

**MINISTRY OF HEALTH & FAMILY WELFARE,
GOVT. OF INDIA, NEW DELHI
(Department of AYUSH)**

Tender (Second Call)

For

Design, Supply, Installation, Testing & Commissioning of Sewage Treatment Plant (STP) and Effluent Treatment Plant (ETP) including Civil and other associated works in the existing All India Institute of Ayurveda Campus for Deptt of AYUSH at Sarita Vihar, New Delhi

Volume-IV

TECHNICAL SPECIFICATIONS

December'2013



**HSCC (INDIA) LTD.
(CONSULTANTS & ENGINEERS FOR MEGA HOSPITALS & LABORATORIES)
E-6(A), sector-1, NOIDA(U.P) 201301 (India)**

Phone : 0120-2542436-40

Fax : 0120-2542447

Tender No. HSCC/AIIA/STP/2013

TECHNICAL SPECIFICATIONS

1.0 SEWAGE TREATMENT PLANT

1.0 GENERAL

Package type Effluent treatment plant followed by filtration is to be set up on turnkey basis. The system should be fully automatic with level control, compact, odor free, and shall consume low power. The raw sewage will be generated from different sources such as kitchen, lab Sinks, toilet of Hospital and Residential campus etc. The treated waste water will be used for gardening, toilet flushing etc. The detailed scope of work and specification are mentioned in subsequent paragraphs.

This is a performance based contract with the contractor's guarantee for output of the effluent at specified parameter for a continuous running plant for minimum period of one year.

Contractor must include all and required equipment accessories, piping, control and monitoring equipment to ensures that the offer is for a fully operational plant.

The main elements of the plant, media tank sizes, pumps, piping and all allied equipment and accessories must be of capacities to meet the performance requirement of the plant.

Any shortcoming or failure in the plant to provide the desired results will be considered as a failure on part of the contractor to supply and install the system according to the contract requirement. Contractor may replace or rectify any part of the system or equipment so that the system operates to special performance criteria.

The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work. No extra charge made in consequence of any misunderstanding, incorrect information on any of these points or on ground of insufficient description will be allowed.

Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the HSCC. Any materials declared defective by HSCC/Client shall be removed from the site within 48 hours.

On award of the work contractor shall submit a test procedure for the entire system to enable the Engineer-in-Charge to monitor installation and testing of the plant as the work proceeds.

Tests shall be performed in the presence of the Engineer-in-Charge/ Consultant.

2.0 PROCESS DESCRIPTION

The raw sewage and effluent of the hospital and residential campus will be diverted from existing sewerage system to the raw effluent sump and pump house which will have a Bar screen and Oil and Grease trap. The Bar Screen has narrow slits that capture the material , Oil and Grease trap will trap the oil from the sewage/effluent and further the waste water pass through to the next sage of treatment. The sump is connected to the equalization tank. Raw Effluent/ waste water transfer

pumps are provided for pumping the Effluent from the equalization tank to the aeration chamber through fine screens placed in the screen channel/chamber and primary treatment unit.

Primary treatment for the specific lab. effluent with appropriate dosing system required for treating the lab. raw effluent before discharging into the secondary treatment stage.

From equalization sump the sewage will be pumped to Bio-reactor through submersible pumps. Diffused air will be passed through Air Blower to dissolve organic matter. The biodegraded water will be sent to tube settler by gravity. The digested sludge settles down in tube settler from where the sludge will be pumped to Filter Press. The clear water will be pumped to Dual Media Filter from where it will be stored in treated water tank. Treated water will be used for gardening and other purposes above.

2.1 Equalization Tank

The incoming sewage/Lab/Hospital waste will be collected in equalizing tanks. The tank shall be of RCC and raw sewage will be aerated with coarse bubble diffusers. The liquid will be transferred to the FAB units for further treatment. Treated ETP effluent shall meet the DPCC norms and may or may not be added in the STP Equalization tank as per site condition

2.2 Aeration Tanks FAB (MBBR)

The main ETP comprising of a fluidized Aerobic Bio-reactor FAB (in set of two compartments run as series streams) comprising RCC tanks provided with inlet controls, launders, baffle walls and chequered plate platform with MS railing all-round at top and a ladders at convenient locations. The units will have required quantity of HDPE media. The reactors will be aerated as specified below.

2.3 Aeration

Following units will be aerated with air supplied from common air blowers

Equalization Tank with coarse bubble diffusers

FAB Treatment Units with fine bubble diffusers

Sludge holding tanks with coarse bubble diffusers

The aeration will be done by air blowers of required capacity to be based on contractor's design and kept in pump house as indicated on the tender drawing.

2.4 Settling Tanks

Aerated sludge in FAB units will be settled in tube settlers using PVC tubes media. Settled sludge will be transferred to the sludge holding tank for further disposal.

2.5 Effluent & disinfection Contact tank

The clarified effluent from the unit will be transferred to an Effluent & Chlorine Contact tank. The incoming effluent shall be disinfected by non-toxic mixed oxidant solution and will have a contact period as specified.

2.6 Tertiary Treatment of effluent

The chlorinated/oxidant effluent will be filtered in pressure filter using multi grade sand gravel filter media and **Activated carbon filter** and final treated effluent will be collected in final effluent RCC tank.

The final effluent will then be pumped to the point of re-use for horticultural operation and use in flushing, gardening as directed by the Engineer-in Charge.

Excess flow, if any from the STP shall be disposed off by pumping into the natural or municipal drainage system as directed by the Engineer-in Charge.

2.7 Sludge Holding Tank

Sludge from the settling tanks shall be transferred to a sludge holding tank. The tank will be aerated by means of coarse air bubble diffusers system for thickening and disposal through pumps. (The sludge holding tank shall be constructed in RCC).

2.8 Excess sludge disposal

Excess sludge from the sludge holding tank will be pumped and further treated in centrifuge to increase its consistency in order to produce cakes to be used as soil conditioner as per the directions of the Engineer-in-Charge.

3.0 RAW WATER SEWAGE CHARACTERISTIC

Tentative raw sewage characteristics are mentioned below, however the actual characteristic may vary widely as per site conditions. The bidders are requested to make their judgment for design of system.

Average daily flow: as per BOQ

pH	:	5.5 to 8.5
BOD (mg/l)	:	150-350
COD (mg/l)	:	250-600
Suspended solid (mg/l)	:	200-400
Oil & grease (mg/l)	:	20-30

4.0 TREATED WATER CHARACTERISTIC

General characteristics of treated water will be as below or as per pollution control board norms

BOD	:	Less than 10 mg/l
COD	:	Less than 50 mg/l
Suspended Solid	:	Less than 10 mg/l
Oil & grease	:	Less than 5 mg/l
pH	:	6.5 -7.5
Bio-assay test	:	Survival of fish after 96 hrs 100 %

5.0 SCOPE OF WORK FOR SEWAGE TREATMENT

The scope of work includes planning, designing, detailed engineering, supply, erection, commissioning and testing of complete Effluent treatment Plant on lump sum turnkey basis. Scope of Work would include but not necessarily limited to the following:-

Planning and designing of the package type sewage treatment plant of capacity as stated in BOQ as per latest standards laid down by Government of India, State Govt. or Statutory Local Bodies.

Preparation & Submission of detailed design, working drawings for Civil/ Structural Work, hydraulic flow diagram, GA drawings, plumbing, electrical, mechanical work etc. Structure design must be earthquake resistant.

Execution, erection, commissioning and testing of all Civil, plumbing, electrical, mechanical works etc.

Any other allied work required for the functioning of the treatment plant conforming to the Statutory Acts, Rules, Standards etc.

The contractor shall submit and obtain the approval of the following from the HSCC (Consultants), and where required from the concerned statutory local bodies such as Pollution Control Board etc.:

Process design calculation and hydraulic flow chart

b) Equipment layout and its related specifications and makes

Design calculations and construction drawings for all Civil/Plumbing Electrical/Mechanical works.

d) Detailed GA drawings

Vendor data sheet / drawings for all equipment.

f) As built drawings

g) Operational manuals for the entire plant and equipments.

Laboratories testing facilities for testing raw and treated sewage by setting up laboratory at site.

Operation & Maintenance of ETP including the consumables for 12 months after completion of commissioning & trial run period and training of Hospital Staff for running and maintenance of Plant as per BOQ item.

Site development i.e. area grading, peripheral road, drain, lighting along ETP, individual unit lighting, railing, fencing, horticulture etc.

Getting approval from State Pollution Board for the sewage treatment plant and to confirm that the treated effluent is within standard limits for recalculation to Horticulture/ toilet flushing/ disposal into existing sewerage system.

6.0 COMPONENTS OF ETP (20KLD)

Major components of ETP/STP will be as below:

A. Civil Works (As per BOQ)

- | | | | |
|----|---|---|-----------------|
| 1. | Covered with chequered plate Screen chamber RCC | : | As per drawing. |
| 2. | Equalization tank RCC | : | 1 No. |
| 3. | Bio reactor RCC | : | 2 Nos. |
| 4. | Tube Settler | : | 1 no. |

5. Treated water tank RCC : 1 No.
6. Foundation and shed for different equipment : As per drawing
7. Connecting last Manhole to STP : As per site condition
8. Laboratory cum office of suitable size : 1 no.
9. Sludge Sump : 1 No.

B. ELECTRO MECHANICAL EQUIPMENT (As per BOQ)

1. Removable screen and flow regulating box in SS : As per drawing
2. Submersible type sewage transfer pump with level controller
In SS : 2 Nos.
3. Floating media : 1 lot
4. Air blower with motor (2workig +1standby) : 3 Nos.
5. Sludge lifting pump (2 nos.) : 1 set
6. Non-toxic mixed oxidant dosing tank with electronic metering type : 2 set
7. Filter feed pump (1working+1stand by) : 1 set
8. Dual Media filter : 1 No.
9. Activated Carbon filter : 1 No.
10. pump for treated water supply
(1 working + 1 standby) : 1 set
11. Filter Press : 1 No.
12. Interconnecting pipeline / valves & fittings in
13. Electric panel powder coated cables etc.
14. Flow measuring devices, water level controllers, pressure gauge etc.
15. Laboratory equipment for measuring as per BOQ : 1 Set
16. Mixed oxidant generation system : 1 set

Note: Any other work not specifically mentioned but subsequently required for efficient and successful running and commissioning of the STP and associated work shall be done by contractor at no additional cost.

Further, The raw effluent of ETP will be collected from Lab. OT/treatment area of Ayush Sarita Vihar Hospital. Accordingly the Agency has to access the various parameter of the raw effluent. The ETP has to be planned and design in such a way that it has a capacity to treat such a wide spectrum effluent. Tender drawings are indicating type only. The non-metallic pipe and fittings such as cPVC, HDPE will be used in most of the part.

GENERAL SPECIFICATION

7.1 CIVIL WORKS

All water containing structure should be designed by latest IS: 3370 and other relevant codes of practice.

- b) All the internal and external faces of such structures shall be plastered with water proofing compound. In the internal faces grouting shall have to done as per requirement before plastering.

Rubber water bars to be suitably used in construction joints.

- d) All water structure will be RCC covered and shall be designed to take load of ETP equipment etc. Agency has to make its own assessments for connecting last manhole but it will not be more than 100M

7.2 MECHANICAL

7.2.1 GENERAL

- a) All mechanical equipment shall be suitable for continuous and heavy duty operation.
- b) Equipments shall be supported in a manner to eliminate undue stresses, vibration and noise.
- c) All equipment shall be corrosion protected by approved type of epoxy paint.
- d) Bearings used shall be self lubricating non-corrosive type with easy access for inspection and maintenance.
- e) All materials shall be of the best and new quality conforming to specifications and subject to the approval of Engineer-in-Charge.
- f) All equipment shall be of the best available make manufactured by reputed firms.
- g) All equipment shall be installed on suitable foundations, true to level and in a neat workmanlike manner.
- h) Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.
- i) Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.
- j) All piping, valves and accessories for the entire Plant shall be of material fully resistant to internal and external corrosion using stainless steel grade 316 or CPVC piping and valves or other types of material recommended by the equipment manufacturer and accepted by the HSCC Engineer-in-Charge.
- k) **Main STP Unit (FAB Reactor)**
 - i) The main FAB units shall be constructed in RCC and provided with launders, baffle plates, inlet, outlet and all other connections necessary as required. The units will also include a MS deck at top with railing and ladder and supports for the air distribution piping diffusers, and all other accessories.

- ii) The deck of units shall be provided with a 1.2 m wide structural platform using chequered plates for flooring, provided with 25 mm dia. pipe railing and vertical supports to railing not exceeding 1.8 m spacing on the top for access and inspection on all four sides of the unit.
- iii) The units will also be provided with a 1 m wide access ladder at suitable locations fabricated with MS tubular sections

7.2.2 SEWAGE PUMPS

- a) Sewage pumps shall be Non clog fully submersible type of SS body suitable for handling raw sewage with solids up to 40 mm size.
- b) Pumps shall operate with high water level in sump and stop at low water level by means of an electronic level controller.
- c) **Air Blowers**
 - i) Air blowers shall be of twin lobe type suitable to give constant pressure for aeration in Sewage Treatment Plant and of duties as given in BOQ.
 - ii) It shall be capable of continuous operation.
- d) **Effluent Filters (Sand & Gravel Multigrade Filter)**
 - i) Filter shall be designed in accordance with the code of unfired pressure vessel conforming to I.S. 2825.
 - ii) Filter media shall be as specified by the manufacturer to give the required results.
 - iii) Filters shall be vertical type of required diameter. The shell and dished ends shall be fabricated from M.S. plates conforming to I.S. 2002 Gr.2A suitable to withstand a working pressure given in schedule of quantities. The minimum thickness of shell shall be 6mm and dished ends shall be 8 mm.
 - iv) Each filter shall be provided with screwed or flanged connections for inlet, outlet individual drain connections and all face piping, diaphragm valves and all other connections necessary as required. Face piping shall be CPVC/HDPE of 10kg/sqcm.class. Joints shall be screwed and threaded as and where required. All other joints shall be made with suitable solvent cement.
 - v) All pressure vessels shall be hydraulically tested at manufacturer's works for a minimum pressure of 1.5 times the working pressure.
 - vi) Each pressure filter shall be provided with internal distribution network piping and spray nozzles, collecting nozzles and pipe work as per manufacturer's design. Internal pipes, fittings and the spray nozzle shall be corrosive resistant uPVC, HDPE or ABS plastic.
 - vii) Suitable sampling cocks to draw water samples for raw water and treated water shall be provided.
 - viii) Valves on the face piping shall be PVC/ABC Plastic valves with accompanying flanges, GI nuts and bolts of correct length to suit each valve.

7.2.3 SLUDGE RE-CIRCULATION PUMPS

- a) It shall be horizontal/submersible centrifugal pumps with cast iron body and cast iron open impeller suitable for continuous duty sewage sludge handling. Pump and electric motor shall be connected by a flexible coupling and mounted on a common base plate.

7.2.4 LEVEL CONTROLLERS

- a) Level controllers shall be provided for controlling of operation for various pumps
- b) Level controllers shall be electronic type with PVC sheathed stainless steel probes.
- c) Number and length of probes for each level controller shall be in accordance with the functions to be performed.

7.2.5 FILTER PRESS

Filter press of required size should be CI moulded manual plate type with PP frames, filter cloth for sludge solids separation with water.

7.2.6 TERTIARY TREATMENT

- a) Dual media filter / activated carbon filter should be in MS –epoxy coating provided with multi port valve and PVC/CPVC ISI marked frontal piping and fittings.
- b) Non-toxic mixed oxidant dosing pump should be Electronic metering type of suitable capacity with storage.

7.2.7 PIPING & FITTINGS

- a) All interconnecting pipes and fitting shall be PVC/CPVC heavy class ISI marked.

7.2.8 PAINTING

- a) Steel work shall be sand blasted and applied with one coat primer.
- b) Steel work and equipment in contact with water shall be painted with epoxy paint as per paint manufacturer's recommendation.
- c) Steel work exposed to atmosphere shall be painted with three coats of synthetic enamel paint of approved shade.
- d) **Instruments**
 - i) 100 mm dia gunmetal "Bourdon" pressure gauge with isolation cock and connecting piping for each pump shall be provided.
 - ii) Approved type of flow meter on the plant inlet calibrated in litres/ minute shall be installed.
 - iv) Level switches in equalisation tank shall be provided, which shall be interlocked with sewage forwarding pumps to prevent dry running of pumps during no flow conditions and also to prevent flooding during overflow.

7.2.9 ELECTRICAL

- a) Equipment supplied shall be suitable for 415 Volts, 3 phase, 50 Hz A.C. supply.
- b) Motors shall be for heavy duty TEFC suitable for open out door installation. Motors shall be rated 10-15% above the required H.P.
- c) Each motor shall be provided with a weather proof terminal box.
- d) Connections to all motors shall be made with water-proof flexible connections with suitable bushes and terminal lugs.
- e) Starters for motors shall be fully automatic type with push buttons and shall be Direct on Line for motors upto 5 HP, 5 HP and above shall be automatic Star-Delta.
- f) Motor control centre for the entire plant shall be dust and vermin proof construction (out door duty) fabricated from corrosion resistance M.S. sheet 2mm thick and comprising of:
 - i) One incoming switch fuse unit.
 - ii) Copper bus bar in separate chamber of ample capacity.
 - iii) One isolation switch fuse unit for each motor.
 - iv) One suitable starter of required type for each motor.
 - v) One set ON/OFF indicating lamps for each motor.
 - vi) One voltmeter with selector switch on incoming main.
 - vii) One ampere meter for each motor with selector switch.
 - vii) One single phasing preventor for each motor with provision of cable for termination, glands etc.
 - viii) All interconnecting colour coded wiring within the control centre.
 - ix) Separate energy meter.

Any other devices and accessories necessary and required for a complete working system, if required, may be provided.

- g) Provide all power and control cabling from MCC panel to all motors and controls. Cables shall be 1100 volts grade with copper conductors.
- h) Entire electrical installation shall be earthed in accordance with local electrical rules.

7.2.10 CABLES

- a) Contractor shall provide all power and control cables from the motor control centre to various motors.
- b) Cables shall conform to I.S. 1554 and carry ISI mark.

- c) Wiring cables shall conform to IS: 694.
- d) All power and wiring cables shall be aluminium conductor PVC insulated armoured and PVC sheathed of 1100 volts grade.
- e) All control cables shall be copper conductor PVC insulated armoured and PVC sheathed 1100 volt grade.
- f) All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.
- g) Joints in cables shall not be permissible.

7.2.11 CABLES TRAYS

- a) Contractor shall provide M.S. slotted cables trays at locations as shown on the drawings and/or of sizes as given in the Schedule of Quantities.
- b) Cables trays shall be supported from the bottom of the slab at intervals of 60 cms at both ends by welding support rods with insert plates or to reinforcement bars. Cutting of holes in the slab for exposing of reinforcement bars and making good the same after welding of support rods shall be included in the rate of the tray and no separate payment shall be made on this account.
- c) Cost of clips, bolts, nuts, supports rods and any other materials required to fix the trays in proper manner shall be included in the rate for trays.

7.2.12 EARTHING

All equipment installed by the Contractor shall be suitably earthed by making proper connection by means of G.I. wire strips to the main earthing system laid by the electrical Contractors.

7.2.13 INSTRUMENTATION

- a) Provide 100 mm dia gunmetal "Bourden" pressure gauge with isolation cock and connecting piping for each pump.
- b) Provide approved type of flow meter on the plant inlet / outlet calibrated in litres/minute.

7.2.14 CHEMICAL DOSING

- a) Provide gravity feed drip type chemical dosing tank, piping and valves for pH correction of incoming sewer when required.

8.0 COMMISSIONING AND TESTING

The plant shall be commissioned and tested at peak flow and the test results of the treated sewage verified, checked and recorded as per quality standards during the operation/maintenance period.

- 8.2 After successful commissioning of the plant, the contractor shall conduct performance tests on the equipment to satisfy the engineer that all equipments perform to the rated outputs. Any or all equipment shall be replaced if the same is not working.

9.0 GUARANTEES

- 9.1 On award of the work contractor shall submit a guarantee covering the quality and performance of all material supplied and installed under the contract. This guarantee shall cover each and every material whether manufactured by the contractor or not.
- 9.2 Contractor shall satisfy a suitable procedure to test the rated performance of the equipments and shall provide all necessary equipments, gauges etc. for conducting such tests.
- 9.3 The guarantee shall cover a period of 1 (One) year from the date of expiry of trial run of the plant.

10.0 COMPLETION

On completion of the job, the contractor shall hand over to the Engineer the following

One flow chart drawn in color on thick paper and mounted in a glass frame showing the flow diagram of the process including legend showing valves to be normally open or closed and instruction for operation and maintenance of aerators, diffusers, filters etc. for display near the sewage treatment plant.

Five sets of instruction manuals for operating and maintenance with spare parts list and their manufacturers and/ or suppliers.

- 10.3 Five sets of catalogues and drawings for all equipments supplied.
- 10.4 After commissioning of the plant, contractor shall provide the services of one trained supervisor for period of 2 calendar weeks to train the client's staff in the operation and maintenance of the plant.

11.0 RATE

The rate quoted shall be for the turnkey completion of the job & should include all taxes, design, supply, supervision, erection of mechanical, electrical equipment, processing & ancillary equipments, piping, electrical cable, civil, plumbing works etc. involved in the above described operations & any other cost associated with the works not mentioned above but required to be installed/carried out for the successful operation, commissioning and approval of the sewage Treatment plant and its associated works.

All mechanical parts will be replaced and not repaired during Defect liability period of 12 months from the date of completion of trial run.

The firm will include all items, equipments etc in the quoted rate whether mentioned or not for successful completion, operation of plant and approval of Local/State Pollution Board.

The battery limit of the plant under head Effluent treatment Plant will be from screen chamber to treated effluent. Tank with all connecting piping, electrical work, equipment, Civil, Mechanical work, building with R.C.C. roof, housing, office, laboratory, air blowers, pumps etc. are to be built without any extra cost.

Note: Any other work not specifically mentioned but subsequently required for efficient and successful running and commissioning of the ETP and associated work shall be done by contractor at no additional cost. The work under head Operation & maintenance cost, Sewerage and Drainage and water supply (flushing system and horticulture) will be based on item rate/approved shop drawings.

17.02 APPROVED MAKES FOR SEWAGE TREATMENT PLANT

1.	Air Blower	SWAM/ EVEREST/ KAY
2.	Blower Motor	KIRLOSKAR/ NGEF/ SIEMENS
3.	Submersible Non-Clog Pump	KSB/GRUNDFOS/ ZENIT/ABS
4.	Cable	GLOSTER/ UNIVERSAL/ NATIONAL/ KALINGA
6.	Aeration System	NORTON/ UEM/ V.K.ENVIROTECH/MM AQUA
7.	Sludge Transfer Pump	KSB/ GRUNDFOS/ZENIT/ABS
8.	Butter Fly Valve	AUDCO/ KEYSTONE/ KSB
9.	Control Panel	L & T/ SIEMENS/ ENGLISH ELECTRIC COMPONENTS
10.	Gun Metal Valve	LEADER/ ZOLOTO /ADCO/CASTLE
11.	PVC Pipe Class III With Fitting	FINOLEX/ SUPREME/ PRINCE/ ORIPLAST
12.	G.I. / M.S. Pipe Heavy Class	TATA/ JINDAL(HISSAR)/SAIL /SURYA PRAKASH
13.	Filter/bar screen	THERMAX/IONEXCHANGE/AKAR IMPLEX/GEO MILLER/POLLUCON TECHNOLOGY/FONTUS/Aquaprocess Or equivalent approved make
14.	HDPE Solution Tank	Sintex, Polycon, Prakash, SOSOON
15.	Effluent/ Water Pump	KIRLOSKAR/ STORK/ CROMPTON / JONSON / HITESH/GRUNDFOS
16.	CPVC Pipe	Ajay, ASTRAL,LUBRIZOL, Prince
17.	Dosing pumps	Asian, Toshcom, Grundfos/Aquapro/Dionic/LMI
18.	Filter Press	Sachin/Dinshaw/Pharmatech
19.	Centrifuge	Humboldt/or equivalent approved make
20.	MCCB/Contactor/Relay	L&T/ABB/Siemens
21.	Water proofing chemical	CICO, PIDILITE, CHRYSO, SIKA
22.	Mixed oxidant and disinfection system	Oxibee, I2M technologies, Faith Innovation
23.	HDPE pipe & fittings	Oriplast, So-Soon, Finolex

Note : Wherever makes have not been specified for certain items, the same shall be as per BIS and as per approval of data sheet by HSCC.