grade AA" of I.S. 651-1980.

Glazing:

The interior and the exterior surfaces of the pipes and fittings which remain exposed after jointing shall be as specified.

Internal Diameter of Pipes:

The internal diameter of pipes shall be as specified.

Permissible Variation: The internal diameter of the barrel of a pipe shall not deviate from the internal diameter specified by more than the following:

Internal Dia. of Pipes (mm)	Permissible deviation from dia. (mm)
100	3
150	5
200 to 230	6
250 to 350	8
400 to 450	10
500 to 600	12

Thickness of Barrels, Sockets and Bends:

The mean thickness of the barrel and the socket of the pipes shall be not less than the mean thickness as per I.S.S. such mean thickness of the barrel or sockets of any individual pipe shall be ascertained by making several measurements and adding the measured least thickness (not in the groove) to the greatest thickness and dividing the sum by two.

The mean thickness of the barrel and socket shall be determined separately.

Permissible Variation - The difference between the measured least thickness and the greatest mentioned shall not exceed the amount given below:

Internal Dia. of Pipe : Permissible Variation in Sockets. (mm) Thickness of Barrel and mm

Not exceeding 450 2

500 to 600 3

Length and straightness of barrels & taper pipes:

The length of the barrel of straight and taper pipes: Junctions and half - section channels, exclusives and the internal depth of the socket, shall be 60, 75, or 90 cm.

Permissible Tolerance on Length:

The permissible tolerance on length shall not be more than 10mm for pipes of 60mm and 75mm of length and 15mm for pipe of 90cm length.

Permissible Deviation from Straightness:

The maximum permitted deviation from straightness of the barrel of a pipe measure on the inside of the curve and tested by means of a straight edge, for all diameters of pipe shall be 5mm for pipes 60cm in length, 6mm for pipes of 75cm length and 7mm for pipes of 90 cm length.

Dimensions of Barrels and Sockets: The dimension shall be as per IS 651.

Grooving:

The interior of the sockets and the exterior of the spigots shall be grooved circumferentially, and sub-grooving on the spigot shall be for a length equal to one and a half times the depth of sockets, and the depth of such grooves shall be between 1mm and 2mm.

Workmanship:

Handling of S.W. pipes and fittings:

While unloading the S.W. pipes from a truck the pipes shall not be thrown down on hard ground. Pipes shall be unloaded manually and placed gently on the ground. Pipes shall not be dragged on the ground or road surface to avoid damage.

Under no circumstances the stoneware pipes shall be dropped or dumped into the trench. The pipes have to be transferred from a person standing by the side of the excavated trench to a person standing in the trench and gently placed in the trench bed. In deep trenches pipes shall be lowered into the trench using ropes.

Laying of S.W. pipes:

Provision of Minimum Cover: The minimum support or protection for glazed stoneware pipe shall be as follows:

Where the pipe is laid under roadway - a minimum cover of 90 cm is necessary. Where the cover is less than 90 cm under roadway - encasing of pipe with concrete is necessary.

Where pipes are unavoidably exposed above ground surface - the pipes shall be completely encased or surrounded with concrete.

Provision of Bed Concrete for soft soil filled up Earth and in places of High ground water table:

Where the pipes are laid in a soft or filled up earth with the maximum water table level laying at the invert level of the pipe, the pipe sewer shall be bedded on concrete.

Where the pipes have to be laid in a soft soil with the maximum water table level rising above the invert, level of the pipe but below the top of the barrel, the pipe sewers shall be hunched.

Where the maximum water table level is likely to rise above the top of the barrel, the pipe sewers shall be completely encased or surrounded with concrete.

Where the sewers are to be laid adjacent to growing trees, the pipe sewers shall be encased or surrounded with concrete, to avoid damage to the pipes likely to be caused by the roots of the trees.

Detection of Cracks in Pipes and Fittings:

The pipe and fittings shall be inspected for defects, and be rung with a light hammer preferably while suspended to defect cracks just before laying.

Cleaning of Pipes and Fittings:

All lumps, blisters and excess coating materials shall be removed gently from the socket and spigot and of each pipe and the outside of the spigot and the inside of the socket shall be wiped clean and dry before the pipe is laid.

Every precaution shall be taken to prevent foreign materials from entering the pipes when it is being placed in the line. Normally the socket ends should face the upstream. When the line runs uphill the socket ends should face the up-grade.

Laying S.W. Pipes:

Pipes shall be laid carefully to the alignment correct levels and gradients as directed and care shall be taken to prevent any sand, earth or other matter from entering the pipes during laying. The pipes between manholes shall be laid, truly in straight lines without vertical or horizontal undulations.

All invert levels shall be fixed from sight rails fixed at the required true levels, with proper boning rods. The pipes shall be laid sockets facing the up gradient, beginning at the lower end, and with the socket resting in the socket holes cut in the concrete bed in specified. Each pipe shall be laid single and no pipe shall be laid until the trench, has been excavated to the required depth for a distance of twenty yards in front of the pipe to be laid.

After placing a length of pipe in the trench or on concrete bedding where it is specified, the spigot end shall be centered in the socket and the pipe forced home and aligned to gradient. After ensuring the grade of pipes laid the joints are caulked with hemp yarn for a reach of pipeline. Boning rod shall be

kept on the socket of each S.W. pipe and correct grading of the pipe line ensured. For this purpose a separate strip of timber piece shall be secured in place with approved backfill material or concrete tamped under it except at the socket. Pipe and fittings, which do not allow sufficient and uniform space in the socket for joints, shall be removed and replaced with pipe and fittings of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.

Closing open Ends of Pipes:

At times when pipe laying is not in progress, the open ends of pipe shall be closed by a water tight plug or canvas or their means approved by the Engineer.

Cutting of Pipes:

The cutting of pipe for inserting, fittings or closure pieces shall be done in a neat and workman like manner without damage to the pipe or cement lining so as to leave a smooth and at right angles to the axis of the pipe.

Connection to existing sewer:

The connection to an existing sewer shall be through manholes.

Connections to Manholes:

Before connecting a pipe to a manhole, a relieving arch or any other similar protection divide should be made in the manhole for the safety of the pipe.

S.W. pipes when laid should not be subjected to super imposed load beyond their safe crushing strength (1600 Kg/M). Protection may be provided by the following methods.

a) Bedding, haunching, or encasing the pipe.

b) Providing of horizontal wooden struts at suitable intervals near the mid-depth of the trench to distribute a portion of the load to the two side walls of the trench.

c) Socket hollows shall be provided to ensure resting of barrel of pipes on trench bottom. Laying and jointing of pipes without providing socket hollows and instead raising each socket by brick supports is an incorrect practice and should not be allowed as this may give rise to unfilled gap below the pipe barrel after back cracks due to bending action caused by the weight of refilled earth acting on the pipe.

Jointing of S.W. Pipes:

The stoneware pipe shall be cement jointed using spun yarn or tarred gaskets, cement (conforming to IS: 269 or IS: 455) and sand (conforming to IS: 1542) The sand to be used on the work shall conform to IS 1542. It shall be of natural sand crushed stone sand or crushed gravel sand and shall be hard, durable, clean and free from organic matter, alkalis, salts, coal, mica, shell fine and fine dust. Fine sewer sand shall be used for jointing of sewers.

- Caulking of Yarn or Gasket:

In each joint, spun yarn soaked in neat cement slurry or tarred gasket shall be passed round the joint and inserted in it by means of a caulking tool. More skeins of yarn or gasket shall be added if necessary and shall be well caulked. Yarn or gasket so rammed shall not occupy more than one fourth of the depth of socket. The required depth of caulking of spun yarn can be controlled by measuring the depth with a wooden gauge having marking groove to show the depth to be maintained for cement mortar packing. Wooden gauge shall be prepared with suitable marking for each diameter of S.W. Pipe.

- <u>Caulking of Cement Mortar:</u>

Cement mortar (1:1) (One part of cement to one part of sand) shall be slightly moistened and carefully inserted by hand into the remaining space of the joint after caulking of yarn or gasket. The mortar shall then be caulked into the joint with a caulking tool. More cement mortar shall be added until the space of joint has been completely filled with tightly caulked mortar. The joint shall then be finished off nearly outside the socket at an angle of 45 degrees.

Wooden caulking tool shall be used for forcing the mortar home into the sockets. The inside of each pipe shall immediately after making the joint be carefully wiped clean with a mop or scrapper

sufficiently long to pass two joints from the end of the pipes. All pipes entering manholes shall be set in cement concrete to effect complete water tightness.

Curing of Joints:

All joints shall be kept moist by means of wet rag or earth to protect them from quick drying which may induce cracks in the mortar due to the action of heat or wind. The cement mortar joints shall be cured at least for a period of seven days.

Approximate Quantity of Jointing Materials required per joint:

Nominal dia. of pipe in mm	Internal depth of Socket	Cement Kg.	Spun Yarn Kg.
100	50	1.0	0.25
150	57	1.5	0.35
200	63	2.0	0.70
250	70	2.5	0.80
300	70	3.25	1.10
350	75	4.5	1.25
400	75	5.5	1.50

Hydraulic Testing:

Testing for accepting of pipes and fittings

For accepting stoneware pipes to be used on the works sample stoneware pipes supplied by the contractor shall be got tested for.

1) Hydraulic test,
2) Absorption test and
3) Crushing strength test.

Brief test procedure is furnished. Detailed test procedure for carrying out the tests may be referred in latest IS - 651. No. of samples to be tested shall be 5 pipes per 1000 pipes or 3 pipes per 500 pipes drawn at random. These quality tests shall be carried out for all works involving used of 500 Nos. or more stoneware pipes. The tests may be done in any laboratories of Engineering colleges, PWD, Highways etc., and results produced to Engineer.

Besides the following parameters have to be checked at site at random on 2 pipes every 100 pipes supplied at site for all works, the parameters to be checked are:

I. Internal diameter of pipes.
ii. thickness of barrels and sockets.
iii. Length and straightness of barrels.
iv. Grooving at the spigot ends and within the socket.

A) Hydraulic Test:

When subjected to the hydraulic test, straight pipes shall withstand an internal hydraulic test pressure of 1.5 kgf/ sq.cm. on the barrels and fittings shall withstand a test pressure of 0.75 kgf/sq.cm without showing signs of injury or leakage. The pressure shall be applied on pipes and fittings at a rate not exceeding 0.75 kgf/sq.cm in 5 seconds, and full pressure shall be maintained for at least 5 seconds. Care shall be taken to ensure that all air is expelled before the test is commenced.

B) Absorption Test:

The specimen for testing shall be taken from the body of a pipe or fittings and in the case of straight pipe not closer than 15cm to the ends. Each test piece shall be of the whole thickness of the wall of the pipe or fitting and shall have two glazed surfaces each having an area of not less than 50 sq.cm. and not more than 130 sq.cm. The test pieces shall be cleaned by wire brush to dislodge and loose particles, which may incur weight loss during boiling. The test piece shall be dried at a temperature of not less than 150^{o} C until no further loss of weight is noted and cooled in a desiccators to room

temperature and the specimen weighed to an accuracy of 0.1 g. The test piece may be suitable suspended in cold distilled water by means of thread so that the test piece may not strike against each other or the container and incur loss in weight and the water in the container shall then be brought to boiling point. The water shall be maintained at that temperature for one hour and after it has been allowed to cool to room temperature, the test pieces shall be removed carefully wiped with a dry cloth and then reweighed. The percentage increase in weight of each test, piece by absorption of water shall not exceed the following values. 5 pieces per 1000 pieces or 3 pipes per 500 pieces may be chosen at random and got tested before accepting the pipe for use in work.

Thickness of pipe of fitting (mm)	Increase in weight percent
Up to 20	6
Over 20 and up to 25	7
Over 25 and up to 32	8
Over 32 and up to 38	9
Over 38	10

C) **Test to find Resistance to action of Acids:**

This can be done in case of doubtful quality of pipe as prescribed in IS. 651.

D) **Test for Crushing Strength:**

When tested along the full length of the pipe barrel from shoulder to spigot in accordance with Appendix - A of IS: 651-1980, the pipe tested shall have a minimum crushing strength of 1600 kgf/m in length. This is a simple test, which can be got done in the site. Five samples for every 1000 or 3 per 500 pipes supplied can be done before accepting the pipe for use in works.

E) **Marketing:**

Every pipe and fittings shall have legibly impressed upon it before firing, the name or trade-mark of the manufacturer. In addition the grade of the pipe, namely, Grade AA shall be stenciled or stamped on the pipe. Each pipe and fitting may also be marked with the ISI certification mark.

F) **System Testing Method:**

The sewer testing plug is inserted at the upstream and downstream end and also in the various house service tappings and plugged. The testing plug comprises of two flanges, one rubber ring, wing nut etc.

The plug is inserted at the upstream end the lock is obtained by expanding the ring against the pipe wall by tightening the wing nut. To build up necessary compressive force to cause expansion of the rubber ring a roller washer is used.

Water for filling in is let through the funnel connected to the plug provided at the upstream end. To allow the air to escape a small hole is made on the pipe wall at the upstream end and after filling the pipe completely the hole is plugged with a wooden plug would with hemp.

The downstream end of the sewer and all slants in the sewer line (provided for house service) are plugged with the sewer testing plug and capped.

The funnel is kept at a height of 2.5m from the invert of the sewer duly filled with water.

The pipe line is considered sound if the water in the funnel does not empty within thirty minutes.

After applying test pressure the pipes and joints shall be thoroughly inspected for leakage of water, which will be indicated by fall in water level of the funnel.

Subsidence of the test water in funnel may be due to one or more of the following causes.

a. Absorption of pipes and joints.
b. Sweating of pipes or joints.
c. Leakage at joints or from defective pipes and
d. Trapped air.

Allowance shall be made for (a) by adding water until absorption has ceased and after which the proper test should commence.

If any leakage will be visible the defective part of the work should be cut out and made good. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe or joints shall be made good.

G) **Rectification of Faulty Joints:**

Any joints found leaking or sweating shall be rectified or embedded into 15cm layer of cement concrete 30cm in length and the section retested.

Finally test pressure may be applied for a minimum period of 30 minutes. The pipe line is considered sound if the water level in the funnel does not empty within 30 minutes.

Measurement:

A) The measurements shall be net without any allowance for cutting and waste. The length of bends, junctions and other connections shall be included in the total length of the drain pipes. Nothing extra shall be paid for the same.

B) The rate includes necessary excavation refilling trenches etc. complete.

C) The rate shall be for a unit of one running meter.

TRAPS

NAHANI TRAP OR FLOOR TRAPS

Nahani traps or floor traps shall be cast iron, 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 centering 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.

FLOOR TRAP INLET

Bath room traps and connections shall ensure free and silent flow of discharging water. Where specified, the Contractor shall provide a special type galvanised iron inlet fitting without or with one, two or three inlet sockets to receive the waste pipe. Joint between waste and fitting shall be connected to a C.I. '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.

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.

CLEANOUT PLUGS

Contractor shall provide cast brass 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 G.I. socket and lead caulked joint.

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.

SEWER APPURTENANCES:

INSPECTION CHAMBERS AND MANHOLES:

i. Size of Chambers / Manholes:

The size given in Bill of Quantities and drawings shall be internal finished size of chamber. The work shall be done strictly as per standard drawing and following specifications.

ii. Bed Concrete:

Shall be in 1:4:8 cement concrete 200 mm thick

iii. Brick Work:

Brick work shall be with best quality bricks in 1:6 cement mortars.

iv. Plaster:

Inside of the walls of chamber/manhole shall be plastered with 12/15 mm thick cement plaster 1:3 (1

cement: 3 coarse sand) and finished smooth with a floating coat of neat cement. Manholes shall be plastered from out side as above but with rough plaster.

Water proofing compound as approved by the Client's Representative shall be added in the cement sand mortar ratio as specified by manufacturer.

v. Benching:

Channel and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement. The following depth of channel and benching shall be adopted:

Size of Drain	Top of channel at the center above Bed conc.	Depth of benching at side walls above 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

vi. Manhole Covers and Frames:

The covers and frames shall conform to IS: 1726-1960 and shall be of the following grades and types:

a) Medium Duty:

These shall be denoted by the letter 'MD' circular or rectangular solid type for use under light traffic conditions such as foot paths, carriage drives and cycle tracks

The covers and frames shall be leanly cast and they shall be free from air and sand holes and from cold shuts. They shall be nearly dressed and carefully trimmed. All castings shall be free from voids whether due to shrinkage gas inclusion or other causes. Covers shall have a raised chequered design on the top surface to provide an adequate non-slip grip.

The covers shall be capable of easy opening and closing and it shall be fitted in the frame in workmanship like manner. The cover shall be gas tight and water tight.

The size of covers specified shall be taken as the clear internal dimensions of the frame.

The approximate weights of the various types of manhole covers and frames shall be as in table given below:

Description of C.I. Manhole Cover	Weight of Cover Kg.	Weight of Frame Kg.	Total Weight of Cover and Frame Kg.
MD 500 mm dia	58	58	116

2 ½% variations in weight shall be permissible on either side.

Covers and frames shall be coated with a black bituminous composition. The coating shall be smooth tepacious. It shall not flow when exposed to a temperature of 63 Deg. and shall not be brittle as to chip off temp. of 0 Deg. C.

The frame of manhole cover shall be firmly embedded to correct alignment and levels in RCC 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.

vii. Foot Rests:

All manholes deeper more than 0.6 m shall be provided with CI foot rests. These shall be embedded 20cm, deep with 20 x 20 x 10cm blocks of cement concrete 1:2:4 (1 cement :2 coarse sand :4 graded stone aggregate 20cm, nominal size). The block with plastic foot rest placed it's center shall be cast in situ along the masonry and surface finished with 12mm thick cement plaster 1:3 (1 cement :3 coarse sand) finished smooth.

All cast iron and Mild Steel items shall be provided with two coats of bitumastic paint

viii. Measurement

Manhole shall be measured in numbers as indicated in the Bill of Quantity. The depth of manhole shall be measured from invert of channel to the top of manhole cover. Quoted rate shall cover the range of ± 0.24 meter on the depth specified in schedule and also the cost of items specified in the Bill of Quantities and Specifications viz.

Manhole with depth greater than specified under the main item shall be paid for under "Extra Depth" and shall include all items as given for manholes depth will be measured to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel.

a. Bed concrete.
b. Brick work.
c. Plastering.

d. R.C.C. Top slab, benching and channeling including drop connections.
e. Supply and fix M.S. foot rests.
f. Keeping holes and embedding pipes for all the connections.

g. Excavation, refilling, necessary dewatering and disposing off surplus soil to a place as directed by Client's Representative.
h. Curing.
i. Cost of frame and cast iron cover including reinforcement, angle frame and embedding the frame in concrete bed.
j. Testing.
k. De-watering of chambers.

Gully Trap:
1.0 Materials: (1) Water (2) Cement mortar of proportion 1:5 (3) Burnt brick (4) The stoneware Gulley trap of 100 mm. x 100 mm. size
2.0 Workmanship:
Excavation for gulley trap shall be done true to dimensions and levels as indicated on plans or as directed. The excavation work shall generally be done as per relevant specification.

Fixing:
The gulley trap shall be fixed over cement concrete 1 : 5 : 10 (1 cement : 5 sand : 10 graded brick bats aggregate 40 mm. nominal size) foundation, 650 mm. square and 100 mm. thick. The depth of top of concrete below the ground level shall be 675 mm. The jointing of gulley outlet to the branch drain shall be done similar to jointing of S. W. pipe as described in item No. 1.28

Brick masonry chamber : After fixing and testing gulley and branch drain, a brick masonry 300 x 300 mm. inside with bricks in C. M. 1 : 5 (1 cement : 5 sand) shall be built be built with a 100 mm. brick work round the gully trap from the top of bed concrete upto ground level. The space between the chamber walls and the trap shall be filled with cement concrete 1 : 5 : 10. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1 : 3 (1 cement : 3 sand) finished with floating coat of neat cement. The corners and bottom of the chamber shall be rounded of so as to slope towards the grating.

C.I. cover with frame 300 mm. x 300 mm. (inside) size shall than be fixed on the top of the brick masonry with C. C. 1 : 2 : 4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) 40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from entering the gully trap.

Mode of measurements & payment :
The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item as described above.

The rate shall be for a unit of one number basis.

DROP CONNECTIONS: (If required as per actual site condition)
In case where branch pipe sewer enters the manhole of main sewer, a drop connection should be provided. H.C.I. pipes and specials conforming to IS: 1729-1964 as revised from time to IS: 1729-1964 as revised from time to time shall be of the size same as of the branch pipe sewer.

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

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 upto the bed concrete of the manhole and to the full width of the branch line.

LAYING:
At the ends of branch sewer line Cast Iron tee shall be fixed to the line which shall be extended through wall of the manhole by horizontal piece of Cast Iron pipe form an inspection on cleaning eye, the open end shall be provided with chain and lid. The Cast Iron drop pipe shall be connected to the tee at the top and to Cast Iron bend at the bottom. The end shall be extended through the wall of the manhole by a piece of Cast Iron pipe which shall discharge into the channel. Necessary channel shall be made with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate to 20mm nominal size) and finished smooth to connect the main channel. The joint between Cast Iron pipes to fittings shall be lead caulked. The joint between Cast Iron tee and RCC branch line shall be made with cement mortar 1:1 (1 cement: 1 fine sand). The exposed portion of the drop connection shall be encased all-round with minimum 15 cm thick concrete 1:3:6 (1 cement: 3 fine sand: 6 graded stone aggregate 40mm nominal size) and cured. For encasing the concrete around the drop connection, necessary centering and

shuttering shall be provided.

The holes made in the walls of manholes shall be made good with brick work in cement mortar 1:5 (1 cement: 5 fine sand) and plastered with cement mortar 1:3 (1 cement: 3 coarse sand) on the inside of the manhole wall. The excavated earth shall be back filled in the trench in level with the original ground level.

MAKING CONNECTIONS:
The Contractor shall connect the new sewer line to the existing manhole by cutting the walls, benching and restoring them to the original conditions. A new channel shall be cut in the benching of the existing manhole for new connections. The Contractor shall remove all sewage and water if encountered in making the connection without additional cost to the Owner.

MEASUREMENTS:
Item for making connection to municipal sewer shall be paid for by number and shall include all items given in the Bill of Quantities.

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 1:5 (1 cement: 5 fine sand).

v) Plastering not less than 12mm/15mm 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.

12.0 Measurement:
Manhole shall be measured in numbers as indicated in the Bill of Quantity. The depth of manhole shall be measured from invert of channel to the top of manhole cover. Quoted rate shall cover the range of ± 0.24 meter on the depth specified in schedule and also the cost of items specified in the Bill of Quantities and Specifications viz.
Manhole with depth greater than specified under the main item shall be paid for under "Extra Depth" and shall include all items as given for manholes depth will be measured to the nearest cm. Depth of the manholes shall be measured from top of the manhole cover to bottom of channel.

14.0 MISCELLANEOUS WORK

Identification color code
All piping systems shall be suitably painted or otherwise color identified according to Appendix - E - identification of pipes of IS : 2065 (code of practice for water supply in buildings). The identification colors and letter symbols for various services shall be as follows

Service	Identification Color	Letter Symbol
1. Soil, Waste and Vent Piping and all drains	Black	S
2. Water Supply Lines	Sea Green	CW

The letter symbols shall either be legibly painted or affixed in an appropriate manner to be read conveniently. At locations where painting cannot be done, the piping system shall be identified by fastening self-adhesive PVC tapes of appropriate, color in an approved manner. The tapes varying in 50mm to 15mm wide strips depending on the size of pipe on which the tapes are fastened- shall be applied at regular intervals on continuous runs and at all bends junctions and tees

Painting
The Contractor shall supply all materials, labour tools and other equipment necessary for carrying out painting work. Painting as described herein shall be applied to all surfaces requiring painting. Paint materials used in the work shall be of approved make of ready mixed variety supplied to site in manufacturers original containers. Thinning where necessary shall only be done as per manufacturer's instructions. All surfaces to be painted shall be cleaned free of all dirt and dust before painting is started. Painting shall only be started after the receiving surfaces are in a condition fit to receive painting as certified by the Construction Manager. Properly qualified foreman and skilled experienced painters shall be employed to painting work

Preparation of surface
All steel and iron surfaces to be painted shall be washed with mineral spirits to remove all dirt and grease. Where rust or scale is present, the surfaces shall be wire brushed to remove such rust. The cleaned surfaces shall be given one coat of approved phosphate before priming coat is applied.

All galvanised metal to be painted shall be thoroughly cleaned with naphthalene and treated with a solution of 5 gallons of 36% acetic acid, 1.36 kg. of blue vitrial and 1.36 kg. of powered dissolved in 225 litres of alum water.

Painting finishes
The Painting Finishes shall consist of the operations briefly mentioned below.

All cast iron soil, waste vent pipes, manhole covers, gratings and frames shall be painted witty three coats of bitumastic paint.

All cast iron water mains pipes shall be painted with one coat Zinc Chromate primer followed by three coats of synthetic enamel paint.

All non-galvanised steel surface shall be painted with one coat of Zinc Chromate primer followed by three coats of synthetic enamel paint.

All galvanised surfaces shall be prime coated with one coat of zinc chromate after washing with galvanised metal cleaner. The surfaces shall then be painted with three coats of synthetic enamel paint.

All painted finished surfaces shall be smooth throughout and retain a consistent uniform shade all through. Where in the opinion of the Construction Manager, the painting is not consistent in application or appearance, the painting shall be redone to his satisfaction by the contractor at his own cost.

5.0 Disinfecting of piping system
Before commissioning the filtered water supply system the contractor shall arrange to disinfect the entire system as described in the succeeding paragraph.

The filtered water pipes shall first be filled with water and thoroughly flushed out. The storage tanks shall then be filled with water again and disinfecting chemical containing chlorine added gradually while tanks are being filled to ensure thorough mixing. Sufficient chemical shall be used to give the water a dose of 50 parts of chlorine to one million parts of water. If ordinary bleaching powder is used, the proportions will be 150 gms. of powder to 1000 litres of water. The powder shall be mixed with water in the storage tank. If a proprietary brand of chemical is used, the proportions shall be as specified by the makers. When the storage tank is full, the supply shall be stopped and all the taps on the distributing pipes opened successively working progressively away from storage tank. Each tap shall be closed when the water discharge begins to smell of chlorine. The storage tank shall then be filled up with water from supply pipe and added with more disinfecting chemical in the recommended proportions. The storage tank and pipe shall then remain charged at least for three hours. Finally the tank and pipes shall be thoroughly flush out before any water is used for domestic purposes.

6.0 Connections to mechanical equipment's supplied by other agencies.
All inlets, outlets, valves piping. and other incidental work connected with installation of all mechanical equipment supplied by other agencies shall be carried out by the Contractor in accordance with the Drawing, requirements for proper performance of equipment manufacturers instruction and the directions of the Construction Manager.
The equipments to be supplied by the other agencies consist mainly of Water Treatment, Sewage Treatment, Pumps and Equipment, (Hydropneumatic system). The connections to the various equipments shall be effected through proper union and isolating valves. The work of effecting connections shall be executed in Consultation with and according to the requirement of equipment suppliers, under the directions of the Engineer-in-charge. The various aspects of connection work shall be executed in a manner similar to the work of respective trades mentioned elsewhere in the specification.

7.0 Connection to water tank
The Contractor shall provide all inlets, outlets, washouts, vents, overflow and all such other piping connections to Water Storage Tanks as called for as pipe embedments indicated in the Drawings.

15.0 TESTING, ERECTION AND COMMISSIONING OF EQUIPMENTS

16.0 TESTING – GENERAL
Tests of the plant at the manufacturer's premises will be required in accordance with the conditions of contract. All inspection, examination and testing shall be carried out in accordance with appropriate standards.

All instruments used for such tests shall be calibrated and certified by an approved independent testing authority not more than 3 months prior the test in which they are used. The engineer's representative reserves the right to impound any instrument immediately after test for independent testing. A certificate shall be produced by the contractor prior to carrying out every test showing the readings obtained, calculations and full details of the calibration certificates referred to.

If the engineer's representative witnesses a test he shall be given a copy of the test results and certificates immediately. Whether he witnesses a test or not, copies of test certificate shall be sent to the engineer's

representative. No item of the plant shall be forwarded to the site until its test certificate has been approved writing by the engineer's representative. Six copies of the test certificates shall be supplied in suitable folders with proper index.

Certificates shall be clearly identified by serial or reference number where possible to the material being certified and shall include information required by the relevant reference standard or specification clause.

INSPECTION AT MANUFACTURER'S PREMISES

The inspection of all equipment required to be supplied to complete the works shall be done as detailed in this specification. Only defect free and sound material meeting the technical requirements of this specification and in accordance with a high standard of engineering would be acceptable to the engineer's representative.

For meeting these requirements of inspection, testing (including testing for chemical analysis and physical properties) shall be carried out by the contractor and certificates submitted to the engineer's representative who will have the right to witness or inspect the above mentioned testing/inspection at any stage desired by him. Calibration certificates or test instruments shall be produced for the engineer's consent in advance of testing and if necessary instruments shall be recalibrated or substituted before the commencement of the test. Items of plant or control systems not covered by standards shall be tested in accordance with the details and program agreed between the engineer and contractor.

If during or after testing, any item of the plant fails to achieve its intended duty or otherwise prove defective it shall be modified or altered as necessary, retested and re-inspected as required by the engineer.

At least 21 days notice shall be given to the engineer before the specified tests are carried out.

No material is to be delivered to site without the above described inspection having been carried out or officially waived in writing by the engineer's representative.

ERECTION - GENERAL

The contractor's staff shall include at least one competent erection engineer with proven suitable, previous experience on similar contract to supervise the erection of the works and sufficient skilled, semiskilled and unskilled labour to ensure completion of the works in time. The contractor shall not remove any representative, erector or skilled labour from the site without the prior approval of the engineer's representative.

One erection engineer who shall be deemed to be the contractor's representative shall be conversant with the erection and commissioning of the complete works. Should there be more that one erector, one shall be in charge and the contractor shall inform the engineer's representative in writing which erector is designated as his representative and is in charge. Erection engineer is to report to Project Manger.

The contractor's erection staff shall arrive o the site on date to be agreed by the engineer's representative before they proceed to the site, however, the contractor shall first satisfy himself, as necessary, that sufficient plant of his (or his sub-contractor's) supply has arrived on site so that there will be no delay on this account.

The contractor shall be responsible for setting up and erecting the plant to the line and levels of reference given by the engineer in writing, and for the correctness (subject as above mentioned) of the positions, levels dimensions and alignment of all parts of the works and for provision of all necessary instruments, appliances and labour in connection therewith. The checking of setting out of any line or level by the engineer or engineer's representative shall not in any way relieve the contractor of his responsibility for the correctness thereof.

Erection of plant shall be phased in such a manner so as to obstruct the work being done by other contractors or operating staff who may be present at the time. Before commencing any erection work, the contractor shall ckeck the dimensions of structures where the various items of plant are to be installed and shall bring any deviations from the required positions, lines or dimensions to the notice of the engineer. Plant shall be erected in a net and workmanlike manner on the foundations and at the locations shown on the approved drawings. Unless otherwise directed by the engineer, the contractor shall adhere strictly to the aforesaid approved drawings. If any damage is caused by the contractor during the course of erection to new or existing plant or buildings or any part thereof, the contractor shall, at no additional cost to the employer, make good, repair or replace the damage, promptly and effectively as directed by the engineer and to the engineer's satisfaction.

During erection of the plant the engineer will inspect the installation from time to time in the presence of the contractor's site representative to establish conformity with the requirements of the specification. Any deviations and deficiencies found or evidence of unsatisfactory workmanship shall be corrected as instructed by the engineer.

RECORD, PROCEDURES AND REPORTS

The contractor shall maintain records pertaining to the quality of installation/erection work and inspection, testing, compliance with all technical requirements in respect of all his works as described in the previous paragraphs. The reporting formats shall be in the approved formats. The contractor shall submit such records to the engineer after the completion of any particular work before submitting the bill of supply/progress of work. Such report shall comprise of shop inspection reports, shop testing reports, material test reports, based on which dispatch clearances are provided, all the quality control reports of welding, erection and alignment records.

All the above mentioned records shall be submitted in the final form duly countersigned by the engineer's representative attesting conformity to specifications and is approval of installation and duly incorporating all the additions, alternations and information as required by the engineer, on the basis of preliminary reports giving the progress of the work. Such records notwithstanding any records submitted earlier with bill of supply/progress etc. shall be duly bound and submitted to the engineer in six copies by the contractor on his notification of the mechanical completion of erection.

COMPLETION OF ERECTION

The completion of plant under erection by the contractor shall be deemed to occur, if all the units of the plant are structurally and mechanically complete and will include among other such responsibilities the following :

(a) Plant in the scope of the contractor has been erected, installed and grouted as per specifications.
(b) Installation checks are completed and approved by the engineer.
(a) The erected plant are totally ready for commissioning checks.

At the stage of completion of erection, the contractor shall ensure that all the physical, aesthetic and workmanship aspects are totally complete and the plant is fit and bound to undergo commissioning checks/tests on completion.

Upon achieving the completion as described above, the contractor shall notify the engineer by a written notice intimating such mechanical completion of units and notify the engineer for inspection and acceptance of mechanical completion. The engineer / engineer's representative shall proceed with the inspection of such units within 14 days of such a notice. Thereafter :

(a) The engineer shall certify completion when there are no defaults in the works and the plant is acceptable or
(b) The engineer shall inform the contractor list of deficiencies for rectification hereinafter referred as Punch List and the contractor shall complete the rectification work within a jointly agreed period before tests on or approval of the same before proceeding with the Tests on Completion or
(c) The engineer may inform the contractor that the works are accepted with the 'punch' list (Items which do not hamper operability, safety or maintainability) and allow the contractors to proceed with the pre-commissioning checks followed by Test on Completion when the contractor undertakes to complete such outstanding works within an agreed during Defects Liability Period.

Taking over shall be based on rectification of all deficiencies as advised by punch lists.

The erection period indicated by the contractor would be deemed to cover all the activities upto completion as stipulated in previous paragraphs, notice of completion by the contractor, inspection by the engineer for completion, and contractor rectification of all deficiencies as noticed by the deficiency/punch list, and acceptance by the engineer of such rectification, prior to Test on Completion.

Minor defects, which in the opinion of engineer which do not hamper operability and maintainability will not be taken in to account for deciding mechanical completion. Such defects shall be rectified concurrent to commissioning checks before Test on Completion. However, the engineer's decision in this regard is final.

The commissioning period as notified by the contractor shall be deemed to occur beyond the date of completion and shall include all period of pre-commissioning, trials and Test on Completion.

It is in the contractor's interest to offer the sections/units/systems, progressively under identified milestones within overall erection period, duly completed for inspection by the engineer's representative, obtain his 'punch' list, for rectification of any deficiencies pointed out by the engineer and to achieve mechanical completion before undertaking the Test on Completion within the specified erection period. The engineer also reserves a right to withhold the cost as estimated to be equivalent to the rectification of deficiencies pointed out to the contractor until such a time such deficiencies are rectified to the

satisfaction of the engineer.

SETTING TO WORK

On completion of erection the contractor shall request the engineer's representative to carry out the installation inspection.

After the plant has been set to work the contractor shall continue to operate the plant for a period of one week.

INSTALLATION INSPECTION

In addition to the progressive supervision and inspection by the purchaser the contractor shall offer for inspection to engineer, the completely erected plant/part of plant on which tests are to be carried out. After such inspection by engineer, each equipment/sub-system shall be tested by the contractor in accordance with the applicable standards in the presence of engineer. Such tests shall include but not be limited to the tests specified in following clauses.

PIPING AND VALVES

(a) The erected pipe work shall be subjected to a hydraulic test at 1.5 times the maximum pressure or twice the working pressure whichever is higher to test the soundness of the joints. Provision of the necessary pumps, gauges, blank flanges, tappings etc. for carrying out these tests shall be include in the contract.

(b) Leakage tests shall be carried out on all erected pipe work, pumps and valves immediately after erection and where possible before being built in.

(c) Operating tests shall be conducted on valves.

COMMISSIONING

SCOPE

At the time of commissioning, the engineer will appoint his representative as commissioning engineer. The contractor shall carry out commissioning tests in the presence of the commissioning engineer. Though the mechanical completion may have been checked and calridied by the site engineers, the commissioning engineer may verify any mechanical completion checks to satisfy himself that the plant is fit and sound, if such checks had not been witnessed by him. It will be the responsibility of the contractor to make all arrangements for carrying out these tests. The evaluation of test results and decision passed by the commissioning engineer regarding the test results will be final and binding on the contractor. Any additional tests or repetition of tests to establish satisfactory operation of any equipment shall be carried out by the contractor at no extra cost.

MISCELLANEOUS

Completion checks and commissioning tests on items not covered under above, shall be carried out by the contractor as per the instructions of the engineer's representative.

8.0 TAKING OVER

No item of plant will be certified for taking over by the purchaser unless it has successfully passed all the tests called for under the contract. If nevertheless the employer uses any part of the works, that part which is used shall be deemed to have been taken over at the date of such use.

Taking Over Certificate for plant shall not be issued unless the following documentation are duly compiled and submitted in final formats in duly bound volumes.

(a) A compilation of all shop inspection results/reports of the plant/machinery with due attestation that the plants have been manufactured to specified standards (5 copies).

(b) All erection/construction quality control checks in appropriate approved formats for all installation works with attestation that installation has been carried out as per acceptable/stipulated standards (6 copies)
(c) The intent of this document is to specify the systems and equipments for HVAC system described under Volume 1 above.

16.0 APPROVED VENDOR LIST

SR. NO	ITEM	APPROVED MAKE LIST
1	STONEWARE PIPE	GIRCO / TIRUMALA / RAJULA
2	GULLY TRAP	SUPREME / FINOLEX
3	C.I.COVERS	NECO / BHARAT / KALPESH
4	UPVC PIPE	SUPREME / DUTRON / ASTRAL
5	METAL TO METAL & METAL TO PVC THREAD JOINTS	CHAMPION
6	VALVES	ZOLOTO / LEADER / VB / RB / KIRLOSKAR
7	ASBESTOS YARN	CHAMPION / CAPTAIN
8	BATH FIXTURES	JAQUAR OR EQUIVALENT / As approved byArchitect
9	SANITARY FIXTURE	HINDWARE / PARRYWARE / CERA / As approved by Architect
10	PUMPS	GRUNDFOSS/KIRLOSKER / CRI
11	STARTER	SIEMENS / L&T / GELCO
12	SEWAGE TREATMENT PLANT	THERMEX / NAIK Environmental Engineers Pvt. Ltd. / FLOW DYNAMICS/The supplier /Contractor shall submit the Technical Data Sheet along with the bid.
13	RCC HUME PIPES (For Under Ground DrainageLine).	INDIAN HUME PIPE / PRANALI

Signature of contractor.

Specification For Fire Hydrant & Sprinkler System

SCOPE OF WORK

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet riser, fire hydrant & sprinkler system as required for Tower A & B & as per the drawings and specified here in after or given in the Bill of Quantities.

Without restricting to the generality of the foregoing,

the fire safety system shall include the following :-

a) M.S. main including valves, hydrants and appurtenances (where specified)

b) M.S. pipe fire risers within the building.

c) Landing valves, hose reels, hose cabinets, fire brigade connections and connections to pumps and appliances etc.

d) Fire pumps and control panels.

e) Suction, Delivery & header pipe, fittings, flanges & valves

f) Sprinkler piping & fittings, valves

g) Sprinklers for basement, ground, first, second, third & fourth floors. For 5th, 6th, 7th & 8th floors, only sprinkler hook up is to be provided.

h) Fire extinguishers & sand buckets

PIPE WORK

GENERAL REQUIREMENTS :

All the materials shall be of TAC approved, best quality conforming to the specifications and subject to the approval of the Client or his representative. If so directed, materials shall be tested in an approved testing laboratory & the contractor shall produce the test certificate in original to the Engineer-in-charge & the entire charges for original as well as repeated tests shall be borne by the Contractor.

Before welding, the pipe faces shall be cleared & then shall be welded conforming to IS : 9595 – 1980. The electrodes used for welding shall comply with IS:814. the laying of welded pipe shall also comply to IS 5822 – 1986. The welding joints shall be tested in accordance to IS:3600, Part 1973.

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

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.

Pipes shall be securely fixed to walls and ceilings by suitable clamps or supported at every 3 mtr. & at change of direction as required. Only approved type of anchor fasteners shall be used for RCC ceiling and walls.

Valve and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

PIPING

Pipes of the following types are to be used :

G.I. / Mild steel black pipes as per IS : 1239, heavy duty (for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall be lagged as per IS:10211.

Steel pipe lines up to 150 mm dia. shall have all fittings as per IS:1239, Part-II (heavy grade) while pipelines above 150 mm dia shall be fabricated from IS:3589 Gr.320 pipes as applicable or from steel plates.

For steel pipelines up to 50 mm dia screwed jointing shall be adopted, while for pipelines above 50 mm dia welded or flanged construction is to be carried out.

Hangers and supports shall be capable of carrying the sum of all concurrently acting loads. They shall be designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor, braces, dampener, expansion joint and structural steel to be attached to the building structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultant / Client / Architect.

The piping system shall be capable of withstanding 150% of the working pressure including water hammer effects.

Flanged joints shall be used for connections to vessels, equipment, flanged valves and also on suitable straight lengths of pipeline of strategic points (@ at every 15-20 mtr.) to facilitate erection and subsequent maintenance work.

Excavation for pipe line shall be in open trenches. Pipes shall be buried at least one meter below ground level and shall have 230 mm x 230 mm masonry supports at least 300mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand: 8 stone aggregate) of size 380 x 380 x 75 thick resting on firm soil.

Wherever required Contractor shall support all trenches or adjoining structures with adequate supports to prevent landslides.

On completion of testing and painting trenches shall be refilled with excavated earth in 15 cm layers and compacted.

Contractor shall dispose off all surplus earth within the site.

Contractor shall provide suitable cement concrete anchor blocks for overcoming pressure trusts in underground / external pipes. Anchor blocks shall be of cement concrete 1:2:4 mix.

VALVES

Valves shall be used to start, stop or control flow. Non-return valves shall be provided unidirectional flow.

Butterfly valve conforming to BS 5155 or as indicated in BOQ will be used for isolation of flow in pipelines. For sizes up to 40 mm, gate valves shall be outside screw rising spindle type and shall be as per IS: 778 Class-1 and Class-2, as applicable. For sizes 50mm to 200mm, Butterfly valve shall be as per IS: PN = 1.6. Non-return valves shall be dual plate check or swing door type. An arrow mark in the direction of flow shall be marked on the body of the valve. These valves shall conform to IS:5312 or API 596/598

Valves below 50 mm size shall have screwed ends while those of 50 mm and higher sizes shall have flanged connections. Drain lines will have locks for draining.

YARD / EXTERNAL HYDRANT

Yard or External Hydrants shall be as per IS:908 and the valve as per IS:5290. The hydrant shall consist of stand post assembly and a masonry base 200 mm X 200 mm X 200 cm high

and shall be made at the point where it comes out of the soil. The valve shall complete with hand wheel, quick coupling connection spring and blank cap. The hydrant shall be laid on 150/100 dia main tee off to 100mm dia.

Yard or External hydrant shall be controlled by a cast iron sluice valve. Hydrant shall have oblique female instantaneous pattern 63 mm diameter outlets with caps and chains. The hydrant shall be of gunmetal and flange inlet and single outlet conforming to IS:5290, a duck foot bend and flanged riser of required height to bring the hydrant to level above ground. The valve body, stop valve, check valve, nut, instantaneous female outlet and blank cap shall be of leaded-tin bronze conforming to Grade-II of IS:318-1962. The valve spindle shall be of brass rod conforming IS:320 - 1962. The hand wheel shall be mild steel or cast iron washers gaskets shall be of rubber conforming to IS:638 - 1965 or leather conforming to IS:581 : 1969.

Each external hydrant shall be provided with two nos. 63 mm. Diameter 15 mtr. Long hose pipe with gunmetal male and female instantaneous type coupling, machined wound with
wire hose of IS 636 type A and couplings to IS:903 with IS certification, gunmetal branch pipe with 20 mm nozzle conforming to IS:903.

HYDRANT VALVES (LANDING VALVES)

Landing valves shall be 63 mm dia. oblique female instantaneous pattern with caps and chains. Landing valves shall conform to IS:5290 in all respects. Double headed landing valves shall have separate control valves. Landing valves shall be of gunmetal and fitted with instantaneous coupling conforming to IS:901. The valve body, stop valve, check valve, nut, instantaneous female outlet and blank cap shall be of leaded-tin bronze conforming to Grade-II of IS:318-1962. The valve spindle shall be of brass rod conforming IS:320 - 1962. The hand wheel shall be mild steel or cast iron washers gaskets shall be of rubber conforming to IS:638 - 1965 or leather conforming to IS:581 : 1969. The coupling shall be fitted with an internal plug secured by chain landing valves shall be installed on hydrant riser at a height of 1.0 to 1.2 meter from the floor level.

Each internal hydrant shall be provided with two nos. 63 mm. Diameter 15 mtr. Long hose pipe with gunmetal male and female instantaneous type coupling, machined wound with
G.I. wire hose of IS 636 type A and couplings to IS:903 with IS certification, gunmetal branch pipe with 20 mm nozzle conforming to IS:903.

HOSES

Hoses pipes shall be of fabric reinforced rubber lines as per IS:636 Type II or canvas hose as per IS:4927, with nominal size of 63 mm and lengths of 15 meter or 7.5 meter, as per quantities specified for in schedule or bill of quantity.

All hose pipes shall carry ISI marking on the body of the hose.

The hose shall have instantaneous spring lock-type coupling on ends. The instantaneous coupling shall be as per IS:903. It shall be fixed to each other by copper rivets and galvanized M.S. wires and leather bands. All coupling shall be interchangeable with each other, and shall bear ISI markings.

HOSE REEL

The hose reel shall be directly tapped from the riser through a 25 mm dia pipe, the drum and the reel being firmly held against the wall by use of dash fasteners. The hose reel shall be swinging type (180degrees) and the entire drum, reel etc. shall be as per IS:3876 and IS:884. The rubber tubing shall be of best quality and the nozzle shall be 5 mm dia shut off type.

BRANCH PIPES

Branch pipe shall be of either gun metal or aluminum and should conform to IS:903. One end of the branch pipe will receive the coupling while the other end shall have a nozzle screwed to it. It shall bear ISI marking.

HOSE CABINETS (HOSE BOX)

Each hydrant shall be housed in a Hose cabinet of suitable size. The hydrant cabinet shall hold twin headed hydrant, 2 hoses and one branch pipe as required. Internal hydrants shall normally fit the size of the niche made for it. The cabinet shall be of minimum 14 SWG M.S. sheet with centre opening, double glass front doors (cleat glass of 4mm thickness). The glass shall be firmly fixed by means of steel clips and screw with rubber beading. Hinges shall also be screwed and not welded. The corner members (frame) shall be of 25 x 25 x 3 mm thick angle. The hose box shall be firmly fixed to the wall/support by means of brackets and dash fasteners. The steel work shall have one coat of primer and two coats of red paint. The words "Yard Hydrant", "Hydrant" etc. should be painted in white or red on the glass in 75 mm high letters. The hose box shall be lockable.

AIR CUSHION TANK

Every wet riser shall be provided with an air cushion tank at its top most point. The air cushion tank shall be provided with an automatic air release cock, 20 mm dia. drain pipe, drain valve and shut off valve.

FIRE BRIGADE INLET CONNECTION

A fire brigade inlet connection with a non-return valve shall be provided to facilitate the fire brigade to pump water into the installation by the use of their own equipment. Four way or 150 mm dia connection to the system shall comprise of four instantaneous pattern 63 mm dia. male inlets shall be with caps and chains complete with 150 mm dia. sluice valves, non-return valve housed in a M.S. cabinet with glass fronted door. The cabinet shallbe suitable for recess mounting.

Two way or 100 mm fire brigade inlet connection to the system shall comprise of two instantaneous pattern 63 mm dia. male inlets shall be with caps and chains complete with 100 mm dia sluice valve, non-return valve housed in a M.S. cabinet with glass fronted door. The cabinet shall be suitable for recess mounting.

SYSTEM DRAINAGE

The systems shall be provided with suitable drainage arrangements with G.I. piping of 40 mm dia. complete with all accessories, and provided with 40 mm dia drain valve.

VALVE CHAMBERS

A valve chamber shall be brick masonry chamber in cement mortar 1:5 (1 cement : 5 coarse sand) on cement concrete foundation 150 mm thick foundation 1:5:10 mix (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size), 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling, complete. The wall shall be 230 mm thick with heavy duty ISI marked C.I. manhole covers.

HYDRANT SYSTEM

The hydrant system shall comprise of AC motor driven pump sets. Diesel pump (IF REQUIRED), Jockey pump etc. with all required accessories including valves, appurtenances, instrumentation and controls etc. comp

lete in all respects. The system shall cover the entire area from independent pipe work from the fire water pump set. The hydrant work shall remain pressurized through the proposed Jockey pump taking care of any leakages in the system pipelines and valve glands. All pumps / motors / engines to be of makes approved by T.A.C./ local Fire Authority.

The hydrant system shall be kept charged by pressurized water at approximately 3.5 Kg/cm2 at all times. In the event of fire when any of the hydrant valves in the net work is opened, the resultant fall in header pressure should enable starting the Electric Motor driven fire water pumping set through pressure switches automatically. One Diesel Engine driven pump shall be a stand-by pump serving hydrant system. In case of failure of electricity or failure of Elec. Pump to start on demand, the stand-by Diesel pump shall automatically take over. Apart from the automatic starting of the pump sets, provision

shall be kept for manual starting also. However shutting down of the pump sets shall be manual.

The hydrant system in the yard shall be furnished with external hydrants consisting of landing valves (positioned approx. one meter above ground level) fitted M.S. (Heavy) flanged single headed stand pipes installed on underground hydrant headers distributed 45 M apart approximately or as marked on the plan.

The entire system including all pumps, motors, diesel pump set and panels shall be of approved make by TAC / Local Fire Authority.

PRESSURE GAUGE

All pressure gauges shall be dial type with Borden tube element of SS 316. The dial size shall be of 150 mm diameter and scale division shall be in metric units marked clearly in black on a white dial. The range of pressure gauge shall be 0-10 kg.sq.mm. The pressure gauges shall be complete with isolation cock, siphon tubing, etc.

PRESSURE SWITCHES

(a) The pressure switch shall be industrial type single pole double throw electric pressure switch designed for starting or stopping of equipment when the pressure in the system drops or exceeds pre set limits. It shall comprise of a single pole change over switch, below element assembly and differential spindle.

(b) All pressure switches shall have ¼" BSP (F) inlet connection and screwed cable entry for fixing cable gland. All control cabling shall be provided.

SPECIFICATION FOR PUMPS AND ANCILLARY EQUIPMENT

SCOPE OF WORK

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated pumps for fire hydrant installations as required by the drawings and specified hereinafter or given in the schedule of quantities.

Without restricting to generality of the foregoing the pumps and the ancillary equipment and shall include the following:

a) Electrically operated pumps with motors base plate and accessories.
b) Pump suction and delivery headers, valves, air vessel and connections.
c) Pressure gauges / pressure switch.
d) Only single point 3 phase supply will be made available to the Contractor. From their, all provision viz. Electrical switchboard, wiring, cabling, cable tray, control panel, ear thing, etc. shall be made.

GENERAL REQUIREMENT

a) Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in concrete foundations.
b) Pumps and motors shall be truly aligned with suitable instruments.
c) All pump connections shall be standard flanged type with appropriate number of bolts.
d) Manufacturer's instructions regarding installation connections and commissioning shall be followed with respect to all pumps, switchgear and accessories.

FIRE AND JOCKEY PUMPS

a) The main Fire hydrant & Sprinkler pumps shall be End Suction Back Pull Out type while Jockey pumps shall be of Centrifugal Mono block Pump type having following specifications.

b) Shut off head should not exceed 140% of rated head. Pump shall not develop less than 65% of rated head at 150% of rated capacity.

MATERIALS OF CONSTRUCTION

Part	Material
Casing	Cast Iron
Impeller	Bronze IS:318, Gr. LTB 2
Casing Wearing	SS
Shaft	AISI – 410 / Stainless Steel
Shaft Sleeve	S.S. 316
Stuffing Box	Gland Packed

c) Pumps shall be provided with pressure gauge with isolation cock on the delivery side.
d) In case of motor driven pump the motor rating should be adequate to drive the motor rating should be adequate to drive the pump at 150% of rated discharge.
e) The pump and its prime mover (Electric motor or Diesel Engine) shall comply with all the equipment of the Rules of the Traffic Advisory Committee.
f) All pumps shall have positive suction & shall be provided with suction strainer of SS & CI bell mouth

A) JOCKEY PUMP

B) Starting and stopping of Jockey Pump set shall be automatic at predetermined levels through pressure switch. However, arrangements for manual start and stop of the pump shall also be made. Jockey Pump shall take care of small leakages in the piping system and pumps cushion tanks.

B) ELECTRIC DRIVEN

Electrically driven pumps shall be provided with totally enclosed fan cooled, foot mounted, squirrel cage induction motors suitable for fire pumps with IP-55 enclosure.
The motors should be rated not to draw more than 4.5 times the starting current.
Motors shall be at least equivalent to the horse power required to drive the pump at 150% of its rates discharge.
The motors shall be wound for class-F insulation and windings shall be vacuum impregnated with heat and moisture resisting varnish, glass fiber insulated.

D) DIESEL ENGINE

a) Diesel engine shall have suitable no. of cylinders with individual heat assemblies. The engine shall be water cooled and shall include heat exchanger and connecting piping strainer, isolating pressure reducing valves, bye-pass line, exhaust pipe, silencer, day tank for fuel all interconnected piping etc., complete in all respects.

b) Engine shall be direct injection type with low noise and exhaust omission levels,

c) The speed of engine shall match the pump speed for direct drive.

d) The engine shall be capable of being started without the use of the wicks, cartridge heater plugs or either at engine room temperature of 4°C and shall take full load within 15 seconds from the receipt of the signal to start.

e) The engine shall effectively operate at 46°C ambient temperature at 150 meter above mean sea level.

f) Noise level of the engine shall not exceed 120 dB (free sound pressure) at 3 meters distance.

g) Engine shall be suitable for running on high speed diesel oil.
h) The system shall be provided with a control panel with push button starting arrangement also wired to operate the engine on differential pressure gauge.

i) The entire system shall be mounted on a common structural base plate with anti-vibration mounting, Dunlop make, and flexible connections on the suction and delivery piping.

j) Contractor provide one fully mounted and supported Day Oil Tank fabricated form 6mm thick MS sheet electrically welded for 8 hours working load and having suitable capacity of oil. Provide level indicators – low level and full level in the Day Oil Tank on the control panel through float switches and an breather. Day Oil Tank shall also be provided with filling connection (Threaded) with cap, gauge glass indication and cocks, drain cock, inspection / cleaning cover with gasket and nuts / bolts. MS dyke to hold 150% of the Day Tank capacity to be built around the Day Tank.

k) Contractor to provide one exhaust pipe with suitable muffler (residential type) to discharge the engine gasses to outside in open air as per site conditions (Contractor to check the site).

l) Contractor to provide all accessories, fittings and fixtures necessary and required for a complete operating engine set. The exhaust pipe shall be taken outside the building with minimum number of bends (approx. length 30 Meters) and shall be duly heat insulated with 50mm thick glass wool covered with 24 gauge aluminum cladding.

m) Contractor shall indicate special requirements, if any, for the ventilation of the Pump Room.

BOOSTER PUMP

A booster pump shall be provided (if called) at terrace to pressurize the wet riser system. The pump shall be centrifugal mono block type.

BASE PLATE

Pumps and motors shall be mounted on a common structural base plate and installed as per manufacturer's instructions.

CUBICLE TYPE SWITCH BOARD / L.T. PANEL

Cubicle type switchboards and components shall conform to the requirements of the latest revision including amendments of the following codes and standards.

IS:8623 Specification for factory built assemblies of switchgear and control gear for voltage up to and including 1000V AC / 1200V DC.

IS:4237 General requirements for switch-gear and control-gear for voltage not exceeding 1000-V.

IS:2147 Degree of protection provided by enclosure for low voltage switch-gear and control-gear.

IS:1018 Switch-gear and control-gear selection/installation and maintenance. IS:6005 Code of Practice for phosphate of iron and steel.

IS:13947-1993/ Air circuit breaker / molded case circuit breaker. IEC 947 - 1989

IS:1248 Direct acting indicating analogue electrical measuring instruments and testing accessories.

IS:2705 Current transformers for metering and protection with classification Part - I, burden ad insulation.

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FIRE BRIGADE CONNECTION

4 Way & 2 way, 63 mm Fire Brigade inlet connection shall be provided.

TESTING OF THE HYDRANT SYSTEM:

All air shall be trapped from the pipeline through hydrants & air valves. Each section of the pipe shall be slowly filled with the water & allow to stand the water for few hours with the ends closed.

Flushing of underground connections: Underground mains and lead-in connections to system risers shall be flushed before connections made to piping in order remove foreign materials which may have entered the underground during the course of installation. For hydrant system the flushing operation shall be continued until water is clear.

Underground mains and lead-in connection shall be flushed at a flow rate of not less than 480 ltrs. per minute.

Provision shall be made for the disposal of water issuing from test outlets to avoid property damage.

Acceptance Test

ITEM 12.01 At the time of taking over, the hydrant system shall fulfill the following acceptance tests:-

a) Starting up of the pressure suction (Jockey Pump) : The pressure switch shall be set at 4.5 kg/cm^2 at the lower limit and 7.0 kg/cm^2 at the upper limit. The system drain shall be opened to cause a drop in the pressure. The Jockey Pump shall start as soon as the pressure gauge needle falls down to 6 kg. The Jockey pump shall also stop automatically when the system has been pressurised again up to 7.0kg/cm^2.

b) The main electrical pump shall be set to start at 3.5 kg/cm^2. An external hydrant valve using a single length of hose and branch pipe shall be fully opened to cause a drop of pressure in the system. At first, the jockey pump shall start when the pressure drops to 6 kg. Further, drop in the pressure to 3.5 kg should be allowed to test automatic start-up of the electrical pump. The electrical pump shall continue to run at least for 5 minutes and register rise in the pressure up to 7.0 kg the Jockey Pump shall be automatically stop at this. The electrical pump shall be stopped manually by pressuring the stop button.

c) After having the system got fully charged at 7.0 kg/cm^2 the external hydrant valve using hose and branch pipe at (ii) above shall be opened. When the pressure has dropped to 3.5 kg/cm^2, the electric main pump shall come into operation automatically. After the main pump has run for 5 minutes, the power supply in the pump house shall be switched off. The diesel pump shall automatically come into operation immediately.

All these tests mentioned above shall be repeated after one hour interval. The result of all the tests shall be identical again. After the system has satisfactorily withstood the above tests, it can be taken over from the contractor.

START-UP/SYSTEM TESTING

It will be the responsibility of the tenderer to cause interim/stage inspection by the TAC/S.F.O during execution of the work as and when so called for by the Employer / Architect and shall carry out any rectification / modification as may be suggested by the Tariff Advisory Committee (TAC) / State Fire Officer (SFO).

Soon after the work is completed, the contractor shall inform the TAC/SFO in writing with a copy to the Architect / Employer for getting the complete system including all sub system and instrumentation, control etc. thoroughly inspected and tested for satisfactory performance. After satisfactory completion of tests of the systems by the TAC / SFO the contractor shall be required to submit in built drawings on tracing cloth to the Architect which have been so approved.

In addition to TAC, the contractor shall also be responsible for getting the system and equipment tested and approved by other Statutory Authorities like the Area Fire Officer or the State Fire Services as may be required.

COMMISSIONING OF SYSTEM

Pressurised the fire hydrant system by running the main fire pump and after attaining the required pressure shut off the pump.

Open bye-pass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the pre-set pressure. If necessary adjust the pressure switch for the jockey pump. Close bye-pass valve.

Open bye-pass valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the preset pressure and should not cut-out automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pump should cut out as soon as the main pump starts.

Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.

When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant simultaneously and allow the hose pipe to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.

Diesel engine driven pump should also be checked in the same manner as given in Para above by running for 8 hours.

Check each Hydrant valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly, shall be replaced by the Contractor. Yard Hydrant valves shall be checked by opening and closing under pressure.

HANDING OVER

All commissioning and testing shall be done by the Contractor to the complete satisfaction of the Engineer-in-Charge / Consultants, and the job handed over to the Client.

Contractor shall also hand over to the Client all maintenance and operation manuals and all items as per the terms of the contract.

(Technical information to be furnished in following format by Bidder)

SR. NO.	SPECIFICATION	DESCRIPTION
1.0	**HYDRANT CUM SPRINKLER PUMP(S)**	
1.1	Type(s)	
1.2	Make(s)	
1.3	**General Specifications :**	
1.3.1	Capacity (Lit/Sec)	
1.3.2	Head in (mtr.)	
1.3.3	Sizes of suction and delivery pipes in mm	
1.4	Material for Impeller	
1.5	Material for Pump Casing	
1.6	Material for Shaft	
1.7	Efficiency of the Pump	
1.8	**Electrical Motor**	
1.8.1	Type	
1.8.2	Make	
1.8.3	Speed in R.P.M	
1.8.4	Efficiency of the Motor	
1.8.5	H.P and Voltage of driving motor, type of enclosure and class of winding insulation, Motor full load current (Remote controlled starting arrangement, if any)	
1.8.6	Details of electric supply	
1.8.7	Type of Starter	

(Technical information to be furnished in following format by Bidder)

SR. NO.	SPECIFICATION	DESCRIPTION
1.9	**Diesel engine**	
1.9.1	Speed and Horse power of the engine driving pump(s)	
1.9.2	Method of starting the engine	
1.9.3	Fuel Consumption	
1.9.4	Details of batteries, Battery Charger and Diesel Engine control panel	
1.9.5	Efficiency of the engine	
2.0	**HYDRANT MAINS**	
2.1	Material & Type of underground and / or overhead mains with method of joining	
2.2	To what pressure have the pipes been tested?	
2.3	No. & dia. Of wet riser	
3.0	**HYDRANT VALVES**	
3.1	Type and Make	
3.2	No. & type of Yard hydrants valve	
3.3	No. & type of floor hydrants	
4.0	**HOSE**	
4.1	Material and diameter	
4.2	Manufacturer's Name and Guarantee for bursting pressure.	
4.3	No. of Hose & length	
4.4	At what pressure the hose has been tested by the insured?	
4.5	Where is hose kept?	
4.6	No. of branch pipes and nozzles and their diameters	
5.0	**SPRINKLER**	
5.1	No. & type of isolation valves	
5.2	Type, make and fusing temperature of the sprinkler heads used.	

Signature of contractor

ELECTRIFICATION

GENERAL

01. The work shall be carried out as per C.P.W.D. specifications of electrical works 1972 for internal E.I. the Indian electricity rule 1956 as amended up to date for such work, unless otherwise specified in writing by the O.O.W.

02. All materials should be of ISI mark,standard and of approved quality.

03. The run of the cables position of junction boxes, fittings etc. should be approved by the O.O.W. The layout of the above should be marked on the site and approved by the O.O.W. before actual execution.

04. Persons executing electrical work should have electrical license as required according to IE Ac.

05. The earthing should be done in presence of the O.O.W. or his authorized representative.

06. Contractor shall quote rates including cost of all materials and labour charges of following item in point included

(a) **in case if required** the point wiring with 1.0 mm^2 copper PVC insulated-wire with 1.0 mm^2 copper PVC insulated wire for earth continuity in PVC casing capping having double locking arrangement with grooves, trunking of as per ISI for light & fan. Complete with 5A tissino type shockproof accessories erected on polished wooden block covered with 3mm thick laminated sheet.

(b) Point wiring with 1.0 mm^2 copper PVC insulated-wire with 1.0 mm^2 copper PVC insulated wire for earth continuity in PVC casing capping having double locking arrangement with grooves, trunking of as per ISI for plug with tissiono type shock proof 3 pin socket & switch 5 Amp. Erected & polish wooden block covered with 3 mm thick laminated sheet.

(c) Mains with ISI marked copper conductor PVC insulated wire in PVC casing capping erected with copper conductor PVC insulated wire for earth continuing of following size 2 wire 1.5mm^2, 2 wire 2.5mm^2.

(d) 240V MCB Double pole switch. 6 to 32 Amp. With enclosure –
(e) Steel meter box with shutter and locking arrangement

07. Completion certificate and test report must be submitted after the end of the works or during the execution as per requirement of the O.O.W.

The electrification work carried out should be provided with necessary Test Report, the cost of testing is to be borne by the agency.
The items to be supplied and used for the electrification work should be got approved from the engineer in charge. All electrical supplies, fittings, fixing of electrification work shall be got approved from engineer in charge and the whole work is to be carried out and completed under his supervision and instructions, as well.

MEDIUM VOLTAGE DISTRIBUTION SYSTEM
(INTERNAL LIGHTING & POWER WIRING)

01. GENERAL
Medium voltage distribution system shall be applicable for wiring 3 phase, 4 wire 440 Volts, 50 HZ. A.C. supply & single phase, 2 wire 240 Volts, 50 HZ. A. C. supply.

02. REGULATIONS & STANDARDS
The system shall be governed by the requirements of 1S:732: I.E. rules, & lEE regulations.
I.S. standard & codes applicable for medium voltage distribution is also listed in standardspecification.

03. PVC CASING CAPPING & ACCESSORIES
The thickness of PVC conduits consild shall be as follows as per IS-14927 Part-I 200140 mm dia. 1.5 mm

32 mm dia.	1.5 mm
25 mm dia.	1.5 mm
20 mm dia.	1.5 mm
15 mm dia.	1.5 mm

04. WIRING CONDUCTORS
All wiring conductors shall be PVC insulated, standard copper conductors of 650 V/1100V grade. Wiring conductors shall be confirmed in all respects to IS: 694.

The current rating for wiring conductors shall be based on the following parameters

(a) Ambient temperature 40° C.
(b) Conductor temperature 70° C.

Wiring conductors shall be supplied in red, black, yellow, blue colors for easy identification of wires. The wiring conductors shall be supplied in sealed coils of 100 m. length. The wiring conductor shall bear manufacturer's trade mark name, ISI mark, voltage grade etc.

Wiring for power, lighting circuit's, television systems shall be carried out in separate and distinct wiring system.

The wiring system envisaged will be generally shown on the layout drawings and linediagrams, however, a brief account of the general wiring system is given below :-

(a) SUBMAINS WIRING
Wiring from switch board to the individual distribution board.

(b) CIRCUIT WIRING
Wiring from DBs to the points control boxes for lighting, fans, SA socket etc. and from DBs to the power sockets in the case of power wiring.

The sub-main wiring shall be single phase 2 wire system. Each sub-main wiring circuit shall als0 have its own copper earth continuity wire. The number & size of copper earth continuity wire shall be as per the detailed drawings and Standard specification.

Circuit wiring shall generally be of single phase system. However a maximum of 3 to 4 single phase circuits belonging to the same phase/pole could be installed in the same conduit or race-way. Each circuit wiring shall be provided with suitable copper earth continuity conductor as per standard specification No. ADF-150-85. Not more than eight light points/fan points shall be grouped on one lighting circuits. The load per circuit shall not exceed 800 watts. The minimum size of conductor for wiring of lighting circuits shall not be less than 1.5 mm in case of copper conductor. Power wiring shall not have than one sockets connected to one circuit. AII the wiring shall be carried out in looping in-loop system. .

The maximum number of various size conductors that could be drawn into various sizes of conduits shall be as per table II of IS: 732. The wiring shall be color coded for easy identification of phases and neutral. The following color code shall be adopted.

Phase R Red
Y Yellow / White
B Blue

Neutral Black
Earth Green

The circuit wiring may be separately measured or included in point wiring as per the nomenclature specified in BOQ.

05. SWITCHES, SOCKETS & ACCESSORIES

GENERAL REQUIREMENTS

Light control switches shall be 5A rating for controlling up to four light points and 15A rating for more than four light points. Light control switches shall be of piano key type design suitable for flush mounting for general lighting. Wherever specifically called for tumbles type switches shall be used for surface mounting. Light control shall have either integral mounting plates or white PVC/Perspex plates as specified / approved.

All sockets 6A & 16A ratings shall be flush mounting type with control switches of piano key type design of the same rating as that of the sockets. All sockets outlets shall be of 5 pin type. The base of the socket shall be of high quality porcelain with pins made of brass. Sockets shall be provided with PVC surface plates with round comers and beveled edges. All the sockets shall be provided with plug tops of approved quality and design.

LAMP HOLDERS, CEILING ROSES ETC.

Accessories for, light outlets such as lamp holders, ceiling roses etc. shall be in conformity with requirements of specifications. Only approved make of accessories shall be supplied.

INSTALLATION OF SWITCHES, SOCKET & ACCESSORIES

All the switches shall be wired on phase. Connections shall be made only after testing the wires for continuity, cross phase etc. with the help of meter. Switches, sockets, fan regulator etc. shall be housed in proper approved. Teakwood / PVC / metal box with PVC / Perspex sheet plates. Regulators shall be fixed on adjustable MS flat straps inside the enclosure. The arrangement of switches and sockets shall be neat and systematic. Covers for enclosures accommodating switches, sockets, etc. (Point control boxes) shall be of 3 mm thick, fine finished PVC / Perspex materials and fixed to the enclosure in plumb with counter-sunk head, chromium plated brass screws. Outlets shall be terminated into a ceiling rose for fan points and into auto way porcelain or bakelite connector for ceiling light points. For wall plug sockets, the conductors may be terminated directly into the switches and sockets. The outlets, points control boxes etc. shall be set out as shown on the drg. Before fixing these, the contractor shall obtain clearance from the O.O.W. with regard to their proper location. The enclosures of sockets and 3rd pin of the sockets shall be connected to the ground through a proper size earth continuity wires as laid out in standard specification.

06. LUMINAIRES

6.1 GENERAL

The MCBs shall be rated for 9 KA fault level in each circuit The MCBs shall be checked & coordinated with the down-stream MCBs for proper operation.ELCB Mains for each Quarter/flat.

07. POINT WIRING

Point wiring shall commence from the first point control box / local control box for the points connected to the same circuit. Point wiring for, lights, fans, 5A -15A sockets etc. shall be carried out with copper conductor PVC insulated wires of 1.0 & 1.5 Sq.m. cross section as per

BOQ. The points wiring shall be inclusive of 40m / 32mm / 25mm / 20mm PVC casing capping of standard and approved make (As specified hereinbefore) along with approved quality accessories such as bends, reducers, junction boxes, etc. together with wiring accessories such as ceiling roses, lamp holder, connector, points control boxes (enclosure for electrical accessories) etc. Points wiring shall be provided with 1.0mm copper conduit PVC insulated earth continuity wire for earthing 3rd pin of sockets, luminaries and fan fixtures. Light Control shall be either single, twin or multiple points controlled by a switch as specified.

08. TESTING & ELECTRICAL INSTALLATION

Testing and installation shall be as per IS: 7362-1963.

(a) The insulation resistance shall be measured by applying between earth and the whole system of conductors or any section thereof with all fuses in places and alai switches closed and except in earthen concentric wiring all lamps in position or both poles of the installation otherwise electrically connected together, where a direct current pressure of not less than twice the working pressure, provided that it need not exceed 500 Volts for medium voltage circuits. Where the supply is derived from the three wires (A.C. or D.C.) or a poly phase system, the neutral pole of which is connected to earth direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the outer or phase conductor and the neutral.

(b) The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuits provided, that the whole installation shall be required to have an insulation resistance greater than one megahm.

(c) Control rheostats, heating and power appliances and electric signs may, if required, be disconnected from the circuit during the test, but in event the insulation resistance between the case of frame work and all live parts of each rheostat appliance and sign shall not be less than that specified in the relevant Indian standard specification or where there is no such specification shall not be less than half a mega ohm.

(d) The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and the entire conductor connected to the middle wire or the neutral or to the other pole or phase conductor of the supply and its value shall not be less than specified in sub clause (b).

(e) On completion of an electric installation (or an extension to an installation) a certificate shall be furnished by the Contractor countersigned by the qualified supervisor under whose direct supervision the installation was carried out. The certificate shall be in the prescribed form as required by the local electric supply authorities. One such recommended from is given in Appendix.

TESTING OF EARTH CONTINUITY PATH

The earth continuity conductor including metal conduits and metallic envelopes of all cases shall be tested for electric continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or leakage circuit - breaker measured from the connection with the earth electrodes to any point in the earth continuity conductor in the completed installation shall not exceed one mega ohm.

TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCHES.

(a) In two wires installation a test shall be made to verify that all non linked single pole switches have been fitted in the same conductor throughout and such conductor shall be labeled or marked for connection to an outer one phase conductor or to be the nonearthed conductor of the supply.

(b) In a three wire or four wire installation a test shall be made to verify that every non linked signal switch is fitted in a conductor which is labeled and marked for connection to one of the outer phase conductor of the supply.

09. CERTIFICATE OF INSPECTION

The contractor shall be responsible for getting the installation inspected and approved by the Electrical Inspector and other local electric supply authorities concerned, for getting the electric supply at the earliest.

The contractor shall obtain and deliver to the owners the certificate of final inspection and approved by the local electrical authorities concerned. The inspection fees etc. shall be paid by the, Contractor. In case any defects are pointed out by the Electrical Inspector the contractor shall remove these defects at his own cost, and arrange for re inspection by the Electrical Inspector till such time the installation is finally approved and the required certificate is issued. The contractor shall bear all expenses and deposit the necessary fees for the second and subsequent inspections by the Electrical Inspector.

10. ADDITIONAL SPECIFICATION AND CONDITIONS

The contractor shall keep himself in touch with the building work and shall adjust his work accordingly so as to minimize breaking of masonry / concrete. No claim whatsoever on account of delay due to building work shall be entertained.

Any damage done to the building during the reaction of the work shall be made good by the contractor, free of charge to the satisfaction of the Engineer-In-charge. On his failure to do so the same will be made good at his risk and cost through another agency.

11. EARTHING WORK FOR EACH BUILDING :

Supplying & erecting funnel type earthing having earth plate of following size burrid in specifically prepared earth pit 3 mtr. Below ground with 40 kg. charcol and salt with alternate layers of charcol & salt, 20mm dia. G.I. pipe with Funnel with a wire mesh for watering & bricks masonry block, C.I. cover complete as per para 7.3 of IS 3043 with necessary length of double G.I. / copper earth wire No. 6 SWG bolted with lug to the plate and covered in 12mm dia. G.I. pipe 2.5 mtr. long complete connected to the nearest switch gear with end socket as per direction & duly tested by earth tester confirming to ISS (As per drawing) with following specification.

CRC Pipe Fixing:

Providing and laying M S steel pipe (CRC Pipe) size 75 mm x 25 mm fixing vertical front elevation portion with brushing red oxide primer and synthetic enamel colour approved quality, leveling, plumbing etc. complete as per the instructions of engineer incharge.

Deputy Executive Engineer
Rajkot Municipal Corporation

Addl. City Engineer
Rajkot Municipal Corporation

Signature of Contractor