

1.

AHMEDABAD MUNICIPAL CORPORATION
(NORTH ZONE)



TENDER DOCUMENT

TENDER DOCUMENT

E-Tender Notice No. 02-(26-27)

E.T.No:- 01

**Name of Project: Construction of Vegetable Market at T.P.No-123/C (Naroda)
F.P.No.- 39 in Thakkarbapanagar Ward of North Zone of AMC (Reinvite)**

Volume -1

PART- A: General Conditions

PART- B: Technical Specification For Civil Work

PART-C: Technical Specification For Electrical Work

Volume -2 Price Bid

Client-

**DY.MUNICIPAL COMMISSIONER
1ST FLOOR RAJIV GANDHI BHAVAN,
NR; MEMCO ROAD
NORTH ZONE
AHMEDABAD MUNICIPAL CORPORATION
AHMEDABAD.**

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1.0 OVERVIEW OF PLUMBING SYSTEM

A GENERAL:

The scope of this section is to describe materials and systems for Plumbing & Drainage installation of building which form together with the project documents, a complete volume of work and quality description.

All Plumbing & Drainage installations shall be of high quality, safe, complete and fully operational including all necessary items and accessories whether or not specified in details. All Plumbing & Drainage works shall be completed in accordance with the regulations and standard to the specification AUTHORITY, the general provisions, special provisions and general requirements apply to all items of this specification.

The work shall be carried out simultaneously with building work, civil work, etc. and shall be continued till it is completed satisfactorily along with the completion of essential portions of the building works.

During the progress of work, completed portion of the building may be occupied and be put to use by AUTHORITY but the contractor will remain fully responsible for the maintenance of Plumbing & Drainage installations till the entire work covered by this contract is satisfactorily completed by him and handed over to AUTHORITY. Decision of DTA/Authority shall be final, on any issue arising out of such discrepancies.

B ACCOMPANIMENT TO TENDER:

The Contractor will attach to the Tender, at the time of submission, a statement containing information on the following points on separate Performa:

List of all the confirmation of materials to be used as per specification along with manufacturer's name, catalogue and other technical details. Any deviation from the specifications shall be separately pointed out.

C INTENT:

It is the intention of the specification and drawings to call for finished work, tested and ready for operation. Whenever the words "Supply" or "Provide" are used, it shall mean delivery of material as specified in an assembled manner, ready for installation. Any apparatus, material or work not shown on drawings but mentioned in the specification or vice versa, or any incidental accessories necessary to make the work complete and perfect in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed by the contractor without additional expenses to AUTHORITY. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work and in the contract.

D INTERPRETATION OF PROJECT DOCUMENTS:

a) The Specification, Drawings, and Bill of quantity shall be interpreted in accordance with good installation practice defined in the appropriate regulations and standards whether specifically referred to or not. If there is any discrepancy or shortfall in the application of the regulations to any aspect of this contract or the contractor considers there is anything detrimental to the standards or inconsistent with his obligations and guarantees, AUTHORITY shall be informed prior to signing the contract and shall thereafter inform the contractor in writing the course to be followed. Where the drawings are to a small scale or are expressed in symbolic terms or are in the form of a diagram , then

exact location of items shall not be inferred and in all cases, the work shall be fully integrated with the work of other trades and with the fabric of the building. The contractor shall appraise the duties of all plants and equipments taking account of any additions or variations and shall inform the AUTHORITY of any matters which may affect the design. In all cases the equipment installed shall be of appropriate rating for the duty it performs.

b) The Specifications and Bill of quantity shall be considered as part of this contract and any work or material shown on BOQ and not called for in the specification or vice versa, shall be executed as if specifically called for in both. The Drawings indicate the extent and general arrangement of the PLUMBING Equipment Layout etc. and are essentially diagrammatic.

The work shall be installed as indicated on the drawings, however, any minor changes found essential to coordinate the installations of this work with other services shall be made. The drawings are for the guidance of the contractor, exact locations, distances and levels will be governed by the building. The contractor shall examine all structural and Plumbing & Drainage drawings before starting the work, and report to AUTHORITY or its representative, any discrepancies which in his opinion appear on them, and get them clarified.

E SCOPE OF WORK :

a) The work to be carried out under this contract comprises of the PLUMBING work for Design Supply Installation Testing and Commissioning of Domestic cold & hot Water Supply & Distribution System, Soil+ waste water collection & disposal, storm water collection & disposal system, Plant equipments like pumps, hydro pneumatic system, Hot water generators, Drinking water system, equipment, Water Treatment plants, etc. for hospital. The work covered under this contract comprises of SITC of the PLUMBING & Drainage System commencing from point of supply & disposal within the project site as per specifications, relevant Indian standards, National Building Code of practice & local regulations.

The contractor shall carry out and complete the said work under this contract in every respect in conformity with the above Standards and with the directions of and to the satisfaction of the D.T.A. and authority. The Contractor shall furnish all labor and install all materials, appliances, equipment (except those items which will be supplied by the Authority to the contractor at site), necessary for complete provision and testing of the whole PLUMBING System.

Design Supply Installation Testing and Commissioning as specified herein and shown on the drawings. This also includes any material, appliances, equipment not specifically mentioned herein or noted on the drawing as being furnished or installed but which are necessary and customary to make complete installation with all outlets for PLUMBING systems shown in the schedule or described herein, properly connected and in working order.

The work shall include all incidental jobs connected with PLUMBING System installation such as excavation for trenches and back filing, cutting/drilling holes through walls/floors and grouting for fixing of fixtures, equipment etc. Chiseling in the wall or principal structure is not permitted. In general, the work to be performed under this contract shall comprise of the following:-

b) PLUMBING System Comprises of :

- i. Design supply erection and commissioning of internal as well as external Water supply & Distribution system including domestic water, hot water & drinking water system with all pumps, hydro pneumatic systems, piping & fittings, valves, treatment units, instruments & gauges with all required accessories

- ii. Design, engineering, supplying of Drainage (Sewage) system including internal & external system with piping, gully chambers, grease traps, sewer traps, pumps (if called for in BOQ) inspection chambers, manholes, etc. complete
- iii. Design, engineering, supplying of Drainage (Storm water) system including internal & external system with piping, catchment pits, manholes, open channels, gratings, drain pumps, percolation wells, etc. complete
- iv. Construction, fabrication, erection, testing, commissioning entire system
- v. Connection to the city sewer/city drain/water source
- vi. Excavation, dewatering, trenching, bedding, refilling, etc. with necessary civil work for laying of water supply / drainage pipe with good practice. RCC hume pipes for all road crossings.
- vii. Collection of sewage, treatment of sewage & ultimate disposal, Storm water collection, percolation, ultimate disposal
- viii. All quantities mentioned in the Bill of quantity are approximate and the contractor shall not be eligible for any claim due to any variation in / or omission of any item.

F ABBREVIATIONS:

The following abbreviations have been used in the accompanying specifications, drawings and Bill of quantity:

SR NO	ABBREVIATION	MEANING
1	SV	Sluice Valve
2	NRV	Non-Return Valve
3	HP	Hydro pneumatic System
4	WTP	Water Treatment Plant
5	R.O.	Reverse Osmosis
6	MH	Man hole Chamber
7	IC	Inspection Chamber
8	GT	Gully Trap
9	DP	Drain Pump
10	AV	Air Vessel
11	ARV	Air Release valve
12	SP	Soil pipe
13	WP	Waste Pipe
14	NT	Nahani Trap
15	FT	Floor Trap
16	CP	Catchment pit
17	WS	Water Supply
18	BV	Ball Valve
19	BFV	Butterfly Valve
20	PG	Pressure Gauge
21	PS	Pressure Switch

G REGULATIONS AND STANDARDS:

The design shall follow guidelines appearing in the following Standards:

IS code	Description
27 – 1992/2002	Specifications for Pig Lead
269- 1989 /2004	Specifications for 33 grade Ordinary Portland Cement
407- 1981 / 2001	Brass tubes for General purposes
456- 2000	Code of practice for Plain & Reinforced concrete.
458- 2003	Specifications for Concrete Pipes.
554- 1999	Dimensions for pipe thread where pressure tight joints are required.
638- 1979 / 2003	Sheet rubber jointing & rubber insertion jointing
651- 1992 / 2003	Specifications for Salt glazed stoneware pipes & fittings.
771 (Pt. I &VII)	Glazed Fire Clay Sanitary Appliances.
771- 1979 / 2003	General requirements
771- 1985 (Pt. II) / 2003	Specific requirements of kitchen & laboratory sinks
771- 1979 (Pt. III/ Sec 1) / 2003	Specific requirements of urinals (section 1- Slab urinals)
771- 1985 (Pt. III/ Sec2) / 2000	Specific requirements of urinals (section 2- Stall urinals)
771- 1979 (Pt. IV) / 2003.	Specific requirements of postmortem slabs.
771- 1979 (Pt. V) / 2003	Specific requirements of shower trays
771- 1979 (Pt. VI) / 2003	Specific requirements of bed pan sinks
771- 1981 (Pt. VII) / 2003	Specific requirements of slop sinks
774- 1984 / 2000	Flushing cistern for water closet and urinals.
775- 1970 / 2000	Cast iron brackets and supports for wash basin and sink.
778- 1984 / 2000	Specifications for copper alloy gate & Globe check valves for water works
779- 1994 / 2004	Water meters (domestic type)
781- 1984 / 2001	Specifications for cast copper alloy screw down bib taps & stop cocks for water services
782- 1978 / 2003	Specification for Caulking lead.
783- 1985 / 2001	Code of practice for laying concrete pipes.
784- 2001 / 2002	Pre-stressed concrete pipes.
1172- 1993/ 2002	Code of basic requirements for water supply, drainage and sanitation
1200-1979 (Pt. 16) / 2002	Method of measurements for Laying of water and sewer lines
1200-1981 (Pt. 19) / 2002	Method of measurements for Water supply, plumbing and drains.
1230	Specifications for CI Rain Water pipes
1239- 2004 (Pt I)	Specifications for Mild steel tubes
1239- 1992 (Pt. II) / 2002	Specifications for Mild steel Tubular & other wrought steel pipe fittings
1300- 1994 / 2000	Phenolic moulding material specification

1536- 2001	Specifications for Centrifugally cast iron (spun) pressure pipes for water, gas, sewage
1537- 1976 / 2000	Specifications for Vertically cast iron pressure pipes for water, gas and sewage
1538- 1993 / 1999	Cast iron fittings for pressure pipes for water, gas and sewage
1700- 1973 / 2003	Drinking fountains
1701- 1960 / 2003	Combination valve , mixing valves
1703- 2000	Ball valve (horizontal plunger type) including floats for water supply.
1711- 1984 / 2000	Self-closing taps.
1726- 1991 / 2003	Cast iron manhole covers and Frames.
1729- 2002	Cast /ductile iron drainage pipes & fittings for over ground NP pipeline S/S series.
1742- 1983 / 2002	Code of practice for building drainage
1795- 1982 / 2000	Pillar taps for water supply purposes
1879	Malleable Cast Iron Pipe Fittings
1978- 1982/2002	Specification for line pipe (M S Seamless)
1979- 1985 / 2002	Specification for high test line pipe
2065- 1983 / 2001	Code of practice for water supply in buildings.
2097 - 1983 / 2000	Specification for foam making branch pipe.
2104- 1981 / 2003	Water meter boxes (domestic type)
2326- 1987 / 2003	Automatic flushing cistern for urinals
2373	Specification for Water Meter (Bulk type)
2379- 1990 / 2000	Colour code for identification of pipe lines.
2401- 1973 /2003	Code of practice for selection, installation & maintenance of domestic water meters
2470 (Pt. I to II)	Code of practice for installation of septic tanks
2470- 1985 (Pt. I) / 2001	Design criteria & construction
2470- 1985 (Pt. II) / 2001	Secondary Treatment & disposal of septic tank effluent
2527- 1984 / 2000	Code of practice for fixing rain water gutters and down pipes for roof drainage.
2548- 1996(Pt. I) / 2002	Plastic water closet seats and covers.
2548- 1996(Pt. II) / 2002	Plastic water closet seats and covers.
2556 (Pt. 1 to XV)	Specification for Vitreous (Vitreous China) sanitary appliances.
2556- 1994 (Pt.1) / 2004	General requirements
2556- 2004 (Pt. 4)	Specific requirements of wash basins
2556- 1994 (Pt.5) / 2004	Specific requirements of laboratory sinks
2556- 1995(Pt.6) / 2003	Specific requirements of urinals & partition plate
2556- 1995 (Pt.7) / 2003	Specific requirements of accessories for sanitary appliances
2800- 1991 (Pt. I)	Construction of tube well
2800- 1979 (Pt. II)	Testing of tube well
2951- 1965 (Pt. I) / 2003	Head loss in straight pipes due to frictional resistance
2951- 1965 (Pt. II) / 2003	Head loss in valves & fittings.
3006- 1979 / 2003	Specification for Chemically resistant glazed S.W. pipes

	and Fitting
3076- 1985 / 2003	Low density polyethylene pipes for potable water supply
3114- 1994 / 2004	Code of practice for laying of Cast Iron pipes.
3486- 1966 / 2000	Specification for Cast iron spigot and socket drain pipes
3589- 2001	Specifications for steel pipes for water & sewage (168.3 to 2540 mm outside dia.)
3597- 1998	Method of test for concrete pipes.
3950- 1979 / 2003	Specification for Surface boxes for sluice valve.
3989- 1984 / 2000	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings & accessories
4038- 1986 / 2000	Foot valves for water works purposes.
4111- 1985 (Pt. II) / 2001	Flushing tanks
4111- 1985 (Pt. III) / 2001	Inverted syphon
4736- 1986 / 2001	Specification for hot –dip zinc coating on mild steel tubes.
4984- 1995 / 2002	Specifications for HDPE pipes for water supply
4985- 2000	Specifications for unplasticised PVC pipes for potable water supplies
5312 (Pt. I)	Swing check type reflux (non return) valves
5312- 1984 (Pt. I)/ 2000	Reflux (non return) valves – single door pattern
5382- 1985 / 2003	Specifications for rubber sealing rings for water, gas & sewer mains
5455- 1969 / 2003	Cast iron steps for manholes
5600- 2002	Specifications for Sewage and drainage pumps
5611- 1987 / 2002	Code of Practice for waste stabilization ponds (Facultative type)
5822- 1994 / 2004	Code of Practice for laying of welded steel pipes for water supply
5961- 1970 / 2003	Specifications for Cast Iron grating for drainage purposes
6295- 1986 / 2001	COP for water supply & drainage in high altitude & / or sub-zero region
6392- 1971 /1998	Steel pipe flanges
6411- 1985 / 2000	Specifications for gel coated glass fiber reinforced polyester resin bath tubs
6418- 1971/2000	Cast Iron & malleable flanges for general Engg. Purpose
6494- 1988 / 2000	COP for water proofing of underground water tanks & swimming pools
6587- 1987 / 2003	Specifications for Spun hemp yarn
7181- 1986 / 2000	Horizontally Cast Iron Double Flanged pipe for water, gas & sewage.
7231- 1994 / 2004	Specifications for Plastic Flushing Cisterns for w.c.& urinals
7558- 1974 / 2001	Code of Practice for domestic hot water installations
7634 (Pt. I to III)	Code of Practice for Plastic pipe work for potable water supplies
7634- 1975 (Pt. II) / 2002	Laying & jointing polyethylene (PE) pipes
7634- 2003 (Pt. III)	Laying & jointing unplasticised PVC pipes

7740- 1985 / 2001	Code of Practice for road gullies
8727- 1978 / 2000	Specifications for vitreous enameled steel kitchen sinks
8835- 1978 / 1999	Guideline for planning and design of surface drains.
8931- 1993 / 2003 p	Specifications for copper alloys Fancy single taps, combination tap
9338- 1984 / 2000	Specifications for Cast Iron screw down stop valves and stop & check
9739- 1981/ 2003	Specifications for Pressure reducing valves for Domestic water supply system.
9758- 1981 /2003	Flush valves and Fittings for water closets and urinals
9762- 1994 / 2004	Specifications for polyethylene floats for float valves
10500- 1991 / 2003	Specification of Drinking water
12231 - 1987 / 2003	UPVC pipes for section & delivery lines of agricultural pumps–Specification.
12235 - 1986 / 1998	Method of test for UPVC pipe for potable water supply
12288 - 1987 / 2002	Code of practice for use and laying of Ductile Iron pipes.
12469 - 1988 / 2002	Specifications for pumps
12592- 2002	Precast concrete frame & cover (SFRC frame & cover)
12701-1996 / 2002	Specifications for rotational moulded polyethylene water storage tanks
12820 - 1989 / 1999	Dimensional Requirements of Rubber Gaskets for Mechanical Joints & push in joints for use with CI pipe & fittings for carrying water, gas, sewage
13095 - 1991 / 2003	Butterfly valves for general purposes
13114 - 1991 / 2003	Spn. For forged brass gate, globe & check valves for water works purposes
13382-2004	Cast Iron specials for mechanical & push-on flexible joints for pressure pipeline for water, gas & sewage
13592- 1992 / 2002	Specifications for PVC soil, waste & rain water (SWR) including ventilation pipes
13593 - 1992 / 2002	UPVC pipes fittings for use with section and delivery lines for agriculture pumps
13983-1994 / 2004	Specifications for stainless steel kitchen sinks & drain boards for domestic purpose
14333-1996 / 2001	Specification for HDPE pipes for sewerage system.
14735-1999 / 2004	UPVC injection moulded fittings for UPVC – SWR pipes – Specifications.
14845- 2000 / 2004	Resilient seated cast iron air relief valves for water works purposes – Spn
14846- 2000	Specifications for sluice valve for water works purposes (50 to 1200 mm size)
15328 – 2003	15328 – 2003 -- UPVC non-pressure pipes for use in underground drainage and sewerage system spec.
15450- 2004	Polyethylene/Aluminium/Polyethylene composite pressure pipes for hot & cold water supply

Codes for Motors, Cabling, wiring and accessories shall be as per relevant Indian / international codes and standards.

H UTILITY SUPPLY:

The location of receipt of incoming utilities supply (Hook up Points) like LT power supply, It is the responsibility of the contractor to co-ordinate with various utility agencies, the exact location of such Hook up Point and mode of connection. Further the contractor shall co-ordinate with such utility agencies to provide necessary drawings, documents, get their approval.

I ACTUAL ROUTE OF PIPING:

The location of the pumps, tanks, water supply & distribution piping, drinking water tap, soil & waste water piping, storm water piping, etc. are indicative only, therefore, the actual route of piping and the location may differ from the plans according to the details of the building construction and the conditions of executions of the installations.

The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of ref. piping that are found necessary during the work, to the complete satisfaction of the authority's representative.

J MATERIAL AND EQUIPMENT:

All material and equipment shall conform to the relevant standards and shall be of the approved make and design. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all the materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the AUTHORITY within 10 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical detail giving sizes, particulars of materials and the manufacturer's name and shall be submitted along with the tender or bid offer. At the time of the submission of proposed substitute the Contractor shall state the credit, if any due to the authority. In the event the substitution is approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from AUTHORITY. AUTHORITY's decision in the matter shall be final.

All materials of the same kind of service shall be identical and made by the same manufacturers. Any deviation to this rule shall be approved by the D.T.A.. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

Make of plumbing & drainage equipments, components, accessories, etc. has been mentioned in order of priorities. The Contractor has to quote for the first priority as mentioned above after ascertaining that the first preference materials are available. If at a later stage during executing the work, material of the first preference make are not available, the contractor has to get approval from the AUTHORITY to use other make of material prior to procurement.

K MANUFACTURERS :

Where manufacturers have furnished specific instructions relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

When interfacing occurs, equipment shall be mutually compatible in all respects.

L RATING:

Rating of all items shall be appropriate for the conditions on the particular site on which the items will be used. All the equipment shall be fit for continuous work under the worst conditions of site and shall be rated for the following ambient condition.

- ◆ Outdoor temperature 45 deg. cel.
- ◆ Temperature under shed 40 deg. cel.
- ◆ Salty, dusty and humid

M INSPECTION AND TESTING:

AUTHORITY'S representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times during manufacture of items for this contract. Tests on site of completed works shall demonstrate, among other things:

- a. That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.
- b. That all items operate efficiently and quietly to meet the specified requirements.
- c. That all the features performed at its best and loading _unloading of the system.
- d. That all the accessories used in low side work are of specified make only. And any deviation in the same needs written approval from our D.T.A..

The contractor shall provide all necessary instruments and labor for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the AUTHORITY and shall provide test certificates signed by a properly authorized person. Such test certificates shall cover all works.

The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

N TEST CERTIFICATES:

The contractor shall submit test certificates for all the High side PLUMBING system installed. These shall be issued by DTA in charge certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications, ISI and when ISI is not applicable other approved certifying agencies.

O INSTRUCTION MANUAL:

The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and maintenance of the supplied equipment and installations, and submit 3 sets to AUTHORITY, at the time of handing over.

P SAMPLES AND CATALOGUES:

Before ordering the material necessary for these installations, the contractor shall submit to AUTHORITY for approval, a sample of every kind of material such as valve, pipe, etc., along with the catalogues.

For big items such as pumps, hydro pneumatic systems, panels, WTP, hot water generator, the submission of catalogues shall be enough. Prior to ordering any plumbing & drainage equipment/material/system, the contractor shall submit to AUTHORITY, the catalogues, along with the samples, at least from three different manufacturers. After the selection of manufacturer by AUTHORITY, the contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the AUTHORITY.

Q CONTRACTOR AND SHOP DRAWINGS:

The contractor shall prepare and submit to AUTHORITY, for his approval, Six sets of Contractor detailed drawings of PLUMBING Plant Room Equipments, Water Piping & drainage Route Proposed, and equipment to be fabricated by the contractor, or other Contractor within 10 days of signing of the contract.

Before starting the work, the contractor shall submit to AUTHORITY for his approval in the prescribed manner, the shop/execution drawings for the entire installation, specially the main connections and junctions, the route of water & drainage piping, and any other information required by AUTHORITY. AUTHORITY reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they do not offer the most satisfactory performance or accessibility for maintenance.

R AS BUILT DRAWINGS:

At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to AUTHORITY, three sets of layout drawing drawn at appropriate scale indicating the complete wiring system "as installed". These drawings must provide (in plan, folded elevation and section)

- a. Location and specification details of all Plumbing Pumps, WTP, hydro pneumatic system
- b. Location of all water piping routes and Valve Locations.
- c. Route and particulars of soil + waste piping & other components.
- d. Route and particulars of storm water piping & other components.
- e. All Kitchen and Toilet drainage system
- f. Basement drainage System
- g. GA Drawing of all major PLUMBING Equipment

S SAFETY OF MATERIALS:

The contractor shall provide proper and adequate, storage facilities to protect all the materials and equipment including those issued by AUTHORITY against damage from any cause whatsoever.

T COMPLETION CERTIFICATE:

On completion of the PLUMBING SITC (or an extension to an installation) a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local supply authority. The contractor shall be responsible for getting the Plumbing & Drainage installation inspected and approved by the local concerned authorities.

U SITE ENGINEER AND TRAINING :

The contractor shall employ a competent fully licensed qualified, full time Civil engineer to direct the work of PLUMBING & DRAINAGE installation in accordance with the drawings and specifications. The engineer shall be available all times at site to receive instructions from AUTHORITY, in the day to day activities throughout the duration of contract. The engineer shall correlate the progress of the work in conjunction with all the relevant requirements of the supply authority. The engineer coordinates with DTA for any coordination site issues.

Contractor shall give training to technical staff of authority for Operating, Control and Basic maintenance for easy operation.

V RESTATING & FINISHING OF CIVIL DAMAGES:

For erection of equipment / Piping etc., if any civil structure is required to be broken, the same shall be done, restated and finished as original by the Contractor.

1.1 EXTENT OF WORK

The scope includes design, supply , inspection & testing at manufacturer's works, delivery to site, unloading & storage at site, Supply , installation, testing and Commissioning at site, final painting and handing over to authority the complete Plumbing & Drainage work to be carried out at the site.

The scope of work includes the following:-

- a. Plumbing & Drainage System Comprises of:
 - i. SITC of Water supply & distribution (cold & drinking) system including, external water piping, valves with valve chambers, tank dewatering piping systems
 - ii. SITC of Internal plumbing (cold) system with risers within the building, air vents, internal plumbing piping, insulation, CP fittings.
 - iii. SITC of external sewage collection & disposal system with pipe, manhole, inspection chamber, Gully traps.
 - iv. SITC of internal waste & soil water drainage with down takes, vent, vent cowls, floor traps, Nahani traps.
 - v. SITC of external storm water collection & disposal system with pipe/channel, catchment pits, grating.
 - vi. SITC of internal roof / terrace water drainage with down takes, channels, basement drainage system with pumps, etc. complete.
 - vii. SITC of RCC Hume pipe for services at road crossing & sleeves for building ceiling, wall
 - viii. SITC of necessary instruments like meters, indicators, gauges, switches, etc. & bellows
 - ix. SITC of required electrical starters, cable, wiring, junction boxes, cable trays, trench, earthing, etc. complete for the plumbing & drainage equipments
 - x. Excavation, dewatering, bedding, trenching, backfilling, removal of surplus soil, necessary civil work to lay the water & drainage piping
 - xi. Core cutting of floors for suspended plumbing.
 - xii. Sewage Treatment Plants & Percolation wells (if called for in BOQ) (As per BOQ)
 - xiii. SITC of Necessary foundation, supports, thrust blocks, hangers, anchors, etc. required for equipments, valves & piping
 - xiv. Connection of site sewage & storm water network with the existing city sewer & drain with necessary chamber, pipe & special required at the single/multiple points (As per BOQ)
 - xv. All civil work, equipment, piping, accessories, etc. required for complete erection of Plumbing & Drainage system. (As per BOQ)
 - xvi. Painting of the equipments, structures, supports, piping, etc.

- xvii. Providing all documents, shop drawings, foundation & installation detail, catalogues, O & M manuals.
- xviii. As built Drawings.

2.0 GENERAL TECHNICAL SPECIFICATION FOR PLUMBING WORK

2.1. General:

A. The work shall be carried out in the accordance with the drawings and design as would be issued to the Contractor by the D.T.A. duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications etc. not bearing D.T.A. signature and stamp. Similarly the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Authority's Representative in writing.

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

C. 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.

D. 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.

E. 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.

F. 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 Authority's Representative for approval by the D.T.A.s in order to conform to the contract schedule.

G. MEASUREMENTS:

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

2.2. Applicable codes and standards:

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

Plumbing Works:

Vitreous Chinaware	-	IS: 2556 - 1994 (Part - I)
	-	IS: 2556 - 2004 (Part - II)
	-	IS: 2556 - 2004 (Part - III)
Ball Valve	-	IS: 1703 - 2000
Cistern Brackets	-	IS: 775 - 1970
Toilet Seat Cover	-	IS: 2548 - 1996

Vitreous China Cistern	-	IS: 2326 - 1987
Sand Cast Iron Pipes and Fittings	-	IS: 1729 - 2002
Spun Cast Iron Pipes and Fittings	-	IS: 3989 - 1984
GI Pipes	-	IS: 1239 - 2004
Galvanizing for GI Pipes	-	IS: 4736 - 1986
Pipe Threads	-	IS: 554 - 1999
Malleable Iron Fittings	-	IS: 1879 - 2010
Cast Iron Sluice Valves	-	IS: 780 - 1984
Full Way Valves	-	IS: 778 - 1984
Brass Ferrule	-	IS: 2692 - 1989
Stone Ware Gully Trap	-	IS: 651 - 2007
RCC Pipes	-	IS: 458 - 2003
Cast Iron Class LA Pipes	-	IS: 1536 - 2001
Cast (Spun) Iron Fittings	-	IS: 1538 - 1993
Pig Lead	-	IS: 782 - 1978
Induction Motors	-	IS: 4691
Code for Measurements	-	IS: 1200
UPVC Pipes and Fittings	-	IS: 4984
Specification for Caulking Lead	-	IS: 782
Code of Practice for laying of concrete	-	IS: 783

2.3. Quality assurance and quality control:

A. 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.

B. 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 Authority'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.

C. The Authority'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.

D. The test shall be conducted at Standard Laboratory selected by Authority's Representative. Contractor shall keep the necessary testing equipment such as hydraulic testing machine, smoke testing machine, gauges and other necessary equipment required.

E. The Authority's Representative shall transport the samples to the laboratory.

F. Testing charges shall be borne by the Authority's Representative.

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

2.4. Sanitary fixtures &c.p. fittings:

2.4.1 Scope

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

B. The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.4.2 General Requirements

A. 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.

B. 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.

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

D. All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights shown on the drawings & in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions.

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

F. All fitting shall be of the chromium plated materials.

G. 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.

H. 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.

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

2.4.3 European W.C.

A. European W.C. of glazed vitreous china shall be wash down, single or double symphonic type, floor or wall mounted set, flushed by means of flush valve 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.

B. 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.

C. Flush valves shall be of the best approved quality procurable with C.P. control valve and C.P. flush pipe.

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

E. Alternatively if flushing cistern to be used shall conform to the requirements of IS: 774-2004. 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 D.T.A./Authority. The cisterns shall be mosquito proof & shall fulfil the requirements of the local Authority.

F. The levels of the WC should be checked by placing spirit level on the W.C. W.C. should be tested on completion of fixing by putting small paper balls and flushing out. If all the paper balls are not flushed out. The fixing will have to be rectified / re-aligned.

2.4.4 Kitchen / Pantry Sinks

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

B. 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 Authority's Representative.

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

2.4.5 Wash Basins

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

B. 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.

C. 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.

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

2.4.6 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.

2.4.7 Urinals

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

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

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

- a) G.I. Pipes
- b) Rigid PVC/High density polyethylene.
- c) Waste pipes may be exposed on wall or concealed in chase as directed by the Authority's Representative.

2.4.8 Bath Tub

Bath tub & panel shall be white enameled cast iron or pressed steel as specified in the Bill of Quantities of guaranteed quality and specifications.

Each bath tub shall be provided with 40mm dia CP brass waste with 32mm C.P. brass overflow, 40mm dia cast brass overflow-cum-waste trap with pop-up waste assembly.

Bath tub shall be provided with four Nos. C.P. brass concealed stop cocks, bath spout and overhead shower or as specified in the Bill of Quantities.

Bath tubs shall be fixed true to level firmly fixed to another or supports provided by the manufacturer. Edges touching the wall shall be slightly recessed in the wall finishing so as ensuring water tightness. The fixing shall be perfectly done so that the wall behind does not tend to get damp or patchy.

Contractor shall during the entire period of installation and afterwards protect the bathtub by providing suitable cover or any other protection so as to absolutely prevent any damage to the bathtub until handing over.

2.5. Water supply:

2.5.1 Scope

A. Work under this section consists of furnishing all labour, materials equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereinafter and given in the bill of quantities.

B. The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

C. Without restricting to the generality of the foregoing, the water supply system shall include the following:-

- a. Pipe protection & painting.
- b. Connections to all plumbing fixtures, tanks, pump etc.
- c. Providing hot water pipe lines and supply point with isolation valves, wherever required.
- d. Control valves, masonry chambers and other appurtenances.
- e. Connections to all plumbing fixtures, tanks and appliances.

- f. Excavation and refilling of pipe trenches, wherever necessary.
- g. Internal galvanized water supply piping inside the toilets shaft/plant room/terrace.
- h. Testing all line and fixtures as specified.

2.5.2 General Requirements:

- A. All materials shall be new of the best quality and shall be furnished, delivered, erected, connected and finished in every detail conforming to specifications and subject to the approval of Authority's Representative.
- B. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- C. Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.
- D. As far as possible all bends shall be formed by means of hydraulic pipe bending machine for pipes up to 65mm dia.
- E. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc. and shall be selected and arranged so as to fit properly into the allocated building space.
- F. Pipes shall be securely fixed to walls by suitable clamps at intervals specified.
- G. Valves and other appurtenances shall be located to provide easy accessibility for operation, maintenance and repairs.
- H. Connection between dissimilar materials.
- I. All G.I. pipes jointing shall be with white lead and spun yarn.
- J. Drawings illustrating block out and penetration of pipes in the wall/floor/slab.
- K. UNIONS:

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

2.5.3 INTERNAL WORKS

A. Materials:

a. G.I. PIPES

- i. The pipes shall be galvanised mild steel threaded pipes conforming to the requirement of IS: 1239 Part-I for heavy grade upto 150mm dia and IS: 3589 for pipes above 150mm dia. They shall be of the dia (nominal bore) specified in the description of the item. Galvanising shall conform to IS: 4736.
- ii. The pipes shall be clearly finished, well galvanised in and out and free from cracks, surface flow,

laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with axis of the tube.

iii. All screw tubes shall have pipe threads conforming to the requirements of IS: 544-1955 (or revised).

b. G.I. Fittings

i. All fittings shall be conforming to IS: 1239 Part II (or as revised). All fittings shall have manufacturer's trade mark stamped on it. Fittings in G.I. pipe lines shall include elbows, tees, bends, reducers, nipples, union, G.I. Clamps / Steel structural supports of approved design, nuts, bolts, washers, etc. All fittings shall be tested at manufacturer's works. Contractors may be required to produce certificate to this effect from the manufacturers.

ii. The fittings shall have screw threads at the ends conforming to the requirements of IS: 544-1955 (or revised). Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.

c. Cutting and jointing:

i. The pipes and fittings shall be inspected at site before use to ascertain that they conform the specification given in para no. 5.3.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filled out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 544-1955 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in water tight joint.

ii. The screw threads of pipes and fittings shall be protected from damage until they are fitted.

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

B. Installation of G.I.:

Tender drawings indicate schematically the size and location of pipes. The Contractor on the award of the work, shall prepare detailed coordinated with other trades working drawings, showing the cross-section, longitudinal sections, details of fittings, locations of isolating and control valves, drain valves and all pipe support, structural supports. He must keep in view the specific openings in buildings and other structures through which pipes are designed to pass.

i. Piping shall be properly supported on or suspended from connection clamps, hangers as specified and as required. Install pipes in a manner to avoid strain on equipments connections. The Contractor shall adequately design all the brackets, saddles, anchors, clamps and hangers, and be responsible for their structural sufficiency.

ii. Pipe supports shall be of steel, adjustable for height and primer coated with rust preventive paint

and finish coated back. Where pipe and clamps are of dissimilar materials a dielectric fitting shall be provided in between. Spacing of pipe supports shall not exceed the following:

Pipe Size	Spacing between Supports
Upto 12 mm	1.5 meter
15 to 25 mm	2.0 meter
32 to 150 mm	2.0 meter
150 mm and over	2.5 meter

iii. Vertical risers shall be parallel to walls and column lines and shall be straight and plumb. Risers passing from floor to floor shall be supported at each floor by clamps or collars steel structural supports attached to pipe and with a 15 mm thick rubber pad or any resilient material. Where pipes pass through the terrace floor, suitable flashing shall be provided to prevent water leakage. Risers shall have a suitable clean out at the loNORTH point and air vent at the highest point.

iv. Pipe sleeves, 50 mm larger diameter than pipes, and 50mm above F.F.L. Shall be provided wherever pipes pass through walls and slabs, and annular space filled with fire proof materials like putty, fire seal etc.

v. All pipe work shall be carried out in workmen like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation also coordinated with other Contractors work so that particular area work shall be carried out in one stretch.

vi. Cut outs in the floor slab for installing the various pipes are indicated in the drawings. Contractor shall carefully examine the cut outs provided and clearly point out wherever the cut outs shown in the drawings, do not meet with the requirements.

vii. The Contractor shall make sure that the clamps, steel structural supports, brackets, clamp saddles and hangers provided for pipe supports are adequate. Piping layout shall take due care for expansion and contraction in pipes, and include expansion joints where required.

viii. All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reducers shall be used for the piping to drain freely. In other locations, concentric reducers may be used.

ix. All buried pipes shall be cleaned and coated with zinc chromate primer and bitumen paint, then wrapped with bitumen faced hesian.

x. In case the pipe is embedded in walls or floors, it should be painted with two coats of anti-corrosive bitumastic paint of approved quality, covered with one layer of fiberglass tissue and finally painted with one coat of bitumen paint. The pipe should not come in contact with cement mortar or cement concrete as the pipe will be affected by cement. Under the floors, the pipes shall be laid in layer of filling under concrete floors.

xi. For pipes 15mm to 25mm dia, the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick work or concrete. However, for bigger dimension pipes the holes shall be carefully made of the smallest size as directed by the Authority's Representative. After fixing the pipes the holes shall be made good with cement mortar 1:3 (1 cement: 3 coarse sand) properly finished to match the adjacent surface.

xii. All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipes shall be painted to standard colour code/or as specified by the Authority's Representative.

xiii. Springing or forcing pipe into place will not be permitted. Protect piping at all times from dirt and moisture. During storage at construction site, keep end plugged to prevent dirt and moisture entering.

xiv. Carefully grade all pipes to eliminate traps and pockets. Where air pockets or water traps can not be avoided provide means of drainage with valved hose connection for water traps and valved automatic air vents for air pockets.

xv. Below grade piping shall be installed in such a manner that it does not appear directly on ground.

xvi. Any location where pipes/valves through or closed to basement walls shall be protected from direct contact of concrete block.

xvii. Pipes passing through building walls shall be protect by cast iron sleeves large enough to permit changes size eccentric fittings shall be used except where branch pipes connect into mains and in domestic system.

C. 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. 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.

D. Painting:

The pipes shall be finally provided with synthetic enamel paint of approved quality for exposed pipes after the Hydrostatic test pressure.

E. Measurements:

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include G.I. pipe and G.I. 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.

2.5.4 External works:

A. Materials:

a. G.I. PIPES

- i. The pipes shall be galvanised mild steel threaded pipes conforming to the requirement of IS: 1239 Part-I for heavy grade upto 150mm dia and IS: 3589 for pipes above 150mm dia. They shall be of the dia (nominal bore) specified in the description of the item. Galvanising shall conform to IS: 4736.
- ii. The pipes shall be clearly finished, well galvanised in and out and free from cracks, surface flow, laminations and other defects. All screw threads shall be clean and well cut. The ends shall be cut cleanly and square with axis of the tube.
- iii. All screw tubes shall have pipe threads conforming to the requirements of IS: 544-1955 (or revised).

b. G.I. FITTINGS

- i. All fittings shall be conforming to IS: 1239 Part II (or as revised). All fittings shall have manufacturer's trade mark stamped on it. Fittings in G.I. pipe lines shall include elbows, tees, bends, reducers, nipples, union, G.I. Clamps / Steel structural supports of approved design, nuts, bolts, washers, etc. All fittings shall be tested at manufacturer's works. Contractors may be required to produce certificate to this effect from the manufacturers.
- ii. The fittings shall have screw threads at the ends conforming to the requirements of IS: 544-1955 (or revised). Female threads on fittings shall be parallel and male threads (except on running nipples and collars of unions) shall be tapered.
- iii. Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks, or check valves and on straight runs as necessary at appropriate locations as required and/or directed by Authority's Representative.

c. CUTTING AND JOINTING:

- i) The pipes and fittings shall be inspected at site before use to ascertain that they conform the specification given in para no. 5.4.1.1 above. The defective pipes shall be rejected. Where the pipes have to be cut or re-threaded, the ends shall be carefully filled out so that no obstruction to bore is offered. The end of the pipes shall then be threaded conforming to the requirements of IS: 544-1955 with pipe dies and taps carefully in such a manner as will not result in slackness of joints when the two pieces are screwed together. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack, as the later procedure may not result in water tight joint.
- ii) The screw threads of pipes and fittings shall be protected from damage until they are fitted.
- iii) The pipes shall be cleaned and cleared of all foreign matter before being laid. In jointing the pipes, the inside of the socket and the screwed end of the pipes shall be oiled and rubbed over with white lead and a few turns of spun yarn wrapped round the screwed end of the pipe. The end shall then be screwed in the socket. Care should be taken that all pipes and fitting are properly jointed so as to make the joints completely water tight and pipes are kept at all times free dust and dirt during the fixing. Burr from the joint shall be removed after laying. The open ends of the pipes shall be temporarily plugged to prevent access of water, solid or any other foreign matter.

d. INSTALLATION:

- i) **Trenches :**

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

Dia of pipe	Width of trench	Depth of trench
15 mm to 50 mm	30 cm	60 cm
65 mm to 150 mm	45 cm	75 cm

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

If the trench bottom is extremely hard and rocky or loose stony soil, the trench shall be excavated at least 150mm below the trench grade. Rocks, Stone or other hard substances from the bottom of the trench brought back the required grade by filling with selected fine earth or sand and compacted so as to provide smooth bedding for the pipe. When excavation required blasting operation, it shall be ensured that no pipes have be stacked in the vicinity and completed pipe in the vicinity has already been covered before starting of blasting operations; this is necessary to prevent damage to the exposed pipe in the vicinity by falling stone as result of blasting.

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

Roots of tree within distance of about 0.5 meter from the side of the pipe line shall be removed or killed.

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

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

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

properly. If required by the Authority's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

ii) **Pipe Protection:**

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

Coat of hot bitumen R 85/25

- a) Wrapping of fiberglass tissue.
- b) Coat of hot bitumen R 85/25 over fiberglass tissue.

The pipes shall be laid on a layer of 7.5 cm sand and filled upto 15 cm above the pipes. The remaining portion of the trench shall then be filled with excavated earth. The surplus earth shall be disposed off as directed.

iii) **Jointing :**

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

iv) **Thrust Blocks :**

Thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on every one meter and all bends as directed by the Authority's Representative.

e. **TESTING:**

- i. All external water supply pipes shall be tested by hydrostatic pressure of 1.5 times the working pressure or 10 Kg/Sq.cm whichever is more.
- ii. Pressure shall be maintained for a period of at least 180 minutes without any drop in the pressure after fixing at site.
- iii. In addition to the sectional testing carried out during the construction. Contractor shall test the entire installation after connections to the hydro pneumatic system or pumping system. He shall rectify all leakages, and shall replace all defective materials in the system. Any damage done due to careless will has to be replaced by the Contractor.
- iv. The initial back fill shall be placed evenly in a layer of about 100mm thick. This shall be properly consolidated and this shall be continued till there is a cushion of at least 300mm of cover over the pipe.
- v. The joint or coupling during the testing of mains shall be left exposed for inspection before cover-up, sufficient back fill shall be placed on the pipe to resist the movement due to pressure while testing.

f. **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 Authority'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.

g. MEASUREMENTS:

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

All C.I. class (LA) pipes below ground level shall be measured per linear meter (to the nearest cm) and shall be inclusive of all fittings e.g. tees, elbows, bends, deduction for valves shall be made. The portion of the pipe within the collar at the joints shall not be included in the length of the pipe work. It shall be inclusive of all fittings, excavation, back filling of surplus earth including consolidation and compaction of earth.

2.5.5 CPVC Pipes & Fittings:

The pipes and fittings chemically known as Chlorinated Poly Vinyl Chloride [CPVC] shall be produced in Copper Tube Size [CTS] from ½" to 2" with two different standard dimensional ratios – SDR 11 and 13.5. The fittings shall be produced as per SDR 11. All the CPVC pipes and fittings in SDR 11 and SDR 13.5 shall be made from the identical CPVC compound having the same physical properties. Pipes and fitting shall be produced as per SDR 11 & shall meet the requirement of ASTM D 2846 where as the pipes produced with SDR 13.5 shall meet the requirement derived from ASTM F 442, specific to CPVC in Iron Pipe Size[IPS] dimension, which also shall be applied to CPVC pipes in Copper Tube Size[CTS] dimension.

iv) Cutting and jointing and installation of CPVC pipes & fittings:

a. Cutting:

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

b. Deburring / Beveling:

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

c. Fitting preparation:

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

d. Solvent cements application:

Use only CPVC cement or an all – purpose cement conforming to ASTM -493 or joint failure may result. When making a joint, apply a heavy, even coat of cement to the pipe end. Use the same applicator without additional cement to apply a thin coat inside the fitting socket. Too much cement can cause clogged water ways.

e. Assembly:

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

f. Set and cure times:

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

g. Cementing:

- Verify the cement is the same as the pipes and fittings being used.

- Check the temperature where the cementing will take place.

- Cement takes longer time to set up in cold weather. Be sure to allow extra time for curing. Do not try to speed up the cure by artificial means – this could cause porosity and blisters in the cement film.

- Solvents evaporate faster in warm weather. Work quickly to avoid the cement setting up before the joint is assembled. Keep the cement as cool as possible. Try to stay out of direct sunlight.

- Keep the lid on cements, cleaner and primers when not in use. Evaporation of the solvent will affect the cement.

- Stir or shake cement before using.

- Use ¾" dauber on small diameter pipes, 1 ½" dauber up through 3" pipe, and a natural bristle brush, swab or roller ½ the pipe diameter on pipes 4" and up.

- Do not mix cleaner or primer with cement.

- Do not use thickened or lumpy cement. It should be like the consistency of syrup or honey.

- Do not handle joints immediately after assembly.

- Do not allow dauber to dry out.

- Maximum temperature allowable for CPVC pipe is 180o F.

- All colored cements, primers and cleaners will have a permanent stain. There is no known cleaning agent.

- Use according to the step outline in ASTM D – 2846, joining of pipe and fittings.

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

vi) Measurements

The length above ground shall be measured in running meter correct to a cm for the finished work, which shall include pipe and fittings such as bends, tees, elbows, reducers, crosses, plugs, sockets, nipples and nuts, unions etc... Deductions for length of valves shall be made. It 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.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.5.6 Valves:

A. Butterfly valves:

All the isolation valve 50cm and above on the equipment and water lines, where specified or shown on drawings shall be wafer type butterfly valves. They shall be designed to fit without gaskets, the water tight seal being obtained by EPDM seat projection at the faces compressed between the flanges. The valves shall be supplied inclusive of M.S. pipe flanges and high tensile steel bolts of dimensions recommended by suppliers of valves.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

The valves shall comply with following specifications:

- | | |
|-------------------------|---|
| a) Test Pressure | : Body 24 Bar, Seat 16 Bar |
| b) Valve Component | : Material of Construction |
| i) Body | : Cast Iron, Gr. FG 260, IS:210 |
| ii) Disc | : Nylon or Epoxy powder coated high duty iron, Gr, FG 260 |
| iii) Stem | : Stainless Steel or carbon steel IS: 1570, Part-II. |
| iv) Seat | : EPDM |
| v) Hand Lever | : Cast Iron (Mechanical Memory Stop) |
| vi) Bearings and pivot. | : PTFE or Nylon covered S.S. bush bearings at stem |
| vii) Primary Seal | : Reinforced PTFE slide bearings |
| viii) Temperature | : 80 Degree C (max.) |

B. Installation:

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

Packing and gasket shall not contain asbestos.

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

Valve above 150mm diameter shall be self-locking worm gear type water proof and proctor lubricated.

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

C. Non return valves:

All non-return valves shall be provided as shown in the drawings conforming to relevant Indian Standards and in accordance with the following specifications.

Size	Construction	Ends
Up to 50 mm.	Gun metal	Screwed
65 mm and above	Gun metal/cast iron	flanged

Non-return valves shall be of approved make. Flap type non-return valve shall be used and tested to 15 Kg. / Sq.cm. pressure.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

D. Ball valves (float valve):

The ball valve shall be of high pressure class and shall be confirm to IS: 1703 of sizes as specified. The nominal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball shall be of brass or gun metal as specified and the float shall be of polythene sheet. The minimum gauge of copper sheet used for making the float shall be 0.45mm for float upto 115mm dia and 0.55mm for float exceeding 115mm dia and shall be special in shape. The valve shall be constructed to permit replacing without console of the valve body from the valve line and the system shall not blow out under pressure. The jointing of the float shall be made by efficiently burnished, lapped and soldered seam or by bracing. Plastic float may also be used if specified. The body of ball valve when assembled in working conditions with the float immersed to not more than half of its volume shall remain closed against a test pressure of 10.5 Kg/Sq.cm. All ball valves shall be capable of withstanding a pressure of 14 Kg/Sq.cm.

The ball valve shall generally conform to IS specifications No. 1703-2000.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item

E. Ball valves:

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

High Pressure:

Indicated by the abbreviation 'HP' for use on mains having pressure. These shall remain closed at a test pressure of 10.5 Kg/Sq.cm.

SL. NO.	NOMINAL SIZE OF BALL VALVE					
	15 mm	20mm	25mm	32mm	40mm	50mm
1. Diameter of spherical float (mm)						
High Pressure	127	152	203	229	254	305
Low Pressure	114	127	178	203	203	254
Minimum weight of ball valve including back nut, body and piston (gms)	283	446	823	1149	1589	1852

The ball valves shall be of following nominal sizes 15mm, 20mm, 25mm, 32mm, 40mm and 50mm. The nominal size shall correspond with the nominal bore of the inlet shanks.

F. Air valves:

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

G. Testing:

All valves shall be tested while installed in pipe by hydrostatic pressure of 1.5 time of the working pressure 10 Kg/Sq.cm whichever is more.

H. Measurements:

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

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.5.7 Chlorination of domestic water lines:

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

b. CHLORINATED SYSTEMS SHALL INCLUDE:

i. Domestic fresh water tanks

ii. Fire water tanks

iii. All pipe work systems receiving suction from the above mentioned tanks apart from the fire systems.

c. Before handover of the system, submit to the DTA

d. copies of the certification of performance and laboratory report (if required)

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

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

2.6. ASTM - PVC Pipes & Fittings

A. Scope:

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

B. Codes & standards:

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

C. Materials

ASTM D 1785 - Specification for Poly Vinyl Chloride (PVC) Plastic Pipes, SCH 40 & SCH 80.

ASTM D 2466 - Socket type Vinyl Chloride Plastic Pipe Fittings SCH 40

ASTM D 2467 - Socket type Vinyl Chloride Plastic Pipe Fittings SCH 80

ASTM D 2564 - Solvent Cement for Plastic Pipes & Fittings

ASTM D 2774 - Underground installation of Thermo plastic Pipes

D. Design

Design of uPVC pipes shall be according to ASTM D-1785 & fittings shall be made according to ASTM D-2467 (for Schedule 80). The pipe shall have socketed solvent welded fittings.

E. Trenching

The width of the trench at the crown of the pipe shall be not less than the outside diameter of pipe plus 300 mm to allow proper compaction of the side fills & at a 225 mm above the crown of the pipe. The trench width shall be as below :

NOMINAL PIPE SIZE (IN MM)	TRENCH WIDTH MIN. (IN MM)	TRENCH WIDTH MAX. (IN MM)
110	450	600
160	450	600
200	600	700
225	600	700
250	600	700
315	700	850
355	750	900
400	800	950
450	850	1000

F. The minimum trench depth shall be width plus outer diameter of pipe or 0.75 Mtr. Above crown of pipe whichever is more.

G. The trench shall be backfilled as soon as possible.

- H. The excavated material shall be deposited at a sufficient distance away from the edge of the trench to avoid damage to the pipes through falling stones & debris.
- I. Pipe shall be laid with a cover, measured from the top of the pipe to the surface of the ground of not less than 1.2 mtr. under roads
- J. The pipe bedding shall be with a granular material & backfilling shall be performed in layer of 6 inch with each layer & shall be sufficiently compacted to 85% to 95% compaction.
- K. A Mechanical compaction shall be carried out for compacting sand & gravel backfill. Optionally manual compaction shall be carried out.
- L. A trench shall be completely filled & backfilling shall be placed & spread in uniform layers to prevent any unfilled spaces or voids. Large rocks, stones, etc. shall be removed. Heavy tampers or rolling equipment shall be used for final backfilling only.

2.6.1 Pipe handling & storage

The pipe shall not be pushed or dragged from the truck bed. Pallets for pipe shall be removed with a fork lift. Loose pipe can be rolled down on timber.

The pipe shall be stored in open ground which shall be dry & free from sharp objects.

The pipe shall be protected from the sun & shall be in area with proper ventilation.

If the pipe shall be stored in racks or it shall be supported throughout its length with the spacing not more than 3 feet.

2.6.2 Laying & jointing

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

NOMINAL PIPE SIZE (MM)	TEMPERATURE IN DEG. C				
	15.5	26.6	37.7	48.8	60
15	4.5 MTR.	4.5 MTR.	4 MTR.	2.5 MTR.	2.5 MTR.

NOMINAL PIPE SIZE (MM)	TEMPERATURE IN DEG. C				
20	5 MTR.	4.5 MTR.	4 MTR.	2.5 MTR.	2.5 MTR.
25	5.5 MTR.	5 MTR.	4.5 MTR.	3 MTR.	2.5 MTR.
32	5.5 MTR.	5.5 MTR.	5 MTR.	3 MTR.	3 MTR.
40	6 MTR.	5.5 MTR.	5 MTR.	3.5 MTR.	3 MTR.
50	6 MTR.	5.5 MTR.	5 MTR.	3.5 MTR.	3 MTR.
63	6.5 MTR.	6 MTR.	5.5 MTR.	4 MTR.	3 MTR.
75	7 MTR.	7 MTR.	6 MTR.	4 MTR.	3.5 MTR.
100	7.5 MTR.	7 MTR.	6.5 MTR.	4.5 MTR.	4 MTR.
150	8.5 MTR.	8 MTR.	7.5 MTR.	5 MTR.	4.5 MTR.

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

Set time :

Temperature	Pipe size	Pipe Size	Pipe Size
Range	15 mm to 32 mm	40 mm to 75 mm	100 & 150 mm
15.5-37.7 deg C	15 minute	30 minute	60 minute
4.4-15.5 deg C	60 minute	120 minute	240 minute

Cure time :

Temperature	Pipe size	Pipe Size	Pipe Size
Range	15 mm to 32 mm	40 mm to 75 mm	100 & 150 mm
15.5-37.7 deg C	6 hrs.	12 hrs.	24 hrs.
4.4-15.5 deg C	12 hrs.	24 hrs.	48 hrs.

J To compensate the expansion & contraction, suitable means shall be provided by expansion loops with 90 deg elbows / bellows subject to the application for the above ground installation

K For underground application, the compensation for expansion & contraction shall be done by anaking the pipe in trench.

2.6.3 Testing

A The pipe shall be tested with water. Before testing, it shall be properly anchored.

B Thrust blocks shall be provided at dead ends, at change in direction & at cahnge in size.

C The piping shall be slowly filled with water with velocity not exceeding 1ft./sec.

D Vents shall be provided at high points & air shall be release before testing.

E All valves & vents shall kept open during testing to release the air.

F The piping shall be tested for 125% of design working pressure for one hour maximum

G During testing, if any joint is leaking, it shall be cut & replaced.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.7. HDPE PIPE & FITTINGS

A. Scope:

This specification covers the requirements for manufacture, supplying, lowering, laying, jointing, testing and commissioning Polypropylene (PE 100) HDPE pipe with fittings, transit, saddles, etc. required for the conveyance & distribution system for above ground as well as below ground installation with required civil work for domestic water application.

C. Codes & standards:

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

D. Excavation of Trenches

Trenches for pipes shall be excavated to lines and levels described and sketched or as otherwise instructed by the DTA.

The Contractor shall dispose of all excavated material off site in approved locations, as soon as it is removed from the trench. It shall not be used for backfilling. Stockpiling of excavated material alongside the trench will not be permitted.

The Contractor shall cut completely through all concrete surfaces and asphalt surfaces prior to commencing trench excavation.

Trenches shall be excavated in lengths of not more than 50 metres. A length shall be at least 2/3 complete before excavation can start on the subsequent length. Portable pedestrian bridges across the open trenches shall be provided at 10m intervals. Trenches shall not be left uncovered overnight. They shall be covered with steel sheets or equivalent.

The Contractor shall include in his price for bracing and strutting where required and shall conform to all relevant local safety requirements.

E. Width of Excavation

The width of excavation in all cases shall be the minimum necessary for the construction works. In addition to the approval in writing by the DTA, the work with any approved length must have been completed satisfactorily by the Contractor before starting work in another section.

F. Collapse and Slides

The Contractor will take care and all the necessary measures to prevent collapse and slides along the trench excavations.

G. Backfilling

Backfill material shall be evenly graded and not include constituents exceeding 50mm or any clay or organic material. All backfill material shall be approved by the DTA.

Backfill will be compacted by distributing and compacting it in horizontal layers with a uniform thickness and thickness of non compacted material not exceeding 300mm. The value of moisture content of the soil shall be checked carefully.

The compaction shall be done by mechanical rollers, compactors, vibrators or other machinery approved and such that provide a dry density not less than 95% of the maximum dry density.

During backfilling, the Contractor shall do the necessary tests under the supervision of the DTA to guarantee the required parameters.

H. Monitoring of Backfill

The Contractor shall monitor the backfill and shall ensure that at all times during, and at the end of the period of maintenance all finished levels are in accordance with those established in the Contract.

I. Reinstatement of Surfaces

All surfaces of roads, driveways and foot-paths, etc., whether public or private that are disturbed during execution of the works, shall be reinstated by the Contractor.

Trenches, channels, drainage ditches, kerbs shall be reinstated to the condition in which they were before execution of the works.

Road surfaces shall be reinstated to at least the previous condition.

J. Dewatering

All excavations shall be kept free of water at all times during the construction of the Works. The Contractor shall carry out all dewatering, groundwater lowering, pumping, temporary drainage, etc., which may be necessary for the purpose of removing water from the excavations.

K. Construction of Pipelines

The Contractor shall provide all skilled and un-skilled labour to complete the installation of all pipelines included under the Contract.

It shall be the Contractor's responsibility to safeguard by means of temporary or permanent support or otherwise all pipes, structures and other items which would be liable to suffer damage as a result of his work, if such precautionary measures were not taken.

Excavation of pipe trenches shall follow the details shown in the designs and drawings. Deviations from the drawings shall be agreed by the DTA and are fully at the Contractor's risk. Deviations will be permitted only with the written consent of the DTA.

Trench bottom must be compacted and levelled.

Trench bottom will be covered by a 150mm layer of granular material (single size 10mm) or sand, which has to be carefully levelled. Pipe-laying and jointing have to follow instructions of the manufacturers of pipes. Pipes shall be properly and completely bedded on the bedding material.

L. Pipe Tests

The applied test pressure shall be 1.6 times the working pressure. The leakage rate shall be restricted to applicable standard.

The Contractor shall provide all necessary labour, materials, water and equipment for the testing.

The Contract shall include for any pressurizing pipe, blank flanges, pressure gauges, etc., required for the purpose of pressure testing all pipe-work. The pressure tests shall be carried out according to DIN 4279, ISO 4427 or other equivalent standard.

The Contractor shall carry out final testing of the equipment and commissioning of all pipelines to the satisfaction of the DTA.

M. Disinfection of Pipelines, Valves and Fittings

The pipelines, valves and fittings will be incorporated in a public water supply, and the Contractor shall be responsible for the thorough cleaning and sterilization of all parts in contact with water in accordance with the requirement of the waterworks department.

N. High Density Polyethylene Pipes

Polyethylene pipes and fittings for water supply services shall comply with the provisions of IS 4984/1995, ISO 4427:1996, DIN 16963, or equivalent

The raw material must also have the following features;

The pipe specifications shall be PE 100 with pressure class of PN 12.5 for 20 mm pipe, PN 10 for 25 & 32 mm size & PN 6 for above 32 mm

Colour of the pipe(the raw material must be dark blue or black with blue stripes, which are internationally recognized as potable water pipe colours and must have UV additives to increase resistance against sunlight.

Dimensions

Normal outside diameters and normal pressures shall be in accordance with the requirements of ISO 161 –1:1996, Part 1, Metric series.

O. Pipe Laying and Jointing

i) Joints

- HDPE pipes shall be joined by butt fusion welding, electro fusion welding compression fittings, flanges or mechanical couplings, as appropriate to the pipe, fittings and location.
- Polyethylene butt fusion joints and fittings for use with cold potable water shall comply with the relevant provisions of ISO 121761:1998.
- Mechanical joint compression fittings for use with cold potable water shall comply with the relevant provisions of ISO 142361:2000.
- Electro-fusion fittings shall comply for use with cold potable water shall comply with the relevant provisions of ISO 121762:2000.

ii) Laying

- HDPE pipes up to DN 125mm can be delivered in rolls. For larger diameter, pipe shall be

delivered in 5/6 m lengths.

iii) Handling

- The Contractor shall ensure that during transport, handling and storage, each item (pipe and fitting) is free from damage prior to installation. Damaged pipes and fittings shall be discarded. The protection of the pipe ends is particularly important. Pipes and fittings should never be dropped to the ground. They should be unloaded from the transport either by hand or using slings and lifting equipment.
- Pipes shall be cut by an approved method which provides a clean square cut of the pipe and lining (if applicable) without damage. All cut or trimmed ends shall be cleaned before the pipes are laid.

iv) Installation of HDPE pipes

- Polyethylene piping shall be laid in accordance with the pipe manufacturer's recommendations and to the approval of the DTA.
- 0.3 m above the crown of the pipes a 150mm wide blue polyethylene marker tape 100mm thick shall be laid along the whole length of all water mains laid. It shall include the wording "caution water-main below" or similar in Turkish. The tape shall incorporate a tracer wire to facilitate tracing of the pipeline route from above finished ground level.
- When placing concrete on HDPE pipeline care should be taken to avoid encasing the pipe completely. A thin membrane, such as bituminised paper, thin roofing felt or polythene film shall be applied between the concrete and the HDPE pipe.
- The Contractor shall forward to the DTA certificates showing that the materials have been tested and comply with the requirements of this Specifications and the relevant Standard.
- The Contractor shall provide, install and maintain temporary protective caps or discs to prevent water, animals or extraneous material entering pipelines during construction. Such caps or discs shall not be removed until the pipes are jointed.
- All buried pipes shall be jointed using electro fusion welding techniques.
- Small diameter pipes (DN<63mm), pipes within structures and pipes connecting to metal fittings shall be jointed using mechanical jointing techniques.

v) Thrust Blocks :

Thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on every one meter and all bends as directed by the Authority's Representative.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.8. INTERNAL DRAINAGE (SOIL, WASTE, VENT AND RAIN WATER PIPES):

2.8.1 Scope:

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

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

i. Cast Iron / UPVC vertical and horizontal soil waste and vent pipes, rainwater pipes and fittings, joints clamps and connections to fixtures.

ii. Floor traps, floor drain clean out plugs, inlet fittings and rainwater roof drain, area/local drains, trench drain...

iii. Waste pipes connections from all fixtures e.g. wash basins, sinks, kitchen equipment.

iv. Testing of all pipes.

v. Connection of main.

B. The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.8.2 General Requirements

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

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

C. 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.

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

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

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

2.8.3 Cast Iron Pipes & Fittings

A. Soil, waste, vent and anti-siphonage pipes shall be cast iron pipes with socket and spigot. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. Pipes shall be centrifugally spun iron soil pipes conforming to sand cast I.S. 1729-1967.

B. Standard weight dimensions and pig lead required for joints shall be as follows:-

For conforming to I.S. 1729-1967 (sand cast iron soil pipes and fittings)

Diameter	Thickness	Overall Weight	Internal diameter	Depth of
----------	-----------	----------------	-------------------	----------

		6'length or 1.83 M	of socket	lead
50	5	11.41	76	25
75	5	16.52	101	25
100	5	21.67	129	25
150	5	31.91	181	32

C. Tolerance

Acceptable tolerance for pipes to I.S. 1729 shall be as follows:-

a) Wall thickness -15%

b) Length ± 20 mm

c) Weight $\pm 10\%$

D. Fittings

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

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

E. Jointing:

All soil, waste and vent pipes including fixture connections between traps and soil pipes shall be jointed with refined pig lead conforming to IS: 27-1977 sufficient sken of jute rope shall be caulked to leave a minimum space for the pig lead as given in 6.3.2 to be poured in. After pouring the lead shall be caulked into the joint with caulking tool and hammer. All surplus lead shall be cut and joint left flush with the rim of the socket neatly.

F. Vent pipes penetration through roof shall be by means of sleeves. The sleeve will be kept 100mm higher the finish roof level and annular space filled with fire proof materials like putty, fire seal etc.

G. Pipe, Hangers, Support, Clamp, Bracke etc.:

All vertical pipes shall be fixed by M.S. Clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl (terminal guard).

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

M.S. clamps shall be of standard design and fabricated from M.S. flat 40mm x 3mm x 3mm thick. They shall be painted with two coats of black bitumen paint before fixing.

Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels, flats, as per detailed drawing or as directed. Contractor shall provide all nuts, bolts, welding and paint the clamps with one coat of red oxide. Wooden saddles shall be provided.

Slotted angle/channel supports on walls shall be provided wherever shown on drawings or as required. Angles/channels shall be fixed to brick walls and bolts embedded in cement concrete blocks

and to RCC walls with suitable anchor fasteners. Holes required in RCC walls shall be neatly drilled by electric drills and no manual chiseling will be allowed. The spacing of supports horizontally shall not exceed 1.8 M.

Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement and for making good with cement concrete 1:2:4 (mix 1 cement :2 coarse sand :4 stone aggregate 20mm nominal size) as directed by the Authority's Representative.

H. Testing:

All pipe work shall be tested before connecting any appliances and then again after connection of appliances. Pipe shall be tested after installation by one of the test given below as directed by the Authority's Representative.

Before use at site, all C.I. soil pipes shall be tested by filling up with water for at least 10 minutes at 3 meter head. After filling, pipes shall be struck with a hammer and inspected for blow holes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours.

Water Test:

Pipes shall be tested after installation by filling up the stack with water. All openings and connections shall be suitable plugged. The total head in the stack shall however not 3 M exceed. The level of water in the stack shall not drop within 8 hours. If there is a drop in level of water the leak shall be detected and rectified and test shall be re-conducted until satisfactory result is achieved.

Smoke Test:

Contractor may test all soil and waste stacks by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlet and outlet connections.

The stack shall then be observed for leakages and all defective pipes and fittings removed or repaired as directed by the Authority's Representative.

I. UPVC pipes and fittings (Rain Water):

The pipes shall be round and shall be supplied in straight lengths with socketed ends. The internal and external surfaces of pipes shall be smooth, clean, and free from grooving and other defects. The ends shall be cleanly cut and square with the axis of the pipe. The pipes shall be designated by external diameter and shall conform to IS: 4985 – 2000.

OUTER DIA. (MM)	PRESSURE (KG/CM ²)	INNER DIA. (MM)	WEIGHT/MT (KG.)
110	4	104.5	1.315
125	4	118.7	1.712
140	4	133.0	2.131
160	4	152.0	2.783
180	4	175.9	3.560
200	2	190.1	4.526
225	4	213.8	5.480

Fittings:

Fittings shall be of the same make as that of pipes, injection moulded and shall conform to Indian Standard.

Laying and Jointing:

The pipes shall be laid and clamped to wooden plugs fixed above the surface of the wall. Alternatively plastic clamps of suitable designs shall be preferred. Provision shall be made for the effect of thermal movement by not gripping or disturbing the pipe at supports between the anchors for suspended pipes. The supports shall allow the repeated movements to take place without abrasion.

Jointing for UPVC pipes shall be made by means of solvent cement for horizontal lines and 'O' rubber ring for vertical line. The type of joint shall be used as per site conditions/direction of the Authority's Representative. Where UPVC pipes are to be used for rain water pipes, the pipe shall be finished with G.I. adopter for insertion in the R.C.C. slab for a water proof joint complete as directed by Authority's Representative.

Supports:

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

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:

All lengths of PVC rain water pipes shall be fully tested for water tightness by means of water test maintained for not less than 30 minutes. All pipes shall be subjected to a test pressure of at least 1.5 meter head of water head. The test pressure shall, however, not exceed 6 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

J. Waste pipe from appliances:

a. Waste pipe from appliances e.g. wash basins, sinks, urinals, chrome plate where seen water coolers shall be of galvanised steel (heavy class) conforming to IS:1239 – 2004.

b. All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:-

	Vertical	Horizontal
G.I. Pipes	300 cms	240 cms
P.V.C. Pipes	180 cms	120 cms

K. Painting

Soil, waste vent and rainwater pipes in exposed location, in shafts and pipe spaces shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two or more coats of synthetic enamel paint to give an even shade.

Paint shall be of approved quality and shade, where directed pipes shall be painted in accordance with approved pipe colour code.

Waste pipes in chase shall be thoroughly cleaned to remove dirt, rust and other contamination, and painted with two coats of bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats of synthetic enamel paint.

C.I. soil and waste pipes below ground and covered in cement concrete shall not be painted.

L. Measurements:

C.I. / CPVC/ G.I. waste/soil, waste, vent and rain water pipes shall be measured over all along the centre line correct to a centimetre including all fittings along its length. The rate for these pipes shall be inclusive of all fittings, holder bat clamps, lead caulked joint for C.I. and cement joints for CPVC and all other items described in the Bill or Quantities. The portion of the pipe within the collar for C.I./CPVC pipe at the joint shall not be included in the length of the pipe work.

2.8.4 SWR CPVC Pipes and fittings:

Soil, waste, vent SWR Low Noise Ring Fit/Solvent pipes with socket and spigot. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects. These pipes conform to EN 1329 and are designed to withstand continuous internal hydraulic pressure of 6 Kgf/cm so as to ensure life-long trouble free working. The pipes are provided with an integral rubber ring type socket at one end while the other end is kept plain, smooth and free from burrs. Rubber ring type socket ends provide easy push – fit type jointing. Simultaneously, allowance for thermal expansion can also be provided during installation. Pipes shall be centrifugally spun iron soil pipes conforming to sand cast I.S. 1729-1967.

A. Fittings:

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

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

B. Jointing:

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

sealing.

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

C. Pipe, Hangers, Support, Clamp, Bracket etc.:

Supports:

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

D. Testing:

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

2.8.5 HDPE PIPE & FITTINGS

A. Scope:

This specification covers the requirements for manufacture, supplying, lowering, laying, jointing, testing and commissioning Polypropylene (PE 100) HDPE pipe with fittings, transit, saddles, etc. required for the conveyance & distribution system for above ground as well as below ground installation with required civil work for domestic water application.

B. Codes & standards:

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

C. Excavation of Trenches

Trenches for pipes shall be excavated to lines and levels described and sketched or as otherwise instructed by the DTA.

The Contractor shall dispose of all excavated material off site in approved locations, as soon as it is removed from the trench. It shall not be used for backfilling. Stockpiling of excavated material alongside the trench will not be permitted.

The Contractor shall cut completely through all concrete surfaces and asphalt surfaces prior to commencing trench excavation.

Trenches shall be excavated in lengths of not more than 50 metres. A length shall be at least 2/3 complete before excavation can start on the subsequent length. Portable pedestrian bridges across the open trenches shall be provided at 10m intervals. Trenches shall not be left uncovered overnight. They shall be covered with steel sheets or equivalent.

The Contractor shall include in his price for bracing and strutting where required and shall conform to all relevant local safety requirements.

vi) Width of Excavation

The width of excavation in all cases shall be the minimum necessary for the construction works. In addition to the approval in writing by the DTA, the work with any approved length must have been completed satisfactorily by the Contractor before starting work in another section.

vii) Collapse and Slides

The Contractor will take care and all the necessary measures to prevent collapse and slides along the trench excavations.

viii) Backfilling

Backfill material shall be evenly graded and not include constituents exceeding 50mm or any clay or organic material. All backfill material shall be approved by the DTA.

Backfill will be compacted by distributing and compacting it in horizontal layers with a uniform thickness and thickness of non compacted material not exceeding 300mm. The value of moisture content of the soil shall be checked carefully.

The compaction shall be done by mechanical rollers, compactors, vibrators or other machinery approved and such that provide a dry density not less than 95% of the maximum dry density.

During backfilling, the Contractor shall do the necessary tests under the supervision of the DTA to guarantee the required parameters.

ix) Monitoring of Backfill

The Contractor shall monitor the backfill and shall ensure that at all times during, and at the end of the period of maintenance all finished levels are in accordance with those established in the Contract.

x) Reinstatement of Surfaces

All surfaces of roads, driveways and foot-paths, etc., whether public or private that are disturbed during execution of the works, shall be reinstated by the Contractor.

Trenches, channels, drainage ditches, kerbs shall be reinstated to the condition in which they were before execution of the works.

Road surfaces shall be reinstated to at least the previous condition.

xi) Dewatering

All excavations shall be kept free of water at all times during the construction of the Works. The Contractor shall carry out all dewatering, groundwater lowering, pumping, temporary drainage, etc., which may be necessary for the purpose of removing water from the excavations.

xii) Construction of Pipelines

The Contractor shall provide all skilled and un-skilled labour to complete the installation of all pipelines included under the Contract.

It shall be the Contractor's responsibility to safeguard by means of temporary or permanent support or otherwise all pipes, structures and other items which would be liable to suffer damage as a result of his work, if such precautionary measures were not taken.

Excavation of pipe trenches shall follow the details shown in the designs and drawings. Deviations from the drawings shall be agreed by the DTA and are fully at the Contractor's risk. Deviations will be permitted only with the written consent of the DTA.

Trench bottom must be compacted and levelled.

Trench bottom will be covered by a 150mm layer of granular material (single size 10mm) or sand, which has to be carefully levelled. Pipe-laying and jointing have to follow instructions of the manufacturers of pipes. Pipes shall be properly and completely bedded on the bedding material.

xiii) Pipe Tests

The applied test pressure shall be 1.6 times the working pressure. The leakage rate shall be restricted to applicable standard.

The Contractor shall provide all necessary labour, materials, water and equipment for the testing.

The Contract shall include for any pressurizing pipe, blank flanges, pressure gauges, etc., required for the purpose of pressure testing all pipe-work. The pressure tests shall be carried out according to DIN 4279, ISO 4427 or other equivalent standard.

The Contractor shall carry out final testing of the equipment and commissioning of all pipelines to the satisfaction of the DTA.

xiv) Disinfection of Pipelines, Valves and Fittings

The pipelines, valves and fittings will be incorporated in a public water supply, and the Contractor shall be responsible for the thorough cleaning and sterilization of all parts in contact with water in accordance with the requirement of the waterworks department.

xv) High Density Polyethylene Pipes

Polyethylene pipes and fittings for water supply services shall comply with the provisions of IS 4984/1995, ISO 4427:1996, DIN 16963, or equivalent

The raw material must also have the following features;

The pipe specifications shall be PE 100 with pressure class of PN 12.5 for 20 mm pipe, PN 10 for 25 & 32 mm size & PN 6 for above 32 mm

Colour of the pipe (the raw material must be dark blue or black with blue stripes, which are internationally recognized as potable water pipe colours and must have UV additives to increase resistance against sunlight.

Dimensions

Normal outside diameters and normal pressures shall be in accordance with the requirements of ISO 161 –1:1996, Part 1, Metric series.

xvi) Pipe Laying and Jointing

xvii) Joints

- HDPE pipes shall be joined by butt fusion welding, electro fusion welding compression fittings, flanges or mechanical couplings, as appropriate to the pipe, fittings and location.
- Polyethylene butt fusion joints and fittings for use with cold potable water shall comply with the relevant provisions of ISO 121761:1998.
- Mechanical joint compression fittings for use with cold potable water shall comply with the relevant provisions of ISO 142361:2000.
- Electro-fusion fittings shall comply for use with cold potable water shall comply with the relevant provisions of ISO 121762:2000.

xviii) Laying

- HDPE pipes up to DN 125mm can be delivered in rolls. For larger diameter, pipe shall be delivered in 5/6 m lengths.

xix) Handling

- The Contractor shall ensure that during transport, handling and storage, each item (pipe and fitting) is free from damage prior to installation. Damaged pipes and fittings shall be discarded. The protection of the pipe ends is particularly important. Pipes and fittings should never be dropped to the ground. They should be unloaded from the transport either by hand or using slings and lifting equipment.
- Pipes shall be cut by an approved method which provides a clean square cut of the pipe and lining (if applicable) without damage. All cut or trimmed ends shall be cleaned before the pipes are laid.

xx) Installation of HDPE pipes

- Polyethylene piping shall be laid in accordance with the pipe manufacturer's recommendations and to the approval of the DTA.
- 0.3 m above the crown of the pipes a 150mm wide blue polyethylene marker tape 100m thick shall be laid along the whole length of all water mains laid. It shall include the wording "caution water-main below" or similar in Turkish. The tape shall incorporate a tracer wire to facilitate tracing of the pipeline route from above finished ground level.
- When placing concrete on HDPE pipeline care should be taken to avoid encasing the pipe completely. A thin membrane, such as bituminised paper, thin roofing felt or polythene film shall be applied between the concrete and the HDPE pipe.
- The Contractor shall forward to the DTA certificates showing that the materials have been tested and comply with the requirements of this Specifications and the relevant Standard.

- The Contractor shall provide, install and maintain temporary protective caps or discs to prevent water, animals or extraneous material entering pipelines during construction. Such caps or discs shall not be removed until the pipes are jointed.
- All buried pipes shall be jointed using electro fusion welding techniques.
- Small diameter pipes (DN<63mm), pipes within structures and pipes connecting to metal fittings shall be jointed using mechanical jointing techniques.

xxi) Thrust Blocks :

Thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on every one meter and all bends as directed by the Authority's Representative.

2.8.6 Traps:

FLOOR TRAPS/P-TRAP:

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

2.8.7 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.

2.8.8 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 Authority's Representative with rim, of approved design and shape. Minimum thickness shall be 4-5mm or as specified in the Bill of Quantities.

2.8.9 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.

2.8.10 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.

2.9. EXTERNAL DRAINAGE SYSTEM (SEWERAGE AND STORM WATER):

2.9.1 Scope:

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install the drainage system as required by the drawings and specified hereinafter or given in the Bill of Quantities.

Without restricting to the generality of the foregoing, the drainage system shall include:

Sewer lines including excavations, pipe lines, man holes, drop connections, underground storm water drains, including pipes, man holes, catch basins and open drains, thrust blocks.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.9.2 General requirements:

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

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

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

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

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

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

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

2.9.3 Trenches for pipe & drains:

A. Alignment and grade:

The drains are to be laid to alignment and gradients in continuous shown on the drawings but subject to such modifications, as shall be ordered by the Authority's Representative from time to time to meet the requirements of the works. No deviations from the line, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express direction in writing of the Authority's Representative.

B. Opening out trenches:

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

Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Authority's Representative. The Contractor shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under them unless the Authority's Representative shall order to the contrary.

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

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

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

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

C. Construction across the roads:

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

D. Excavation to be taken to proper depth:

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

E. Refilling:

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

Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and approved by Authority's Representative. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and tops of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and consolidated. The clods and lumps of earth exceeding 8cm in any direction shall be broken or removed before the excavated earth is used for filling. Generally no test is done to determine the instrument diversity of filled earth but on the discretion of Authority's Representative the 95

proctor's compaction test may be done to ensure the in situ density after filling. Consolidation is removal of water from the pores and compaction is the explosion of air from the pores. In case of refilling consolidation places most important role as the watering of the each layer is being done properly. If required by the Authority's Representative proctors needle may also be used for the proper checking of the refilling items of in situ density.

F. Contractor shall restore settlement and damages:

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

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

G. Disposal of surplus soil:

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

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

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

H. Protection of existing services:

All pipes, water mains, cables etc encountered in the course of excavation shall be carefully protected and supported. In case of any damage caused the same shall be made good which necessary works will be carried out by the Authority's Representative and contract charged to the Contractor.

2.9.4 RCC Pipes:

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

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

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

B. LAYING:

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

C. JOINTING (RIGID SPIGOT AND SOCKET JOINT):

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

D. CURING:

The joint shall be cured for at least seven days.

E. CEMENT CONCRETE FOR PIPE SUPPORTS:

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

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

b. RCC pipes or CI pipes may be supported on brick masonry or pre-cast RCC or in situ cradles. Cradles shall be as shown on the drawings.

c. Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

F. TESTING:

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

getting the required head.

Permissible drops in water head should not exceed.

G. MEASUREMENT:

- a. Excavation:
Measurement for excavation of pipes trenches shall be made per linear meter.
- b. Trenches shall be measurement between outside walls of manholes at top and the depth shall be the average depth between the two ends to the nearest cm.
- c. RCC pipes shall be measured for the length of the pipe line per linear meter i.e.:
 - i. Length between manholes shall be recorded from inside of one manhole to inside of other manhole.
 - ii. Length between gully trap and manhole shall be recorded between socket of pipe near gully trap and inside of manhole.

2.9.5 Foam core pvc pipe

General Requirements

- All materials shall be new of the best quality conforming to specifications and subject to the approval of the D.T.A./ Authority.
- Drainage lines shall be laid to the required gradients and profiles.
- All drainage work shall be done in accordance with the local Municipal by-laws.
- Contractor shall obtain necessary approval and permission for the drainage system from the Municipal or any other competent authority.
- Location of all manholes, catch basins etc. shall be got confirmed by the D.T.A./ Authority before the actual execution of work at site.
- All works shall be executed as directed by D.T.A./ Authority.

A. Alignment and Grade

The sewer and storm water drainage pipes shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the D.T.A./ Authority from time to time to meet the requirements of the works. No deviation from the lines, depth of cutting or gradients of sewers shown on the plans and sections shall be permitted except by the express direction in writing of the D.T.A. / Authority.

B. Excavation

The excavation for sewer works shall be open cutting unless the permission of the D.T.A. / Authority for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the D.T.A./ Authority may order the excavation to be made partly in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

C. Obstruction of Roads

The contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and sufficient space shall be then left for public and private transit. He shall remove the materials excavated and bring them back again when the trench is required to be refilled. The contractor shall obtain the consent of the Architect in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

D. Excavation to be taken to proper depth

The trenches shall be excavated to such a depth that the sewer shall rest on concrete as described in the several clauses relating there to and so that the inverts may be at the levels given in the sections. In bad ground, the D.T.A./ Authority may order the contractor to excavate to a greater depth than that shown on the drawings and to fill up excavation to the level of the sewers with the concrete, broken stone, gravel or other materials. If the extra work was ordered by the D.T.A. / Authority in writing, but if the contractor shall excavate the trench to a greater depth than is required without a specific order to that effect in writing of the D.T.A./ Authority

E. Refilling

After the sewer or other works has been laid and proved to be water tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and upto 75 cms. Above the crown of the sewer shall consist of the finest selected materials placed carefully in 15 cms. Layers and consolidated. After this has been laid, the trench and other excavation shall be refilled in 15 cms. Layers with materials taken from the excavation, each layer being watered to assist in the consolidation, unless the Architect shall otherwise direct.

F. Contractor to restore settlement and damages

The contractor shall make good promptly during the whole period for the works in hand, any settlement that may occur in the surfaces of roads beams, footpaths, gardens, open spaces etc. whether public or private caused by his trenches or by his other excavations and he shall be liable for any accident caused thereby. He shall also, at his own expense and charges, repair and make good any damage done to building and other property. If in the opinion of the D.T.A./ Authority he fails to make good such works with all practicable dispatch, the D.T.A./ Authority shall be at the liberty to get the work done by other means and the expenses thereof shall be paid by the contractor or deducted from any money that may be or become due to him or recovered from him any other manner according to the law of land.

G. Disposal of surplus soil

The contractor shall charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

H. Timbering of sewer and trenches

a. The contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, pilling and sheeting and they shall be closed, timbered in loose or sand strata and below the surface of the sub soil water level.

b. All timbering, sheeting and piling with their walling and supports shall be of adequate dimension and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.

c. The contractor shall be held responsible and will be accountable for the sufficiency of all timbering, sheeting and piling used as also for all damage to persons and property resulting from improper quality, strength, maintaining or removing of the same.

I. Shoring of buildings

The contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the work and shall be fully responsible for all damage to persons or property resulting from any accidents.

J. Removal of water from sewer, trench etc.

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

b. If any excavation is carried out at any point or points to a greater width the specified cross section of the sewer with its envelop, the full width of the trench shall be filled with concrete by the contractor at his own expense and charges to the requirements of the D.T.A./ Authority.

K. Width of trench

The DTA/ Authority shall have power by giving an order in writing to the contractor to increase the maximum width in trenches for various classes of sewer, manholes and other works in certain lengths to be specifically laid down by him where on account of bad ground or other unusual conditions, he considers that such increased widths are necessary in view of the site conditions.

Recommended width of trenches at the bottom of the trench is as follows:

100 mm dia pipe	55 cms
150 mm dia pipe	55 cms
225-250 mm dia pipe	60 cms
300 mm dia pipe	75 cms

L. PVC-U Structured wall pipes/Foam core pipes

PVC-U Structured wall pipe shall be of first class quality salt glazed and free from rough texture inside and outside and straight. All pipes shall have the manufacturers names marked on it and shall comply to IS 16098- 2013.

All pipes shall be true to shape, straight, perfectly sound and free from cracks and flaws. DWCP pipes have good Resistance to Corrosion, Chemically Inert & Environmentally safe; they have Good Impact strength, are Light in weight and easy to handle and transport.

PVC-U Structured wall pipes are resistant to a broad range of corrosive chemicals. Do not support biological growth. The corrosion of pipe occurs due to electro chemical activity occurring in the presence of acid, alkaline salt, organic waste etc. Fundamentally, this electro chemical corrosion occurs vigorously in case of metals. On the other hand DWCP HDPE Pipe being nonconductors are not vulnerable to this phenomenon. Hence, these pipes are suitable for drainage and sewerage even with acidic or alkaline fluids.

M. Laying and jointing of PVC-U Structured wall pipes:

Laying

PVC-U Structured wall pipes shall be laid on cement concrete bed of cradles as specified and shown on the detailed drawings. The cradles may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12 mm below the invert level of the pipe and properly placed on the soil to prevent any disturbance. The pipe shall then be placed on the bed concrete or cradles and set for the line and gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the DTA in charge.

Jointing

Elastomeric sealing ring joints/Solvent cement joint

These pipes shall be socketed on automatic socketing machine with self-socket length. Such pipes shall be either joined with solvent cement or groove inside with rubber ring.

N. Testing

- a. All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least 1.5 mtrs. head of water. The test pressure shall, however, not exceed 6 metres head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both sides. The upper end shall, however, be connected to a pipe for filling with water and getting the required head poured at one time permit.
- b. Sewer lines shall be tested for a straightness by :
 - I. Inserting a smooth ball 12 mm less than the internal diameter of the pipe. In the absence of obstruction such as yarn or mortar projecting at the joints the ball should roll down the invert of the pipe and emerge at the lower end.
 - II. Means of a mirror at one end and a lamp at the other end. If the pipe line is straight the full circle of light will be seen otherwise obstructions or deviations will be apparent.
 - III. The contractor shall give a smoke test to the drain and sewer at his own expense and charges, if directed by the D.T.A./ Authority.
 - IV. A test register shall be maintained which shall be signed and dated by D.T.A.

O. Masonry Work

Masonry work for manhole, chambers, septic tanks and such other works as required shall be constructed from local best quality bricks in cement mortar 1 : 5 mix (1 cement : 5 coarse sand) or as specified in the Bill of Quantities. All joints shall be properly raked to receive plaster.

P. Cement Concrete For Pipe Support

- a. Wherever specified or shown on the drawings, all pipes shall be supported in bed all round or in haunches. The thickness and mix of concrete shall be as given in the Bill of Quantities. Widths of the bedding shall be as per Para 13.

b. Unless otherwise directed by the D.T.A./ Authority, cement concrete of bed, all round or in haunches shall be laid as follows:

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

c. RCC pipes or C.I. or stoneware pipes may be supported on brick masonry or precast RCC or in situ cradles. Cradles shall be as shown on the drawing.

d. Pipes in loose soil or above ground shall be supported on brick or stone masonry pillars as shown on the drawings.

e. Hand mixing on properly constructed platforms may be allowed for small quantities by the D.T.A./ Authority.

f. Concrete work shall be of such thickness and mix as given in the Bill of quantities.

g. All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during curing period.

2.9.6 HDPE PIPE & FITTINGS

A. Scope:

This specification covers the requirements for manufacture, supplying, lowering, laying, jointing, testing and commissioning Polypropylene (PE 100) HDPE pipe with fittings, transit, saddles, etc. required for the conveyance & distribution system for above ground as well as below ground installation with required civil work for domestic water application.

B. Codes & standards:

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

C. Excavation of Trenches

Trenches for pipes shall be excavated to lines and levels described and sketched or as otherwise instructed by the DTA.

The Contractor shall dispose of all excavated material off site in approved locations, as soon as it is removed from the trench. It shall not be used for backfilling. Stockpiling of excavated material alongside the trench will not be permitted.

The Contractor shall cut completely through all concrete surfaces and asphalt surfaces prior to commencing trench excavation.

Trenches shall be excavated in lengths of not more than 50 metres. A length shall be at least 2/3 complete before excavation can start on the subsequent length. Portable pedestrian bridges across the open trenches shall be provided at 10m intervals. Trenches shall not be left uncovered overnight. They shall be covered with steel sheets or equivalent.

The Contractor shall include in his price for bracing and strutting where required and shall conform to all relevant local safety requirements.

D. Width of Excavation

The width of excavation in all cases shall be the minimum necessary for the construction works. In addition to the approval in writing by the DTA, the work with any approved length must have been completed satisfactorily by the Contractor before starting work in another section.

E. Collapse and Slides

The Contractor will take care and all the necessary measures to prevent collapse and slides along the trench excavations.

F. Backfilling

Backfill material shall be evenly graded and not include constituents exceeding 50mm or any clay or organic material. All backfill material shall be approved by the DTA.

Backfill will be compacted by distributing and compacting it in horizontal layers with a uniform thickness and thickness of non compacted material not exceeding 300mm. The value of moisture content of the soil shall be checked carefully.

The compaction shall be done by mechanical rollers, compactors, vibrators or other machinery approved and such that provide a dry density not less than 95% of the maximum dry density.

During backfilling, the Contractor shall do the necessary tests under the supervision of the DTA to guarantee the required parameters.

G. Monitoring of Backfill

The Contractor shall monitor the backfill and shall ensure that at all times during, and at the end of the period of maintenance all finished levels are in accordance with those established in the Contract.

H. Reinstatement of Surfaces

All surfaces of roads, driveways and foot-paths, etc., whether public or private that are disturbed during execution of the works, shall be reinstated by the Contractor.

Trenches, channels, drainage ditches, kerbs shall be reinstated to the condition in which they were before execution of the works.

Road surfaces shall be reinstated to at least the previous condition.

I. Dewatering

All excavations shall be kept free of water at all times during the construction of the Works. The Contractor shall carry out all dewatering, groundwater lowering, pumping, temporary drainage, etc., which may be necessary for the purpose of removing water from the excavations.

J. Construction of Pipelines

The Contractor shall provide all skilled and un-skilled labour to complete the installation of all pipelines included under the Contract.

It shall be the Contractor's responsibility to safeguard by means of temporary or permanent support or otherwise all pipes, structures and other items which would be liable to suffer damage as a result of his work, if such precautionary measures were not taken.

Excavation of pipe trenches shall follow the details shown in the designs and drawings. Deviations from the drawings shall be agreed by the DTA and are fully at the Contractor's risk. Deviations will be permitted only with the written consent of the DTA.

Trench bottom must be compacted and levelled.

Trench bottom will be covered by a 150mm layer of granular material (single size 10mm) or sand, which has to be carefully levelled. Pipe-laying and jointing have to follow instructions of the manufacturers of pipes. Pipes shall be properly and completely bedded on the bedding material.

K. Pipe Tests

The applied test pressure shall be 1.6 times the working pressure. The leakage rate shall be restricted to applicable standard.

The Contractor shall provide all necessary labour, materials, water and equipment for the testing.

The Contract shall include for any pressurizing pipe, blank flanges, pressure gauges, etc., required for the purpose of pressure testing all pipe-work. The pressure tests shall be carried out according to DIN 4279, ISO 4427 or other equivalent standard.

The Contractor shall carry out final testing of the equipment and commissioning of all pipelines to the satisfaction of the DTA.

L. Disinfection of Pipelines, Valves and Fittings

The pipelines, valves and fittings will be incorporated in a public water supply, and the Contractor shall be responsible for the thorough cleaning and sterilization of all parts in contact with water in accordance with the requirement of the waterworks department.

M. High Density Polyethylene Pipes

Polyethylene pipes and fittings for water supply services shall comply with the provisions of IS 4984/1995, ISO 4427:1996, DIN 16963, or equivalent

The raw material must also have the following features;

The pipe specifications shall be PE 100 with pressure class of PN 12.5 for 20 mm pipe, PN 10 for 25 & 32 mm size & PN 6 for above 32 mm

Colour of the pipe(the raw material must be dark blue or black with blue stripes, which are internationally recognized as potable water pipe colours and must have UV additives to increase resistance against sunlight.

Dimensions

Normal outside diameters and normal pressures shall be in accordance with the requirements of ISO 161 –1:1996, Part 1, Metric series.

N. Pipe Laying and Jointing

a. Joints

- HDPE pipes shall be joined by butt fusion welding, electro fusion welding compression fittings, flanges or mechanical couplings, as appropriate to the pipe, fittings and location.
- Polyethylene butt fusion joints and fittings for use with cold potable water shall comply with the relevant provisions of ISO 121761:1998.
- Mechanical joint compression fittings for use with cold potable water shall comply with the relevant provisions of ISO 142361:2000.
- Electro-fusion fittings shall comply for use with cold potable water shall comply with the relevant provisions of ISO 121762:2000.

b. Laying

- HDPE pipes up to DN 125mm can be delivered in rolls. For larger diameter, pipe shall be delivered in 5/6 m lengths.

c. Handling

- The Contractor shall ensure that during transport, handling and storage, each item (pipe and fitting) is free from damage prior to installation. Damaged pipes and fittings shall be discarded. The protection of the pipe ends is particularly important. Pipes and fittings should never be dropped to the ground. They should be unloaded from the transport either by hand or using slings and lifting equipment.
- Pipes shall be cut by an approved method which provides a clean square cut of the pipe and lining (if applicable) without damage. All cut or trimmed ends shall be cleaned before the pipes are laid.

I. Installation of HDPE pipes

- Polyethylene piping shall be laid in accordance with the pipe manufacturer's recommendations and to the approval of the DTA.
- 0.3 m above the crown of the pipes a 150mm wide blue polyethylene marker tape 100muthick shall be laid along the whole length of all water mains laid. It shall include the wording "caution water-main below" or similar in Turkish. The tape shall incorporate a tracer wire to facilitate tracing of the pipeline route from above finished ground level.
- When placing concrete on HDPE pipeline care should be taken to avoid encasing the pipe

completely. A thin membrane, such as bituminised paper, thin roofing felt or polythene film shall be applied between the concrete and the HDPE pipe.

- The Contractor shall forward to the DTA certificates showing that the materials have been tested and comply with the requirements of this Specifications and the relevant Standard.
- The Contractor shall provide, install and maintain temporary protective caps or discs to prevent water, animals or extraneous material entering pipelines during construction. Such caps or discs shall not be removed until the pipes are jointed.
- All buried pipes shall be jointed using electro fusion welding techniques.
- Small diameter pipes (DN<63mm), pipes within structures and pipes connecting to metal fittings shall be jointed using mechanical jointing techniques.

J. Thrust Blocks :

Thrust blocks of cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm nominal size) shall be constructed on every one meter and all bends as directed by the Authority's Representative.

2.9.7 Sewer manholes with frame and cover:

A. Scope

This specification covers the requirements for providing and constructing of Brick Masonry (for up to 3 mtr. depth) / RCC M 20 grade or 1:1x1/2 :3 mix (for more than 3 mtr. depth) manholes with steps, frame, cover and vent shafts.

B. Standards

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

IS : 210	Specification for gray iron castings
IS : 269	Specification for ordinary and low heat Portland cement
IS : 383	Specification for coarse and fine aggregates from natural sources for concrete
IS : 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
IS : 516	Methods of tests for strength of concrete
IS : 651	Specification for salt-glazed stoneware pipes and fittings
IS : 1077	Specification for common burnt clay building bricks
IS : 1726	Specification for cast iron manhole covers and frames
IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement
IS : 2116	Specification for sand for masonry mortars
IS : 3495	Methods of tests of burnt clay building bricks
IS : 5455	Specification for cast iron steps for manholes

C. Codes Of Practice

IS : 456	Code of practice for plain and reinforced concrete
IS : 2212	Code of practice for brickwork

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

D. Location

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

E. Construction manholes:

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

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

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

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

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

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

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

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

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

F. Excavation

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

G. Bed Concrete

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

H. Brick Masonry / Cement Concrete Work

BRICK MASONRY

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

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

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

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

CEMENT CONCRETE WORK

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

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

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

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

PLASTER AND POINTING

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

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

I. Benching

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

SIZE OF DRAIN	TOP OF CHANNEL AT	DEPTH OF BENCHING
	THE CENTER ABOVE BED CONC.	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

J. Foot Rests

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

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

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

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

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

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

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

K. Manhole Covers and Frames

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

L. Measurements

Manholes shall be enumerated under relevant items. The depth of the manhole shall be reckoned from the top level of FRP Heavy duty cover to the invert level of channel. The depth shall be

measured correct to a cm. The extra depth shall be measured and paid as extra over the specified depth.

2.9.8 Drop Connection

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

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

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

A. Excavation

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

B. Measurements

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

C. Testing

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

Water for testing of manholes along with pipeline shall be arranged by Contractor

D. FRP HEAVY DUTY Pre Cast M.H.F.C.

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

E. General Specification

FRP HEAVY DUTY Precast manhole frame & cover shall be manufacture as per standard type design. Frame shall confirm to latest IS. Cover shall confirm to latest IS.

F. Material

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

G. Inspection

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

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

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

H. Transit Risk

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

I. Test Certificate

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

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

J. Fixing

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

K. Measurement

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

L. Marking

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

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

2.10. HYDROPNEUMATIC SYSTEM

2.10.1 Scope:

The specification covers design, performance, manufacture, construction features, inspection, testing, delivery, installation, commissioning of Hydro pneumatic pressurized system

consisting of balancing tank with mounting pads, pump-motor set with coupling and coupling guard, common base plate, bell mouth, piping, isolation valves, NRVs, fittings, control panel, pressure switches, Foundation SS Nut, SS washers, SS bolt, antivibration, suction header Pipe and Valve from UG tank to Pump, Strainer, Suction, discharge and All flanged end, pumps & allied piping and accessories, expansion bellow, Completing the pipe alignment at the joint of discharge header to supply pipe with bolts nuts & rubber packing, chain pulley block with endless chain, Electrical Panel, Cable, cable tray upto pump panel and other accessories required for complete installation of hydro pneumatic system at site.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.10.2 Construction features:

The major components of the system shall be as follows:

A. TANK:

FRP tank (Pressure vessel) for min. 8 Kg/cm² Pressure rating with inbuilt aircell to be provided if specified in BOQ.

The tank shall be provided with all accessories viz. mounting arrangement, isolation valve, pressure gauge, etc.

B. PUMP:

Two types of pumps i.e. inline vertical multistage pump or centrifugal end suction / monoblock pumps shall be provided. Variable frequency drive shall be provided with one of the installed pump – if specified in Schedule of quantity.

The pump – motor set and shall be suitable for 3 Ph., 415 V, 50 Hz. AC power supply and having 2900 RPM speed. The pump shall be installed with isolation butterfly valve, non return valve, etc. The detailed specification for pump & motor is as below:

Vertical inline Pump

C. Codes & Standards :

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

D. Design Features:

The pump shall be capable of developing required total head at rated capacity. Impeller shall be closed type and shall be dynamically balanced. The pump shall have non overloading characteristics.

E. Constructional Features:

The casing shall be of rigid construction and shall have side suction and side delivery in case of inline pump and side suction and central delivery in case of submersible centrifugal pump.

The pump shall have very small length suction and delivery pipe connections which will result in minimum friction loss.

Impeller shall be of one piece and shall be of SS CF8 M.

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

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

Bearing shall be ball or roller type.

Mechanical seal shall be provided to avoid any leakage.

F. Inspection & 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.

G. Drawings:

Following drawings shall be furnished by the Contractor:

Overall dimensional drawing.

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

H. Accessories:

The pump shall be provided with all accessories such as base plate, foundation bolts, strainer, pressure gauge, etc. All accessories required for proper and safe operation shall be furnished with the pumps.

I. Pressure Switch:

The system shall be installed with the pressure switch which shall be set at predetermined pressure to automatically control the pump operation.

2.11. VALVES

2.11.1 Scope:

This specification covers the design requirements, features of construction, inspection, testing, painting, delivery, installation and commissioning of manually hand wheel operated butterfly valves, spring operated dual / single plate non return valve & non rising sluice valve with hardwares & gaskets, etc. at site.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.11.2 Codes & standards:

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 contractor of this responsibility. Ball valve according to relevant BS/Butterfly Valves shall be confirming to BS 5155, PN 1.0, Non Return Valves shall conform to API 594 / 598 & Sluice valve shall conform to IS 14846 PD.

2.11.3 Design requirements for ball valves :

Ball valve shall be provided on suction and delivery side of each pump.

Valves shall be provided with SS ball & stem.

The valve shall be flanged type.

All internal wetted parts shall be of S.S.

Seating shall be of PTFE.

OR

2.11.4 Design requirements for butterfly valves :

Butterfly valve shall be provided on suction and delivery side of each pump.

Valves shall be provided with integrally moulded liner to provide perfect seating arrangement.

The valve shall be flanged type.

All internal wetted parts shall be of S.S.

Disc seal shall be of EPDM.

2.11.5 Design requirements for non-return valves:

Non-Return Valve shall be provided on delivery side of each pump.

The non-return valves shall be provided with soft seating.

The valve shall be mounted horizontally.

The valves shall be designed for minimum head loss

Hydraulic passage shall be designed to avoid cavitations.

The valves shall have non-slam characteristic. This is to be achieved by suitably designed spring.

All internal wetted parts shall be of S.S.

2.11.6 Design requirements of sluice valve :

A) Valves shall be provided with back seating arrangement.

B) Integral / Renewable body and wedge rings shall be provided.

C) Collared drain plugs of gunmetal shall be provided for all valves.

D) Stuffing box gland shall be of bolted type.

E) Valves shall be with non-rising spindle type.

F) The seat rings shall be riveted over and above press fitted.

G) Valves shall be flanged and drilling shall conform to the standard as specified in data sheet.

H) Face to face dimension shall conform to IS 14846, PD.

2.11.7 Cleaning:

Prior to factory inspection, all manufacturing waste such as metal chips debris and all other foreign material shall be removed from interior of valve. All mill scale, rust, oil, grease, chalk and all other deleterious material shall be removed from the interior and exterior surfaces.

2.11.8 Painting:

Valves shall first be given two coats of zinc base primer after completely cleaning the surface and then it shall be coated with three coats of coal tar epoxy paint. The resulting coating shall be uniform and smooth and shall adhere perfectly to the surface.

Valves used in pipes carrying water, the inside coating shall not contain any constituent soluble in water or any ingredient which could impart any taste or odour to the water.

2.11.9 Tests & inspection:

Valves shall be tested as per the relevant Standards with latest revisions.

Valves shall be offered for visual inspection and dimensional checks.

The hydrostatic and water tightness testing shall be witnessed by the purchaser.

Valve shall be offered for inspection and following tests. (before painting) at contractor's shop.

- Visual inspection with dimensional checks.
- Hydrostatic test

2.11.10 Tender drawings:

The following drawings shall be submitted by Contractor along with their offer.

Preliminary outline dimensional drawings.

Typical cross section drawings.

Flow v/s head loss curve for Non-return valves

2.11.11 Suction and delivery pipe, fittings, flanges:

All suction, delivery and header pipe shall conform to IS 1239, heavy duty (Class C) and shall be hot dipped galvanized. Fittings shall be as per the pipe thickness. All pipe shall have flanges connection & pipe shall conform to BS 10, Table - D. All hardware shall be zinc plated.

2.11.12 System operation:

When the system will switch on, the pump shall start pumping water into hydro pneumatic or balancing tank when all the service taps will close in the system, pressure shall build in the tank. As soon as the pressure will reach to cut off pressure, the pump shall shut off. When the taps will open and the end user shall get pressurized water and as the pressure will reach to cut in pressure, the pump shall automatically start.

2.11.13 Testing:

The system shall be tested minimum 1.5 times the working pressure.

TECHNICAL DATA SHEET FOR DOMESTIC / FLUSHING WATER SUPPLY:

SR.NO.	PARTICULAR	SPECIFICATIONS	DATA TO BE FILLED BY CONTRACTOR
1.0	DOMESTIC / GARDEN WATER HYDRO PNEUMATIC SYSTEM		
1.1	Capacity	As per BOQ	
1.2	No. of Unit	As per BOQ	
1.3	Material of Construction	FRP	
1.4	Shell thickness	8 mm / Suitable for 8 Kg/cm ² pressure rating.	
1.5	Dished end thickness	10 mm/ Suitable for 10 Kg/cm ² pressure rating.	
1.6	Test Pressure	10 kg / cm ² minimum	
1.7	Painting	Epoxy	
1.8	Type of Air Compressor	Oil free, Teflon coated / Inbuilt Air cell	
1.9	Tank outlet size	As per Manufacture's configuration	
2.0	PUMPS		
2.1	Type	In line vertical multistage	
2.2	Number of Units	As per BOQ	
2.3	Design capacity of each pump Main Pump	As per BOQ	
2.4	Total head at design capacity	As per BOQ	
2.5	Suction Pressure at rated capacity (NPSHa)	Positive Suction	
2.6	Total duration of operation	Continuous	
2.7	Speed	1500 / 2900 RPM	
2.8	Location	Indoor	
2.9	FEATURE OF CONSTRUCTION		
2.9.1	Impeller	Closed	
2.9.2	Shaft	Coupled	
2.9.3	Drive Transmission	Direct	
2.9.4	Seal	Gland Packing	
2.9.5	Mounting	Common base plate	
2.9.6	No. of stage	Single	
2.9.7	Starter		

SR.NO.	PARTICULAR	SPECIFICATIONS		DATA TO BE FILLED BY CONTRACTOR
	Pump	DOL / VFD		
2.9.8	Flange drilling	As per BS 10, Table D, flat face with off centre bolt holes		
2.10	LIQUID DATA			
2.10.1	Liquid handled	Water		
2.10.2	Specific gravity	1.0		
2.10.3	Temperature	Ambient temp.		
2.11	MATERIAL OF CONSTRUCTION	(AS INDICATED IN BOQ OR AS SPECIFIED BLEOW IF NOT GIVEN IN BOQ)		
2.11.1	Base plate	M.S. IS 226		
2.11.2	Pump Casing	SS 304		
2.11.3	Impeller	SS CF 8 M		
2.11.4	Shaft	S.S AISI 410		
2.11.5	Wearing Ring	SS 316		
2.11.6	Painting	Epoxy		
2.11.7	Hardware in contact with water	Hot dipped galvanized		
2.11.8	Companion flanges	M.S., BS 10, Table D		
2.12	ACCESSORIES & SERVICES REQUIRED			
2.12.1	Base Plate	YES		
2.12.2	Foundation bolts	YES		
2.12.3	Companion flanges	YES		
2.12.4	Spare parts required	YES		
2.12.5	Maintenance tools required	YES		
3.0	Cut in pressure	Working Pump (As per IS)	Stand by Pump (As per IS)	
4.0	Cut off pressure	Working Pump (As per IS)	Stand by Pump (As per IS)	
5.0	INDUCTION MOTOR			
5.1	Type	Squirrel cage Induction		
5.2	Mfg. Standard	IS 325		
5.3	Rated Voltage	415 Volts, 3 Phase, 50 Hz., AC		
5.4	Voltage and frequency variation	± 10% voltage variation ± 5% frequency variation ± 10% combined voltage and frequency variation		
5.5	Speed in RPM	2900 RPM		
5.6	Class of Insulation	Class F		
5.7	Degree of Protection	IP 57 for		

SR.NO.	PARTICULAR	SPECIFICATIONS	DATA TO BE FILLED BY CONTRACTOR
6.0	Suction & delivery piping	MS, hot dipped galvanized, Class 'C'	
7.0	Suction, delivery valves & header valves	Required, flanged Cast Iron valves with SS internal parts Make : Kirloskar / KSB / AUDCO / FLOVEL Flanged Ball / Butterfly valve on suction and delivery of each pump & Flanged Non slam, spring operated dual plate type check valve on delivery side of each pump & on header	
8.0	Control Panel	With Starter. One pump of similar rating shall have VFD Required with all protections & sequential timer for main pumps Also required Finolex / CCI / Gloster make cable from motor to panel	
9.0	Level Indicator	Required for 0-5 mtr. Range and shall be panel mounted and interlocking with pump	
10.0	Pressure switch	Provided for each pump	
11.0	Pressure Gauge	Required at delivery of each pump & on header. Range 0-7 kg/cm ²	
12.0	Gaskets	'Champion ' make	
13.0	Hardware	Zinc coated	

2.12. CENTRIFUGAL PUMPS

2.12.1 Scope:

This specification covers the supply, installation, testing & commissioning of Centrifugal type (monoblock/moonset/End suction) pumps. The scope also includes Foundation SS Nut, SS washers, SS bolt, antivibration, suction header Pipe and Valve from UG tank to Pump, Strainer, discharge header from Pump to WTP/UG tank, with necessary pipe, fittings, etc. and All flanged end, pumps & allied piping and accessories, expansion bellow, Completing the pipe alignment at the joint of discharge header to supply pipe with bolts nuts & rubber packing, chain pulley block with endless chain , Electrical Panel, Cable, cable tray upto pump panel. and other accessories required for complete installation. Each pump shall have isolation gun metal gate valve & NRV at delivery side. The pipe shall be GI class C.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.12.2 Codes and standards:

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

2.12.3 Design features:

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

Impeller shall be enclosed type and shall be dynamically balanced.

The pump shall have non overloading characteristics.

The pump shall have positive suction.

2.12.4 Constructional features:

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

The casing shall be of Cast Iron.

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

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

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

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

Bearing shall be ball or roller type.

Mechanical seal shall be provided to avoid any leakage.

2.12.5 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.

2.12.6 Drawings:

Following drawings shall be furnished by the CONTRACTOR:

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

TECHNICAL SPECIFICATIONS FOR CENTRIFUGAL PUMPS

SR.	PARTICULAR	SPECIFICATIONS	DATA TO BE FILLED BY CONTRACTOR
1.0	Type	Centrifugal Monoblock / Monoset / End suction	
2.0	Number of Units	As per BOQ	
3.0	Design capacity of each pump	As per BOQ	
4.0	Total head at design capacity	As per BOQ	
5.0	Total duration of operation	As per BOQ	
6.0	Speed	2900 RPM	
7.0	Location	Raw water Pumps : Centrifugal monoblock/End suction HVAC make up water Pumps in the U.G. Tank HVAC make up compartment : Centrifugal moonset	
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	DOL for up to 5 KW & Star / Delta for more than 5 KW rating	
8.9	Flange drilling	As per BS 10, Table F, raised face with off centre bolt holes	
9.0	LIQUID DATA		
9.1	Liquid handled	HVAC make up soft Water	
9.2	Specific gravity	1.0	
9.3	Temperature	Ambient temp.	
10.0	MATERIAL OF CONSTRUCTION		
10.1	Base plate	M.S. IS 226	
10.2	Pump Casing	Cast Iron	
10.3	Impeller	SS CF8 M	
10.4	Shaft	S.S AISI 410	
10.5	Wearing Ring	S.S AISI 410	
10.6	Painting	Epoxy	
10.7	Hardware in contact with water	Hot dipped galvanized	

SR.	PARTICULAR	SPECIFICATIONS	DATA TO BE FILLED BY CONTRACTOR
10.8	Companion flanges	M.S., BS 10, Table F	
10.9	Make	GROUNDFOSS/XYLEM	
11.0	ACCESSORIES & SERVICES REQUIRED		
11.1	Base Plate	YES	
11.2	Foundation bolts	YES	
11.3	Companion flanges	YES	
11.4	Spare parts required	YES	
11.5	Maintenance tools required	YES	
12.0	MOTOR :		
12.1	Power Supply	230 / 415 Volts, 3 phase, 50 Hz. AC	
12.2	Class of Insulation	Class B	
12.3	Degree of Protection	IP 57	
13.0	Delivery piping	GI, Class 'C'	
14.0	Delivery valves & header valves	Gun Metal flanged valves Make : AUDCO / KSB / IVC For monoset pump : Flanged Ball / Butterfly valve on delivery side of each pump & Flanged Non Return Valve on delivery side of each pump & on header For monoblock / end suction pump : Flanged Ball / Butterfly valve on suction & delivery side of each pump & Flanged Non Return Valve on delivery side of each pump & on header	
15.0	Starter Panel	Required with pump interlocking with respect to tank levels. Also required Finolex / Polycab make cables up to starter panel.	
16.0	Level Indicator	Required shall be panel mounted and interlocking with pump and over head tank.	
17.0	Pressure Gauge	Required at delivery of each pump & on header. 0 –7 kg/sq.cm	

2.13. GUN METAL GATE VALVE

2.13.1 Scope:

This specification covers supply, installation, testing & commissioning of Gun Metal gate valve with gaskets, hardware, etc. at site.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.13.2 Codes and standards:

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 Contractor of this responsibility. Valves shall be conforming to IS 778 PN 1.0 (Class 1).

2.13.3 Design requirements for gate valves:

Valves shall be provided with back seating arrangement.

Body seat shall be Integral type.

Collared drain plugs of gunmetal shall be provided for all valves.

Stuffing box gland shall be of integral bolted type.

Valves shall be with non-rising spindle type.

Valves shall be flanged and drilling shall conform to the standard as specified in data sheet.

Face to face dimension shall be as per IS 778 PN 1.0.

All face and seat rings shall be force fitted and additionally shall be riveted to the recesses in the C.I. casting.

2.13.4 Cleaning:

Prior to factory inspection, all manufacturing waste such as metal chips, debris and all other foreign material shall be removed from the interior of the valve. All mill scale, rust, oil, grease, chalk and all other material shall be removed from the interior and exterior surfaces.

2.13.5 Painting:

Valves shall first be given two coats of zinc base primer after completely cleaning the surface and then it shall be coated with three coats of coal tar epoxy paint. The resulting coating shall be uniform and smooth and adhere perfectly to the surface.

Valve used in pipes carrying water, the inside coating shall not contain any constituent soluble in water or any ingredient which could impart any taste or odour to the water

2.13.6 Direction of flow:

Direction of flow shall coincide with the flow direction indicated by "arrow" cast on the valve body.

2.13.7 Tests and inspection:

Valves shall be offered for visual inspection and dimensional check.

Valves shall be tested as per IS 778 PN 1.0 with latest amendments.

The hydrostatic testing shall be witnessed by the purchaser.

Valve shall be dispatched only after visual inspection and clearing instruction for dispatch.

2.13.8 Tender drawings:

The following drawings shall be submitted by Contractor along with the quotation.

Preliminary outline dimensional drawings.

Typical cross section drawings.

DOCUMENT: TECHNICAL DATA SHEET FOR GUN METAL GATE VALVE

SR. NO.	PARTICULARS	PUMP HOUSE	DATA SHEET TO BE FILLED BY CONTRACTOR
1.0	Type of Valves	Flanged, Non rising spindle type	
2.0	Size range and quantity	As per BOQ	
3.0	Fluid	Water	
4.0	Pressure Rating	Class 1	
5.0	Stem	Non-Rising	
6.0	Ends	Flat faced Flanged as per IS 778 Class 1	
7.0	Bonnet	Screwed on	
8.0	Disc.	Solid wedge	
9.0	Operation	Hand wheel Operation	
10.0	Seat	Integral	
11.0	Other requirements	Valves shall close in clockwise rotation of the hand wheel.	
12.0	Body / bonnet	Leaded Tin Bronze conforming to IS 318, LTB2	
13.0	Disc	Leaded Tin Bronze conforming to IS 318, LTB2	
14.0	Stem	High Tensile Brass	
15.0	Body seat	Bronze IS 318 Gr LTB2	
16.0	Disc seat	Bronze IS 318 Gr LTB2	
17.0	Stem nut	Bronze IS 318 GR LTB2	
18.0	Back Seat Bush	Bronze IS 318 GR LTB2	
19.0	Stuffing box	Bronze IS 318 Gr LTB2	
20.0	Gland	Bronze IS 318 Gr LTB2	

SR. NO.	PARTICULARS	PUMP HOUSE	DATA SHEET TO BE FILLED BY CONTRACTOR
21.0	Packing	Graphited Asbestos	
22.0	Bolts, studs & nuts	Carbon Steel IS :1367 Class 4.6 / 4	
23.0	Testing : Shell test Seat test	15 Kg / Cm ² 10 Kg / Cm ²	

2.14. GUN METAL NON RETURN VALVE

2.14.1 Scope:

This specification covers the supply, installation, testing & commissioning of Gun Metal Non Return Valve with gasket hardware etc. at site.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.14.2 Codes and standards:

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 Contractor of this responsibility. The valve shall be conforming to IS 778 PN 1.0 (Class 1).

2.14.3 Design requirements for non return valves:

The non return valves shall be provided with metal seating.

The valve shall be mounted horizontally.

The valves shall be designed for minimum head loss.

Hydraulic passage shall be designed to avoid cavitations.

The valves shall have non slam characteristic.

2.14.4 Cleaning:

Prior to factory inspection, all manufacturing waste such as metal chips debris and all other foreign material shall be removed from interior of valve. All mill scale, rust, oil, grease, chalk and all other deleterious material shall be removed from the interior and exterior surfaces.

2.14.5 Painting:

Valves shall first be given two coats of zinc base primer after completely cleaning the surface and then it shall be coated with three coats of coal tar epoxy paint. The resulting coating shall be uniform and smooth and shall adhere perfectly to the surface.

Valves used in pipes carrying water, the inside coating shall not contain any constituent soluble in water or any ingredient which could impart any taste or odour to the water.

2.14.6 Tests and inspection:

Valves shall be tested as per the relevant Standards with latest revisions.

Valves shall be offered for visual inspection and dimensional checks.

The hydrostatic and water tightness testing shall be witnessed by the purchaser.

Valve shall be offered for inspection and following tests. (Before painting) at Contractor's shop.

- Visual inspection with dimensional checks.
- Hydrostatic test

2.14.7 Tender drawings:

The following drawings shall be submitted by Contractor along with their offer.

Preliminary outlines dimensional drawings.

Typical cross section drawings.

Flow v/s head loss curve for Non-return valves

TECHNICAL DATA SHEET FOR GUN METAL NON RETURN VALVE

SR. NO.	PARTICULARS	PUMP HOUSE	DATA SHEET TO BE FILLED BY CONTRACTOR
1.0	Type of Valves	Flanged, Single door Swing type	
2.0	Size range and quantity	As per BOQ	
3.0	Fluid	Domestic Water	
4.0	Pressure Rating	Class 1	
5.0	Ends	Flat faced Flanged as per IS 778 Class 1	
6.0	Bonnet	Screwed On	
7.0	Disc.	Single door swing type	
8.0	Seat	Integral	
9.0	Body / bonnet	Leaded Tin Bronze conforming to IS 318, LTB2	
10.0	Disc	Leaded Tin Bronze conforming to IS 318, LTB2	
11.0	Hinge pin	High Tensile Brass	
12.0	Body seat	Bronze IS 318 Gr LTB2	
13.0	Disc seat	Bronze IS 318 Gr LTB2	
14.0	Back Seat Bush	Bronze IS 318 GR LTB2	
15.0	Stuffing box	Bronze IS 318 Gr LTB2	
16.0	Gland	Bronze IS 318 Gr LTB2	
17.0	Packing	Graphited Asbestos	
18.0	Bolts, studs & nuts	Carbon Steel IS :1367 Class 4.6 / 4	
19.0	Testing :		
19.1	Shell test	15 Kg / Cm ²	
19.2	Seat test	10 Kg / Cm ²	

2.15. DEWATERING PUMP FOR SUMP DRAIN

2.15.1 Scope

The scope includes supply installation testing & commissioning of submersible non clog dewatering pump set with starter panel, cable up to starter panel, GI C Class delivery pipe, non-return valve, fittings, level guard switch, hardwares etc. The pumps shall have auto stop operation.

The items/quantities shall be measured and paid upon completion of the linked milestone as per schedule 10 for the respective item.

2.15.2 Design Requirement:

The total head capacity curve shall be continuously rising towards the shutoff with the highest at shut off.

The pump shall run smooth without undue noise and vibration.

The power rating of the pump motor shall not be less than the power required from zero discharge to zero head.

Pump shall be submersible, single stage and non clog type.

It shall be suitable for handling turbid water containing stringy materials. The pump shall be designed to handle solids up to 50 mm dia size.

Delivery pipe shall be GI C Class. The required length of pipes and fittings up to discharge point shall be provided with necessary fittings.

Level switch (mercury/magnetic reed) to stop the pump automatically shall be supplied with the pump. Pump shall have three phase connection.

TECHNICAL DATA SHEET FOR DEWATERING PUMPS

SR. NO.	PARTICULARS	DETAILS	DATA TO BE FURNISHED BY THE CONTRACTOR
1.0	MAKE	AS PER TENDER	
2.0	Model	Pl. Furnish	
3.0	Quantity	As per BOQ	
4.0	Type	Non clog vertical type to be installed in sump & in pump house for dewatering / Desilting	
5.0	Capacity	As per BOQ	
6.0	Head in mtr.	As per BOQ	
7.0	Speed	2900 RPM	
8.0	Power supply	3 Phase, AC, 50 Hz	
9.0	Efficiency	Pl. furnish	
10.0	Motor Rating	Pl. furnish	
11.0	Material of Construction		
11.1	Casing	Cast iron	
11.2	Impeller	SS	
11.3	Shaft	Stainless Steel	
12.0	Size of delivery connection	Pl. furnish	
13.0	Solid Handel Capacity	Up to 50mm	
14.0	Control Panel	IP 57	

Note:

- 1) M – Denotes material test certificate required.
- 2) Other specifications not mentioned in datasheet, shall be considered as per tender specification.

2.16. DEWATERING PUMP FOR SEWAGE APPLICATION WITH CUTTER SETS

2.16.1 Scope

The scope includes supply installation testing & commissioning of submersible non clog dewatering pump set with starter panel, cable up to starter panel, GI C Class delivery pipe, non return valve, fittings, level guard switch, hardwares etc. The pumps shall have auto stop operation.

The total head capacity curve shall be continuously rising towards the shutoff with the highest at shut off.

The pump shall run smooth without undue noise and vibration.

The power rating of the pump motor shall not be less than the power required from zero discharge to zero head.

Pump shall be submersible, single stage and non clog type.

It shall be suitable for handling turbid water containing stringy materials. The pump shall be designed to handle solids up to 50 mm dia size.

Delivery pipe shall be GI C Class. The required length of pipes and fittings up to discharge point shall be provided with necessary fittings.

Level switch (mercury/magnetic reed) to stop the pump automatically shall be supplied with the pump. Pump shall have three phase connection.

TECHNICAL DATA SHEET FOR DEWATERING PUMPS

SR. NO.	PARTICULARS	DETAILS	DATA TO BE FURNISHED BY THE CONTRACTOR
1.0	MAKE	AS PER TENDER	
2.0	Model	Pl. Furnish	
3.0	Quantity	As per BOQ	
4.0	Type	Non clog vertical type to be installed in sump & in pump house for dewatering / Desilting	
5.0	Capacity	As per BOQ	
6.0	Head in mtr.	As per BOQ	
7.0	Speed	2900 RPM	
8.0	Power supply	3 Phase, AC, 50 Hz	
9.0	Efficiency	Pl. furnish	
10.0	Motor Rating	Pl. furnish	
11.0	Material of Construction		
11.1	Casing	Cast iron	
11.2	Impeller	SS	

SR. NO.	PARTICULARS	DETAILS	DATA TO BE FURNISHED BY THE CONTRACTOR
11.3	Shaft	Stainless Steel	
12.0	Size of delivery connection	Pl. furnish	
13.0	Solid Handel Capacity	Upto 50mm	
14.0	Nos. of blade	6 nos.	
15.0	Control Panel	IP 57	

Note:

- 1) **M – Denotes material test certificate required.**
- 2) **Other specifications not mentioned in datasheet, shall be considered as per tender specification.**

2.17. WASTE WATER TREATMENT PLANT

The Waste water treatment plant will be designed to treat a waste water quantity as mentioned in the respective description of section wise summary (Min. 110 cum/day).

The scope shall include, all electro-mechanical equipments, interconnection piping, valves, gauges, pumps, filters, cabling, earthing, necessary protection, inlet, outlet & bypass connections.

The Waste Water treatment plant will consist of the following units:

2.17.1 Bar screen :

Screens in the form of perforated stainless steel 304 plates with 20 mm dia openings shall be installed at inlet to retain extraneous materials such as plastic bags, waste paper etc. from entering the Receiving sump.

2.17.2 Oil & grease trap:

Oil & Grease trap is in civil. To be done by Client. Oil Skimmer is provided as per data sheet.

2.17.3 Waste Water collection / Equalization tank :

Usually, Waste Water generation is more during morning hours & evening hours & no Waste Water or very less Waste Water is generated during night hours. Any biological system needs constant feed for bacteria to work efficiently. Hence, collection cum equalization tank is proposed to collect excess flow during peak hours & feed Waste Water in lean hours.

The tank will collect Waste Water generated from the proposed building and pump the same at a uniform rate to the subsequent treatment units. The provision of air grid is to be made for thoroughly mixing of Waste Water to make it homogeneous quality & to keep the suspended matter in suspension to avoid septic condition. The air will be supplied by twin lobe air blowers.

Two numbers of horizontal centrifugal non-clog pump & motor sets of adequate capacity (to take care average as well as peak flow) shall be provided to transfer the homogeneous Waste Water from the receiving sump to the subsequent biological treatment unit. The pump shall be

capable of handling a maximum particle size of 12 mm. These pumps are provided to transfer the Waste Water from receiving sump to the aeration tank.

2.17.4 Neutralization & Flash Mixer, Flocculator, Primary Clarifier / Tube Settler Tank & Fluidized aerobic media reactor (FMR) Tank, :

Neutralization & Flash Mixer, Flocculator, Primary Clarifier / Tube Settler Tank is provided.

Fluidized Media Reactor (FMR) shall consist of floating media which will provide more surface area for bacteria to grow on. The FMR media shall allow bio mass concentration of 20-40 kg/m³ material. The FMR tank will consist of biological system for removal of organic matter (BOD, COD), lamella for clarification & chlorine contact tank for pre chlorination all in single tank.

The effluent will enter into FMR tank from top. Incoming Waste Water BOD load will be 250-300 mg/l. The effluent will be aerated with fine bubble air diffusers, 90mm dia with silicon coated membranes diffuser with air diffusion capacity of ---cum /hr/ meter of diffuser. These diffusers will be provided to mix the contents of aeration tank as well as to diffuse air in it. The dissolved organic matter will be subjected to biological degradation by bacterial action in presence of oxygen & nutrients. This will convert dissolved organic matter into stable settleable matter.

The bacterial concentration (MLSS) of 3000mg/l and dissolved oxygen of 2.0mg/l will be maintained in the aeration tank.

After oxidation, the bacteria will grow & need to be separated out from aeration tank liquor. For the same lamella plates are to be provided which will help in clarification & separation of bacteria (sludge) & clear overflow will flow into chlorine tank. In chlorine contact tank, sodium hypochlorite is added for pre disinfection of the clarified Waste Water.

2.17.5 Air blowers for equalization & aeration :

Suitable rating Rotary twin lobe, air cooled air blowers (1 working + 1 stand by) shall be provided for equalization & diffused aeration process. The blower shall be complete with all accessories such as safety valves, suction filters, vee belts, vee belt guard, driving and driven pulley, base frame, discharge silencer, anti-vibration pad, foundation bolts and set of tools coupled to TEFC motor of suitable capacity. The motor shall have IP55 enclosure and class B insulation. The BLOWER shall be provided with acoustic enclosure to keep noise level within 70 db.

The compressed air grid consisting of one lot to be installed in each equalization tank & aeration tank. The air grid inside the tank shall be made from PVC Pipes. The laterals shall be kept 300 mm clear of the walls at ends and 300mm at sides.

The MOC of air supply line from blower to top of aeration tank will be MS class B pipe.

2.17.6 Secondary Tube settling/Clarifier tank :

The biological sludge developed in the aeration tank shall be settled in a treated water tank / secondary settling tank. The sludge accumulating in the central sludge pit is transferred to the Sludge Holding Tank by means of sludge pumps. The bottom slope for the settling tank shall be 1:12.

2.17.7 Dual media filter :

The treated effluent from the treated Waste Water collection / secondary settling tank shall be pumped to dual media filter for removal of solid particles.

2.17.8 Carbon filter :

The outflow of Dual Media Filter will further be treated through Activated carbon filter to remove odour& taste.

2.17.9 Sludge holding tank :

Adequate size sludge holding tank shall be proposed. Two nos. of horizontal non-clog centrifugal pumps set shall be installed adjacent to settling tank to pump the sludge to Sludge holding tank & to recirculate the sludge to aeration tank to maintain the MLSS ratio. The pump will be coupled to a motor of suitable capacity. The motor shall be with IP55 winding and class B insulation. The pumps shall be mounted horizontally. The delivery shall be provided with valves to regulate the flow in the aeration tank.

2.17.10 Filter Press :

The sludge from the sludge holding tank shall be dewatered in the filter press. Available sludge cake shall be disposed manually & can be used as manure.

2.17.11 Final treated Waste Water collection tank :

The treated Waste Water after post chlorination will be stored into final treated Waste Water collection tank. The final treated water can be further pumped for recycling for domestic use like gardening, flushing, car washing, etc.

High flow UV sterilisers are to be installed for disinfection before Treated waste water will be entered into collection (Flushing) tank.
Please find below ETP data sheet & process scheme.

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
I	Capacity	300 KLD	
II	Operation Hours	17-20	
III	Mode of Operation	Semi Automatic	
IV	Type of Process	MBBR	
V	STP Flow Process Covered		
a	Primary	Bar screen, Oil & grease Trap, Equalization tank,	
b	Secondary	Neutralisation, Cogulation, Flocculation, Primary Tube Settler, Aeration with MBBR Media, Secondary Clarifier / Tube Settler	
c	Tertiary	Disinfection and Filtration system	
VI	Design Basis		

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
A	Waste Water Quality (mg/ltr.)		
a	pH	6.5-8.5	
b	Total Suspended Solids	200	
c	BOD	250-300	
d	COD	350-400	
e	Oil & Grease	50	
B	Treated Water Quality (mg/ltr.) as per PCB		
a	pH	6.5-8.5	
b	Total Suspended Solids	>10	
c	BOD	<20	
d	COD	<30	
e	Oil & Grease	<5	
VII	Technical Specifications		
1 1A	Bar screen chamber Bar Screen Chamber size Civil work Bar Screen No of Units MOC for Bar screens Screen mesh Size Bar Screen Size	RCC(CONTRACTOR SCOPE) As per Vender As per Vender SS 316 As per Vender As per Vender	
2	Oil & Grease Trap No of Units Size	RCC(CONTRACTOR SCOPE) As per Vender As per Vender	
3	Oil & Grease skimmer No of Units Type Capacity	1 Belt Type (SS 316) 0-6 LPH for lifting Oil & Grease	
2	Air Blower (For Aeration tank, equalization tank & sludge holding tank) No. of Units	Two (1W+1S)	
	Type	Rotary Twin Lobe	
	Capacity & Head MOC KW rating/unit Make	As per Vender CI As per Vender Everest/Kay	

SR. NO.	DESCRIPTION			Tender Requirement	Data to be filled by vendor
				International/Equivalent	
3	Air Grid (For Aeration tank, equalization tank & sludge holding tank) No of Units Type MOC			1 Lot Coarse Bubble Air Diffusion HDPE/CPVC SCH 80/	
4	Effluent transfer pump No. of Units			Two (1W+1S)	
	Capacity & Head Pump Type MOC			1.5 Cum/hr, 15M head centrifugal non-clog sewage handling type pump CI/SS	
	KW rating/unit			As per Vender	
	Make			Groundfos/Xylem/Wilo/Kirloskar	
9	Sludge Transfer Pump No. of Units Capacity & Head Pump Type MOC KW rating/unit Make			Two (1W+1S) As per Vender Centrifugal Sludge Transfer pump CI/SS As per Vender Groundfos/Xylem/Wilo/Kirloskar	
10	ACID DOSING SYSTEM Quantity Pump Make Pump Capacity MOC OF PUMP Tank Make			Two (1W+1S) Milton roy/Approved Equivalent as per vendor Suitable as per Requirement Syntex	
	Tank Capacity			as per vendor	
	Tank MOC Mixing Arrangement			HDPE as per vendor	
11	ALUM DOSING SYSTEM				
	Quantity			Two (1W+1S)	
	Pump Make Pump Capacity			Milton roy/Approved Equivalent as per vendor	

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
	MOC OF PUMP Tank Make	Suitable as per Requirement Syntex	
	Tank Capacity	as per vendor	
	Tank MOC Mixing Arrangement	HDPE as per vendor	
12	Poly Dosing System		
	Quantity	Two (1W+1S)	
	Pump Make Pump Capacity MOC OF PUMP Tank Make Tank Capacity	Milton roy/Approved Equivalent as per vendor Suitable as per Requirement Syntex as per vendor	
	Tank MOC	HDPE	
	Mixing Arrangement	as per vendor	
13	Neutralazation& Flash Mixer Tank & process No. of Units Capacity Tank Size Tank MOC Mixing Arrangement	As per Vender As per Vender As per Vender RCC(CONTRACTOR SCOPE) as per vendor	
14	Flocculator No. of Units Capacity Tank Size Tank MOC Mixing Arrangement	As per Vender As per Vender As per Vender RCC(CONTRACTOR SCOPE) as per vendor	
15	Primary & Secondary Clarifier / Tube Settler Tank & Media		
	No. of Units	As per Vender	
	Flow Volume Tank MOC Media	As per Vender As per Vender RCC(CONTRACTOR SCOPE) As per Vender	
16	MBBR/FMR/Aeration tank		
	No. of Units	One	
	Volume	As per Vender	

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
	MOC	RCC(CONTRACTOR SCOPE)	
17	MBBR/FMR MEDIA		
	Make	Energy Equipments /Approved Equivalent	
	Type		
	Thickness	as per vendor	
	MOC	Imported Bio-wheels on PP	
	Dimnesionm	as per vendor	
	Density	as per vendor	
	Specific surface area	as per vendor	
	Bio film formation duration	as per vendor	
	Nitrification Efficiency	as per vendor	
	Life Period		
	self cleaning		
18	CHLORINE DOSING PUMP		
	Quantity	Two (1W+1S)	
	Make	Milton – Roy	
	Type	Electronic	
	Pump Capacity	6 LPH@ 10 Bar pressure	
	MOC OF PUMP	PP	
	Tank Make	Syntex	
	Tank Capacity	as per Vendor	
	Tank MOC	HDPE	
19	Chlorine contact tank/Filter Feed Tank		
	No. of Units	One	
	Volume	As per Vender	
	MOC	RCC(CONTRACTOR SCOPE)	
20	Filter Feed Pump		
	No. of Units	Two (1W+1S)	
	Capacity & Head	4 cum/hr, 30M Head	
	Pump Type	Horizontal Centrifugal	
	MOC	SS	
	KW rating/unit	As per Vender	
	Make	Groundfos	
21	MULTI GRADE PRESSURE SAND FILTER		

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
	Quantity	1 No	
	Design Code	IS-2825	
	Flow	4m3/hr	
	Filtration Rate:	15 cum/sqmt/hr	
	Backwash flow rate	as per Vendor	
	Size Media	as per Vendor	
	Media Qty.	As per Vendor	
	Media Depth	As per Vendor	
	Shell thickness	As per Vendor	
	Dished end thickness	As per Vendor	
	Bed plate thickness	As per Vendor	
	Frontal Pipe	As per Vendor	
	Side manhole for media removal.	CPVC SCH 80/	
	MOC	Required	
	Design Pressure	MSFRP/MSEP	
		5.0 kg/cm2	
	Working Pressure	3.5 kg/cm2	
	Make	Ion Exchange/Thermax/Aakar Engineers/Equivalent	
22	ACTIVATED CARBON FILTER		
	Quantity	1 No	
	Design Code	IS-2825	
	Flow	4m3/hr	
	Filtration Rate:	15 cum/sqmt/hr	
	Backwash flow rate	as per vendor	
	Size	as per vendor	
	Media	Activated Carbon & supporting media	
	Media Qty.	As per Vendor	
	Media Depth	As per Vendor	
	Shell thickness	As per Vendor	
	Dished end thickness	As per Vendor	
	Bed plate thickness	As per Vendor	
	Frontal Pipe	CPVC SCH 80	
	Side manhole for media removal.	Required	
	MOC	MSFRP/MSEP	
	Design Pressure	5.0 kg/cm2	
	Working Pressure	3.5 kg/cm2	
	Make	Ion Exchange/Thermax/Equivalent	
23	Sludge Holding Tank		
	No. of Units	One	

SR. NO.	DESCRIPTION			Tender Requirement	Data to be filled by vendor
	Volume			As per Vender	
	MOC			RCC(CONTRACTOR SCOPE)	
24	Filter Press Feed Pump			Two (1W+1S)	
	No. of Units			As per Vender	
	Capacity & Head			Centrifugal Sludge Transfer	
	Pump Type			pump	
	MOC			CI	
	KW rating/unit			As per Vender	
	Make			0	
25	Filter Press			As per Vender	
	No. of Units			As per Vender	
	Capacity				
23	pH Transmitter(at flash mixing tank)				
	Quantity			as per Vendor	
	Range			as per Vendor	
24	PLANT ROOM SIZE			One	
	No. of Units			As per Vender	
	DIMENSION			RCC	
	MOC				
25	LEVEL CONTROLLER & pressure Gauge			1 lot	
	Quantity			Float type	
	Type			ASTER/approved Equivalent	
	Make				
26	ETP INLET & OUTLET FLOW METERS				
	Quantity			2 Nos.	
	Type			Electromagnetic	
	Size			as per Vendor	
27	pH meter (at ETP outlet)				
	Quantity			1 Nos.	
	Type				
	Size			AS SUGGESTED BY VENDOR	

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
28	Interconnection Piping/Valves & Accessories		
	Sewage & Air submerged Piping Sewage not submerged Piping Air Not Submerged Piping Butterfly Valve Ball Valve	CPVC SCH 80/ CPVC SCH 80/ MS C CLASS WITH EPOXY COATED Cast Iron Gunmetal	
29	Eletric Panel	IP 55	
30	INSTRUMENT	TO BE MENTION BY VENDOR	
31	OVER ALL PLANT ROOM SIZE No. of Units DIMENSION MOC	One As per DRAWING	
32	Instrumnet list & Approved Make		
▶	Pump make : Groundfos/Xylem/Wilo/Korloskar		
▶	Submersible and horizontal centrifugal pump make : Groundfos/Xylem/Wilo/Korloskar		
▶	Metering pump make : Jee/Milton Roy		
▶	CPVC Pipe Make: Supreme / Astral / Ashirvad		
▶	Air Blower Make: Kay / Everest / KPT		
▶	Filter: Pentair/Ion Exchange/Thermax/Aakar Engineer/approved equivalent		
▶	Electrical Panel Component – L&T / Siemens /Lecrano/Schneioer		
▶	Electrical Cable – Polycab / RR Kable		
▶	Valves – L&T / Audco		

SR. NO.	DESCRIPTION	Tender Requirement	Data to be filled by vendor
►	Pressure Gauge: Mass/ H Guru/ Approved Equivalent		
►	Pressure Transmitter: E&M/ Toshbro/ABB		
►	Level Switch: E&M/ Toshbro/ABB/		
►	Pressure Switch: Danfoss/ Honeywell/ABB		
►	Electromagnetic Flow Meter -- E&H/ABB		
►	MS Pipe: TATA/JINDAL/ Approved Equivalent		
33	Civil & Mechanical/Electrical Design, shop, as build drawing of plant	To be submitted	
34	Overall Power requirement in KW Connected KW Operated KW	To be calculated and to be given To be calculated and to be given To be calculated and to be given	
35	POWER AND COST REQUIRED FOR RUNNING THE PLANT PER DAY		
36	CHEMICAL COST REQUIRED FOR RUNNING THE PLANT PER DAY		
37	Total Chemical Cost /day Delivery Period	-	
38	Time Duration for SITC job	-	
39	Guarantee/ Warranty	Full Guenette of plant against any defect in process, material, construction, operation on the bidder for period of one years.12 month From the date of commissioning.	
40	Approval from local PCB	PCB Approval will be in vendor scope. (only official and receipted payments would be submitted and Re-imbursed)	
41	Contractor shall include comprehensive and labour based operation & maintenance cost including testing for first one year during guarantee period (24hour basis) considering one supervisor, three operator, one or two labour.		

OPERATION & MAINTANANCE (O&M) OF ETP

Operation and maintenance of the treatment plant is very much essential for sustainability of the treatment plant and to achieve discharge standards. The operational aspects include regular checking of the performance of the units including the electrical and mechanical equipment, to identify any non-functionality of the units to evolve the strategic measures to be taken to make the plant fully functional to meet the stipulated standards. Plant shall be operated as per design criteria. Variance in input value of design criteria should be recorded.

The O&M Contract shall comprise all expenses for operation and maintaining the Facilities, as provided in this tender document. In addition to the cost of material/equipment spares, repair/replacement of equipment and labor, all other expenses such as expenses for patrolling, administration and management, permanent & temporary staff, running office, maintenance of all structures, updating of operation and maintenance manual, etc. and all other incidental and indirect expenses for the works detailed in this tender document or for works otherwise required as per good engineering practices for Operation and Maintenance of the entire system except Electricity cost are included in the quoted rates.

1. The contract includes operation and maintenance of entire Effluent Treatment Plant on round the clock basis for a period of 24 Calendar Months (Two Year) on terms and conditions described under this tender. However, the same contract may be extended for another 12 Calendar Months (One Year) on mutually agreed upon basis between Association of beneficiaries and the Contractor.

2. The Effluent Treatment Plant set up on turnkey basis shall be operated and maintained by the contractor including all Electrical, Mechanical, frequently laboratory testing handling with the experts as recommended by vendor. Contractor has to incur all the costs, taxes, vat, duties, transportation, labour, machining, welding, repairing, replacing and making good any and all parts/plant equipment, consumables, motors, pumps, aerators, gear unit, capacitor, HT/LT switchgear, PLC panel, lighting system, cables, battery charger, battery, instruments, meters, chemicals for laboratory etc.

3. Average power factor of 0.96 shall be maintained in electrical bill by the Contractor. Penalty on account of poor power factor (i.e. less than 0.9) will be recovered from the contractor from his monthly O&M bill.

4. The Contractor will be held responsible for O & M and satisfactory performance of the ETP by all means. Major components and works shall include the following but not limited to:

a) Operate the plant efficiently for two year, including all consumables, parts or components, labour transportation and other charges, but excluding the cost of power. Power cost of O & M of plant shall be borne by the association.

b) The contractor shall have to submit analysis report for Raw & treated samples daily. The Contractor is responsible for submission of daily and monthly O & M report.

c) Contractor shall submit six copies of the O & M Manual for approval of AUDA, which may be modified, if required by AUDA, and two copies would be returned by AUDA duly approved and signed.

d) The contractor shall carry out cement paint/ enamel paint/ white wash for exterior finish of civil units once before the end of second year of O & M of the plant and shall also carry out painting on mechanical equipments/ above ground pipe lines/ hand railing before the end of second year of O & M of the plant.

e) The contractor shall hand over the plant back to AUDA on expiry of his contract in fully working condition satisfying the requirement of treated sewage. All the electrical, mechanical and instrumentation including standby shall be in perfect working condition.

f) Contractor shall provide manpower and experts as recommended by supplier to perform treated water as desired result. Contractor shall operate ventilation system for ETP & Pump room and shall be part of SOP.

g) Insurance Certificates

Within 14 days of the acceptance of this tender the Contractor shall produce to the AUDA a certificate or certificates signed by the Contractor's insurers or their duly authorised agents covering all the persons with accidental policy of sufficient amount as per their grade (30 times monthly salary)

5. The Contractor will comply with all safety rules and regulations and all inter-disciplinary measures as followed by the AUDA. The AUDA will not be responsible for any accident / injury to the staff or any person of the Contractor or loss or damage to any property.

6. All Central / State Government / Semi-Government / Local Body's rules and regulation pertaining to this contract, all legal formalities pertaining to provident fund, factory act, all legal formalities shall be followed and observed by the Contractor without any extra cost to the AUDA. Please note that failure in complying so, all liabilities arising as per laws will be to the Contractor's account.

7. The quoted rate shall remain firm and valid for throughout O&M contract period. No price variation / escalation shall be paid.

8. The payment of O&M charges will be made as stipulated under chapter on "Schedule of Payments". All security deposits/retention money shall be released on successful completion of O&M period of one year.

9. First Aid Box

The Contractor shall at his own cost provide and maintain at the Site of Works standard first aid boxes as directed and approved by the AUDA for the use of his own as well as the AUDA's staff on Site as stipulated by local regulations. Contractor shall arrange to train all their staff in first aid treatment within 3 months.

10. Measurement And Analysis

The AUDA has the right to perform any analysis or inspection he deems necessary. The Contractor shall be responsible for the security and protection of flow meters at the designed point. If there is any malfunctioning of the meters, action will be initiated.

2.18. DEVELOPMENT OF TUBE / BORE WELLS

2.18.1 SCOPE :

The scope includes construction of tubewell to get required quantity of potable water with all material, testing, etc.

It is proposed to drill the tube well at the proposed site as per plan (or decided by the Client Authority) in accordance with ISSR No. 2800 - 1964 or latest.

The process to be adopted with direct rotary circulation method and tube well is to be installed as per the schedule where the actual length of housing pipe, stainless steel screen and blind pipe is to be worked out in accordance with the availability of strata. The annular space between the wall of hole and stainless steel screen is to be packed with the suitable size of graded gravel to make the area immediately around the well bore for the flow of water to prevent sand from entering the well during pumping.

2.18.2 GENERAL :-

A. The purpose of constructing the tube well is to obtain optimum quantity of ground water of good quality for domestic purpose. The depth shall be according to the strata available as per site condition. It will have M. S. ERW housing pipes. The minimum thickness of housing pipe will be 8 mm.

B. Below housing pipe, there shall be casing pipe having minimum thickness of 8 mm. Pipes shall be as per IS 1239 or 3589 /1991 and MS heavy duty strainer pipes for deep tube well shall be used.

2.18.3 DEFINITION:

In this contract a tube well will mean :-

A. Satisfactory completion of bore hole drilling to the maximum prescribed depth in all sorts of soil kankar, which shall include various kinds of water bearing strata including small boulder. The stated depths are approximate and the contractor may have to go higher or lower depth as decided by Client as per condition of strata generally available in the site locality

The contractor shall have to arrange for electrologging and cost shall include the same .

B. The work includes installation of casing and housing pipes complete with strainer or slotted pipes including bail plug, reducer, clamp, top half coupling and well cap. The housing pipes, casing pipes, Johnson strainer pipes, reducer, clamp wooden slippers well cap, half coupling and cone of bail plug shall have to be supplied by the contractor.

C. Work includes placing of a gravel packing around casing housing and strainer pipes as per design. All gravel as per specification of required quality of (and) quantity will be supplied by contractor.

D. Work includes Strata wise development of gravel packed tube well with adequate capacity air compressor.

E. The work includes development of gravel packed tube well with submersible pump with the object of obtaining a suitable quantity yield & shall nearly become sand free after 5 minutes of starting.

F. The scope also includes measuring of eccentricity and sound.

G. The scope shall also include well cap, bail plug, etc. complete.

2.18.4 DRILLING PROCEDURE:

A. The contractor will employ direct rotary circulation method rig for the drilling of well. The design of the wall for the discharge anticipated through will be of the firm. Yet the contractor is to continue drilling up to any depth when ordered by the Engineer in Charge (E.I.C.) in writing. The strata chart prepared on the basis of observation has to get approved from E.I.C. before arranging and installing the columns assembly through the responsibility for the design of the well will be that of the firm. If the E.I.C. feels that the sufficient water bearing strata has not been obtained drilling will be stopped when directed by the E.I.C. in writing.

B. All water bearing strata decided by the E.I.C shall be tapped.

C. The contractor shall have to drill first a pilot bore and after completion of which the contractor shall have to inform E.I.C. for Electrologging. Contractor shall have to arrange for

electrologging of each bore. Without electrologging of bore, rimming work should not be started in any case.

D. After pipe and strainer lowering in the bore hole and before gravel packing, minimum hours back washing is required to keep proper mud density.

E. After gravel packing work, minimum hours back washing is required with clean water, putting washing line at the bottom.

F. The contractor shall have to use fresh quality of Bantonite so that the mud salinity should be less than 230 PPM.

G. Bore hole shall be drilled freely in plumb and vertical.

2.18.5 CONSTRUCTION OF TUBE WELL

A. Drilling :

(a) After satisfactory drilling and bore hole rimming the contractor shall have to arrange lowering, installing and welding of housing pipes, casing pipes and strainer pipes including reducer, bail plug, joint covering strip, coupling, well cap etc. The contractor shall have to bring all the materials like bore pipes, reducers, strainer pipes, well cap, cone etc. two days prior to lowering with necessary test certificates for approval of engineer in charge. The contractor shall have to obtain written permission from the engineer in charge only after these he can start lowering of the pipes in presence of Client's engineer. The clamp shall applied to the housing pipes supporting to the pipe 0.5 mt below the ground level and supported with wooden slippers. Before lowering housing and casing pipes it should be painted with black anticorrosive bituminous paint.

B. Gravel packing as per IS 4097-1967 or Latest :

(a) After the pipe assembly is lowered into position it is to be packed with suitable size of gravel to be designed on the basis of the analysis of character of water bearing formations in the first instance of gravel packing is to be done up to the bottoms of housing pipe. The verticality of the housing pipe is to be tested and defects if any to be rectified to assure that it is not out of vertical. Thereafter the position of housing the pipe is to be secured and the gravel packing up to the top to be completed. Feeding of the gravel is to be done in such a manner that there is no bridging in annular space. To avoid the bridging it would be helpful if the circulated fluid is pumped to agitate the gravel as it is being fed.

2.18.6 Development of Tube Well :

(a) The well shall be developed with the help of air compressor in first instance to assure proper slotting of the gravel and after each a strainer it properly dealt. The development is to continue with the help of pumping set at a depression of 30ft. or at a distance of 50% higher than the design discharge of the tube well which so ever is more. The tube well is to be completely made sand free with no turbidity or at a most turbidity as defined in the ministry of health standards for drinking of water. After a contractor has reported that the development of tube well is completed. The tube well to be offered for testing observations are to be recorded in the shape of chart enclosed in the annexure in the manner prescribed in 155 – 2800 – 1964 or latest.

(b) The water tanker for work of drilling and developing for the tube well will not be provided by Client in any circumstances. The contractor has to arrange for water tanker at its own.

2.18.7 Verticality Test :

The tube well when out of alignment containing kinkers bend or core – screw is to be rejected straight way. The housing should be true to the line and the deviation from its top to the reducing socket in no case is more than 50 mm in the case when the housing pipe is 25 mtrs. Long and 75 mm when it is 30 mtrs. The deviation shall be in one direction and in one plan only. The deviation of the tube well is to be determined according to the method specified in ISS 2800 – 1964.

2.18.8 THE CONTRACT REPORT :

The contractor is required to furnish the following information :

- A. He should recommend the suitability of site proposed by the Client and in case of difference in opinion; he should suggest other site near by for the required design of the tube well.
- B. Whether the test bore is proposed, and if yes its diameter and depth.
- C. Depth of tube/borewell for shallow & deep well for availability of landscaping & potable water respectively
- D. Method of drilling.
- E. Size and types of different strainer or slotted pipe etc.
- F. Probably yields of the water.
- G. He should guarantee with regard to the verticality of the tube well and sand contents in the discharge at the time handing over the well.

2.18.9 FINAL TEST

The contractor shall give following certificates.

- A. Material test certificate and routine test certificate for M. S. ERW pipes as per IS 1239 or 3589/1981.
- B. Material test certificate and routine test certificate for Johnson filtration make continuous slotted strainer pipes.
- C. Strata chart showing all the technical detail in triplicate as per the attached annexure.
- D. Compressor development report with details for all the strata in triplicate.
- E. Submersible pump development certificate mentioning nos. of hours pump run, static water level, Verticality test certificate
- F. Acceptance test certificate for clear sounding of tube well and site properly levelled and cleaned and cavity around the tube well duly packed with clay and certificate for well cap, bore pipe, clamp, wooden slipper, earthing terminal and half coupling on the top of the pipe.

G. After the tube well has been completed each joint of housing pipe, blind pipe and that of strainer will both screwed type and continue type welded with 2 nos. M.S. flats of size overlapping by 6" on either side by socket.

**Annexure –I
(Strata Table)**

NAME OF AGENCY :
LOCATION OF TUBE/BORE WELL :

STRATA CHART

Depth drilled

Size of bore

Housing pipe

Blind pipe

Stainless steel screen

Slot size

Gravel packing

Bail plug

Reducer

Housing clamp

Centering guides

Well cap

Total hours developed

Static water level

Yield

Drawn down Pumping

water level Remarks if

any. Engineer – in –

charge.

2.19. BOREWELL SUBMERSIBLE PUMP, PIPE

2.19.1 SCOPE :

The specification covers design, performance, manufacture, construction features, testing, delivery, supply, installation & commissioning of submersible pump set which shall be installed in each Bore Well at site with PVC insulated submersible Cu cable, strainer, foot valve, level guard, column pipe, delivery pipe and fittings, delivery pressure gauge, clamps, etc.

2.19.2 CODES AND STANDARDS :

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

The equipment shall conform to IS 8034 - 1989 or its latest edition.

2.19.3 DESIGN FEATURES :

- A. The pump shall have CI casing with BRONZE impeller.
- B. The pump shall be capable of developing the required total head at rated capacity.
- C. If the pumpset is required to be operated at the reduced discharge, a throttling valve shall be provided to get that discharge, which generally should not be 25% lower than one indicated in selection chart, at duty point.
- D. Head - Capacity curve shall be rising type.
- E. Pumps & motors shall be lubricated by surrounding water, so there shall be no possibility of running pumpset under dry condition.
- F. Motor and pump shall be directly coupled.
- G. Pump shall be installed horizontally, if required.

2.19.4 CONSTRUCTION FEATURES :

Submersible pumpset generally comprises of the following :

- a) Pump
- b) Motor
- c) Non Return Valve
- d) Cable & Cable guards

A. PUMP ASSEMBLY :

This comprises of suction strainer, bowl, shaft, impeller, bearing, discharge casing etc.

Stator winding will be cooled by surrounding water.

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

Pump shaft shall be guided through bearings.

Surface finish of shaft shall be 0.75 mili micron.

The inlet passage of the suction casing shall be streamlined to avoid eddies.

Pump casing shall have provision for securing cable.

Cable guards shall be provided over the cable to prevent any damage.

B. MOTOR :

Motor shall be squirrel cage, water filled, induction, wet type and shall conform to IS 9283 : 1979.

Stator winding will be cooled by surrounding water.

A seal ring and sand slings will be provided to prevent entry of water and sandy particles to the stator tube.

A pressure equalising rubber diaphragm shall be provided in the lower part of the motor to absorb the expansion of water which will take place due to heat dissipation.

A thrust plate shall be provided to take axial thrust of the pump and rotor.

2.19.5 NON RETURN VALVE :

NRV shall be provided to protect piping system in the case of water hammer which shall occur due to power failure.

2.19.6 CABLE :

Cable shall conform to IS 9283 : 1979. This cable shall run along the pump casing. The cable shall be protected by cable guard. The cable shall be PVC insulated copper flat cable.

2.19.7 UPVC COLUMN & Delivery PIPE :

Column pipe shall be 80 mm diameter, conforming to IS latest.

2.19.8 BORE CAP :

It shall be manufactured from M.S. sheet.

2.19.9 CABLE GUARD :

Every pipe joint, flat cable shall be bind with nylon core of (1/16").

2.19.10 CLAMP :

Clamps shall be provided for column pipe and shall be made of heavy duty MS flat

2.19.11 TESTS :

A. VISUAL INSPECTION :

A pump shall be offered for a visual inspection to the client before despatch.

B. HYDROSTATIC TEST :

This test shall be carried out at 1.5 times the maximum discharge pressure for an individual casing or for whole assembled pump. The pump shall be tested for operating head range.

2.19.12 DRAWINGS TO BE FURNISHED BY VENDOR :

- 1) Performance curves
- 2) Overall dimensional drawing
- 3) Cross-sectional drawing with Bill of Material and material of construction.

2.19.13 PAINTING AND MARKING :

The pump shall be painted with epoxy paint and properly marked with :

- 1) Manufacturer's Name
- 2) Model No.
- 3) Motor rating
- 4) Discharge at duty point
- 5) Head at duty point
- 6) Overall efficiency at duty point
- 7) Rated speed
- 8) Rated Voltage
- 9) Frequency
- 10) Delivery size

2.19.14 Contractor has to submit the report with the following data :

- a. Static water level of the bore well
- b. Pumping level of bore well
- c. Discharge of Pump in m³/hr.
- d. Ampere meter, Volt meter, Power meter, etc. reading for 4 hour working of submersible pump.

2.19.15 GUARANTEE :

A The manufacturer shall give guaranteed minimum efficiency at duty point.

B The pump shall be guaranteed by the manufacturer against any defects and workmanship for a period of at least 12 months from the date of commissioning, whichever is less.

2.19.16 TECHNICAL DATA SHEETS

SUBMERSIBLE PUMP (DOMESTIC WATER)

SR.NO	ITEM DESCRIPTION	DATA
1.0	Type of Pump	Submersible Fixed Type
2.0	Mfg. Standard	IS 8034 : 1989 with its latest revision
3.0	Fluid	Bore well Water
4.0	PH	As per water test report
5.0	Sp. Gravity	1.0
6.0	Temperature	30 deg. Cent.
7.0	Solid Handling Capacity	Fine Sand Handling
8.0	Pump Detail	
8.1	Quantity	1 No. For Domestic water
8.2	Capacity in Ltr./hr.	As per BOQ
8.3	Head in mtrs.	As per BOQ
8.4	Operating Condition	Continuous
8.5	Rated Speed	2900 RPM
8.6	No. of stages	Minimum preferred
8.7	Method of Lubrication	Self
8.8	Impeller	Semi Open/Enclosed
8.9	Type of seal	Mechanical
8.10	Type of connection	Flanged
8.11	Maximum Outside Diameter	As per mfg. standard
8.12	Overall efficiency at duty point	*
8.13	Foot Valve	Required (One side threaded, other side column pipe flange)
9.0	Motor	
9.1	Rating	*
9.2	Type	Wet Submersible Squirrel Cage Induction
9.3	Mfg. Standard	IS 9283 : 1985 with its latest revision
9.4	Supply Condition	3 Phase, 415 Volts $\pm 10\%$, 50 Hz. $\pm 5\%$, Combined $\pm 10\%$
9.5	Connection	Directly coupled
9.6	Starter	Star / Delta
9.7	Minimum reserve power required at duty point	15%
10.0	Material of Construction	
10.1	Impeller	Bronze IS 318 Gr. LTB2
10.2	Shaft	S.S. AISI 410 or ASTM A276
10.3	Suction Strainer	SS 304
10.4	Pump casing	C.I FG 200 with 1.5 to 2%
10.5	Bearing Bush	Leaded Tin Bronze
10.6	Thrust plate	Bronze
10.7	Bearing Sleeve	S.S. 316
11.0	Cable	
11.1	Standard	IS 9283 : 1979 Clause 4.4
11.2	Cable type	3 Core water proof flat copper cable
12.0	Drawings	1) Performance curves 2) Overall dimensional drawing

Note : '*' denotes informations to be provided by the bidder

COLUMN PIPE

SR.NO.	ITEM DESCRIPTION	DATA
1.0	Size and material of the column pipe	80 mm dia., UPVC
2.0	Minimum wall thickness of column pipe	AS PER LATEST IS
3.0	Quality of the pipe for the column pipe	New pipe
4.0	Length of the column pipe	AS PER LATEST IS
5.0	Minimum length of the column pipe	AS PER LATEST IS
6.0	Pieces of pipe for column pipe	One piece (Joint less)
7.0	I.S. Specification of pipe for column pipe	AS PER LATEST IS
8.0	ISI mark	Required
9.0	Makers emboss mark	Required
10.0	Negative tolerance in thickness	Not allowed

2.20. LIST OF APPROVED MAKES:

Sr. No.	Item	Approved Make
1	SWR PVC PIPE & FITTINGS 6 KG CM ² ; FITTINGS : 6 KG CM ² ECO. DRAIN PIPE & FITTINGS	ASTRAL/SUPREME/ ASHIRVAD / PRINCE
2	GULLY TRAP	ASTRAL/SUPREME/ ASHIRVAD/ PRINCE
3	RCC HUME PIPES EXTERNAL MAIN UNDER GROUND PIPE	INDIAN HUME PIPE / PRANALI
4	C.I. PIPE & FITTINGS	NECO/KAPILANSH.
5	PPR PIPES & PPR FITTINGS	SUREME/PRINCE
6	M.S/G.I. PIPES FOR WATER SUPPLY	TATA / JINDAL/ SWASTIK
7	ASTM/CPVC/UPVC PIPE & FITTINGS FOR WATER SUPPLY	ASTRAL/SUPREME/ ASHIRVAD/ PRINCE / DUTRON
8	G.I. PIPES FITTINGS WATER SUPPLY	DRP-M / R-BRAND / ZOLOTO
9	GI TO GI JOINTS	CHAMPION / EQUIVALENT
10	SOLVENT CEMENT	SUPREME / KISSAN / FINOLEX
11	BALL VALVES	ZOLOTO / SANT / LEADER
12	WHEEL VALVES	ZOLOTO / SANT / LEADER
13	DCV / NRV	ZOLOTO / SANT / LEADER
14	TAR	SHALIBIND / TIKIBOND-BS
15	SEWAGE AND DRAIN PUMPS	KIRLOSKAR / LUBY / GLOBAL TECHNOLOGY / KSB
16	VALVES	AUDCO/ AIRA/R.B. / KBL/ADVANCE
17	Submersible PUMPS	KIRLOSKAR / LUBY / GLOBAL TECHNOLOGY / KSB
18	STARTER	SIEMENS / L&T
19	PRESSURE GAUGE	BELLS / H GURU
20	DEWATERING PUMPS	GRUNDFOS/ XYLEM/KSB
21	HYDROPNEUMATIC SYSTEM	GRUNDFOS / XYLEM/KSB
22	WATER TRANSFER PUMP	GRUNDFOS / XYLEM/KBL/KSB
23	METALLIC BELLOWS	BELLOW FLEX / PRICISION / DHRUV / B.D. ENGR.
24	R.O.PLANT	DOSHION / SHUBHAM INDIA/ ION EXCHANGE /POWER H2O / THERMAX /AAKAR /APPROVED EQUIVALENT
25	MULTI GRADE FILTER AND ACTIVATED CARBON FILTER	DOSHION / SHUBHAM INDIA/ M.S.N. ENVIROTECH/ ION EXCHANGE /POWER H2O / THERMAX /AAKAR / APPROVED EQUIVALENT
26	WATER COOLER	Blue Star, Power H2o & Eureka Forbs, marshal
27	SEWAGE TREATMENT PLANT/ EFFLUENT TREATMENT PLANT	SHUBHAM INDIA / ION EXCHANGE / THERMAX / AQUILA RO WATER PVT LTD.
28	CABLES	FINOLEX/ RAVIN/POLYCAB / RR KABLE / GEMSCAB/ AUOCAB/ KEJ
29	UV	ALPHA/EUREKA FORBES/Sukurt

Sr. No.	Item	Approved Make
30	WATER METER	KRANTI, ADM
31	SANITARY WARE	JAQUAR CONTINENTAL / CERA / HINDUSTAN PLUMBER / SANITARY WARE / HIND WARE / SOMANY
32	BORE WELL PUMPS	LUBY / KIRLOSKAR / EQUIVALENT

NOTE : (1) The Authority shall have right to select or reject any make.