

**PLUMBING WORKS
TECHNICAL SPECIFICATIONS**

DOC. NO.	OAB REDEVELOPMENT, NLSIU, BENGALURU	PROJECT NO.
PHE / 001	MATERIAL SPECIFICATION – PLUMBING WORKS	AD/0123

1. INTERNAL AND EXTERNAL WATER SUPPLY SYSTEM

1.1. WATER SUPPLY SYSTEM

SCOPE

1. Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install internal and external water supply pipes, pipes, fittings, valves and specialties, construction of valve chambers with Both sides of the chamber / manholes / gully traps must be waterproofed with FOSROC water proofing material. as indicated on the drawings and specifications.
2. Without restricting to the generality of the foregoing works, the scope of the work shall include Supply, Installation and testing of all Piping works like cold Water, hot water, piping and related valves, specialties and accessories for internal and external water supply.
3. The Contractor shall carryout and complete the said work under this contract in every respect in conformity with the rules and regulations of the local Authority. The Contractor shall furnish all labour, supply and install all new materials, appliances, equipment necessary for the complete installation and testing of the internal and external water supply system, as per the relevant BIS codes. This also includes any material, appliance, equipment not specifically mentioned herein or noted in the drawings, but which are necessary and customary to make a complete installation as shown on the drawings or described herein, properly connected and in working condition. However, this specification does not relieve the contractor for the correctness of the system.
4. The contractor shall include all implied/allied items in their offer. Nothing extra will be paid whatsoever for incidental or contingent work.
5. The contractor must get acquainted with the proposed site for the works and study specifications and conditions carefully before tendering. The work shall be executed as per program approved by the Project Engineer. If part of site is not available for any reason or there is some unavoidable delay in supply of materials stipulated by the employer, the program of construction shall be modified accordingly,

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and the contractor shall have no claim for any extras or compensation on this account.

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

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

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

1.2. CODES AND STANDARDS

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

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

Following codes and standards are made part of these specifications.

IS 10446 – 1983	Glossary of terms relating to water supply and sanitation.
IS 11208 –1985	Guidelines for registration of Plumbers
IS 7558-1974	Code of practice for domestic hot water installations
SP 7 -1983	National Building Code of India (Part IX- Plumbing services)
IS 2692-1989	Specification for Ferrules for Water Services

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IS 1239 (Part-II) –1990	Mild steel tubular and other wrought steel pipes and fittings
IS 779 -1978	Specifications for Water Meter s Domestic Type
IS 2104 – 1981	Specification for water meter boxes (Domestic type)
IS 2401–1973	Code of practice for selection, installation, and maintenance of domestic water meters
IS 7413-1981	Insulation Material
IS 2065 –1983	Code of practice for Water Supply in Buildings (Second Revision)
IS 778- 1984	Specifications for copper alloy Gate, Globe and Check Valves for water supply purposes.
IS 1703 – 1977	Specification for ball valves (horizontal plunger type) Including floats for water supply purposes.
IS 3004 – 1979	Specification for plug cocks for water supply purposes.
IS 3950 – 1979	Specifications for surface boxes for sluice valves.
IS 9338 – 1984	Specification for cast iron screw -down stop valves and stop and check valves for water works.
IS 4346 – 1982	Specification for washers for use with fittings for water services.
IS 5219 – Part 1 1982	Specification for cast copper alloy traps – Part1
IS 5312 – part 1 1969	Specification for swing check type reflux (non-return)
IS 13049 – 1919	Diaphragm type (plastic body) float operated valve for cold water services – specification.
IS 13114 – 1991	Forged brass gate, globe and check valves for water works purposes – specification.
IS 14399 – part 1 & Part 1 – 1996	Hot press moulded thermosetting glass fibre reinforced, polyester (GRP) resin sectional water storage tanks.

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IS 310 –1965	Code of Practice for Water Supply
SP –35	Handbook of water supply and drainage (with special emphasis on plumbing)
IS 1172-1983	Code of Basic Requirement for Water Supply, Drainage & Sanitation (Third Revision)
IS 12183 (Part I) – 1987	Code of practice for Plumbing in Multi-Story buildings ((Part 1 water supply)
IS 1200 – 1992 (Part 1 earth work)	Method of Measurement of Building and Civil Engr Works
IS 2379 –1963	Specification of colour code for the identification of pipes.
SP 7 – 1983	National building code of India (Part IX – Plumbing services)
IS 2401 – 1973	Code of practice for selection, Installation, and maintenance of domestic water meters.
IS 780-1984	Specification for Sluice valves for water works purposes (50 to 300mm size) (Sixth Revision)

1.3. WATER SUPPLY

Main source of water is from Roof rainwater /Bore well / Municipal / Tanker water supply.

1.4. CPVC PIPES AND FITTINGS FOR WATER CONNECTIONS

CPVC pipes and fittings shall be used for cold & Hot water services above and below ground applications. All internal and external piping shall be of CPVC SDR 11 up to 50 mm and above 65 mm and above shall be CPVC SCH 80.

All exposed pipes, accessories; fitting, mounting clamps in the kitchen shall be of Chrome plated or stainless steel.

1.5. LAYING AND FIXING

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

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

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

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

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

When using solvents be certain of proper ventilation.

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

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

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

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

Use care when selecting threaded sealants.

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

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

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

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

Pressure test CPVC systems in accordance with local code requirements.

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

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when cutting pipe in extremely cold weather we recommended you choose alternative methods of cutting.

Safe handling of solvents:

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

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

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

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

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

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

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

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

For external work pipes and fittings shall be laid in trenches. The width of the trench shall be the minimum width required for working. The pipes laid underground, the cover on top of pipe shall be not less than 600mm for metal pipes and shall not be less than 900mm for plastic pipes from the finished ground level and a minimum

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horizontal distance of 600mm shall be maintained between other services lines.

Backfilling of trenches shall be as explained elsewhere in the specifications.

1.6. COLOUR CODE FOR WATER SUPPLY PIPE

Colour code for water supply pipes shall be as per standard requirement. Details as mentioned below.

COLOR CODE FOR GENERAL SERVICES

SI No	Description	Ground Colour	First Colour Band	Second Colour Band
A	WATER			
1.0	Cooling	Sea green	French blue	
2.0	Boiler feed	Sea green	-----	-----
3.0	Condensate	Sea green	Light brown	-----
4.0	Drinking	Sea green	French blue	Signal red
5.0	Treated	Sea green	Light orange	-----
6.0	Cold water from storage tank.	Sea green	French blue	Canary yellow

1.7. TESTING

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

1.8. RECTIFICATION

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

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1.9. DISINFECTION OF THE PIPE NETWORK

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

1.10. MODE OF MEASUREMENT.

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

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

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

1.11. INSULATION OF HOT WATER.

All hot water piping shall be of CPVC insulated with Nitrile Rubber Tubular Insulation with CPVC pipes. Before applying insulation, all pipe work and fittings shall be brushed and cleaned. Dust, dirt, mortar and oil shall be removed.

Hot water pipes exposed in kitchen area must be provided with SS Jacket or Zinc aluminium jacket as per local code over the pipe insulation specified above.

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The thickness of insulation to be applied shall be as follows:

Pipe Size	Insulation Thickness (VEDO FLEX)
15 mm, 20 mm	6 mm
25 mm, 32 mm	6 mm
40 mm & above	9 mm

The thickness of insulation mentioned in the table above is exclusive of the thickness of plaster / protective coat to be applied over the insulation material.

1.12. VALVES AND CONTROLS.

GENERAL

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

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

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

All exposed pipe accessories: fitting, mounting clamps in the kitchen shall be of Chrome plated or stainless steel.

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GATE VALVE

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

Supplying, fixing and testing shall correspond to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

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

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

Also, the following standard corresponds to their manufacture.

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

BALL VALVE

The ball valve shall be of high-pressure type and shall be of sizes as specified in the BOQ. The normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed. All exposed ball valves in the kitchen shall be chrome plated or stainless steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE

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FOOT VALVE

Foot valves body and the strainer shall be of stainless-steel construction of approved quality wherever shown.

BUTTERFLY VALVES

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

Also, the following standard corresponds to their manufacture.

Design	API609/BS5155
Face to Face / End to End Flange	ANSI B 16.10
Flange Dimension	ANSI B 16.5
Butt Weld Ends	ANSI B 16.25
Pressure/Temperature Ratings	ANSI B 16.34
Seating	moulded in situ resilient lining of black Nitrile rubber.
Body	Heavy duty CI to IS210 Gr FG220 & BS 1452 lining of black nitrile rubber.
Disk	Nylon coated SG iron of IS 1865 / SF400 / 127BS2729 Gr. 420 / 12
Shaft	Shafts are to be made of SS AISI 431

Only, flanged valves to be used with Flanges drilled to BS10 table F, valves Shall be capable of being locked in open Position. Hand wheel shall be with Worm and

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worm wheel operated for Smooth opening and closing. Key rod with MS Coated extended spindle to be provided wherever the valves are not approachable from the ground surface.

CHECK VALVES

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

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

Y STRAINERS

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

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

FLANGES AND UNIONS

Enough flanges and unions shall be provided as required to facilitate maintenance work after the piping is installed. Mild steel flanges shall be used for pipes. The

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flanges shall be connected to the pipeline by screwing or welding depending on the requirement. The flanges shall conform to the relevant ASTM standard for the material used for its manufacture. The flanges shall also conform to IS 5211.

BRASS BIB COCK AND STOP COCK

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

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

Size in mm	Minimum finished weight	
	Bib tap in kg	Stop tap
8	0.25	0.25
10	0.3	0.35
15	0.4	0.4
20	0.75	0.7

INSTALLATION OF VALVES

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

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Proper care must be taken in welded installation so that the centreline of valve should not deviate from the pipe causing uneven load on the pipe and further stress during its operation. The welding should be done only after proper inspection of the joint by the Engineer in the tacked position of the joint.

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

PCC PIPE SUPPORTS

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

Mode of Measurements

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

- a) Cost of valves and jointing materials.
- b) Fixing and jointing with necessary bolts, nuts, rubber inserting, etc
- c) Testing and making good the defects if any

WATER HAMMER ARRESTOR

The effective fluid hammer which results in breaking of pipeline caused due to series of hydraulic shock should be arrested by means of a water hammer arrestor. The arrestor shall be capable of withstanding pressures up to 500 P.S.I. It shall be maintenance free with a companion flange to suit in the pipeline. The following materials are used for its manufacture.

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Barrel Type 'K' hard drawn copper.

CAP Standard wrought copper fittings attached to Barrel with 95-5 solder.

Piston & Thread
Adaptor Machined of free turning brass.

Seals "O" rings shall be of Parker spec. EP-5778-80

Seal Lubricant Dow-corning silicone compound #111, FF & DA

Listed for use in potable water system or Nickel plated for seawater application.

PRESSURE REDUCING VALVE

Pressure reducing valves shall be of approved make, bronze body, pilot operated spring loaded for reducing pressure as per BOQ suitable for the specified Dia of pipe

For all other areas the pressure reducing valves shall be of approved make in bronze material.

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2. INTERNAL SANITARY SYSTEM

INTERNAL SANITARY SYSTEM (SOIL, WASTE AND VENT AND RAINWATER PIPES)

2.1. SCOPE OF WORK

Work under this section consists of furnishing all labour, materials, equipment, and appliances necessary and required to completely install soil, waste, vent and rainwater pipes as indicated in the specifications and as per the instructions of the Engineer.

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

- a) Vertical and Horizontal Soil, waste, vent, rainwater pipes and fittings, joints, clamps and connections to fixtures.
- b) Connection of all pipes to sewer lines as shown on the drawings.
- c) Floor and urinal traps, cleanout plugs and inlet fittings.

Testing of all pipelines and all accessories as per Bureau of Indian Standards.

2.2. CODES AND STANDARDS

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

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

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

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

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IS 11208 –1985	Guidelines for registration of Plumbers.
IS 5382 – 1985	Specification for rubber sealing rings for gas mains, water mains and sewers.
SP –35	Handbook of water supply and drainage (with special emphasis on plumbing)
IS 1172-1983	Code of Basic Requirement for Water Supply, Drainage & Sanitation (Third Revision)
IS 1200 - 1992	Method of Measurement of Building and Civil Eng. Works. (Part 1 earth work)
IS 2379 –1963	Specification of colour code for the identification of pipes.
IS 1742 – 1983	Code of Practice for Building Drainage (Second Revision)
IS 301 – 1971	Code of practice for Building Drainage
IS12251- 1987	Code Of Practice for Drainage in Basement
BS 5572 -1978	(Amendment No.2) Sanitary pipe Works
BS 4660- 1973	(Amendment No.1) PVC Underground Drainpipes & Fittings
IS 5329 – 1983	Code of practice for sanitary pipe work above ground for buildings First Revision)

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IS 2527 – 1984	Code of practice for fixing rainwater gutters and down take pipes for roof drainage. (First Revision)
IS 5961 – 1970	Specification for cast iron gratings for drainage purposes
IS 2527 – 1984	Code of practice for fixing rainwater gutters and down take pipes for roof drainage. (First Revision)
IS 1626 (Part 1)	Specification for asbestos cement building pipes and pipes –1980 fittings, gutter and gutter fittings, and roof fittings

2.3. GENERAL REQUIREMENTS

- Materials shall be of the approved make and quality specified. They shall conform to the respective Bureau of Indian Standards, British Standards Specifications, supported by Manufacturing Certificate and any other specification referred to herein.
- Pipes and fittings shall be fixed truly vertical, horizontal or on slopes as required in neat manner.
- Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, and in suspended ceilings.
- Pipes shall be fixed securely to walls and ceilings by suitable pipe supports at intervals specified.
- Access door for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

2.4. POLYVINYL CHLORIDE (PVC) PIPES AND FITTINGS

PVC (SWR) class pipes and fittings of dia 50 mm OD, 75mm OD, 110mm OD and 160mm OD of Type A for use in rainwater and ventilation and of Type B for soil and waste discharging system of pressure rating Max 6Kg/cm² and conforming to IS 13592: 1992, shall be used. The pipes shall be supplied in nominal lengths of 2, 3,

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and 4 or 6 meters, tolerance on specified lengths shall be +/-10mm. Any physical test requirements shall be as per IS13592-1992.

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

2.5. HANDLING

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

2.6. LAYING

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

2.7. JOINTING

The jointing of pipes to fittings shall be done as per the manufacturer's instructions / recommendations and as per the Engineer instruction.

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

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- Cut the spigot end of the pipe square.
- All burrs from the internal and external surfaces should be removed
- The spigot should be marked with a pencil line and a distance equivalent to the socket depth. Clean the surface within the marked area.
- Apply uniform coat of solvent cement on the external surface to the pipe and a lighter coat on the internal surface of the fitting.
- Insert the pipe end into the socket of the fitting and push it in up to the mark.
- Remove the excess solvent cement and hold the joint firmly in position for 30 seconds to dry. Gluing should be avoided in a rainy or foggy weather.

The other method of jointing shall be by rubber rings. The material of rubber ring should conform to IS 5382-1969. The ring is housed in groove formed in a plastic or metallic housing. The rubber is compressed and makes a seal between the pipe and housing.

Lubricating paste should be applied before compressing the rubber. Where natural rubber 'O' rings are used, mineral oil or petrol or grease should be used.

2.8. TESTING

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

2.9. RIGID PVC PRESSURE PIPES AND FITTINGS

The PVC pressure pipes and fittings shall be used for conveying wastewater from washbasins, kitchen sinks, urinals, floor drain connecting to washing machines and condensate drain etc. The pipes shall be 10 Kg/cm². PVC pipes and fittings shall be jointed with solvent cement. Fittings shall be of injection moulded PVC conforming to IS 7634 (Part1) - 1975

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2.10. LAYING AND FIXING

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

2.11. TESTING

The method, which is commonly in use, is filling the pipe with water, taking care to evacuate any entrapped air and slowly raising the system to the test pressure. The test shall be done in accordance with IS 2065 – 1983 – code of practice for water supply in buildings. The test pressure shall be 5 kg/cm² or the maximum working pressure plus 50%, whichever is greater. The pressure shall be maintained for at least 4 hours. The Engineer shall examine carefully all the joints for leakage. The cost of equipment's and accessories required for testing the system shall be supplied by the contractor at his own cost.

2.12. MODE OF MEASUREMENT

PVC PIPES

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

- a) Chambers: Shall be recorded from the inside of one chamber to inside of another chamber.
- b) Gully trap and Chamber: Shall be recorded between socket pipe near gully trap and inside of chamber.

The quoted rate shall include the following:

- i. The cost of pipes, specials and other jointing materials.

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- ii. Laying, jointing and curing.
- iii. Testing and making good the defects, if any.

PVC FLOOR TRAPS

The PVC floor trap shall be of multi-inlet and one single outlet type. The floor trap shall be deep seal type with an effective seal of minimum 50mm. The waste from sanitary fixtures shall be directly discharged to the floor trap. Jointing of the waste pipe to the floor trap shall be done as per manufacturer's instructions. The height riser fitting shall be made use of, wherever the floor drain is in deep-sunk floors or is suspended from the ceiling. The floor trap shall be of reputed make and preferably of the same make as of the pipes used. The floor trap shall be provided with 150 x 150mm square cast chrome plated or stainless-steel grating with rim of approved design. Minimum thickness of the grating shall be 4 to 5mm.

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

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

VENT COWL

The supply and installation of PVC vent cowl shall conform to local codes and or British standards whichever is applicable code of practice. The cost of supply and installation of vent cowl shall be measured as part of soil and waste pipe

ROOF DRAIN

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

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3. EXTERNAL SEWORAGE SYSTEM

3.1. SCOPE OF WORK

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

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

Testing of all pipelines and all accessories as per Bureau of Indian Standards.

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

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

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

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

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

Repair all damage done to the premises because of this installation and remove all debris left by those engaged for this installation to the satisfaction of Engineer.

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

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

3.2. CODES AND STANDARDS

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

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

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

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

IS 11208 –1985 Guidelines for registration of Plumbers.

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

3.3. PVC PIPES AND FITTINGS

PVC (SWR) class pipes and fittings of Dia 75mm OD, 110mm OD, 160mm OD, 200 mm OD and 250mm OD of Type A for use in rainwater and ventilation and of Type B for soil and waste discharging system and conforming to IS 13592: 1992, shall be used. The pipes shall be supplied in nominal lengths of 3 & 6 meters, tolerance on specified lengths shall be +/-10mm. Any physical test requirements shall be as per IS13592-1992.

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- All soil, waste and siphonage pipes and fittings used as vertical external pipes within the shafts shall be PVC SWR grade socket and spigot type pipes confirming to relevant IS or its subsequent revisions.
- All pipes being used on exposed surface shall be UV protected with a UV inhibitor built in during Moulding / extrusion in case of PVC pipes.
- All such pipes shall use only rubber ring joints.
- No pasted joints shall be permitted on external piping.
- All external pipes shall be mounted on special sliding brackets of galvanized MS grouted to the duct wall, with the pipes being held to it using GI “U clamps”. These brackets shall provide for a least 50mm clear working space behind the pipes.

3.4. MANHOLE AND INSPECTION CHAMBERS

Inspection chambers of Internal size 600mm x 600mm up to a depth of 0.9 m and manholes of varying sizes as per IS 4111 shall be constructed beyond 1.2m (depth of the sewer line from the Formation Ground level). Both sides of the chamber / manholes / gully traps have to be waterproofed with FOSROC water proofing material

3.5. LOCATION AND SIZES

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

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3.6. BED CONCRETE

Bed concrete shall be in 1:4:8 cement concrete, and the thickness of bed concrete shall be as tabulated below. Both sides of the chamber / manholes / gully traps must be waterproofed with FOSROC water proofing material.

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

3.7. BRICK MASONRY

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

Sl. No	Depth of manhole/Inspection chambers	Thickness of brick masonry
1	Inspection Chambers up to 1.2 m depth	230mm
2	Manholes up to 2.25m depth	230/345mm
3	Manholes from 3.0m to 5.0m.	230/345/460mm
3	Manholes from 5.0m to 9.0m.	230/345/460/575mm

3.8. PLASTER

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

3.9. BENCHING

Sloping surfaces having slope in transverse direction constructed on either side of channels at the base of manholes or inspection chamber for the purpose of

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confining the flow of sewage, avoiding the accumulation of deposits and providing a safe working platform. Channels and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement. The following sizes of channels for the benching shall be adopted:

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

3.10. CHAMBER / MANHOLE COVERS

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

3.11. STEPS

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

3.12. DROP CONNECTION

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

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3.13. GULLY TRAP CHAMBERS

Stoneware gully traps of specified size shall be provided as per IS 651. It shall be fixed on 150mm thick and 700mm square 1:4:8 cement concrete bedding, and the gully outlet shall be jointed similarly to the jointing of stoneware pipes. A brick masonry chamber 300 x 300 mm (internally) shall be constructed in 1/2 brick masonry with 1:6 cement mortar and the spaces between the trap and the wall shall be filled up with 1:3:6 concrete and the upper portion of the chamber shall be finished with neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating and the bottom of the chamber shall not be less than 230 mm. In addition to 150mmx150mm CI grating, the chamber shall have a CI frame and cover (300mm x 300 mm). The cover and frame shall be placed on top of the brick masonry.

3.14. UNDERGROUND TRENCHES ALIGNMENT AND GRADE PVC PIPES AND FITTINGS

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

3.15. OPENING OUT TRENCHES

In excavating the trenches, the road metalling, pavement kerbing, etc., are to be placed on one side and preserved for reinstatement and the trench or other excavation shall be filled up and laid back to original condition at no extra cost. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Employer. 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 Employer orders the contrary. The contractor shall scrub and clear the surface over the trenches and other excavations of all stumps, roots and other encumbrances affecting execution of work and shall remove the same from the site as per the directions of the Engineer.

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3.16. EXCAVATION TO BE TAKEN TO PROPER DEPTH

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

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

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

3.18. REFILLING

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

3.19. BACK FILLING OF TRENCH

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

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

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

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

3.20. BACKFILL MATERIALS

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

3.21. BACK FILL SAND

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

3.22. BACK-FILL GRAVEL

Gravel used for back fill shall be natural gravel and having durable particles graded from fine to coarse in a reasonably uniform combination with no boulders or stone larger than 50mm in size. It shall not contain excessive amount of loam and clay, and not more than 15 percent shall remain on a sieve of aperture size 75 micron.

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

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

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

3.23. BACKFILL WITH EXCAVATED MATERIALS

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

3.24. CONCRETE SLABS OVER PIPES

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

3.25. SITE CLEANING ON COMPLETION OF WORK

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

3.26. CONTRACTOR SHALL RESTORE SETTLEMENT AND DAMAGES

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

3.27. DISPOSAL OF SURPLUS

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

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3.28. TIMBERING

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

3.29. REMOVAL OF WATER

The Contractor shall always during the progress of 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 public health nor to public or private property, to the work completed or in progress, to the surface of any roads or streets and cause any interference with the use of the same

3.30. TRENCH WIDTH

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

Width at bottom

Excavation up to:	Upto100mm dia pipe	Up to 150mm dia pipe	Up to 300mm dia pipe
900 to 1500 mm depth	650 mm	700 mm	850 mm
1500 to 3000 mm depth	900 mm	950 mm	1100 mm
3000 to 5000 mm depth	1100 mm	1150 mm	1300 mm

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3.31. PROTECTION OF EXISTING SERVICES

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

3.32. ROAD CROSSINGS

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

3.33. CONSTRUCTION ACROSS ROADS

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

MODE OF MEASUREMENT

- Measurement for excavation of pipes trenches shall be made per linear meter under the respective category of soil classification encountered at site.
- All types of soil like soft soil, hard soil, soft rock, and disintegrated rock requires chiselling. Hard rock requiring blasting.