RAJKOT MUNICIPAL CORPORATION

e - Tender No.RMC/ENGG/EZ/22-23/94

Bid Documents For

AMRUT 2.0 : PROVIDING, LOWERING, LAYING, JOINTING, TESTING AND COMMISSIONING OF SEWERAGE LINE IN BHAGVATIPARA IN WARD NO.04 (9th Attempt)

Volume-II

Technical Specifications & Drawings

Milestone Dates for e-tendering is as under	
1. Downloading of e-Tender documents	06-12-23 To 27-12-23 upto 17.00 Hrs.
2. Pre-bid Meeting	16-12-23 upto 18.00 Hrs.
3. Online submission of e – Tender	Before 27-12-23 upto 18.00 Hrs.
4. Physical submission of EMD, Tender fee and other documents required as per Financial and Experience criteria. by Regd. Post. A.D. / Speed Post ONLY	29-12-23 at 11.00 Hours onwards
5. Opening of online technical bid	30-12-23 at 11.00 Hours onwards
6. Verification of submitted documents (EMD, e - Tender fee, etc.)	30-12-23 at 11.00 Hours onwards
7. Agency to remain present in person along with original documents for verification	01-01-24 between 16.00 to 17.00 Hrs
8. Opening of Price Bid (If possible)	02-01-24 at 11.00 Hours onwards
9. Bid Validity	180 Days
For further details, pre-qualification criteria etc. visit www.rmc.nprocure.com	

2022-23

CITY ENGINEER
RAJKOT MUNICIPAL CORPORATION
SHRI ZAVERCHAND MEGHANI BHAVAN
EAST ZONE OFFICE, BHAVNAGAR ROAD,
RAJKOT - 360003 (GUJARAT)

TECHNICAL SPECIFICATIONS CONTENT

:: TECHNICAL SPECIFICATIONS ::

A. GENERAL

1. SCOPE OF CONTRACT :

The work entitled comprise of excavation of trenches with shoring and strutting wherever required bailing out water wherever necessary, laying of pipes, jointing including supply of material and material required for jointing, testing as per specifications, Construction of appurtenances such as brick Masonry / RCC chambers etc. as per the type design specified entirely of the specification of various works stipulated in the e- Tender. The work includes supply of sewer pipes ISI Marked and which shall have to be supplied at site or Municipal store by the contractor at specified and shown in schedule “B”. Other material like cement etc shall have to supplied by the contractor from open market.

2. e-TENDER PRICE:

The rates quoted in the bill of quantities shall cover everything necessary for the due and complete execution of the work according to the drawings and other condition and stipulations of the contract including specifications of the evident, intend and meaning of all or either of them or according to customary usage and for periodical and final inspection and test and proof of the work in every respect and for measuring, numbering or weighing the same, including setting out and laying or fixing in position and the provision of all materials, power, tools, rammers, labour, tackle, platforms with impervious lapped joints for scaffolding, ranging roads, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rods, straight edged, cantering and boxing, wedges, moulds, templates, posts, straight rails, boning staves strutting, barriers, fencing lighting pumping apparatus, temporary arrangement for passage of traffic access to premises and continuance to drainage water supply and lighting (if interrupted by contractor’s work) temporary sheds, painting, varnishing, polishing establishment for efficient supervision and stating arrangements for the efficient protective of life and property and all requisite plant and machinery of every kind.

The contractor shall keep every portion of the work clear of accumulation from time to time and shall leave every portion of the work clean, clear, perfect and at the conclusion of whole, providing at their own cost all such material implement, appliances and labour as the Engineer in charge may require to prove if it to be so.

3. COMPLETION SCHEDULE:

The contract period shall be as prescribed in tender document, from the date of notice to proceed i.e Work Order. The Contractor shall submit his completion schedule and the program of works together with this e-Tender in conformity with completion schedule given in the documents.

4. Packing and Handling:

4.1. Necessary care shall be taken and required packing shall be provided to avoid damage to pipe barrels and the edges of the pipe ends in transit.

4.2. Where the goods are required to be dispatched at Railway risk, special packing as per IRCA rules are absolutely necessary, which would be payable by the contractor himself.

4.3. The contractor shall use proper handling equipment or follow suitable standard handling method for **DI pipes & DI Specials** as approved by the Engineer-in- charge to unload the materials at the delivery site to prevent damage to the goods.

4.4. The contractor shall take all care for Transportation & supply of HC connections items to be supplied with its standard handling process, stored at site under his store / the delivery site to prevent damage to the goods.

5. GENERAL TECHNICAL GUIDELINE:

5.1. All the items occurring in the work and as found necessary during actual execution shall be carried out in the best workman like manner as per specifications and the written order of the Engineer in charge

5.2. Extra Claim in respect of extra work shall be allowed only if such work is ordered to be carried out in writing by the Engineer in charge

5.3. The contractor shall engage a qualified Engineer for the Execution of work who will remain present for all the time on site and will receive instructions and orders from the Engineer in charge or his authorized representative. The instruction and orders given to the contractor representative on site shall be considered as it given to the contractor himself.

5.4. The work order book as prescribed shall be maintained on the site of the work by the contactor and the contractor shall sign the orders given by the inspecting offers and shall carry out them properly.

5.5. Quantities specified in the e-Tender may vary at the time of

actual execution and the contractor shall have no claim for compensation on account of such variation

5.6. Unexcavated lengths shall be left wherever required and so directed by the Engineer in charge during the currency of the contract and shall be tackled. If required, before completion of work.

5.7. Diversion of road, if necessary, shall be provided and maintained during the currency of the contract by the contractor at his cost.

5.8. Figured Dimensions of drawing shall supersede measurements by scale, special dimensions or directions in the specifications shall supersede all other dimensions.

5.9. All levels are given on drawings and the contractor shall be responsible to take regular level on the approved alignment before actually starting the work. The levels shall be commence to the G.T.S. levels and shall be got approved from the Engineer in charge

5.10. If the arrangement of temporary drainage is required to be made during any work of this Contract, this shall be made by the Contractor without claiming any extra cost.

6. CLASSIFICATION OF STRATA:

6.1. All materials encountered in excavation will be classified in the following groups irrespective of mode of excavating the materials and the decision of the Engineer in charge in this regard shall be final and binding to the contractor.

6.2. Soils :

Soils of all sorts, silt, sand, gravel, soft murrum, stiff clay, kunkar and other soft excavation not covered in the items mentioned hereunder.

6.3. Hard Murrum :

Hard Materials comprising of all kinds of disintegrated rock or shale or indurate conglomerate interspersed with boulders, weathered and decomposed rock which could be removed with pick, bar, shove, wedges and hammers, though not without some difficulties.

6.4. Soft – Rock:

This shall include all materials which is rock but which does not need blasting and can be removed with a pick bar, wedges, pavement breakers, pneumatic tools etc.

6.5. Hard Rock:

This shall include rock accusing in mass or boulders which need blasting, this will also include rock to be removed by chiseling

or any other method where blasting is not permissible.

7. The rates are inclusive of dewatering, if required.

8. Regarding water supply for hydro testing, necessary water, power, labour, etc. required for necessary test shall be arranged by the contractor at his own cost.

9. During construction activity, proper care must be taken for labour safety and must follow the provisions of the Labour laws.

10. TMT bars of Fe-415 should be confirming to IS:1786. The approved makes shall be TATA, SAIL, Vizag, Gallent, Electrotherm or other equivalent make as approved by engineer-in-charge.

11. Cement shall be ordinary Portland cement conforming to IS:269, IS:8112 or IS:12269 for all the works as per the instructions of engineer-incharge. The approved makes shall be Ambuja, Ultratect, LOTUS, Siddhi, Sanghi, Hathi or as per IS confirming.

12. Minimum Cement content for the work should be as per attached circular No.RMC/C/Vigi.(Tech)/231 dt. 11/03/2022.

13. Testing of the materials like Brick, Sand, Aggregate, Reinforcement steel, etc. should have to be tested peridiocally as suggested by the Engineer-in-charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.

14. In case of any ambiguity found in inspections / drawings etc, the decision of engineer-in-charge shall be final and binding to the contractor.

DETAILED SPECIFICATIONS OF MATERIALS

M-1 WATER :

1.1 Water shall not be salty or brackish and shall be clean reasonably clear and free from objectionable quantities of silt and tract of oil and injurious alkalis, salts, organic mater and other deleterious materials which will either weaken the mortar or concrete or cause efflorescence in R.C.C.. The container for transport, storage and handling of water shall be clean. Water shall conform to the standards specified in I.S. 456-2000 (latest revision).

1.2 If required by the Engineer-in-charge it shall be tested by comparison with distilled water. Comparison shall be made by means of standard cement tests for soundness, time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness, change in time of setting of 30 minutes either more or decrease of more than 10 percent in strength of mortar prepared with water sample **when compared with the results** obtained with **mortar prepared with distilled water** shall be sufficient cause **for rejection of water** under test.

1.3 Water for curing mortar, concrete or masonry should not be too acidic and also not too alkaline. It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces.

1.4 Hard and bitter water shall not be used for curing.

1.5 Potable water will be generally found suitable for curing mortar for preparing or concrete.

M-2 CEMENT :

2.1 Cement shall be Sulphate Resistant Cement conforming to IS : 12330, Ordinary portland cement as per I.S. 269-1976 or Portland slag cement as per I.S.455-1976.

2.2 Testing of Cement : It should be specifically noted that the cement brought by the contractor at site of work shall be used after the same is tested at the approved laboratory as per the direction of the Engineer-in-charge. Such approved laboratory may be located at Ahmedaba All the charges for transport and testing of the samples shall have to be borne by the contractor. The frequency of testing of such materials shall be in accordance to the relevant Indian standard as directed by the Engineer-in-charge.

M-3 SAND :

3.1 Sand shall be natural sand, clean, well graded, hard strong, durable and gritty particles free from injurious of dust, clay, kankar nodules, soft or flaky particles shale, alkali salts, organic matter, loam, mica or other

deleterious substances and shall be got approved from the Engineer-in-charge. The sand shall not contain more than 8 percent of silt as determined by field test. If necessary the sand shall be washed to make it clean.

3.2 COARSE SAND :

The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse shall be as under:

I. S. Sieve Designation	Percentage by weight passing sieve	I. S. Sieve Designation	Percentage by weight passing through sieve.
4.75 mm	100	600 Micron	30 - 100
2.36 mm	90 - 100	300 Micron	5 - 70
1.18 mm	70 - 100	150 Micron	0 - 50

3.3 FINE SAND :

The fineness modulus shall not exceed 1.0. The sieve analysis of fine sand shall be as under :

I. S. Sieve Designation	Percentage by weight passing through sieve	I. S. Sieve Designation	Percentage by weight passing through sieve.
4.75 mm	100	600 Micron	40 - 85
2.36 mm	100	300 Micron	5 - 50
1.18 mm	75 - 100	150 Micron	0 - 10

M-4 STONE GRIT :

4.1 Grit shall consist of crushed or broken stone and be hard, strong dense, durable, clean, of proper gradation and free from skin or coating likely to prevent proper adhesion of mortar. Grit shall for as possible flaky elongated pieces shall be avoide

It shall generally comply with the provisions of I. S. 383-1970. Unless special stone of particular quarried is mentione Grit special stone of particular quarries is mentione Grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer - in - charge. The grit shall have no deleterious reaction with cement.

4.2 The grit shall conform to the following gradation as per sieve analysis:

I. S. Sieve Designation	Percentage passing through sieve	I. S. Sieve Designation	Percentage Passing through sieve

12.50	100%	4.75	0.20%
10.00	85 - 100%	2.36	0.25%

4.3 The crushing strength of grit will be such as to allow the concrete in which it is used to build up the specified strength of concrete.

4.4 The necessary tests for grit shall be carried out as per the requirements of I. S. 2386 (Parts I to VIII) 1963, as per instruction of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

M-5A STONE COARSE AGGREGATE FOR NOMINAL MIX CONCRETE :

5A.1 Coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

5A.2 The aggregate shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, Aggregates shall be machine crushed from the best black trap or equivalent hard stone as approve Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement concrete and ordinary reinforced cement concrete shall generally be as per the table given below. However in case of reinforced cement concrete the maximum limit may be restricted to 6 mm less than the minimum lateral clear distance between bars or 6 mm. less than the cover whichever is smaller.

TABLE

I.S. Sieve Designation	Percentage Passing for single sized aggregates of nominal size		I.S. Sieve Designation	Percentage Passing for single sized aggregates of nominal size	
	40 mm	20 mm	16 mm	40 mm	20 mm	16 mm
80 mm	-	-	-	12.5 mm	-	-	-
63 mm	100	-	-	10.0 mm	0.5	0.20	0.30
40 mm	85-100	100	-	4.74 mm	-	0.50	0.50
20 mm	0-20	85-100	100	2.35 mm	-	-	-
16 mm	-	-	-	85-100	-	-	-

NOTE :- The percentage may be varied by the Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

5A.3 The grading test shall be taken in the beginning and at the charge of source of materials. The necessary tests indicated in I.S. 383-1970 I. S. 456-1978 shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the inter mixed on different aggregates. If the aggregates are covered with dust, they shall be washed with water to make them clean.

M-5B BLACK TRAP OR EQUIVALENT HARD STONE COARSE :

5B.1 Aggregate for Design Mix concrete : Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard, strong, dense, durable clean and free from skin and coating likely to prevent proper adhesion of mortar.

5B.2 The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed from the best, black trap or equivalent hard stones as approve Aggregate shall have no deleterious reaction with cement.

5B.3 The necessary tests indicated in I. S. 383-1970 and I.S.456-1978 shall have to be carried out to ensure the acceptability of the material.

5B.4 If aggregate is covered with dust it shall be washed with water to make it clean.

M-6 CEMENT MORTAR:

6.1 Water shall conform to specification M-1. Cement shall confirm to specification M-2, sand shall confirm to M-3.

6.2 Proportion of Mix :

6.2.1 cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes. The proportion of cement will be by volume on the basis of 50 Kg/bag of cement being equal to 0.0342 cum. The mortar may be hand mixed or machine mixed as directe

6.3 Preparation of Mortar:

6.3.1 In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform colour is obtaine Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed

6.3.2 The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes.

M-7 BRICK BATS AGGREGATE :

7.1 Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense brick. It shall be homogeneous in texture roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm to 50 mm size unless otherwise specified in the item. The underburnt of overburnt brick bats shall not be allowed

7.2 The brick bats shall be measured by volume by suitable boxes or as directed

M-8 BRICKS :

8.1 The bricks shall be hard or machine moulded and made from suitable soils and kiln burnt. They shall be free from cracks and flaws and nodules of free lime. The shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be moulded with a frog of 100 mm x 40 mm and 10 mm to 20 mm deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

8.2 The size of modular bricks shall be 190 mm x 90 mm.

8.3 The size of the conventional bricks shall be as under :

3" 3"
(9" x 4--- x 2---) 225 x 110 x 75 mm.
4 4

8.4 Only bricks of one standard size shall be used on one work. The following tolerance shall be permitted in the conventional size adopted in a particular work.
Length : = 1/8" (3.0 mm) Width : = 1/16" (1.50 mm)
Height : = 1/16" (1.50 mm)

8.5 The crushing strength of the bricks shall not be less than 35 Kg/Sq.cm. The average water absorption shall not be more than 20 percent by weight. Necessary tests for crushing strength and water absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) - 1976.

M-8A FLY-ASH LIME BRICKS :

The fly ash lime bricks shall conform to Grade-1 or Grade-2 of IS-3812-1981. The frog of the 80 to 100 mm x 40 mm x 10 to 20 mm size.

The size of modular bricks shall be 190 mm x 90 mm x 90 mm.

The size of conventional brick shall be 225 mm x 110 mm x 75 mm.

Only bricks of one standard size shall used on one work. The following tolerances shall permitted in the conventional size adopted in a particular work:

Length : + 3 mm
Width : + 3 mm
Height : + 2 mm

The physical characteristic of bricks shall be as follows.

The minimum compressive strength of fly ash lime bricks shall not be less than 75 Kg/Sq.Cm. and the test shall be conform to IS-3495 (Part-I):1992.

The average drying shrinkage of the brick when tested by the method described in IS 4139-1989 being shall not exceed 0.15 percent.

The averages water absorption not more than 20 percentage by mass and the test shall conform to IS-3495 (Part-3):1992.

M-9 MILD STEEL BARS :

9.1 Mild steel bars reinforcement for R.C.C. work shall conform to I.S. 432 (Part-II) 1966 and shall be tested quality. It shall comply with relevant part of I.S.456-1978.

9.2 All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose of thick rust at the time of placing.

9.3 For the purpose of payment the bar shall be measured correct upto 10 mm length and weight payable worked out the rate specified below :

1. 6 mm 0.22 Kg./Rmt. 8. 20 mm 2.47 Kg./Rmt.
2. 8 mm 0.39 Kg./Rmt. 9. 22 mm 2.98 Kg./Rmt.
3. 10 mm 0.62 Kg./Rmt. 10. 25 mm 3.35 Kg./Rmt.
4. 12 mm 0.89 Kg./Rmt. 11. 28 mm 4.83 Kg./Rmt.
5. 14 mm 1.21 Kg./Rmt. 12. 32 mm 6.31 Kg./Rmt.
6. 16 mm 1.58 Kg./Rmt. 13. 36 mm 7.31 Kg./Rmt.
7. 18 mm 2.00 Kg./Rmt. 14. 40 mm 9.86 Kg./Rmt.

M-10 TMT FE-500 STEEL BARS FOR REINFORCEMENT :

10.1 Reinforcement bars shall conform to IS-432, IS-226 or IS-1786 and welded wire fabrics to IS : 1566. Only TMT bars for reinforcement in RCC duct shall be used which shall be clean, free from pitting, oil, grease, paint, loose mill scale, rust, dirty dust or any other such substance that will destroy or reduce bon

It permitted by the Engineer-in-charge reinforcement shall be done in accordance with IS-2751 or IS-9147 as applicable.

10.2 Other provision and requirements shall conform to specification No. M-7 for mild steel bars.

M-11 MILD STEEL BINDING WIRE :

11.1 The mild steel wire size and quality shall conform to I.S. 280-1972.

11.2 The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust, oil paint grease, loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar.

M-12 STRUCTURAL STEEL :

12.1 All structural steel conform to I.S.226 - 1975. The steel shall be free from the defects mentioned in I.S. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to I.S. 1148-1973.

12.2 When the steel is supplied by the contractor test certificate of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-13 SHUTTERING :

13.1 The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or of steel plates stiffened by steel angles. The shuttering shall be supported on battens and beams and props of vertical ballies properly cross braced together so as to make the centering rigi In places of bullie props, brick pillar of adequate section built in mud mortar may be use

13.2 The form work shall be sufficiently strong and shall have camber, so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even surface and its joints shall not permit leakage of cement grout.

13.3 If at any stage of work during or after placing concrete in the structure, the form sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

13.4 The props shall consist of bullies having 100 mm minimum diameter measured at mid length and 80 mm at thin end and shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm thick and minimum bearing area of 0.10 Sq.m. laid on sufficiently hard base.

13.5 Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

13.6 The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so wet to shrink after erection. The timber shall be properly sawn and planned on the sides and the surface coming in contract with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

13.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

13.8 The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitte

13.9 The shuttering for beams and slabs shall have camber of 4 mm per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset of subsequent deflection for cantilevers the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

M-14 HARD DRAWN WIRE :

The Hard drawn steel wire should confirming to IS-432 (Part 2), Hard drawn steel wire shall be manufacture and its chemical composition should be as per para 3.0. The finished wire should be free from defects and finished in a workman like manner. Nominal sizes, Tolerances, Physical requirements are as per IS : 432 (Part-II) latest edition. Hard drawn steel wire should be tested as specified in IS : 432 (Part-II) latest edition.

DETAIL TECHNICAL SPECIFICATIONS

Item No.1:

Excavation for sewer line trenches, manholes ind. All safety provisions using site rails etc, including refilling the trenches & stacking the excavated stuff including disposal of Excavated stuff within RMC Area Limit in all sorts of soil and soft murrum, hard murrum, boulders, and macadam road and soft rock and hard rock Average Rated Rate including removing surplus earth

1. EXCAVATION AND REFILLING:

Excavation for sewer line trenches, manholes and house connection chambers etc. with shoring strutting bailing our water form trencher wherever necessary including excavation in khal kuvas or soak pits encountered in the work and making the good after the work and all safety measures and provisions such as site rails fencing lighting watching and stacking excavated stuff up to a lead of cleaning the site etc, as stipulated in the e-Tender specifications complete for lifts and soil strata as specified below :-

(i) In all sorts of soil & soft murrum including macadam road, khal kuvas and soak pits.

(ii) In hard murrum boulders.

(iii) In soft rock, masonry structures like in C.M., L.M. or lime concrete.

(iv) In hard rock, in C.C. 1:2:4 or R.C.C. with controlled blasting and or chiseling

1.1. EXCAVATION FOR TRENCHES (MANHOLES, VENT-SHAFT, HOUSE CONNECTIONS CHAMBERS AND CONNECTING SEWERS) IN ALL SORTS OF SOIL AND SOFT MURRUM INCLUDING MACADAM ROAD (WBM), KHAL KUVAS AND SOAK PITS INCLUDING DEWATERING.

1.1.1. The item shall include dry or wet excavation and removal of excavated material and its stacking and disposal in a manner hereinafter specified. The water met with if any, shall be bailed or pumped out by the contractor as necessary.

1.1.2. The contractor shall provide all materials and perform all labour necessary for the excavation and completion of the work in accordance with the drawings and specifications and the intent thereof.

1.1.3. The Contractor shall provide necessary protection to labour materials, equipment etc. to ensure safety against risk and accident. The B.I.S. standard in this regard shall be followed (IS 3764 – 1966)

1.1.4. The Contractor shall be liable to pay compensation for injury to life, and damage to property, if any, caused due to any operation connected with this item.

1.1.5. The Contractor shall hand over the site of work in neat and tidy

condition after completion of work and shall remove all rubbish arising out of construction work.

1.1.6. The contractor shall carry out the work of trial hole of the sizes and depths and at places as directed by the Engineer-in-charge to accurately locate and determine the portions of services like water mains and drains, electric cables, telephone cables .etc, and shall fill them back as required and as ordered. The work shall be paid as per the item of excavation.

1.1.7 Widths of excavation for different diameter of pipes

The width of trenches for different diameters of pipes are to be given I.D. of pipe + 0.90m and it shall be paid as per actual excavation done but limited to ID of pipe +0.90m in case of more width done by the contractor. Contractor shall have to keep in mind that the working space at the bottom for easy laying and jointing of pipes. In case of safety in excavation, in soil more than 3.0 m depth, an excavation chart shown as DRN/PHASE-II PART-II/DRG No. 12 in the e-Tender document shall be used but it shall be measured and paid as per the maximum limits of width of excavation shown in drawing.

1.1.8. Depth of Excavation of Trenches:

The depths of excavation for the trenches shall be calculated from the surface to the bottom of the foundation, No payment shall be made for any excavation, beyond the width and depth, as specified above.

1.1.9. A Grip to be cut for pipe collar :

Where a collar is be provided or where socket of the pipe comes a grip shall be cut in the bottom of the trench or bedding as necessary below the bed of the pipes so that the pipe may have a fair bearing on its shaft and not rest upon its collars. Such grip shall be maintained clear until the joint has been passed by the Engineer – in - charge

1.1.10 Trenches in Rocky Ground:

The trenches in stony or rock ground shall be excavated all along to the full depth such that the bottom of the excavation shall not be higher at any point than the bottom of the concrete bedding layer below the sewer pipe.

1.1.11 Measurement of length of Excavation:

The length of excavation for trenches shall be measured in the horizontal plane between manholes.
The excavation shall be taken up at such places and in such lengths as shall be approved by the Engineer-in-charge. The excavation shall proceed in such portions at one time as the Engineer-in-charge may

direct. No permanent works shall be started unless the Engineer-in-charge approves the excavations. The length of trench excavated ahead of the laying and the length of trench which may remain open at any time shall at all times be subject to the approval of the Engineer-in-charge. It shall be at no time, longer than can properly be protected from caving. In case of tapering in excavation, average width in measurement shall be taken in to account.

The materials from the excavation shall be deposited on either side of the trench leaving a clear berm on each side at least 40cm wide or at such further distances from the edges of the trench, as may be necessary. To prevent the weight of materials from causing the side of the trench to slip or fall, or at such distance and in such a manner as to avoid covering fire-hydrants, sluice valves, gas siphons, manhole covers and the like and so as to avoid abutting any wall or structure or causing inconvenience to the public or other persons, or otherwise as the Engineer-in-charge may direct.

In case, where the Engineer-in-charge decides that the width of the road or lane, where he work of excavations to be carried out is so narrow as to warrant stacking of excavated materials away from the site of the work the contractor shall have to remove the same if so directed within the lead of 250M. The excavated stuff shall be brought back for refilling the trenches when required. The surplus material shall be removed as directed. No claims for stacking the excavated stuff away from the site of work or bringing it back for refilling trenches shall be entertained.

1.1.12. Bottom of Trenches and foundation to be saturated with water

The bottom of all trenches and the foundations of all structure shall be saturated with water and well rammed wherever the Engineer may consider it necessary to do so.

1.1.13. Excess Excavation due to nature of sub-soil for additional foundation

If in any place, the Engineer-in-charge considers on account of the nature of sub soil additional foundations of concrete, rubble or other wise necessary or if at any place, for any purpose whatsoever he required the excavation to be carried out deeper than shown on the plans or described in the specifications, the same shall be carried out as may be ordered by the Engineer-in-charge and such additional works shall be measured and
paid for to the contractors according to the rates. Excavation and necessary dewatering and shoring strutting for chambers, Main holes, Vent shafts etc, is also included in this item and no extra shall be paid for excavation for chambers manholes, Vent shafts etc.

1.1.14. Unauthorized excess excavation:

Where excavations are made in excess of the width and depth indicated on the drawings, either by error or by accident the hollows

so formed shall be filled in with lime concrete or rubble masonry or otherwise as directed by the Engineer-in-charge to his full satisfaction at the expense of the contractor.

1.1.15. Fencing / Lighting and Watching:

The contractor shall make all proper provisions for protecting the work by fences and by watching and lighting at night, or otherwise as may be directed by the Engineer-in-charge. The posts of the fencing shall be of timber or of other approved material securely fixed in the ground not more that 3M apart. The timber posts shall not be less than 75mm in dia, and shall not be less than 1.2 M above the surface of the ground.

There shall be two rails one near the top of the posts and the other about 150mm above the ground and shall be 50 mm to 70mm dia and sufficiently long to run from post to post to which they shall be securely fixed as per direction of the Engineer-in-charge. The method of projecting rails beyond the posts and typing them together where they meet will not be allowed on any account al along the edges of the excavated trenches a bank of earth about 1.20m high shall be formed where required by the Engineer-in-charge for additional protection Adequate number of red lights wherever required shall be provided at night. Also a watchman shall be engaged to see that the lights are properly maintained during night.

In the event of contractor not fully complying with the provisions of this clause, the Engineer may with or without notice to the contractor put up a fence, improve the lighting and adopt such other measures as he may deem necessary for the safety and all costs of such works including penalty as may be decided by the Engineer-in-charge shall be paid by the contractor the contractor shall also provide and display special Boards painted with fluorescent paints indicating the progress of the work along a particular road.

1.1.16 Maintenance of Water Pipes, Gas Pipes, Telephone lines, Electric lines and Drains Khalkuvas, Sewers during Excavation:

The contractor shall at the rates entered in the bill of quantities and rates, carry out all excavation as the Engineer-in-charge may require in order to locate the positions of water pipes, Gas Pipes, Telephone lines, Electric lines, drains, khalkuvas, sewers, or any other structures in connection with them and shall properly maintain and protect these services by means of shoring strutting planking over padding or otherwise as the Engineer-in-charge may direct during works resulting from the same shall be made good and effectively remedied by the contractor at his cost if the contractor fails to comply with the requirements, the Engineer-in- charge will got it repaired from any other agency at the expense of the contractor. If however, the Engineer-in-charge considers it impracticable for the contractor to maintain any such water pipes, drains, Khalkuvas, sewers or other works and that exigencies of the work necessitate the breaking down removal, or

diversion of any such water pipes, drains, khalkuvas, sewers, or other work, them he may direct the contractor to break down or remove any of the above mentioned services and ask the contractor to provide such chutes pumps or other equipment of raising and temporary passage of the water or sewerage. The cost of pumping out or otherwise removing any water or sewerage which may escape from any such broken water pipes, drains, khalkuvas, sewers shall be borne by the contractor.

1.1.17. Shoring:

1.1.17.1 Wherever shoring is found necessary by the Engineer-in-charge the contractor shall provide the same in the best possible manner with the materials as required and as directed by the Engineer-in-charge to his complete satisfaction. The contractor shall employ such kind or kinds of shoring as the Engineer may consider the exigencies of the work to require and it is to be distinctly understood that the word 'shoring' is to comprise all classes of such work and all appliances and appurtenances, including polling Corporations, sheet piling and runners (whether the joints be butt., groove and tongue, feather edge and grove, birds mouth and double splay, rebate or otherwise), together with walkways, strut, props point blank shores, raking shores, blocks, wedges, Iron dogs, bolts, screws, nails and everything that may be required for due execution of the work.

1.1.17.2 Contractors responsibility for secure shoring and / or all damages:

The contractor shall be responsible for providing secured shoring and for taking every other precaution which may be necessary or proper for protecting any building or any other structure from getting damaged by the excavation of any trench or otherwise by the execution of the works in the vicinity of such building of structure.

If the Engineer-in-charge shall require the adoption of any special or extra measures, or precautions, the contractor shall forthwith adopt and supply the same. However, this revision shall not in nay degree relieve the contractor from his responsibility or from liability under the conditions of the contract in respect of any claim made against the Corporation for loss or damage which might be caused to any such building or structures by the execution of any works or otherwise.

After the work is completed near building, the contractor shall remove the shoring safety without slipping of soil of trenches if any and make good any cutting out or other damage that might have been done.

1.1.17.3 Liability of Timbering:

No work approved by the Engineer-in-charge or his

representative about timbering shall absolve the contractor from his responsibility and he will be responsible for making good damage caused as about result of the failure of timbering to give proper support to the sides of the excavation.
The timbering to the sides of excavation for structures shall be carried out in such a way that there is no obstruction caused to the fixing of form work for the walls. The supporting struts and walling shall be removed by the contractor in stage to facilitate progress of concreting pipe laying etc.

If the Engineer-in-charge finds that the standard of timbering is not according to requirements or that the sides of the excavations have not been secured in a manner to render such excavations safe for working may be one hour after notifying the contractor of his representative in writing about this shall employ his own men to mend the timbering and the cost of such workmen and materials employed including penalty shall be paid by the contractor.

1.1.17.4 Removing shoring:

No part of the shoring shall nay time be removed by the contractor without obtaining permission of the Engineer-in-charge While out shoring planks, the hollows if any, formed shall simultaneously be filled in with soft earth well rammed with rammers after watering.

1.1.17.5 Shoring left in Trenches:

The Engineer-in-charge may order in writing portions of shoring to be left in the trenches at such places where it is found absolutely necessary to do so, so at to avoid any damage to buildings, cables, water mains, sewers, etc. in close proximity of the excavation.
The contractor shall not claim, anything, whatsoever for the shoring which might have been left in the trenches.

1.1.17.6 Steel trench sheeting:

Where the subsoil conditions meet with are of a soft and unstable in trench excavation the normal methods of timbering will not prove sufficient to avoid subsidence of the adjoining road surface and other services. In such circumstances, the contractor will be required to use steel trench sheeting or sheet steel pining adequately supported by timber struts, welling etc. without any extra cost. The contractor shall supply, and subsequently remove trench sheeting or piling where no longer required.

1.1.18. Constructing Temporary bunds & sumps:

For the purpose of keeping the excavations dry the work shall, if necessary he divided into sections or separate portions, to be determined by the Engineer-in-charge and temporary bunds shall

be put up by the Contractor. Sump shall be excavated by the Contractor at such distances apart and of such depths, as the Engineer-in-charge may direct to allow the pumps to work. When and as the work progresses, other sumps shall be excavated by the Contractor from time to time. The sumps not in use shall be filled in by the Contractor to the satisfaction of the Engineer-in-charge. The contractor shall not claim anything extra for temporary bunds and sumps or their removal and refilling, nor shall such work be taken into measurements in any way.

1.1.19. Rate for Excavation:

The rates for excavation shall be included and cover without extra charge all the stipulations continued in every portion of these specifications, with regard to setting out, provision for the passage or traffic and for access to premises, arrangements for the continuance of drainage, khalkuvas or such points water supply or lighting (If interrupted by the works) arrangements, for the efficient protection of the life and property, fencing, lighting, watching, shaping the trenches, maintenance of water pipes, gas pipes, telephone lines, electric lines drains, khalkuvas and other work met with in or about the excavation driving them dismantling them, rebuilding them as necessary, subsequent re-excavation, on account of rain, holiday or special occasion, filling necessary dewatering etc. complete.

1.1.20 The excavation shall be carried out in the strata met with as specified in the proper manner and with lifts mentioned therein.

1.2. EXCAVATION FOR TRENCHES, MANHOLES, VENT SHAFTS, HOUSE CONNECTIONS CHAMBERS AND CONNECTING SEWERS IN HARD MURRUM, BOULDERS INCLUDING DEWATERING.

1.2.1 All the items of excavation for trenches and manholes vent shaft, house connections, chambers and connecting sewers as described under 1.1 above shall also apply here.

1.2.2 This shall included all kinds of disintegrated rock or shale or indurate clay tending to the formation of conglomerate interspersed with boulders up to having at least dimension of 300mm in any direction which do not need blasting and could be removed by a pick and bar and shovel with some difficulty.

1.3 EXCAVATION FOR TRENCHES MANHOLES, VENT SHAFTS, HOUSE CONNECTIONS CHAMBERS AND CONNECTING SEWERS, IN LARGE BOULDERS AND SOFT ROCK WITHOUT BLASTING INCLUDING DEWATERING.

1.3.1 All the items of excavation for trenches and foundation as described under 1.1 above shall also apply here.

1.3.2 Excavation shall be in soft rock as lime stone, sand stone, laterite hard conglomerate or other soft of disintegrated rock, which may be quarried on spilt with crow bars, boulders which do not require blasting having diameter in any direction not more than 300mm and any rock which in dry state may be hard, requiring blasting but which when wet becomes soft and manageable by means other than blasting and excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

1.4 EXCAVATION FOR TRENCHES, MANHOLES, VENT SHAFTS, HOUSE CONNECTIONS CHAMBERS AND CONNECTING SEWERS, IN HARD ROCK INCLUDING DEWATERING AND CONTROLLED BLASTING IF REQUIRED AND OF CHIESELING.

1.4.1 All the items of excavation for trenches and foundations under 1.1 above as applicable shall also apply here.

1.4.2 Excavation shall be in any rock or boulders having diameter in any one direction of more than 300mm for which the use of mechanical plant or controlled blasting is required. The classifications of excavation shall be decided by the Engineer-in-charge and his decision shall be final and binding on the contractor.

1.4.3 Controlled blasting shall be carried out only with the written permission of the Engineer-in-charge All statutory laws, regulations rules etc. Pertaining to the acquisition, transport, obtaining permission of respective departments, handling and use of explosives shall be strictly followed,

1.4.4 when controlled blasting is permitted by the Engineer-in-charge in writing the same shall be carried out by any method of blasting consistent with the safety and job requirements.

1.4.5 The magazine for the storage of explosives shall be built to the design and specifications of the explosive department concerned and located at the approved site. No unauthorized person shall be admitted into the Magazine which when not in use shall be kept securely locked. No matches or inflammable material shall be allowed in the magazine. The Magazine shall have an effective lighting conductor, the following shall be in the lobby of magazine.

(a) A copy of relevant rules regarding safe storage both in English and Gujarati
(b) A statement of update stock in the magazine.
(c) A Certificate showing the last date of testing of the lighting conductor.
(d) A notice that smoking is strictly prohibited.

1.4.6 In addition to these, the contractor shall also observe the following instructions and any further additional instructions may be given by the Engineer-in-charge & shall be responsible for damage to property and any accident which may occur to workman or the

public on account of any operations connected with the storage, handling and use of explosives and blasting.

1.4.7 All the materials, tool and requirement used for blasting operations shall be of approved type and approved by the Engineer-in-charge. The fuse to be used in wet locations shall be sufficiently water resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuse shall be uniform and known to determine its length.

1.4.8 The blasting operation shall remain in charge of competent, experienced supervisory staff and workmen who are thoroughly acquainted with the details of handing explosives and blasting operations.

1.4.9 The blasting shall be carried out during the time fixed and approved by the Engineer-in-charge. The hour of blasting shall be made known to the people in the vicinity.

1.4.10 Red danger signals shall be displayed in all directions during the blasting operation. People except those who actually light the fire shall be prohibited from entering the area.
The flags shall be planted at safe distance from the blasting area in all directions and all persons including workmen shall be excluded from the flagged area at least 10 minutes before the firing, a warning whistle being sounded for the purpose.

1.4.11 The charge holes shall be drilled in suitable places to depths approved by the Engineer-in-charge blasting should be as light as possible consistent with required breakage of materials.

1.4.12 When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped in. The powder shall be gently tamped with copper rod with rounded ends. The Explosive Powder shall then be covered with tamping materials which shall be tamped light but firmly.

1.4.13 As the blasting will be only controlled one with light charges, dynamite etc. shall not be used.

1.4.14 At a time not more than the number of charges approved by the Engineer-in-charge will be prepared and fired. The charges shall be fired after observing the instructions given above and the explosions counted. The man in charge shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to work site.

1.4.15 In case of misfire the following procedure shall be observed.

(a) Sufficient time shall be allowed to account for the delayed blast.
The man in charge shall inspect all the charges and determine the missed charges.

(b) In the case of blasting powder missed charge, it shall be completely flooded with water. A new hole shall be drilled about 45 cm. from the old hole and fired. This should be repeated till the old charge is blasted.

1.4.16 The main in charge shall at once report to the contractor's office and the Engineer-in-charge of all cases of misfire the cause of the same and the steps taken in connection there with.

1.4.17 A careful and day to day account of the explosives shall be maintained by the contractor in an approved manner in a register which shall be open for inspection by the Engineer-in-charge at all times.

1.4.18 The rate shall include all stipulations mentioned under 1.1 over and above these stipulations, the rate shall also include excavation by chiselling or controlled blasting as required for the work.

1.4.19 The necessary permission of the concerned district authority shall be obtained by the contractor prior to the blasting operation and all safety and necessary arrangements shall be made as per his directions before the blasting operation is actually started. The rate shall be paid per Cu.M. and will be inclusive of necessary shoring, strutting, scaffolding, bailing out water, dewatering barricading etc. complete.

1.5 REFILLING THE PIPE TRENCHES BY THE EXCAVATED STUFF IN 15CM TO 60 CM THICK LAYER, CONSOLIDATING UP TO POSSIBLE EXTENT AND DISPOSAL OF SURPLUS STUFF AS DIRECTED WITHIN THE PRESCRIBED LIMITS OF CORPORATION OR AS DIRECTED BY THE ENGINEER-IN-CHARGE.

1.5.1 After the sewer pipes have been laid and jointed and the manholes and vent shafts are constructed and as soon as the joints have been inspected and passed by the Engineer-in-charge and after all concrete work thoroughly set the trenches shall be fulfilled with the materials taken there from. In refilling the trenches the utmost care shall be exercised so as not to disturb, break or damage the jointed pipes. Over and around every pipes the finest selected material shall be put. No lumps of rock earth or other material shall be put around the pipe or be thrown into the trenches until the same has been broken to specified size and pipes covered by the fine material above referred to. The selected fine material shall be carefully placed next to the permanent work and well packed and well rammed in layers of 150mm for a depth of at least 300mm over the top of the pipe. The remaining of the excavation shall be filled in with the best and most suitable portions of the excavated material in layers of not more than 600 mm deep or as decided by the engineer in charge. Surplus soil shall be piled on top of the filling to the extent possible for expected subsidence. All road materials to from a compact neat surface. The contractor shall maintain all

refilling and surfaces until completion of entire work. The contractor shall be responsible for claims arising from accidents due to subsidence or inadequate maintenance or improper refilling work. Where excavated material is not considered suitable for refilling by the Engineer-in-charge, the Contractor will be required to cart selected surplus excavated materials in place of unsuitable materials. The contractor may also be instructed to supply suitable granular or other hard filling material for use in refilling such imported filling material shall be paid for at the rates given in the Bill of quantities or as per S.O.R. of Rajkot Municipal Corporation.

When trench is excavated under or near any existing work likely to be affected by subsidence of the material in the trench, or where any permanent work will be constructed later of the trench. The contractor shall fill in the trench with M 100 concrete or take such other precaution means to prevent damage by subsidence as. The Engineer-in-charge may direct, Whether such work is shown in the drawing or not, whether it is billed in the quantities or not. Any extra work necessitated will be paid for according to the provisions of the conditions of Contract. Unless in the opinion of the Engineer-in-charge, it is necessitated by the contractor negligence, bad workmanship faulty materials or lack of reasonable foresight.

1.5.2 Subsidence in filling:

Should any subsidence take place in the filling up of the road on or about any part of the work whatsoever up to the completion of contract works the contractor shall make good the same at his own cost. In case of failure of the contractor to attend to the work, the Engineer-in-charge without notice to the Contractors shall make good the same in any way and with any material that the (Engineer-in-charge) may consider proper at the cost of the contractor. The Engineer-in-charge may, if he anticipates the occurrence of any subsidence employ watchman to give him timely notice of the necessity of making good the subsidence, and the cost of such watchman shall be charged to the contractor.

Item No.2:
Providing c.c.bedding in 1:3:6 (M 100) using 12 to 20mm machine crushed metal incl. Consolidation curing etc. complete. (C-type bedding as per type design)

1.0. Materials

1.1 Water shall conform to M-1. Cement shall conform shall conform to M-3. Sand shall conform to M-6. Stones aggregate 20 mm. nominal size shall conform to M- 12.

2.0 Workmanship

2.1 General

2.1.1 Before starting concrete the bed of foundation trenches shall be cleared of all loose materials, leveled, watered and rammed as directed.

2.2 Proportion of Mix

2.2.1 The proportion of cement, sand and coarse aggregate shall be one part of cement, 3 parts of sand and 6 parts of stone aggregate; and shall be measured by volume.

2.3 Mixing

2.3.1 The concrete shall he mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case of break-down of machineries and in the interest of the work, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mixing in mechanical mixer shall be done for a period 1½ to 2 minutes. The quantity of water shall be just sufficient to produce a. dense concrete of required workability for the purpose.

2.4 Transporting & placing the concrete.

2.4.1 The concrete shall, be handed from the place of mixing to the final position in not more than 15 minute by the method as directed and shall be placed into its final position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences.

2.4.1 The concrete shall be laid in layers of 15 cms to 20 cms.

2.5 Compacting:

2.5.1 The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and to allow all the interstices to be filled with mortar.

2.6 Curing

2.6.1 After the final set, the concrete shall be kept continuously wet if required by ponding for a period of not less then 7 days from the date of placement.

2.7 Mode of measurements and payment:

2.7.1 The concrete shall he measured for its length, breadth, and depth, limiting dimensions to those specified on plan or as directed.

2.7.2 The rate shall be for a unit of one cubic meter.

Item No.3:

PROVIDING AND TESTING OF SWG AND RCC NP3 PIPE :

Inspection and testing of pipes at works shall be carried out as per IS:

3597:1998 or its latest amendment for RCC NP3 pipe and IS: 651:2007or its latest amendment for SWG pipes. No extra payment for testing of pipes at works shall be made. Contractor shall issue inspection call well in advance (min.7 days) to carry out testing of pipes. After successful testing of pipes, RMC or its representative shall give clearance for dispatch of pipes. Random Physical inspection of pipes at site will be carried out after delivery of pipes and if found any damage during transportation or due to any reason, pipes shall be rejected and same will not be used by contractor.

1. PROVIDING AND TESTING OF SWG PIPES AS PER THE TENDER SPECIFICATIONS.

1.1 TECHNICAL SPECIFICATION FOR S & S STONEWARE GLAZED PIPE.

All the specifications mentioned in the I.S Code 651-1992 & its latest revised addition shall be strictly followed.

1.1.1 In the revision of the above said code, grading based on Hydraulic test has been deleted and the standard monogram has also been modified and it appears as ISI symbol with IS:651.

1.1.2 Tests for Acid & Alkali resistance for pipes and fittings which were earlier optional have now been made mandatory.

1.1.3 GLAZED STONEWARE PIPES AND FITTINGS:

1.1.3.1 This standard covers dimensions and performance requirements for the following glazed stoneware pipes and fittings:

a) Straight pipes and taper pipes
b) Bends
c) Taper bend
d) junctions
e) half section channels, straight and taper
f) channel junctions
g) channel bends
h) channel interceptors
i) gully traps, and
j) inspection pipes

1.1.3.1.1 The pipes as covered in this standard are not meant for potable water applications.

1.1.4 Dimensions of glazed stoneware pipes and fittings are grouped into two sections, A&B. Section-A covers dimensions of straight

pipes and all such fittings which normally form part of pipeline and which are subject to same conditions, specifications and tests as straight pipes. Section-B includes dimensions of fittings which are commonly used but do not form a part of the normal pipeline. The fittings in section-B being hand-moulded articles, their conformity to dimensional specifications is not required to be so zccurate as for those in Section-A.

1.1.5 REFERENCES:

1.1.5.1 The following Indian Standards are the necessary adunct to this standard.

IS No	Title
808 : 1989	Dimensions for hot rolled steel beam, column, channel and angle section (third revision)
2730 : 1977	Magnesium sulphate (Epsom salt) (first revision)
2781 : 19/5	Glossary of terms relating to ceramic ware (first
4905 : 1968	Method for random sampling

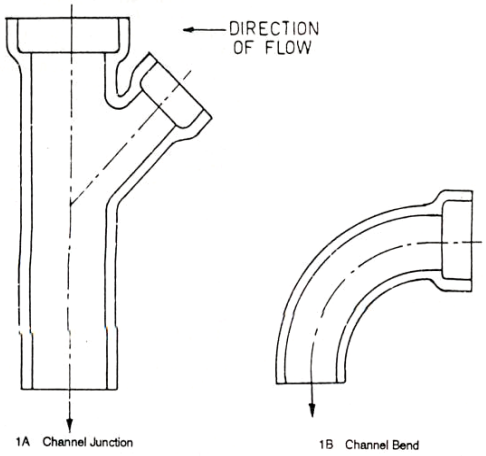
1.1.6. TERMINOLOGY:

1.1.6. For the purpose of this standard, the definitions of terms given in IS 2781 : 1975 shall apply.

1.1.7. RIGHT-HAND AND LEFT-HAND FITTINGS:

1.1.7.1. A right-hand fitting is such that when viewed from the spigot towards the socket, the arm of a junction or the socket of a bend projects to the right (See Fig. 1A and 1B). a left-hand fitting is such that when viewed as above, the arm of socket projects to the left.

RIGHT-HAND FITTINGS



1.1.8 GENERAL QUALITY:

1.1.8.1 All pipes and fittings shall be sound and free from visible defects which impair the strength, durability and serviceability. The glazed of pipes and fittings shall give a sharp clear note when struck with a light hammer

1.1.8.2. For pipes and fittings, a maximum of 10 percent shall be acceptable with any one of the following blemishes which do not impair the strength, durability and serviceability provided these pipes and fittings satisfactorily pass the hydraulic test specified in 4.1.10.2.

a) A thin chipping not exceeding one quarter of the thickness of the body and not exceeding 10 cm^2 on the outside of spigot or on either side of the socket.

b) One blister, unbroken, not more than 3 mm high not more than 40 mm in largest dimension inside or outside of the pipe; and

c) Hairline surface cracks.

1.1.8.3. Colour of pipes / fittings may vary from yellow to dark brown / black.

1.1.9. GLAZING:

1.1.9.1. The interior and exterior surfaces of the pipes and fittings which remain exposed after jointing shall be glazed. The portion which remains covered after jointing may or may not be glazed. The glaze shall be obtained by the action of fumes of volatized common salt on the material of the pipes and fittings during the process of burning or glazed shall be ceramic glaze consisting of glazing material applied prior to fixing.

1.1.10. TESTS:

1.1.10.1. Testing Facilities:

The manufacturer shall at his premises and at his own cost, provide the necessary gauges, supply and prepare all test pieces and supply all labour and apparatus for testing which may be necessary for carrying out the tests as required by this standard.

1.1.10.2. Hydraulic Test:

When subjected to the hydraulic test straight pipes shall withstand the internal hydraulic test pressure of 0.15 MPa (1

MPa = 10.2 kg/cm^2) on the barrels and fittings covered in Section-A and 0.075 MPa for fittings covered in Section-B without showing signs of injury or leakage. The pressure shall be applied on pipes and fittings at a rate not exceeding 0.075 MPa in 5 seconds, and full pressure shall be maintained for at least 5 seconds. Care shall be taken to ensure that all air is expelled before the test is commenced.

1.1.10.3. Absorption Test:

The test pieces for testing shall be taken from the body of the pipe or fittings but not from within 150 mm of the end.

Each test pieces shall be of the whole thickness of the wall of the pipe or fittings and shall have two glazed surfaces each having an area of not less than 50 cm^2 and not more than 130 cm^2. The test pieces shall be cleaned by wire brush to dislodge any loose particles which may increase loss of mass during boiling. The test piece shall be dried at a temperature of not less than 150^{o}C until no further loss of mass is noted and cooled in a desiccator to the room temperature and the specimen weighed to an accuracy of 0.1 g. The test piece may be suitable suspended in cold distilled water by means of thread so that the test piece may not strike against each other or the container and incur loss in mass and the water in the container shall then be brought to the boiling point. The water shall be maintained at that temperature for 1 hour and after it has been allowed to cool to room temperature, the test pieces shall be removed carefully wiped with a dry cloth and then the mass determined. The percentage increase in mass of each test piece by absorption of water shall not exceed the following values:

Thickness of pipe or fitting	**Increase in Mass**
Up to and including 20	6
Over 20 and up to 25	7
Over 25 and up to 32	8
Over 32 and up to 38	9
over 38	10

1.1.10.4. Test for Acid Resistance:

Pipes and fittings shall be tested for acid resistance in accordance with the procedure given in Annexure-A. The loss in mass shall not exceed 2.5%.

1.1.10.5. Test for Alkali Resistance:

Pipes and fittings shall be tested to the action of magnesium sulphate in accordance with the procedure given in Annexure-B. There shall be no evidence of pitting, softening, spalling or cracking in the pipe or fitting after the test.

1.1.10.6. Crushing Strength Test:

When tested along the full length of the pipe barrel from shoulder to spigot in accordance with Annex.C, the pipe tested shall have a minimum crushing strength of 16 k N/m length.

1.1.11 SAMPLING AND CRITERIA FOR CONFORMITY:

1.1.11.1 The scale of sampling and the criteria for conformity of a lot shall be as prescribed in Annexure-D.

1.1.12. MARKING:

1.1.12.1 Every pipe and fitting shall have legibly impressed upon it before firing the following:
a) Name or trade-mark of the manufacturer, and
b) Size (Internal Dia.)

1.1.12.2 Each pipe and fitting may also be marked with the Standard Mark.

SECTION - A PIPES AND FITTINGS FORMING PART OF PIPE LINE

1.13 INTERNAL DIAMETER:

1.13.1 The internal diameter of the barrels of straight pipes, junctions and bends shall be as specified in col 1 of Table-1.

1.13.2 Permissible Tolerances:
The internal diameters specified in 4.1.13.1 shall be within the following tolerances:

Internal diameter of pipes	Permissible Tolerance
100	± 3
150	± 5
200, 230	± 6
250 to 350	± 8
400, 450	± 10
500, 600	± 12

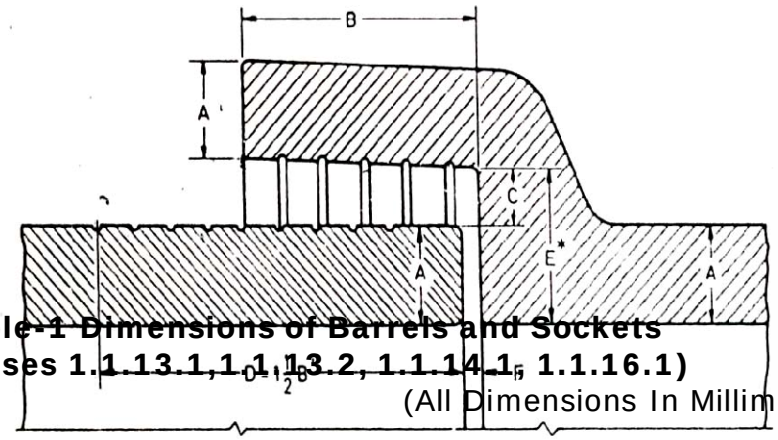


Table-1 Dimensions of Barrels and Sockets
(Clauses 1.1.13.1,1.1.13.2, 1.1.14.1, 1.1.16.1)

(All Dimensions In Millimeters)

Internal Diameter	Mean Thickness of Barrel and Socket, Min A	a) Internal Depth of Socket, Min B	Excess shoulder Measure-ment, Min C	Length of Grooving of Spigot, Min D(1½B)
1	2	3	4	5
100	12	50	10	75
150	15	57	11	85.5
200	16	63	12	94.5
230 +	19	63	12	94.5
250	20	70	16	105
300	25	70	16	105
350	30	75	16	112.5
400	35	75	16	112.5
450	37	76	16	14
500	40	80	19	120
600	43	90	19	135

- E = width of shoulder of socket which shall exceed the mean thickness of the barrel of the pipe (ascertained as directed in 4.1.14.1) by not less than the values for C given in col 4.

+ This is non-preferred size and has been included to facilitate replacements.

1.1.13.3 The pipes shall be inspected by Third Party Inspection Agency, the cost of which is to be borne by contractor. The Third Party Inspection Agency will be from any Government undertaking agency like RITES, EIL, CEIL, MACON, WAPCOS, SGS etc approved by Gujarat Water Supply & Sewerage Board..

1.1.14. THICKNESS OF BARRELS, SOCKETS AND BENDS:

1.1.14.1 The mean thickness of the barrel and the socket of the pipes junctions and bends shall not be less than the means thickness given in col 2 of Table 1. Such mean thickness of the barrels or sockets of any individual pipe junctions and bends shall be ascertained by making several minimum 4 measurements and adding the measured minimum thickness (not in the groove) to the maximum thickness and dividing the sum by two. The mean thickness of the barrel and socket shall be determined separately.

1.1.14.2. Permissible Variation:

The difference between the minimum and maximum measured thicknesses mentioned in 4.1.14.1 shall

not exceed the amounts given below:

Internal diameter of pipe (in mm)	**Permissible variation in Thickness of Barrel and Sockets (in mm)**
Not exceeding 450	**2**
500 and 600	**3**

ANNEX-A (Clause-1.1.10.4.)
TEST FOR RESISTANCE TO ACIDS

A-0 PRINCIPLE:

A-0-1 The test specimen is completely immersed in the test solution and the resistance to acid is determined as the percentage of acid soluble matter expressed as sulphate.

A-1 REAGENTS:

A-1.1 Sulphuric Acid - 4.90 percent, specify gravity 1.84.

A-2 PREPARATION OF TEST SPECIMEN:

A-2.1 Test specimen shall be sound with all edges freshly broken, free from cracks or shattered edges, about 5 cm square, not more than
200 g in mass, and shall be thoroughly cleaned with wire brush.

A-3 WEIGHING APPARATUS:

A-3.1 The weighing shall be made on a balance accurate to 0.01 g when loaded with 200 g.

A-4 PROCEDURE:

A-4.1 The specimens to be tested shall be dried to a constant mass (M_1) at a temperature not less than 150°C. The specimens upon reaching constant mass shall be completely immersed in the test solution at the ambient temperature for a period of 48 hours. Then removed from the solution and carefully and thoroughly washed with hot distilled water, allowing the wash to run into the solution in which specimens were immersed. The solution shall be filtered and to the filtrate shall be added 5 ml of concentrated sulphuric acid. The solution shall then be evaporated (avoiding loss by ignition) and heated cautiously to dryness. It shall then be ignited to constant mass (M_2)

A-5 CALCULATION:

A-5.1 The percentage of acid soluble matter, expressed as sulphate shall be calculated as follows:

$$\text{Loss in mass \%} = \frac{\text{Mass of residue } (M_2)}{\text{Mass of dry specimen } (M_1)} \times 100$$

ANNEX-B

(Clause-1.1.10.5.)

TEST FOR ALKALI RESISTANCE

B-0 PRINCIPLE:

B-0.1 The resistance of stoneware pipes or fittings to alkali is determined by reaching it with magnesium sulphate solution.

B-1 PREPARATION OF SAMPLE":

B-1.1 Test samples measuring not less than 75 cm2 and not more than 130 cm2 shall be broken from the pipe or fittings. The samples shall be sound, free from cracks or surface defects.

B-2 REAGENTS:

B-2.1 Saturated Solution of Magnesium Sulphate - Conforming to IS:2730:1977.

B-3 PROCEDURE:

B.3.1. Heat the magnesium sulphate solution (specific gravity 1.295 to 1.308) to the boiling temperature. Place the test sample in a wire basket and submerge it into the boiling solution; continue heating for two hours. then remove the sample and bring it to a constant mass in a drier or oven at a temperature not less than 110oC. Subject to the test sample to at least five cycles using fresh solution for each cycle. After the completion of five cycles remove the sample from the solution, wash it and bring it to constant mass in a drier or oven at a temperature not less than 110oC. Air cool the sample and observe.

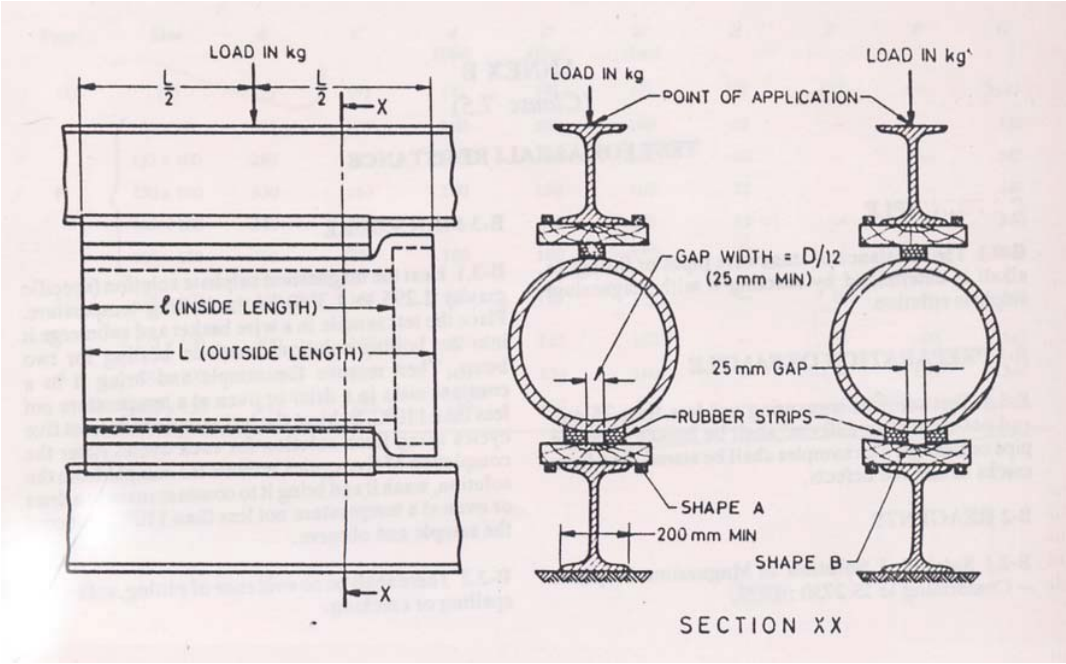
B.3.2. There shall be no evidence of pitting, softening, spalling or cracking.

ANNEX-C (Clause-4.1.10.6.)
CRUSHING STRENGTH TEST

C-1 **CRUSHING STRENGTH TESTING MACHINE:**

C-1.1. While the pipe to be tested is supported in a horizontal position on two bearings parallel to its axis, the load shall be applied to it along the length of the barrel through a third bearing on top of the barrel (see Fig below).

CRUSHING TEST RIG



C-1.2 Any testing machine having a device that will apply the load at a uniform rate of about 30 (kN/m) min. or in increments of not more than 500 N at the same rate, may be used for making the test.

C-1.3 The testing machine shall be substantial and rigid throughout, so that the distribution of the load will not be affected appreciably by the deformation or yielding of any part. The bearings shall be as specified in C-1.4, C-1.5, C-1.6 and C-2.1, and shall be attached to the machine so as to receive and uniformly transmit maximum loads required in the tests without lost motion, vibrations, or sudden shock. The machine and bearings shall be designed to transmit the load in a vertical plane through the longitudinal center lines of the bearings and pipe.

C-1.4 The three bearings shall consist of a lower member, being a rigid

beam on which two bearings strips are symmetrically disposed parallel to a vertical plane passing through the longitudinal axis of the pipe, and an upper member also being a rigid beam, on which one bearing strip is centred and disposed so that it lies in the vertical plane passing through the longitudinal axis of the pipe (See Fig. Crushing Test Rig).

C-1.5 The beam on which the bearing strips are disposed shall be structural steel beams single or of compound sections having moments of inertia about the vertical and horizontal axis of the cross section not less than those of WB 250 (See IS 808 : 1989) and with a width of flange not less than 200 mm.

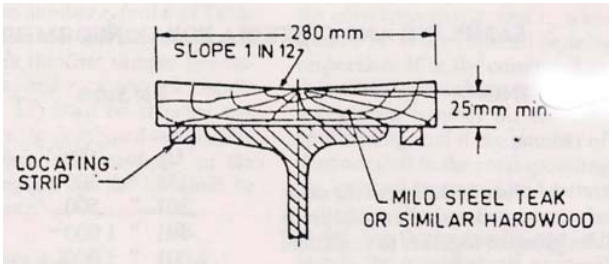
C-1.6 Mild steel, teak or similar hardwood shall be used to face the upper flange of the bottom beam. The facing shall be straight and free of warping or twisting and shall be centrally located on the flange of the beam by means of hardwood strips attached to its lower face and in contact with the edges of the flange. The cross section of the facing may have either of two shapes at the discretion of the pipe manufacturer.

Shape A shall be rectangular 280 x 25 mm minimum, without a joint. Shape B is shown in (Fig. **DETAILS OF ALTERNATIVE FACING**).

A similar facing of shape A may be used to face the lower flange of the upper beam if desired.

DETAILS OF ALTERNATIVE FACING

All dimensions in millimeters



C-2 BEARING STRIPS:

C-2.1 The bearing strips shall consist of rubber cut or formed from material having sufficient hardness. The strips shall be of rectangular cross section having a width of 50 mm and a thickness of not less than 25 mm or more than 40 mm. The two bottom strips shall be of equal thickness.

C-2.2 The single top bearing strip shall be used with the 50 mm dimension in contact with the pipe. It may be positioned on the bearing by the use of wood or metal strips along its outside edges, provided the thickness of the positioning strips does not exceed one-half the thickness of the rubber bearing strip.

C-2.3 The two lower bearing strips shall be laid on the 50 mm dimension and may be positioned on the bearing with wood or metal strips between them and adjacent to their outside edges, provided the thickness of these positioning strips does not exceed one-half the thickness of these rubber bearing strips. The two strips shall be parallel and, when used with a facing of Shape A shall be spaced a distance apart of approximately 1 mm per 12 mm of pipe diameter but in no case has than 25 mm. When used with Shape B they shall be parallel and 25 mm apart for all pipe diameters.

C-2.4 The rubber bearing strips may be attached to the facings, or in the case of the single upper strip, directly to the upper beam, by adhesive if desired, provided, such method of attachment results in the strip remaining firmly fixed in position when carrying the maximum load.

C-3 **APPLICATION OF LOAD:**

C-3.1 The load shall be applied to the top bearing at a point distant from the spigot and of the pipe equal to one-half of the overall length of the pipe including the socket if any. The test load shall be applied to the top bearing in such a way that the bearing is free to rotate in vertical plane through the longitudinal center line, of the top and bottom bearings. In testing a pipe that is not straight it shall be placed between the bearings in the position that appears to give the most favourable bearing conditions for fair test.

C-3.2 The loading of the pipe shall be a continuous operation, and the pipe shall not be allowed to stand under load longer than is required to apply the load and record the observations.

C-4 **EVALUATION OF CRUSHING STRENGTH:**

C-4.1 The ultimate crushing strength in kN per linear metre shall be calculated by dividing the total applied load at fracture by the inside length of the barrel of the sample broken

ANNEX-D (Clause-1.1.11.1)
SAMPLING AND CRITERIA FOR CONFORMITY

D-1 SCALE OF SMAPLING: D.1 Lot:

All the pipes or fittings of the same type, size and manufactured under similar conditions of production, shall be grouped together to constitute a lot.

D.2 The number of pipes or fittings to be selected at random from the lot depends upon the size of the lot and shall be in accordance with col 1 to 4 of Table 2.

D.3 NUMBER OF TESTS:

D.3.1 All the pipes or fittings selected as in D.2 shall be inspected for general quality (See 1.1.8.), dimensions (See Section A or Section B).

D.3.2. The number of pipes or fittings to be tested for hydraulic test (See 1.1.10.2.) shall be 5% of the lot as prescribed in D1. These pipes may be selected at random from those already selected in D.2 and suitable test specimens.

D.3.3 The number of pipes of fittings to be tested for absorption (1.1.10.3.) for resistance to action of acids (1.1.10.4.) and of alkali (See 1.1.10.5) and crushing strength (See 1.1.10.6.) shall be as given below:

Lot	No.of pipes to be tested
Up to	3
151 to 1200	5
1201 to 10,000	8

These pipes may be selected at random from those already selected in D.2 and suitable test specimens shall be selected from them.

D.4 CRITERIA FOR CONFORMITY:

D.4.1 A lot shall be considered as conforming to the requirements of the specifications, if the conditions mentioned in D.4.2 to D.4.6 are all satisfied.

D.4.2. General Quality (See1.1.8.) and Dimensions (See Section A and Section B).

The number of pipes and fittings in the first sample (See Col 2 and 3 of Table-2) shall be first selected and subjected

to inspection for general quality and dimensions. If in the first sample the number of defectives, that is those failing either for general quality or dimensions, is less than or equal to the corresponding acceptance number a_c (col 5 of Table-2), the lot shall be considered as conforming to the requirements of general quality and dimensions. If the number of defectives in the first sample is greater than or equal to the corresponding rejection number r_c (col 6 of Table-2), the lot shall be considered as not conforming. If the number of defectives in the first sample lies between the corresponding a_c and r_c a second sample (see col 2 and 3 of Table-2) shall be selected and subjected to inspection. If in the combined sample, the number of defectives is greater than or equal to the corresponding rejection number r_c the lot shall be considered as not conforming.

Table-2 :Sample Size and Criteria for Conformity (Clause D.2)

Lot size	Sample	Sample Size	Cumulative sample size	General Quality (See 4.1.8) and dimensions Section a & B)	
1	2	3	4	5	6
Upto 150	First Second	20 20	20 40	1 4	4 5
151 to 280	First Second	32 32	32 64	2 6	5 7
281 to 500	First Second	50 50	50 100	3 8	7 9
500 to 1200	First Second	80 80	80 160	5 12	9 13
1201 to 3200	First Second	125 125	125 250	7 18	11 19
3201 to 10,000	First Second	200 200	200 400	11 26	16 27

D.4.3 For the hydraulic test, all the specimens shall satisfy the requirements as specified in 1.1.10.2.

D.4.4 For water absorption test, the mean and range (difference between the highest and the lowest value) of the test results obtained shall be calculated and (mean + 0.6 range) shall be less than or equal to the maximum limit specified in 1.1.10.3.

D.4.5. For resistance to action of acids and of alkali shall satisfy the requirements specified in 1.1.10.4. and 1.1.10.5. respectively.

D.4.6 For crushing strength test all the test specimen shall satisfy the requirement as specified in 1.1.10.6.

Item No.4:
PROVIDING AND TESTING OF RCC PIPES AS PER THE TENDER SPECIFICATIONS.

2.1 SCOPE

All the specifications mentioned in the I.S Code 458-2003 & its latest revised addition shall be strictly followed.

2.1.1 This standard covers the requirements for reinforced unreinforced precast cement concrete pipes, of both pressure and non – pressure varieties used for water mains, sewers, culverts and irrigation. The requirements for collars are also covered by this standard.

NOTES

1 This standard covers the requirements for pressure and also non–pressure pipes of class NP3 and NP4 manufactured by vibrated casting process.

2 In addition to the requirements specified specifically for the collars, the requirements given in the following clause shall also apply for the collars:

2.5.2,2.5.3,2.5.4,2.5.5.1,2.5.5.3,2.5.5.4,2.5.7,2.5.8,2.7.1,2.7.2,2.7.2.1,2.
7.2.2.,2.7.3,2.7.3.1,2.7.4,2.8.2,2.9.1,2.9.1.1,2.9.1.2,2.9.1.3,2.9.1.4, 2.12.1 and 2.12.1.1.

2.1.2 Pre-stressed concrete pipes and pipes with non-circular section are not covered by this standard

2.2 TERMINOLOGY

2.2 For the purpose of this standard, the following definitions shall apply.

2.2.1 Working Pressure – The maximum sustained internal pressure excluding surge, to which each portion of the pipeline may be subjected when installed.

2.2.2 Site Test Pressure – 1.5 times working pressure pertaining to the section or 1.1 times static pressure. Whichever is more (surge pressure is to be controlled within 25 percent pump head in case of pumping mains).

2.2.3 Hydrostatic Test Pressure – It is the maximum pressure which the pipe can withstand without pressure which the pipe can withstand without any leakage when tested for hydrostatic pressure in accordance with this standard and IS 3597.

2.2.4 Surge (Water Hammer) Pressure – It is a pressure which is produce by a change of velocity of the moving stream and becomes maximum when there is a sudden stoppage which may be caused by the closing of a valve or by shutting down a pump station. Surge head.

2.3 CLASSIFICATION

2.3.1 For the purpose of this standard, concrete pipes shall be classified as under:

Class Description Conditions Where Normally Used

NP1 Unreinforced concrete non–pressure pipes

NP2 Reinforced concrete, light–duty, non – pressure pipes

NP3 Reinforced and also unreinforced (in case of pipes manufactured by vibrated casting process) concrete, medium–duty, non–pressure pipes.

NP4 Reinforced and also unreinforced (in case of pipes manufactured by vibrated casting process) concrete, heavy – duty, non–pressure pipes

P1 Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.2 MPa (20m head)

P1 Reinforced concrete pressure pipes tested to a P1 Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.4 MPa (40m head)

P3 Reinforced concrete pressure pipes tested to a hydrostatic pressure of 0.6 MPa (60m head)

For drainage and Irrigation use, above ground or in shallow trenches

For drainage and irrigation use, for cross drains/culverts carrying light traffic

For drainage and irrigation use, for cross drains/culvert carrying heavy medium traffic

For drainage and irrigation use, for cross drain/culvert carrying heavy traffic

For use on gravity mains, the site test pressure not exceeding two – thirds of the hydrostatic test pressure

For use on pumping mains the site test

For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure

For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure

Note:–The uses are only by way of recommendations as a general guidance and the exact usage shall be decided by the engineer – in – charge.

2.3.2 Unreinforced and reinforced concrete non-pressure pipes shall be capable of withstanding a test pressure of 0.07 MPa (7m head).

2.4 MATERIALS

2.4.1 For precast concrete pipes, materials complying with the requirements given in 2.4.2 to 2.4 .8 shall be used.

2.4.2 Cement

Cement used for the manufacture of unreinforced and reinforced concrete pipes shall conform to IS 269 or IS 455 or IS 1489 (Part 1) (see Note 1) or IS 1489 (Part 2) or IS 8041 or IS 8043 or IS 8112 or IS 12269 or IS:12330.

NOTES

1. Unless otherwise specified by the purchaser, the type of cement to be used is left to the discretion of the manufacturer. Fly ash based cement conforming to IS 1489 (Part 1) with fly ash contents up to 25 percent is permitted for non-pressure pipe only.

2. Sulphate resisting Portland cement (see IS 12330) shall be used, where sulphate is predominant.

3. Site blending with fly ash up to a maximum of 25 percent may be carried out provided its uniform blending with ordinary Portland cement is ensured. Such blended cement shall be used only for non-pressure pipes. The fly ash used for blending shall be either from ESP or processed by established fly ash processing units and shall conform to Grade 1 of IS:3812. Specified requirements of concrete strength, permeability, hydrostatic test and three-edge bearing test shall be met to the satisfaction of customer before it is used for regular production.

2.4.3 Aggregates

Aggregates used for the manufacture of unreinforced and reinforced concrete pipes shall conform to 3 of IS:383. The maximum size of aggregates should not exceed one third thickness of the pipes or 20 mm, whichever is smaller for pipes above 250 mm internal diameter. But for pipes of internal diameter 80 to 250 mm the maximum size of aggregates should be 10 mm.

NOTE:- It is preferable to have the size and grading of aggregates conforming to IS 383. It is also preferable that materials finer than 75 micron IS Sieve is restricted to 3.0 percent by mass.

2.4.4 Reinforcement

Reinforcement used for the manufacture of the reinforced concrete pipes shall conform to mild steel Grade 1 or medium tensile steel bars conforming to IS 432 (Part 1) or hard-drawn steel wire conforming to IS
432 (Part 2) or structural steel (standard quality) bars conforming to IS:2062.

NOTE :- Wire fabric conforming to IS 1556 or deformed bars and wires conforming to IS 1786 or plan hard -drawn steel wire for pre-stressed concrete to IS 1785 (Part 1) or IS 1785 (Part 2) may also be used. For such reinforcement maximum tensile stress shall be as given in 6.1.

2.4.5 Concrete Mortar

2.4.5.1 The concrete quality (concrete mix, maximum water-cement ratio, minimum cement content, etc) shall be as per IS 456 for at least very server environment exposure condition. Design mix requirements shall be as per IS 456. However, in case of pipes cast by spinning process higher cement contents, more fines and higher water-cement ration may be the need of the process. For non-pressure pipes, if mortar is used, it shall have a minimum cement content of 450 kg/m3 and a compressive strength not less than 35 N/mm2 at 28 days. For pressure pipes if mortar is used, it shall have a minimum cement content of 600 kg/m3 and a compressive strength not less than 35 N/mm2 at 28 days. However, in case of pipes manufactured by vibrated casting process, concrete shall minimum compressive strength as indicated in Tables 4, 5, 7 and 8 for the respective classes of pipes.

Where the process of manufacture is such that the strength of concrete or mortar in the pipe differs from that given by tests on cubes, the two may be related by a suitable conversion factor. If the purchaser requires evidence of this factor, he

shall ask for it before placing the order. The conversion factor for 28 days compressive strength for spun concrete may be taken as 1.25 in the absence of any data.

2.4.5.2 For pressure pipes, splitting tensile strength of concrete cylinders at 28 days, when tested in accordance with IS
5816, shall be not less than 2.25 N/ mm2.

2.4.5.3 Compressive strength tests shall be conducted on 150 mm cubes in accordance with the relevant requirements of IS 456 and IS 516.

2.4.5.4 The manufacture shall give a certificate indicating the quantity of cement in the concrete mix.

2.4.6 Rubber Ring

Rubber ring chords used in pipe joints shall conform to Type 2 of IS 5382.

2.4.7 Water

Water used for mixing of concrete and curing of pipes shall conform to 5.4 of IS 456.

2.4.8 Chemical Admixtures

The admixtures, where used, shall conform to IS 9103.

2.5 DESIGN

2.5.1 General

Reinforced concrete pipes either spun or vibrated cast shall be designee such that the maximum tensile stress in the circumferential steel due to specified hydrostatic test pressure does not exceed the limit of 125
N/mm2 in the case of mild steel rods, 140 N/mm2 in the case of hard- drawn steel wires and high strength deformed steel bars and wires.

2.5.1.1 The barrel thickness shall be such under the specified hydrostatic test pressure, the maximum tensile stress in concrete, when considered as effective to take stress along with the tensile reinforcement, shall not exceed 2 N/mm2 for pressure pipes and 1.5 N/mm2 for non-pressure pipes. But the barrel wall thickness shall be not less than those given in **Table 1** subject to 2.7.2 (iii) for pipes manufactured by spun process. For pipes manufactured by vibrated casting process, the barrel wall thickness shall be as given in Table **2, 3**

2.5.1.2 Pipes of length above 3 mm and up to 4 m may be

supplied by agreement between the user and the supplier and for such pipes, the quantity of reinforcement shall be modified as per
2.5.1.2.1

2.5.1.2.1 Longitudinal reinforcement

Reinforced cement concrete pipes of lengths up to 4 m may be accepted if the longitudinal reinforcement in increased in proportion to the square of length compared with what is used for 3 m length as specified in Tables 1 and 3, except for Table 2

For 'L' (in metre) length of pipe, longitudinal reinforcement shall be $L^2/3^2$ times the longitudinal reinforcement used for 3 m long pipes.

2.5.1.3 Longitudinal reinforcement shall be provided to ensure rigidity and correct location of cages (girds) longitudinally and to limit the effects of transverse cracking. Minimum longitudinal reinforcement shall be as given in Table-1 for pipes manufactured by spinning process. For reinforced pipes manufactured by vibrated casting process, the minimum longitudinal reinforcement shall be as given in Table 3

2.5.2 Reinforcement

The reinforcement in the reinforced concrete pipe shall extend throughout the length of the pipe and shall be so designed that it may be readily placed and maintained to designed shape and in the proper position maintained to designed shape and in the proper position within the pipe mould during the manufacturing process. The circumferential and longitudinal reinforcement shall be adequate to satisfy the requirements specified under 2.5.1.

For non-welded cages spiral reinforcement of the same diameter shall be closely spaced at the end of the pipe for a length of 150 mm to minimize damage during handling. The spacing of such end spirals shall not exceed 50 mm or half the pitch whichever is less. Such spiral reinforcement at ends shall be part of the total spiral reinforcement specified in different tables.

2.5.2.1 The pitch of circumferential reinforcement shall be not more than the following:

a) 200 mm for pipes of nominal internal diameter 80 to 150 mm.
b) 150 mm for pipes of nominal internal diameter 200 to 350 mm, and
c) 100 mm for pipes of nominal internal diameter 400 mm and above.

The pitch shall also be not less than the maximum size of aggregate plus the diameter of the reinforcement bar used.

2.5.2.2 The quantity and disposition of steel in pipes may be decided by mutual agreement between the purchaser and the supplier; however, it shall be proved by calculations and tests that the quantity of the reinforcement conforms to all the requirements specified in the standard. In the absence of calculations and tests, the reinforcement given in Table 1for pipes manufactured by spinning process and in Table 3 for pipes manufactured by vibrated casting process shall be used as minimum reinforcement subject to the requirements of 2.5.2.2.1.

2.5.2.2.1 Tolerances given in IS 432 (part 1), IS 432 (Part 2), and IS 2062 shall be applied to the minimum mass to longitudinal reinforcement specified in different tables. Total mass of longitudinal reinforcement shall be calculated taking into account the clear cover provided at each end of the pipe.

NOTE: For longitudinal reinforcement conforming to IS:432 (Part-2), tolerance on mass shall be calculated from the diameter tolerance.

2.5.2.3 If so required by the purchaser, the manufacturer shall give a certificating the details relating to quality, quantity and dispersion of steel in the pipes as well as the clears cover to the steel provided in the pipes.

2.5.3 Ends of Pipes

Spigot and Socket ended pipes shall be used for water mains, sewer, irrigation and culverts/cross drains. Whereas, flush jointed (NP3 and NP4) and collar jointed (NP2) pipes shall be used for culverts/cross drains only. The ends of concrete pipes used for water mains, sewer and irrigation shall be suitable for socket and spigot, roll on joints or confined gasket joints. Dimensions of spigot and socket for various classes of pipes shall be as given in Table 4,5for pipes manufactured by spinning process. However the dimensions of spigot and socket shall be as given in Tables 6 in case of pipes manufactured by vibrated casting process. Reinforcement in socket of rubber ring jointed pipes shall be as given in Table 7.

However, the ends of concrete pipes used for road culverts/cross drains may be suitable for flush (NP3 and NP4) or collar joints (NP2) (see Fig.1 and 2). For pipes of diameter up to 700 mm, external flush joint and for diameters above 700 mm, internal flush joint is

recommended.

NOTES

1. Bends, junctions and specials for concrete pipes covered under this standard shall conform to the requirements of IS 7322.

2. Same typical arrangement of reinforcement in socket are illustrated **in Fig. 3 and Fig.4.**

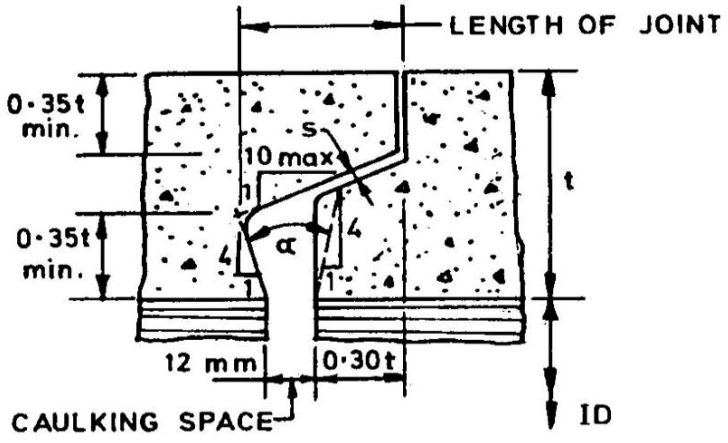
2.5.3.1 Only flexible rubber ring joints shall be used for the joints in (a) all pressure pipes and (b) all non-pressure pipes except when used for road culverts/cross drains. The pipe joints shall be capable of withstanding the same pressure as the pipe.

NOTE : The requirements of 2.5.3.1 does not imply that the collar shall also be tested for the test pressure for pipes specified in 2.3.1, 2.3.2 and 2.9.

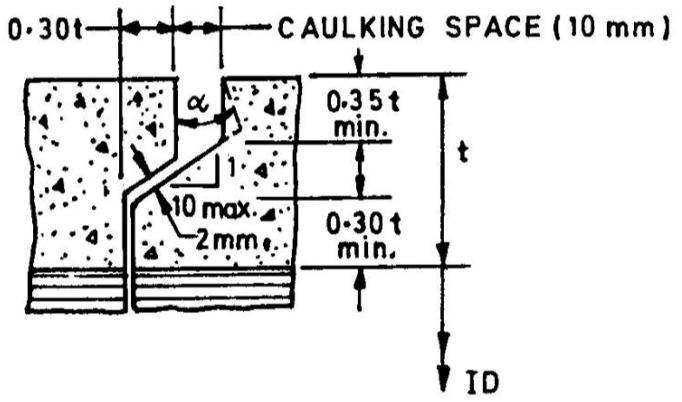
2.5.4 Cover

The minimum clear covers for reinforcement in pipes and collars shall be as given below:

SI NO	***Precast Concrete Pipe/Collar***	***Minimum Clear Cover, mm***
i)	Barrel wall thickness :	
	a) Up to and including 75 mm	8
	b) Over 75 mm	15
ii)	At spigot steps	5
iii)	At end of longitudinal	5



1A Internal Flush Joints



1B External Flush Joints

t – wall thickness.
s – 0.002 of intenal dia or 2 mm, *Min*.
ID – internal diameter.
α – included angle not more than 25° (only for design purp not be measured).

Fig. 1 DETAILS OF FLUSH JOINT

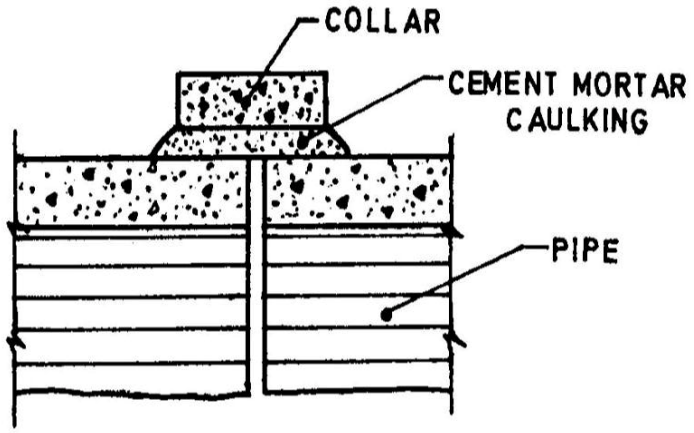
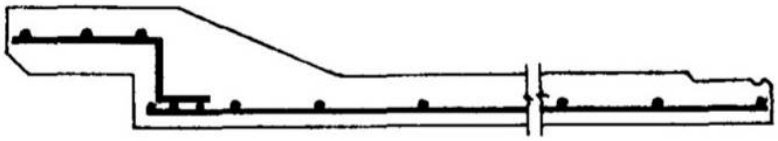


FIG-2 COLLOR JOINT(RIGID)

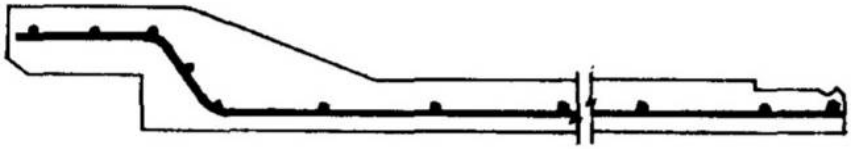
NOTE : - An effective means shall be provided for maintaining the reinforcement in position and for ensuring correct cover during manufacture of the unit. Spacers for this purposes shall be of rustproof materials or of steel protected against corrosion.

NOTE — No. of Z bars : Minimum half the number of longitudinals.
Maximum equal to number of longitudinals.

3A Socket Cage Gonnected to Barrel
Cage by Means of Z Bars

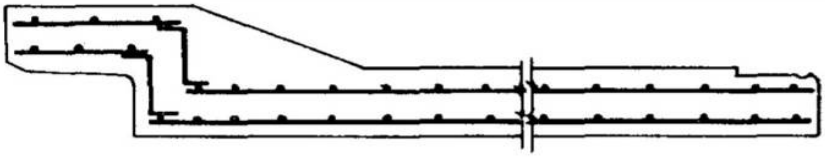


3B Socket Cage Longitudinals Suitably Bent
for Connecting to Barrel Cage



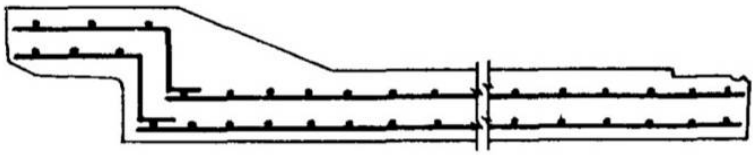
3C Cage made of Continuous Longitudinals

FIG. 3 TYPICAL ARRANGEMENTS OF REINFORCEMENT IN SOCKET FOR SINGLE CAGE

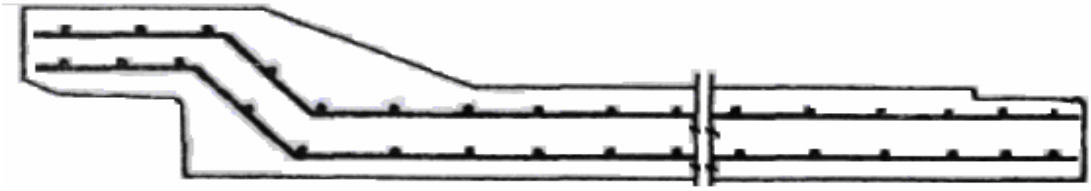


NOTE — No. of Z bars : Minimum half the number of longitudinals.
Maximum equal to number of longitudinals.

4A Socket Cage Connected to Barrel
Cage by Means of Z Bars



4B Socket Cage Longitudinal Suitably Bent for Connecting to Barrel Cage



4C Cage made of Continuous Longitudinal

Fig 4. Typical arrangements of reinforcement in socket for double cage (use suitable type of spacers)

2.6 MANUFACTURE

2.6.1 General

The method of manufacture shall be such that the forms and dimensions of the finished pipe are accurate within the limits specified in this standard. The surfaces and the limits specified in this standard. The surfaces and edges of the pipes shall be well defined and true, and their ends shall be square with the longitudinal axis.

2.6.2 Concrete Mixing and Placing

2.6.2.1 Concrete shall be mixed in a mechanical mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour and consistency, but in no case shall the mixing be done for less than 2 min.

2.6.2.2 Concrete shall be placed before setting has commenced. It should be ensured that the concrete is not dropped freely so as to cause segregation. The concrete shall be consolidated by spinning, vibrating, spinning combined with vibrations, or other appropriate mechanical means.

2.6.3 Reinforcement Cages

Reinforcement cages for pipes shall extend throughout the pipes barrel. The cages shall consist of spirals or circular rings and straights of hard- drawn steel wire or mild steel rod. Reinforcement cages shall be placed symmetrically with

respect to the thickness of the pipe wall. The spirals shall end in a complete ring at both the ends of a pipe.

2.6.3.1 Pipes having barrel wall thickness 100 mm and above shall have double reinforcement cage and the amount of spirals steel in the outer cage shall be 75 percent of the mass of spiral steel in the inner cage, whilst the total shall conform to the requirements specified in the relevant tables of this standard. The mass of longitudinals in the outer cage and inner cage should be the same, that is equal to half the total mass of longitudinals steel per pipe shall be given in the relevant tables.

NOTES : It is preferable that single reinforcement cage should be located near the inner surface of the pipe with adequate clear cover.

2.6.3.2 Diagonal reinforcement may be provided in pipes, the cages for which are not welded so as to help in binding the cage securely. It shall, however, be ensured that the clear cover for any reinforcement is not below the limits specified in 2.5.4. Diagonal reinforcement is a process requirement and shall not be counted against longitudinal and spiral reinforcement.

2.6.4 Curing

Curing shall be either by steam or by water or by a combination of steam and water, or by use of approved curing compounds. If water curing is used, the pipes shall be cured for a minimum period of 7 days in case of non-pressure pipes and 14 days in case of pressure pipes. In case of pipes where cement with fly ash or slag is used, the minimum period of water curing shall be 14 days, if steam curing is used, after that is shall be water cured for 3 days.

2.7. DIMENSIONS

2.7.1 Pipes

The internal diameter, barrel wall thickness, length, the minimum reinforcement and strength test requirements for different classes of pipes (see 2.2.1), shall be as specified in Table 1 to 3. However, in case of pipes manufactured by vibrated casting process, the internal diameter, wall thickness, the minimum reinforcement (in case of reinforced pipes) and strength test requirements for different classes of pipes shall be as given in Table The manufacturer shall inform the purchaser of the effective length of spigot and socket, and flush jointed pipes that he is able to supply. For collar jointed

pipes, effective length shall be 2 m or 2.5 m up to 250 mm nominal diameter pipes and 2.5 m, 3.0 m or 4.0 m for pipes above 250 mm nominal diameter 900 mm and above, the effective length may also be 1.25 m.

NOTES : Pipes of internal diameter, barrel wall thickness and length of barrel and collar other than those specified in 2.7.1 may be supplied by mutual agreement between the purchaser and the supplier. In such case, the design of pipes submitted to the purchaser shall include all standard details as covered in Tables 1 to 3.

2.7.2 Tolerances

The following tolerances shall be permitted:

Sr No.	***Dimensions***		***Tolerances***
i)	Overall length	:	± 1 percent of standard length
ii)	Internal diameter of pipes	:	
	a) Up to and including 300 mm	:	± 3 mm
	b) Over 300 mm and up to and including 600	:	± 5 mm
	c) Over 600 mm	:	± 10 mm
iii)	Barrel wall thickness	:	
	a) Up to and including 30 mm	:	+ 2 mm - 1 mm
	b) Over 30 mm up to and including 50 mm	:	+ 3 mm - 1.5 mm
	C) Over 50 mm up to and including 65	:	+ 4 mm - 2 mm
	d) Over 65 mm up to and including 80 mm	:	+ 5 mm - 2.5 mm
	e) Over 80 mm up to and including 95 mm	:	+ 6 mm - 3 mm
	f) Over 95 mm	:	+ 7 mm - 3.5 mm

NOTE - In case of pipes with flexible rubber ring joints, the tolerance on thickness near the ends will have to be reduced. Near the rubber ring joints, the tolerance on thickness shall be as given in Tables 4 to 6 in case of pipes manufactured by spinning process and as given in Table 5 in case of pipes manufactured by vibrated casting process.

2.8 WORKMANSHIP AND FINISH

2.8.1 Finish

Pipes shall be straight and free from cracks except that craze

cracks may be permitted. The ends of the pipes shall be square with their longitudinal axis so that when placed in a straight line in the trench, no opening between ends in contact shall exceed 3 mm in pipes up to 600 mm diameter (inclusive), and 6 mm in pipes larger than 600 mm diameter.

2.8.1.1 The outside and inside surfaces of the pipes shall be dense and hard and shall not be coated with cement wash or other preparation unless otherwise agreed to between the purchaser and the manufacturer or the supplier. The inside surface of the pipe shall be smooth. For better bond, inner surface of the collar may be finished rough.

Table 1 Design and Strength Test Requirements of Concrete Pipes of Class NP3 – Reinforced Concrete, Medium Duty, Non – pressure Pipes

(Clauses 2.5.1.1,2.5.1.2.1, 2.5.1.3, 2.5.2.2, 2.5.3.2 and 2.7.1; and Table 7)

Internal Diameter of Pipes	Barrel Wall Thickness	Reinforcements			Strength Test Requirement for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce	Ultimate Load
mm	mm	Minimum number	Kg / linear meter	kg / linear meter	0.25 mm Crack kN/linear meter	kN / liner meter
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	40	8	0.78	1.80	15.50	23.25
350	75	8	0.78	2.95	16.77	25.16
400	75	8	0.78	3.30	19.16	28.74
450	75	8	0.78	3.79	21.56	32.34
500	75	8	0.78	4.82	23.95	35.93
600	85	8 or 6+6	1.18	7.01	28.74	43.11
700	85	8 or 6+6	1.18	10.27	33.53	50.30
800	95	8 or 6+6	2.66	13.04	38.32	57.48
900	100	6+6	2.66	18.30	43.11	64.67
1000	115	6+6	2.66	21.52	47.90	71.85
1100	115	6+6	2.66	27.99	52..69	79.00
1200	120	8+8	3.55	33.57	57.48	86.22
1400	135	8+8	3.55	46.21	67.06	100.60
1600	140	8+8	3.55	65.40	76.64	114.96
1800	150	12+12	9.36	87.10	86.22	129.33

NOTE :

1. If mild steel is used for spiral reinforcement, the weight specified under col 5 shall be increased to 140/125
2. The longitudinal reinforcement given in this table is valid for pipe up to 2.5m effective length for internal diameter of pipe up to 250mm and up to 3m effective length for higher diameter pipes
3. Total mass of longitudinal reinforcement shall be calculated by multiplying the value given in col 4 by the length of the pipe and then deducting for the cover

length provided at the two ends.

4. Concrete for pipes shall have a minimum compressive strength of 35 N/mm^2 at 28 days.

Table 2 Design and Strength Test Requirement of Concrete Pipes of Class NP3 – Un reinforced Concrete, Medium – Duty, Nonpressure Pipes Made by Vibrated Casting Process (Clauses 2.4.5.1, 2.5.1.1, 2.5.3 and 2.7.1 and Table 7)

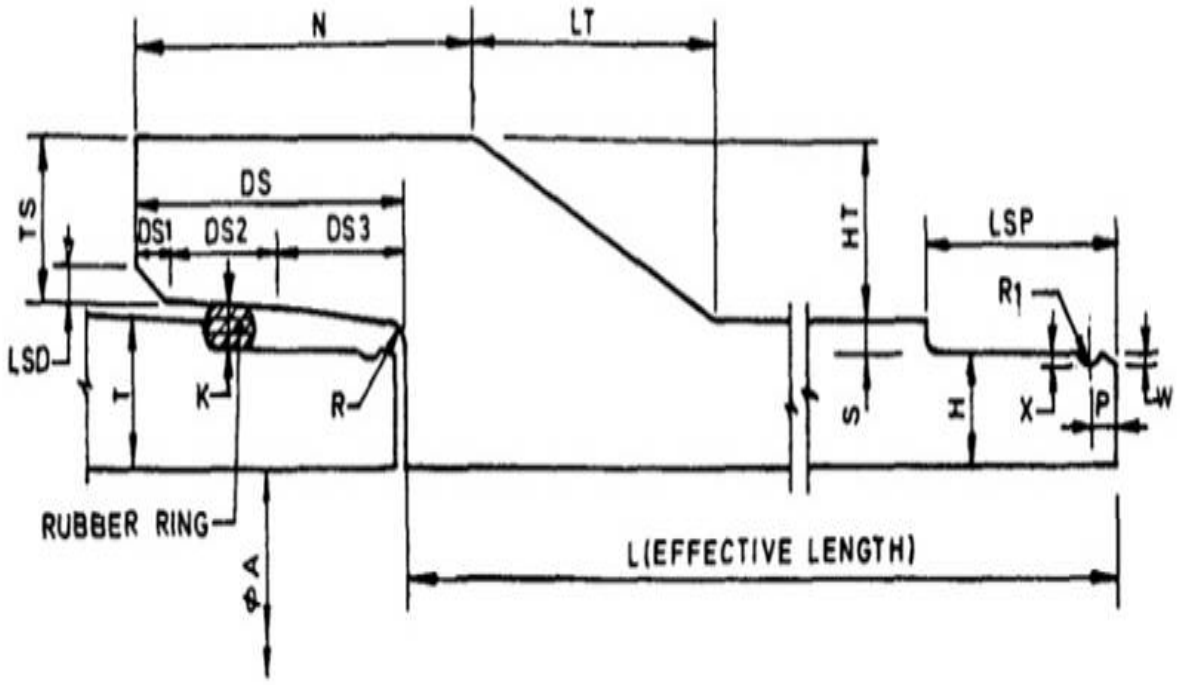
Internal Diameter of Pipes	Minimum Barrel Wall Thickness	Strength Test Requirement for Three Edge Bearing Test,
mm	Mm	kN Bearing Test, Ultimate
(1)	(2)	(3)
300	50	15.50
350	55	16.77
400	60	19.16
450	65	21.56
500	70	23.95
600	75	28.74
700	85	33.53
800	95	38.22
900	100	43.11
1000	115	47.90
1100	120	52.69
1200	125	57.48
1400	140	67.06
1600	165	76.64
1800	180	86.22
NOTE – Concrete for pipes shall have a minimum compressive strength of 45		

Table 3 Design and Strength Test Requirements of Concrete Pipes of Class NP3 – Reinforced

Concrete, Medium Duty, Non – pressure Pipes made by vibrated casting process

(Clauses 2.4.5.1., 2.5.1.1, 2.1.2.1, 2.5.1.3, 2.5.2.2, 2.6.3.2 and 2.7.1;
and Table 7)

Internal Diameter of Pipes	Minimum Barrel Wall Thickness	Reinforcements			Strength Test Requirement for Three Edge Bearing Test	
		Longitudinal, Mild Steel or Hard Drawn Steel		Spirals, Hard Drawn Steel	Load to Produce	Ultimate Load
mm	mm	Minimum number	Kg / linear meter	kg / linear meter	0.25mm Crack kN/linear meter	kN / liner meter
(1)	(2)	(3)	(4)	(5)	(6)	(7)
300	50	8	0.78	1.53	15.50	23.25
350	55	8	0.78	1.58	16.77	25.16
400	60	8	0.78	1.60	19.16	28.74
450	65	8	0.78	1.90	21.56	32.34
500	70	8	0.78	2.0	23.95	35.93
600	75	8 or 6+6	1.18	2.20	28.74	43.11
700	85	8 or 6+6	1.18	4.87	33.53	50.30
800	95	8 or 6+6	2.66	6.87	38.32	57.48
900	100	6+6	2.66	11.55	43.11	64.67
1000	115	6+6	2.66	15.70	47.90	71.85
1100	120	6+6	2.66	19.61	52..69	79.00
1200	125	8+8	3.55	21.25	57.48	86.22
1400	140	8+8	3.55	30.00	67.06	100.60
1600	165	8+8	3.55	50.63	76.64	114.96
1800	180	12+12	9.36	64.19	86.22	129.33
2000	190	12+12	9.36	83.12	95.80	143.70
2200	210	12+12	9.36	105.53	105.40	158.07
2400	225	12+12	14.88	133.30	115.00	172.44
NOTE: - Concrete for pipes shall have a minimum compressive strength of 35 N/mm^2 at						


N
LT
TS
DS
DS1
DS2
DS3
HT
LSP
R1
LSD
T
K
R
S
H
X
P
W
RUBBER RING
ϕA
L(EFFECTIVE LENGTH)

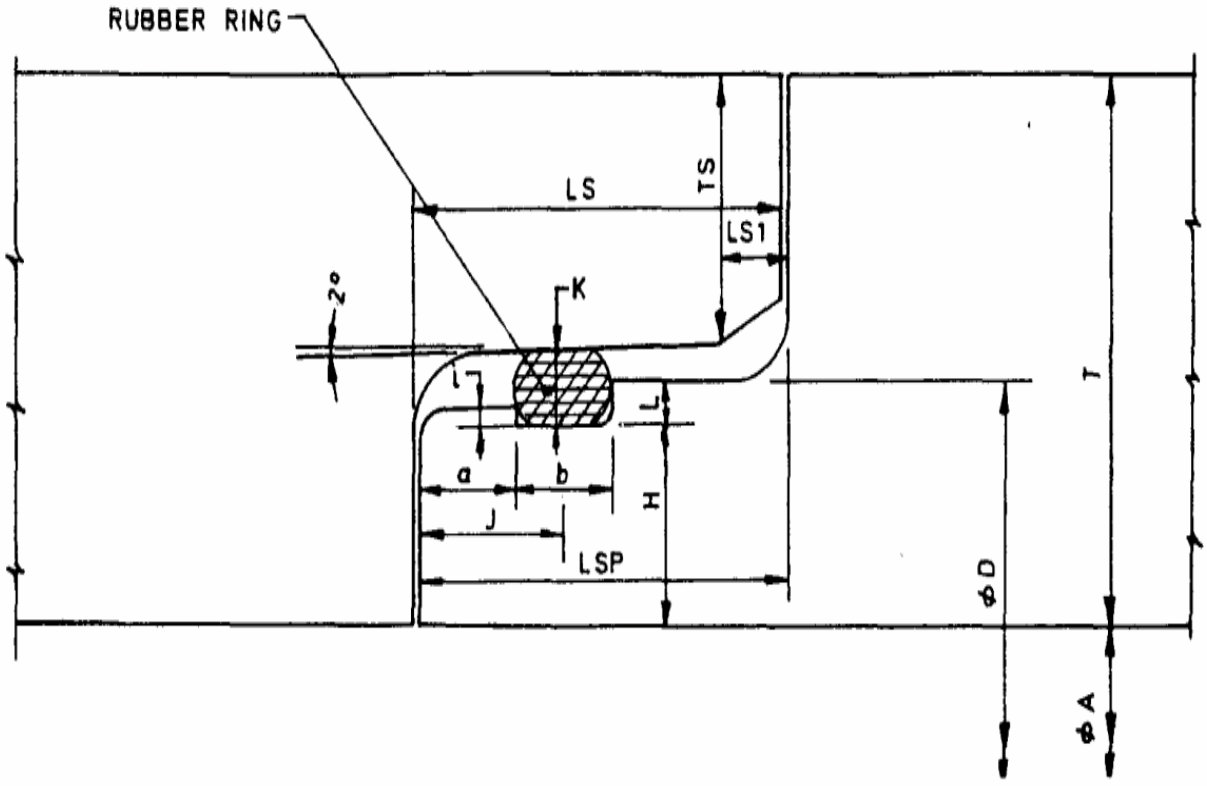

RUBBER RING
LS
TS
LS1
2°
K
L
a
b
J
H
LSP
ϕD
T
ϕA

Table 4 Spigot and Socket Dimensions of NP3 and NP4 Class Pipes (Rubber Ring Roll on Joint) from 80 to 900 mm

Diameter (Clauses 2.5.3 and 2.7.2)

All dimensions in millimeters

Pipe Diameter *ΦA*	Rubber Ring Chord Diameter	Rubber Ring Internal Diameter	T	TS	DS	DS1	DS2	DS3	R	LSD	K	N	LT	HT	LSP	P	S	H	X	W	R1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
80	11	102	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
100	11	120	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
150	11	170	25	32.5	70	8	28	34	3	5.5	6.5	95	84	34	50	7	5.5	19.5	1	1	5.5
200	11	230	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
225	11	255	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
250	11	275	30	38	83	11	38	34	5	6.5	6.5	113	97	39.5	50	7	5.5	24.5	1	1	5.5
300	12	340	40	51	90	12	42	36	6	7	7	130	130	53	55	7.5	6	34	1	1	6
350	16	435	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
400	16	480	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
450	16	525	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
500	16	570	75	75	120	16	56	48	8	10	10	158	135	78	72	10	8	67	2	2	8
600	20	675	85	85	150	20	70	60	10	12	12	193	153	88.5	90	12	10	75	2	2	10
700	20	765	85	85	150	20	70	60	10	12	12	193	153	88.5	90	12	10	75	2	2	10
800	20	875	95	95	150	20	70	60	10	12	12	197	171	98.5	90	12	10	85	2	2	10
900	20	970	100	100	150	20	70	60	10	12	12	200	180	103.5	90	12	10	90	2	2	10

Table 4*(Concluded)*

NOTES

1 Corners to be rounded off

2 The dimensions DS2, DS3, LSP, TS, T.H.S.HT and K shall conform to the values given in this table as there are critical dimensions. Other dimensions are for guidance only. The following tolerance shall apply on the critical dimensions.

Dimensions *Tolerances*

T and *HT* Same as that of barrel wall thickness given in 2.7.2

TS and *H* Half the tolerance on barrel wall thickness given in 2.7.2

DS2, DS3, LSP, K & S The tolerance, in mm, shall be given below :

Chord Diameter	***DS2***	***DS3***	***LSP***	***K***	***S***
11	± 2	± 3	± 4	± 1.25	± 0.75
12	± 2	± 3	± 4	± 1.25	± 0.75
16	±2.5	±3.5	± 5	± 2.00	± 1.25
20	± 3	± 4	±5.5	± 2.25	± 1.50
25	± 4	± 5	±7	± 3.25	± 2

Table 5 Spigot and Socket Dimensions of NP3 and NP4 Class Pipes from 1000 to 2600 mm Diameter (Rubber Ring Confined Joint)

(Clauses 5.3 and 7.2)

All dimension in millimeters.

Pipe Diameter Φ A	*Rubber Ring Chord Diameter*	*Rubber Ring Internal Diameter*	*T*	*TS*	*LS*	*LS1*	*K*	*LSP*	*a*	*b*	*J*	*H*	*I*	*L*	*Ø D*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*
1000	*20*	*920*	*115*	*58.0*	*114*	*20*	*13*	*114*	*25*	*28*	*39*	*42*	*4*	*9*	*1102*
1100	*20*	*1003*	*115*	*58.0*	*114*	*20*	*13*	*114*	*25*	*28*	*39*	*42*	*4*	*9*	*1202*
1200	*20*	*1095*	*120*	*60.5*	*114*	*20*	*13*	*114*	*25*	*28*	*39*	*44.5*	*4*	*9*	*1307*
1400	*25*	*1275*	*135*	*67.5*	*114*	*20*	*16*	*114*	*25*	*35*	*42.5*	*50*	*4*	*10*	*1520*
1600	*25*	*1445*	*140*	*72.5*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*50*	*4*	*10*	*1720*
1800	*25*	*1620*	*150*	*77.5*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*55*	*4*	*10*	*1930*
2000	*25*	*1810*	*170*	*87.5*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*55*	*4*	*10*	*2150*
2200	*25*	*1995*	*185*	*95.0*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*72.5*	*4*	*10*	*2365*
2400	*25*	*2180*	*200*	*102.5*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*80*	*4*	*10*	*2580*
2600	*25*	*2360*	*215*	*110.0*	*114*	*25*	*16*	*114*	*25*	*35*	*42.5*	*87.5*	*4*	*10*	*2795*

Table 5 (Concluded)

NOTES

1 Corners to be rouded off.

2 The dimensions LS, LSP, TS, T, H, L, b and K shall conform to the values given in this table as these are critical dimensions. Other dimensions are for guidance only. The following tolerances shall apply on the critical dimension.

Dimension Tolerances

LS and LSP ±7mm.

T Same as that of barrel wall thickness given in 2.7.2

H and TS Half the tolerance on barrel wall thickness given in 2.7.2

L ±0.5 mm.

b ±1mm. for 20mm. rubber ring chord diameter

K ±2.5mm. for 25mm. rubber ring chord diameter

Table 6

All dimension in millimeters.

di	*G*	*R*	*T*	D_o	L_t	L_b	d_s	D_m	L_m	I_s	*S*
300 ± 4	13	322	50	487 ± 4	112±4	105±2	370.07	386.07	49	50	8.00±1.0
350 ± 5	13	370	55	555 ± 4	112±4	105±2	425.07	441.07	49	50	8.00±1.0
400 ± 5	13	417	60	615 ± 4	112±4	105±2	480.07	496.07	49	50	8.00±1.0
450 ± 5	13	465	65	680 ± 4	112±4	105±2	536.07	552.07	49	50	8.00±1.0
500 ± 5	13	513	70	735 ± 4	112±4	105±2	590.07	606.07	49	50	8.00±1.0
600 ± 5	13	609	75	850 ± 4	112±4	105±2	700.07	716.07	49	50	8.00±1.0
700 ± 7	18	706	85	980 ± 5	141±5	132±3	808.00	830.00	61	65	11.00±1.2
800 ± 7	18	803	95	1100±5	141±5	132±3	924.00	946.00	61	65	11.00±1.2
900 ± 7	18	901	100	1215±5	141±5	132±3	1036.00	1058.00	61	65	11.00±1.2
1000 ± 7	18	998	115	1330±5	141±5	132±3	1148.00	1170.00	61	65	11.00±1.2
1100 ± 7	24	1097	120	1520±6	155±6	145±3	1262.00	1291.30	72	63	14.65±1.5
1200 ± 7	24	1195	125	1640±6	155±6	145±3	1372.48	1401.78	72	63	14.65±1.5
1400±10	24	1383	140	1870±6	155±6	145±3	1590.91	1620.21	72	63	14.65±1.5
1600±10	24	1578	165	2100±6	155±6	145±3	1814.91	1844.21	72	63	14.65±1.5
1800±10	24	1774	180	2340±6	155±6	145±3	2040.00	2069.30	72	63	14.65±1.5
2000±12	28	1850	190	2380±8	173±8	168±4	2126.80	2161.00	75	78	17.10±1.8
2200±12	28	2037	210	2620±8	173±8	168±4	2341.80	2376.00	75	78	17.10±1.8
2400±12	28	2224	225	2850±8	173±8	168±4	2556.80	2591.00	75	78	17.10±1.8

NOTES

1. G is the diameter of the unstretched rubber chord, hardness 40 + 5 IRHD, stretching 15 percent.
2. R is the inner diameter of the unstretched rubber ring.
3. T is the minimum barrel wall thickness.
4. d_x D_m L_m and L_s are nominal diameter

Table 7 Weight of Spirals (Hard Drawn Steel) in Socket of R/R Joint RCC Pipes of Different Classes (kg/Number) (Clause 2.5.3)

Internal Diameter of Pipes	NP2 Class	NP3 Class	NP4 Class	P1 Class	P2 Class	P3 Class
(1)	(2)	(3)	(4)	(5)	(6)	(7)
80	0.08	0.08	0.08	0.08	0.08	0.08
100	0.09	0.09	0.09	0.09	0.09	0.09
150	0.12	0.12	0.12	0.12	0.12	0.15
200	0.14	0.14	0.21	0.14	0.21	0.35
225	0.15	0.15	0.26	0.15	0.26	0.43
250	0.16	0.16	0.31	0.16	0.31	0.51
300	0.45	0.45	0.53	0.45	0.53	0.84
350	0.51	0.64	0.64	0.51	0.74	1.24
400	0.56	0.71	0.71	0.56	0.99	1.66
450	0.63	0.76	0.76	0.63	1.23	2.26
500	0.68	0.87	1.08	0.68	1.57	2.85
600	0.81	1.00	2.12	1.52	2.88	4.74
700	0.92	2.16	3.02	1.79	3.96	6.79
800	1.14	2.87	4.67	2.04	6.28	9.99
900	1.50	4.06	6.03	2.63	8.29	-
1000	1.91	-	-	3.33	11.29	-
1100	2.34	-	-	4.08	-	-
1200	2.80	-	-	4.90	-	-
1400	3.82	-	-	-	-	-
1600	5.64	-	-	-	-	-
1800	7.25	-	-	-	-	-
2000	11.68	-	-	-	-	-
2200	12.88	-	-	-	-	-

NOTES

1. Longitudinal reinforcement shall be proportional to the length of socket cage as given in Table 1 & 2.

2. If mild steel is used for spiral reinforcement, the weight specified above shall be increased to 140/125.

Table 8 Design Requirements of Reinforced Concrete

Collars for Pipes of Class NP3 and

NP4 (*Clauses* 2.5.3 *and* 2.7.1)

Nominal Internal Diameter of Pipe	Collar Dimensions			Reinforcements		
	Minimum Caulking Space	Minimum Thickness	Minimum Length	Longitudinal, Mild Steel or Hard Drawn Steel		Spiral Hard-Drawn Steel
mm (1)	mm (2)	mm (3)	mm (4)	No. (5)	kg/collar (6)	kg/collar (7)
90	13	25	150	6	0.08	0.07
100	13	25	150	6	0.08	0.08
150	13	25	150	6	0.08	0.10
200	13	25	150	6	0.08	0.12
225	13	25	150	6	0.08	0.14
250	13	25	150	6	0.08	0.16
300	16	30	150	8	0.11	0.22
350	19	35	200	8	0.15	0.40
400	19	35	200	8	0.15	0.50
450	19	35	200	8	0.15	0.60
500	19	40	200	8	0.15	0.70
600	19	40	200	8	0.23	1.05
700	19	45	200	8	0.23	1.85
800	19	50	200	8	0.23	2.05
900	19	55	200	8	0.33	2.25
1000	19	60	200	8	0.33	3.09
1100	19	65	200	8	0.33	4.11
1200	19	75	200	12	0.50	5.08
1400	19	80	200	12 or 8+8	0.67	6.55
1600	19	90	200	12 or 8+8	0.67	9.00
1800	19	100	200	12+12	1.00	12.15
2000	19	110	200	12+12	1.00	13.30

2.9 TESTING OF RCC NP3 PIPE

All the specifications mentioned in the I.S Code 3597-1998 & its latest revised addition shall be strictly followed.

SCOPE

2.9 This Standard covers methods for carrying out the following tests on concrete pipes, both reinforced concrete and prestressed concrete and of pressure and non pressure types to evaluate the properties stipulated in the relevant Indian Standards:

a) Three-edge bearing test,
b) Absorption test,
c) Hydrostatic test,
d) Permeability test, and
e) Straightness test.

2.10 INSPECTION

2.10.1 The quality of all materials, process of manufacture and the finished pipes shall be subject to inspection and approval by the purchaser. If the pipe is tested for three-edge bearing or absorption ,inspection of the reinforcement shall be made on the pipe sections used for those tests

2.10.2 The pipes & shall be inspected by Third Party Inspection Agency, the cost of which is to be borne by contractor. The Third Party Inspection Agency will be from any Government undertaking agency like RITES, EIL, CEIL, MACON, WAPCOS, SGS etc approved by Gujarat Water Supply & Sewerage Board**.**

2.11 GENERAL PRECAUTION

2.11.1 The test specimens shall not have been exposed to a temperature below 4^{o} C for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimens shall be inspected and any specimen with visible flaws shall be discarded

2.11.2 If any test specimen fails because of mechanical reasons, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

2.12 SELECTION OF TEST SPECIMENS

In addition to the requirements specified in this standard, the number of test specimens and the method of their selection shall be in accordance with the specification for type of pipe being tested.

2.13 THREE-EDGE BEARING TEST

2.13.1 GENERAL

Three-edge bearing test shall be performed by the method given in 2.13.2. The pipe shall be surface dry when tested. The test specimen shall be tested in a machine so designed that a crushing force may be exerted in a true vertical plane through one diameter and extending the full length of the pipe but excluding the sockets, if any.

2.13.2. Three-Edge Bearing Method

2.13.2.1 Apparatus

2.13.2.2 Testing machine

Any mechanical or hand-powered device may be used in which the head that applies the load moves at such a speed as to increase the load at a uniform rate of approximately 20 percent of the expected crushing load per linear meter per minute. The loading device shall be calibrated within an accuracy of ±2 percent. The testing machine used for the load tests should produce a uniform deflection throughout, that the distribution of the test load along the length of the barrel of the pipe will not be appreciably affected by the deformation or yielding of any part of the machine during the application of the load.

2.13.2.3 Lower bearing block

The lower bearing block (see Fig 1) shall consist of two hardwood or hard rubber strips fastened to a wooden or steel beam or direct to a concrete base, which shall provide sufficient rigidity to permit application of maximum load without appreciable deflection. Wooden or rubber strips shall be straight, have a cross-section of not less than 50mm in width and not less than 25mm nor more than 40mm in height and shall have the top inside corners rounded to a radius of approximately 15mm.The interior vertical sides of the strips shall be parallel and spaced apart a distance of not more than $1/12^{th}$ of the specimen diameter but in no case less than 25mm.The bearing faces of the bottom strips shall not vary from a straight line vertically or horizontally by more than 1mm in 375 mm of the length under load.

About 6 mm thick hard rubber or felt should be placed/fixed at the lower face of the upper wooden block which shall come in contact with the surface of the pipe.

2.13.2.4 Upper bearing block

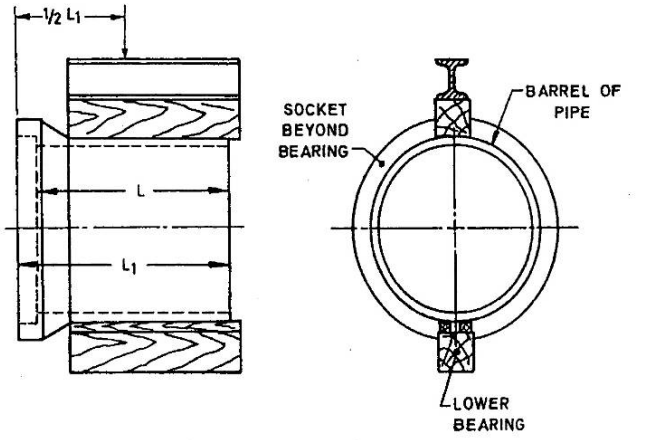
The upper bearing shall be a rigid hardwood block or a block with hard rubber facing at least 150 mm x 150 mm in cross-section. The wood block shall be free of knots and shall be straight and true from end to end. It shall be fastened to a steel or wood faced steel beam of such dimensions that deflection under maximum load will not be appreciable. The bearing face of the upper bearing block shall not deviate from a straight line by more than 1 mm in 375 mm of length under load.

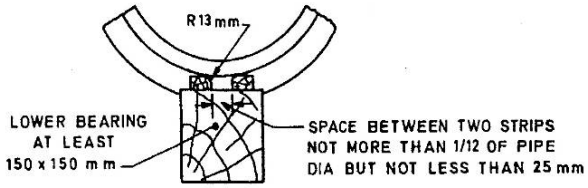
2.13.2.5 The equipment shall be so designated that the load will be distributed about the center of the overall length of the pipe(see Fig. 1).The load may be applied either at a single point or at multiple points dependent on the length of the pipe being tested and the rigidity of the test frame.

NOTE- Multiple points of load applicable to the top bearing will permit use of lighter beams without appreciable deflection.

2.13.2.6 Crack measuring gauge

The crack measuring gauge shall be made from 0.25 mm thick strip and shall be of a shape as shown in fig 2.





ENLARGED DETAIL OF LOWER BEARING

FIG. 1 THREE-EDGE BEARING METHOD

2.13.3 Procedure

2.13.3.1 The specimen shall be placed on the two bottom bearing strips in such a manner that the pipe tests firmly and with the most uniform possible bearing on each strip for the full length of the pipes less the socket portion ,if any.

If mutually agreed upon by the manufacturer and the purchaser prior to the test , a fillet of plaster of Paris not exceeding 25 mm in thickness may be cast on the surface of the upper and lower bearing before the pipe is placed. The width of the fillet cap, top or bottom, shall be not more than 25mm per 300mm diameter, but in no case less than 25 mm.

2.13.3.2 Each end of the pipe at a point mid-way between the lower bearing strips shall be marked and then diametrically opposite points thereof shall be established. The top bearing block

shall be so placed that it contacts the two ends of the pipe at this marks. After placing the specimen in the machine on the bottom strips, the top bearing shall be symmetrically aligned in the testing machine. Load shall be applied at the rate indicated in 2.13.2.2. Until either the formation of 0.25 mm wide crack or ultimate strength load, as may be specified, has been reached.

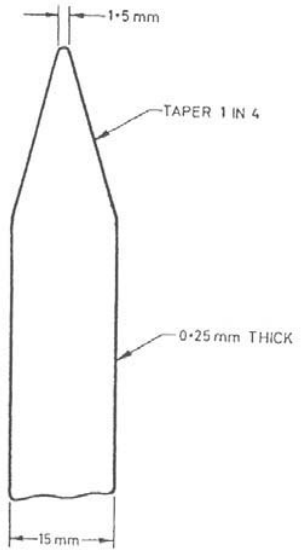


FIG. 2 GAUGE LEAF FOR MEASURING CRACKS

If both the 0.25 mm crack and ultimate load are required, the specified rate of loading need not be maintained after the load at 0.25 mm crack has been determined.

2.13.3.3 The 0.25 mm crack load is the maximum load applied to the pipe before a crack having a width of 0.25 mm measured at close intervals, occurs throughout a length of 300 mm or more. The crack shall be considered 0.25mm in width when the point of the measuring gauge described in 2.13.2.6 penetrates 1.5 mm at close intervals throughout the specified distance of 300 mm. The ultimate load will be reached when the pipe will sustain no greater load.

2.13.4 Calculation

The crushing strength in Newton per linear meter of pipe shall be calculated by dividing the total load on the specimen by the nominal laying length. Effective length of the pipe shall be taken as the nominal laying length of the specimen. In case of spigot

and socket ended pipes, the effective length shall be equal to the overall length minus the depth of socket(see Fig 3) and in case of collar and flush jointed pipes, the effective length shall be equal to the overall length.

NOTE - In most machines the total load will include the dead weight of the top bearing plus the load applied by the loading apparatus.

2.14 ABSORPTION TEST

2.14.1 TEST SPECIMEN

Each specimen selected at random shall have a square area of 100 cm2±10 percent of the length of the pipe as measured on surface of the pipe, and a thickness equal to the full depth of the pipe thickness and shall be free from visible cracks.

2.14.2 Procedure

2.14.2.1 Drying Specimens

Specimens shall be dried in a mechanical convection oven at a temperature of 1050C to 1150C until two successive weighings at intervals of not less than 8 h show an increment of loss not greater than 0.1 percent of the mass of the specimen. The drying time shall be not less than 36 h. the dry mass of the specimen shall be the mass after the final drying determined at ambient temperature.

2.14.2.2 After drying and weighing as specified in 2.14.2.1,the specimens shall be immersed in clean water at room temperature for the specified period. The specimens shall then be removed from the water and allowed to drain for not more than one minute. The superficial water shall then be removed by absorbent cloth or paper and the specimens weighted immediately.

2.14.2.3 The least count/accuracy of the weighing balance shall be 0.1 g which the test specimen shall be weighed.

2.14.2.4 Calculation and report

The increase in mass of the specimen over its dry mass shall be taken as the absorption of the specimen and shall be expressed as a percentage of the dry mass. The results shall be reported separately for each specimen.

2.15 HYDROSTATIC TEST

2.15.1 Test Specimen

The specimens for determination of leakage under interval hydrostatic pressure shall be sound and full size pipe. If the pipes are tested after storing in adverse weather condition presoaking shall be submerged in water or sprayed with water for a period not less than 6 hours prior to testing and excess water removed.

2.15.2 Procedure

2.15.2.1 The pipe shall be supported in such a way so that the longitudinal axis is approximately horizontal and the exterior surface excepting the supports can be examined readily.

2.15.2.2 The equipment for making the test shall be such that the specimen under test can be filled with water to the exclusion of air and subjected to the required hydrostatic pressure. Apply hydrostatic pressure to the whole pipe including the portion of socket and rebated joints, that is, subjected to pressure in 'as laid' condition.

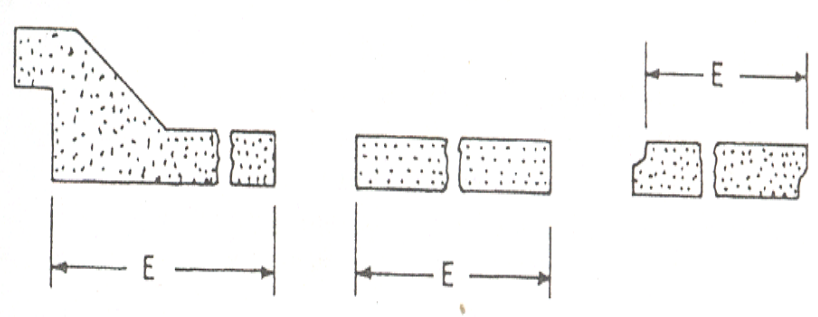


FIG. 3 ILLUSTRATING EFFECTIVE LENGTH 'E' OF PIPES

2.15.2.3 The specimen shall be filled with water and the air expelled. Pressure shall be applied at a gradual rate until the specified test pressure is reached ,or beads of water on the pipe surface is seen , whichever occurs first.

2.15.2.4 Pressure shall be maintained for 1 min + 30 s for each 10mm of wall thickness (for precast concrete pipes wall thickness shall be full barrel wall thickness, whereas it shall be core thickness, in case of prestressed concrete pipe) or for twice that entire period if the application of pressure resulted in the formation of beads of water on the pipe surface.

2.15.2.5 At the end of the holding period, the pressure shall be released immediately if the test pressure has been maintained. If the beads of the water have not grown or run the pressure shall be increased slowly until the test pressure is reached or the beads of water grow or run (whichever occurs first).

2.15.2.6 If the test pressure has been reached without the beads of water growing or running , the test pressure shall be maintained constant for 1 min + 30 s for each 10 mm of wall thickness (for precast concrete pipes wall thickness shall be full barrel wall thickness ,whereas it shall be core thickness , in case of prestressed concrete pipe).At the end of the holding period the pressure shall be released immediately.

After releasing the pressure, the test pipe shall be drained completely.

2.16 PERMEABILITY TEST

2.16.1 Prestressed Concrete pipes and Precast Concrete Pipes

This test shall be done on outside surface of the pipe. No additional treatment of any type shall be done on the pipe before permeability test is carried out. For Prestressed Concrete Pipe, the test shall be conducted at 3 places on coating and for Precast Concrete pipe at 2 places simultaneously, immediately after curing is completed (see Fig 4). In case this is done later, the pipe shall be kept wet for 48 hours prior to test. For plain/flush ended precast pipes, it shall be carried out about 300mm away from both ends.

2.16.1.1 Procedure

The dry surface of the pipe shall be scrapped by wire brush and loose particles, if any, removed. Sealant shall then be applied to the lower portion of the cup and cup shall be pressed on the pipe. After hardening of sealant, water shall be filled in cup with wash bottle. The glass tube with rubber cork shall then be fixed in the cup as shown in fig. Water in the tube shall then be filled using wash bottle and air shall be allowed to escape during filling. Precaution shall be taken , so that water does not leak either from cup ends or from the rubber stopper.

2.16.1.2 Initial Absorption

Water shall be filled up to zero mark and reading shall be taken at every half hour interval up to two hours. The drop in water level in the stand pipe at the end of two hours in the

initial absorption.

2.16.1.3 Final Permeability

Fill the water in the stand pipe again up to zero mark and take the reading at one hour interval up to 4 h.The absorption in the fourth hour, that is , difference between fourth and third hour reading is the final permeability. The average of tests conducted at three places for prestressed Concrete pipe and two places for precast concrete pipe shall be expressed in cm^3 as final permeability.

Criteria for acceptance is the final permeability.

2.16 STRAIGHTNESS TEST

2.16.1 Procedure

2.16.1.1 A rigid straight edge, made into a gauge of the form and dimension shown in (fig 5) shall be placed in the bore of the pipe with edge x in contact with the pipe internal surface and/or the line parallel to the pipe axis. Hold the plane of the gauge in a radial plane.

2.16.2. If both ends of the gauge , when so placed are in contact with the internal surface of the pipe ,the deviation from straightness is excessive. If this condition occurs at any one of four different position of the gauge, approximately equally spaced around the pipe circumference the pipe does not comply with the particular requirement.

2.16.3 If both ends of the gauge , when used as described in 2.16.1.1 are not in contact with the internal surface of the pipe at both ends, the gauge shall be reversed so that edge y, placed as in 2.16.1.1 is adjusted to the internal surface of the pipe. If the two studs in edge y cannot be made to touch the surface of the pipe simultaneously, The deviation from the straightness is excessive.

If this condition occurs at any four position of the gauge the pipe does not conform with this particular requirement.

Item No.5 and 6:

Sewer Manholes, drop manholes, scraper Manholes and house connection chamber

providing and constructing sewer manholes as per the type design in brick masonry in CM 1:3 including C.C. 1:3:6 in foundation and M-150 in benching, inside plastering C.M. 1:3 and outside plastering in C.M. 1:3, coping in R.C.C. M-250 on all manholes, providing and fixing manhole frame & covers (but excluding supply of manhole frame & covers) complete, as per the stipulation in the type design complete.

(a) Manhole type 'A1', 'A', 'B', 'C', 'D1', 'D2', 'S1', 'S2',.
(b) Brick masonry chambers for house connections. HC-1 and HC-2

The type of Manhole to be constructed shall be decided by the Engineer- in-charge depending upon the technical requirement, actual site condition, likely future expansion, economy etc. and the contractor shall have to carry out the work according to the instructions of the Engineer-in-charge.

6.1 THE MANHOLE AND DEPTH OF MANHOLES:-

The manholes on the sewers shall be constructed in the form and of the dimensions shown in the Drawing. The depth of the manholes shall be measured from the top of cover to the invert level of the manhole.

The manholes shall be constructed at places shown on the drawings or whatever directed by the Engineer. Type designs for these manholes are shown on the drawings but the actual type and dimensions shall in each case be determined by the Engineer as the circumstances may require. (Refer drawing No. 3 to 11.- DRN - PHASE-II PART-II)

6.2 CONSTRUCTION OF BRICK MASONRY MANHOLES:

The brick masonry shall be constructed as per the type design shown in the drawing enclosed. The various types of manholes to be adopted as per the requirement have been indicated in the L-section and sewer layout drawing in general. The manhole will be fitted with R.C.C. pre-cast medium or heavy duty manhole frame and cover as the case may be. The brick masonary manhole shall be plastered from inside and outside as shown in the drawing and as shown CM proportion and thickness. .

6.3 FLOORS AND 0.80 ID CHANNEL PIPES:

The floor shall consist of cement concrete. Concrete of R.C. 0.80 ID channel pipes of the required size and curves shall be laid and bedded in cement on the concrete base to the same lines and fail as sewers unless otherwise directed. Both sides of the channel pipes shall be trenched up in concrete and rendered in cement mortar 20 mm thick and formed to a slope of not less than 1 in 12 to the channel.

6.4 STEPS:

Where the depth of the invert exceeds 0.90 M below the surface of the ground, HDPE reinforced steps of approved pattern shall be provided as per type design shown in manhole drawings.

6.5 RATE OF MANHOLES:

The rate for construction of manhole to be quoted in the bill of quantities shall include complete masonry, structure, concrete cap, plastering with cement from inside and outside, bottom concrete or channels including providing and fixing of HDPE reinforced steps and fixing of R.C.C. Manhole frame & covers (but excluding supply of manhole frames and covers) complete as per type design drawing and cutting the pipes flush with the inside plaster of the wall. The manholes will be paid per numbers up to the minimum depth shown in the type design and for depth beyond the specified minimum depth for a particular type of manhole; extra will be paid per running meter depth. The rates include dewatering during all stages of construction.

6.5.1 The brick masonry chambers for house connection will be paid per number excluding excavation but including masonry, bottom concrete, plastering, benching channel fixing of RCC frame and covers (but excluding supply of manhole frames and covers). (Refer. R.M.C. DRG No.- & - for H.C.1, H.C.2)

7 BREAKING OF ASPHALT SURFACE:-

In this works, breaking of Asphalt surface is to be done as directed by Engineer-in-charge. For any damage to Gutter or Manhole due to breaking of asphalt surface, contractor is responsible for repairs. No extra payment will be paid for such work.
Payment will be made per square meter of work done.

EXCAVATION OF ASPHALT PAVEMENT
Under this item contractor shall demolish existing asphalt or WBM pavement met with during laying of RCC or SWG pipes. Only area of pavement intercepted in pipe laying shall be demolished. If excess area is demolished same shall be reinstated by the contractor. Work done to the extent of requirement for laying of drain and as per specifications shall measured in sq.m. and paid at the tender rate.

Item No.7 to 9:

PROVIDING & SUPPLYING RCC PRE-CAST M.H. FRAME & COVER & HOUSE CONNECTION CHAMBER FRAME AND COVER.

i) GENERAL :-

The R.C.C. pre-cast manhole cover shall confirm to IS:12592 / 2002 or its latest version and as per detailed Drawing attached herewith.

ii) SHAPES & DIMENSIONS :-

Shapes :-_The shapes of pre-cast M.H. covers shall be circular only and 10 and 20 MT capacity for MHS and 5MT for HC chambers.

ii.a) DIMENSION & TOLERANCES: - length, breadth & diameter of pre-cast concrete manhole covers shall be such that the maximum clearance at top between the frame & the cover shall be 5mm. The minimum thickness of HD, MD & LD Covers shall be 90, 70 & 60 mm

respectively.

ii.a.i) **GRADES AND TYPES:**

Manhole covers and frames shall be of the following four grades and types:

Grade	Grade Designation	Type / Shape of Cover
Light Duty	LD-5	Rectangular, Square, Circular
Medium Duty	MD-10	Rectangular, Circular
Heavy Duty	HD-20	Rectangular (Scrapper Manhole), Square, Circular Lamphole
Extra Heavy Duty	EHD-35	Rectangular (Scrapper Manhole), Square and Circular

ii.a.ii) Recommended locations for placement of different grades and types/ shapes of manhole covers and frames are as given in ii.a.ii.a to ii.a.ii.c.

ii.a.ii.a) ***LD-5 Rectangular, Square or Circular Types***

Suitable for use within residential and institutional complexes / areas with pedestrian but occasional light motor vehicle traffic. These are also used for 'Inspection chambers'.

ii.a.ii.b) ***MD 10 Circular or Rectangular Types***

Suitable for use in service lanes / roads, on pavements for use under medium duty vehicular traffic including for car parking areas.

ii.a.ii.c) ***HD-20 Circular, Lamphole, Square or Rectangular (Scrapper Manhole) Types.***

Suitable for use in institutional / commercial areas / carriageways / city trunk roads/ bus terminals with heavy duty vehicular traffic of wheel load between 50 to 100 kN, like buses, trucks and parking areas and where the manhole chambers are located in between the pavement and the middle of the road.

iii) SAMPLE:- The contractor shall get approved sample of R.C.C. pre-cast M.H. Cover & frame & house connection chamber frame and covers and shall supply materials as per approved samples from approved factory.

iv) TESTS: - The contractor / manufacturer at his own cost shall give all the required tests of RCC manhole cover and frame and all the testing facilities shall be kept open for the officers of RMC / Engineer-In-Charge at his factory.

v) RESPONSIBILITY: - The contractor shall be responsible for the materials for a period of defect liability period. After payment of final bill of the work and during this period he will be responsible for defects in the

materials & for road accidents due to defective M.H. / H.C.C. Frame & covers. He shall have to replace defective materials during this period at his cost.

vi) LETTER OF COMMITMENT:- Contractor shall have to provide the letter of commitment in favour of Rajkot Municipal Corporation from the standard manufacturer of RCC Pre-cast M.H. / H.C.C. frame and covers to supply the desired quantity given in the e-Tender document in time (i.e. well in advance not to remain any manhole or chamber open at site of work after construction) with all quality control. Manufacturer shall have a long experience for preparing the RCC Pre-cast M.H. / H.C.C. frame and covers of all types i.e. HD, MD and LD as per the relevant I.S. Code of practice. A supply Schedule shall be submitted immediately on receipt of Work Order.

vii) R.C.C. MANHOLE COVERS AND FRAMES, FOLLOWING POINTS SHOULD BE CONSIDERED

Sr.	Particulars	Heavy duty manhole covers	Medium duty manhole covers and	Light duty manhole covers and frames
1	Clear opening of the	500 mm dia.	500 mm dia.	500 mm dia.
2	Type of the covers &	Circular	Circula r	Circular

MATERIAL:

3.1. Cement

Cement used for the manufacture of precast concrete manhole covers shall conform to IS:269 or IS:455 or IS:1489 (Part-1) or IS:1489 (Part-2) or IS:6909 or IS:8041 or IS:8043 or IS:8112 or IS:12330 or IS:12269.

3.2. Aggregates

The aggregates used shall be well graded. The nominal maximum size of coarse aggregate shall not exceed 20 mm. The aggregates shall be clean and free from deleterious matter and shall conform to the requirements of IS:383.

3.3 Concrete

The mix proportions of concrete shall be determined by the manufacturer and shall be such as will produce a dense concrete without voids, honey combs, etc (See IS:456). The minimum cement content in the concrete shall be 360 kg/m^3, with a maximum water cement ratio of 0.45. Concrete weaker than grade M30 shall not be used. Compaction of concrete shall be done by machine vibration.

3.4. Reinforcement

The reinforcement steel shall conform to Grade A of IS 2062 or IS:432 (Part-1) or IS 432 (Part-2) or IS 1786.

3.4.1 Reinforcement shall be clean and free from loose mill scale, loose rust, mud, oil, grease or any other coating which may reduce or destroy the bond between concrete and steel. A slight film of rust may not be regarded as harmful but steel shall not be visibly pitted by rust.

3.5 Steel Fibers

The diameter / equivalent diameter of steel fibres where used, shall not be greater than 0.75 mm. The aspect ratio of the fibers (ratio of the length of the fibre to its diameter / equivalent diameter) shall be in the range of 50 to 80. The minimum volume of fibres shall be 0.5 percent of the volume of concrete.

In case of propriety fibres, manufacturer's recommendations shall be taken into account.

3.6. Admixtures

Where admixtures are used, they shall conform to IS 9103.

3.7. Water

The water used shall be free from matter harmful to concrete or reinforcement or matter likely to cause efflorescence in the units and shall conform to the requirements of IS 456.

3.8 SHAPES AND DIMENSIONS

3.8.1 Shapes

The pre-cast concrete manhole covers and frames shall be of any shape given in (ii.a.i)

3.8.2 Dimensions And Tolerances

The dimensions and tolerances on dimensions of frames shall be as shown in Table-1 but outside dimensions of cover at top shall match with the corresponding frame so that the maximum clearance at bottom between the frame and the cover all round the periphery is not more than 5 mm and the top surface of the frame and cover is in level within a tolerance of ±5 mm. For facility of removing the cover from the frame, suitable taper matching with taper given for the frame shall be provided to the periphery of the cover (See Fig.1)

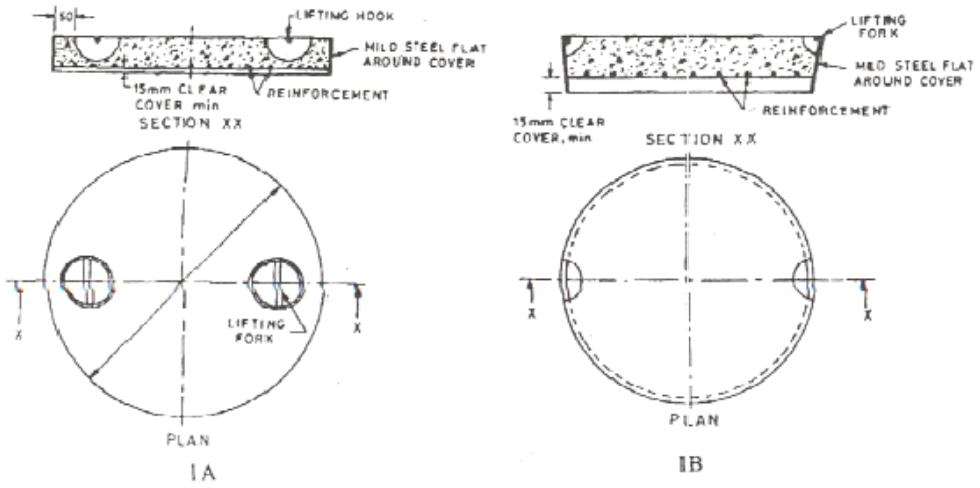


Fig.1 - Typical Illustration of Circular Precast Concrete Manhole Cover
All dimensions in millimeters

3.9 DESIGN:

The reinforced concrete manhole cover and frame shall be designed in accordance with the provisions of IS:456. If required by the purchaser, the manufacturer shall furnish the specification and drawings principle given in IS:456

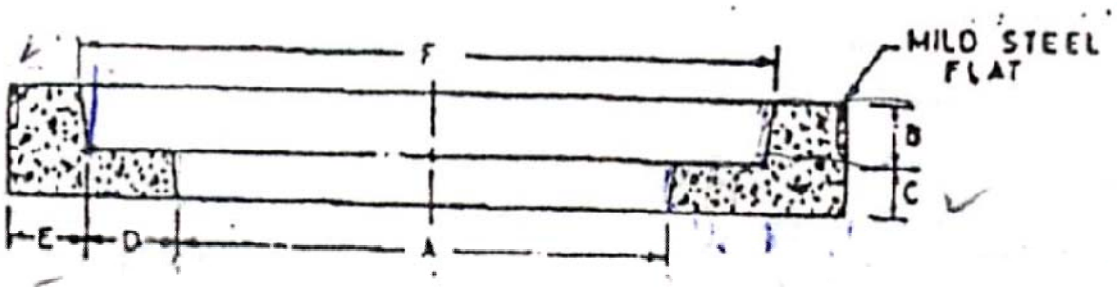
3.10 MANUFACTURER

3.10.1 Concrete SHALL BE MIXED IN A MECHANICAL Mixer. Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in colour nad consistency. If steel fibres are used in addition to reinforcement, it shall be conformed to requirements given in 3.5.

3.10.2 Placing and Compaction

The reinforcement shall be placed in proper position in an appropriate mould coated with a thin layer of mould oil in case of frames and within the protective sheet (See 3.12.1) in case of covers. Concrete shall be filled to slightly overfill and compacted by vibration and struck off level with a trowel.

Table-1 - Dimensions of Frame
(Clause 3.8.2)
All dimensions in millimeters



Grade Designation	Description	Clear Opening in Frame	B	C	D	E	F
1	2	3	4	5	6	7	8
LD-5	Light Duty Rectangular	450 x 450	60	50	50	50	566
LD-5	Light Duty Square	450 x450 400 x400	50 50	50 50	50 50	50 50	566 x 566 516 x 516
LD-5	Light Duty Circular	370 560 500 450	50 50 50 50	50 50 50 50	50 50 50 50	50 50 50 50	486 676 616 566
MD-10	Medium Duty Rectangular	450 x 600	70	50	50	50	570 x 720
MD-10	Medium Duty Circular	450 500 560 600	70 70 70 70	50 50 50 50	50 50 50 50	50 50 50 50	570 620 680 720
HD-20	Heavy Duty Rectangular (Scrapper)	900 x 450	100	75	75	75	1080x 630
HD-20	Heavy Duty Square	560 x 560	100	75	75	75	740 x 740
HD-20	Heavy Duty Circular	450 500 560 600	90 90 90 90	75 75 75 75	75 75 75 75	75 75 75 75	630 680 740 780
HD-20	Heavy Duty Lamphole	350	100	75	75	75	530
EHD-35	Extra Heavy Duty Rectangular	900 x 560	100	75	75	75	1078x 738
EHD-35	Extra Heavy Duty Square	560 x 560	100	75	75	75	738 x 738
EHD-35	Extra Heavy Duty Circular	450 500 560 600	100 100 100 100	75 75 75 75	75 75 75 75	75 75 75 75	628 678 738 778

NOTES:

1. Tolerance on C shall be ± 5 mm, tolerance on A, B, D and E shall be $^{+5mm}_{0}$ mm

2. For facility of removing the manhole cover suitable upward taper not more than 5^0 may be provided to the inner periphery of the frame.

3. If required for the removal of the moulds suitable taper not more than 5^0 can be given at the lower inner periphery of the frame (See figure).

3.10.2.1 Use of needle vibrators for compacting the wet concrete mix containing fibres is not recommended since the holes left by the vibrator in the wet mix may not close after its removal owing to the interlocking of the fibres with the mix. Compaction by means of shutter or form or table vibrators is recommended. In case of extra heavy duty and heavy duty cover and frame, compaction by means of pressure-cum-vibration technique may also be employed so as to achieve dense and strong concrete.

3.10.2.2 Clear cover to reinforcement shall be not less than 15 mm.

3.10.2.3 After demoulding, cover and frame shall be protected until they are sufficiently hardened to permit handling without damage.

3.11 Curing

3.11.1.1 The hardened concrete manhole cover and frame shall be placed in a curing water tank. The period of curing shall be as given in IS:456.

3.11.1.2 Steam curing of manhole cover and frames may be adopted instead of method specified in 3.11.1.1 followed by normal curing for 7 days provided the requirements of pressure or non-pressure steam curing are fulfilled and the manhole cover and frames meet the requirements specified in this standard.

3.12 Edge Protection and Finishing

3.12.1 Cover

To prevent any possible damage from corrosion of reinforcing steel, the underside of the covers shall be treated with anticorrosive paint. The top surface of the covers shall be given a chequered finish.

In order to protect the edges of the covers from possible damage at the time of lifting and handling, it is necessary that the manhole covers shall be cast with a protective mild steel sheet of minimum 2 mm thickness around the periphery of the covers. Exposed surface of mild steel sheet shall be given suitable treatment with anti- corrosive paint or coating.

3.12.2 Suitable arrangement may be made for fixing the manhole cover and frame in position on the manholes by mutual agreement between the manufacturer and the purchaser.

3.12.3 The manufacture of manhole cover and frame shall be such as to ensure the compatibility of their seatings. For classes HD 20 and HD
35, these seatings shall be manufactured in such a way as to ensure stability and quietness in use. This may be achieved by grinding the contact surface, if needed.

3.13 LIFTING HOOKS:

The minimum diameter of mild steel rod used as lifting device shall be 12 mm for light and medium duty covers and 16 mm for heavy and extra heavy duty covers. The lifting device shall be protected from corrosion by hot dip galvanizing or any other suitable means approved by the purchaser or shall be made of naturally corrosion resistant metal rods.
The lifting arrangement shall be as agreed between the manufacturer and the purchaser. Typical arrangements of lifting devices are shown in Fig.1A and 1B.

3.14 PHYSICAL REQUIREMENTS:

3.14.1 General

All the covers and frames shall be sound and free from cracks and other defects which interferes with the proper placing of the unit or impair the strength or performance of the units. Minor chippings resulting from the customary method of handling and transportation shall not be deemed ground for rejection

3.14.2 Dimensions

The dimensions of the cover and frame shall be as specified in 3.8; the overall dimensions of the units shall be measured in accordance with Annexure-B.

3.14.3 Load Test

The breaking load of individual units when tested in accordance with the method described in Annex-C shall be not less than the values specified in Table-2. Also, the permanent set shall not exceed the requirement given in Annexure-C.

Table-2 - Test Load and Diameter of Block
(Clause 3.14.3, 4.18.3 and C.1.1)

Grade of Cover	Type	Load kN	Diameter of Block mm
1	2	3	4
LD-5	Rectangular, Square or Circular	50	300
MD-10	Rectangular, or Circular	100	300
HD-20	Rectangular, Square or Circular	200	300
EHD-35	Rectangular, Square or Circular	350	300

3.15 TESTS

Tests shall be conducted on samples of covers and frames selected according to the sampling procedure given in 3.16, to ensure conformity with the physical requirements laid down in 3.14.

3.16 SAMPLING AND INSPECTION

3.16.1 Scale of Sampling

3.16.1.1 Lot

In any consignment, 500 precast concrete manhole covers and frames or a part thereof the same dimensions and belonging to the same batch of manufacture, shall be grouped together to constitute a lot.

3.16.1.2 For ascertaining the conformity of the materials in the lot to the requirements of this specification, samples shall be tested from each lot separately.

3.16.1.3 The number of covers and frames to be selected from the lot shall depend on the size of the lot and shall be according to Table-3

Table 3 - Scale of Sampling and Permissible Number of Defectives
(Clause 3.16.1.3, 4.17.2. and 4.18.2)

No.of covers or frames in the	Dimensional		Number of samples for load test on
	Sample size	Acceptance Number	
1	2	3	4
Upto 100	10	1	2
101 to 200	15	1	3
201 to 300	20	2	4
301 to 500	30	3	5

Note: If the number of covers in the lot is 20 or less, the number of samples for load test shall be decided by mutual agreement between the purchaser and the manufacturer.

3.16.1.4 The R.C.C. precast manhole frames & covers shall be inspected by Third Party Inspection Agency, the cost of which is to be borne by contractor. The Third Party Inspection Agency will be from any

Government undertaking agency like RITES, EIL, CEIL, MACON, WAPCOS, SGS etc approved by Gujarat Water Supply & Sewerage Board.

3.16.2 Sampling Covers and Frames in Motion

Whenever practicable, samples of covers and frames shall be taken when the units are being moved as in the case of loading, unloading, etc. The batch from where the samples are to be drawn shall be divided into a number of convenient portions such that when one sample is drawn from each of these portions, the
minimum number of units specified under 3.16.1.3, is provided.

3.16.3 Sampling Covers and Frames from a Stack

The number of covers and frames required for the test shall be taken at random from across the top of the stacks, the sides accessible and from the interior of the stacks by opening trenches from the top.

3.17 Number of Tests

3.17.1 All the covers and frames selected according to 3.16.1.3, shall be checked for dimensions (See 3.14.2) and inspected for visual defects (See 3.14.1).

3.17.2 The number of covers to be subjected to load test shall be according to col 4 of Table-3.

3.18 CRITERIA FOR CONFORMITY

3.18.1 The lot shall be considered as conforming to the requirements of the specification conditions mentioned in 4.18.2 and 4.18.3 are satisfied.

3.18.2 The number of covers and frames with dimensions outside the tolerance limit and / or with visual defects among those inspected shall be less than or equal to the corresponding acceptance number given in col 3 of Table-3.

3.18.3 For load test no value shall be less than the load specified in Table-2.

3.19 MANUFACTURER'S CERTIFICATE

The manufacturer shall satisfy himself that the manhole cover and frame conform to the requirements of this specification, and if requested, shall supply a certificate to this effect to the purchaser or his representative.

3.20 MARKING

3.20.1 Following information shall be clearly and permanently marked on top of each manhole cover and frame.

a) Identification of the source of manufacturer
b) Grade designation denoted by LD 2.5/ MD 10 / HD 20/ EHD 35 or 5T / 10T / 20T / 35T.
c) Any identification mark as required by the purchaser.

The Rate shall be paid per Number basis / pair basis.

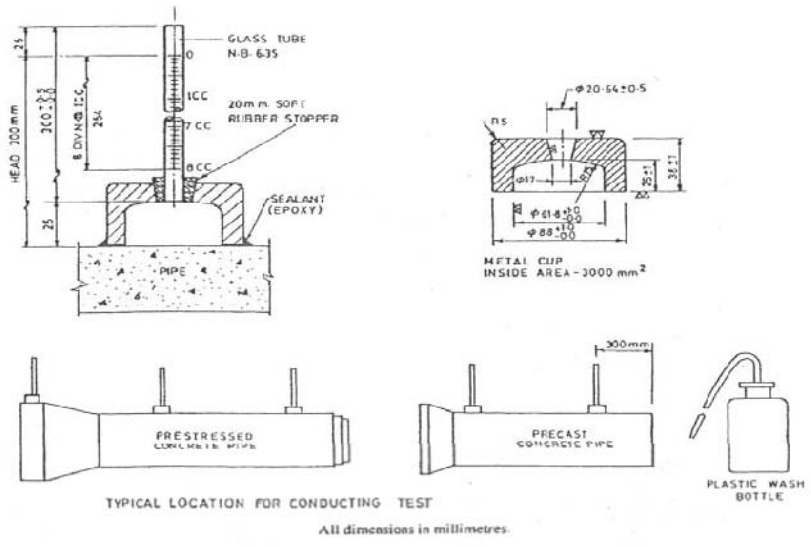


FIG. 4 METHOD FOR PERMEABILITY TESTING OF CONCRETE PIPES

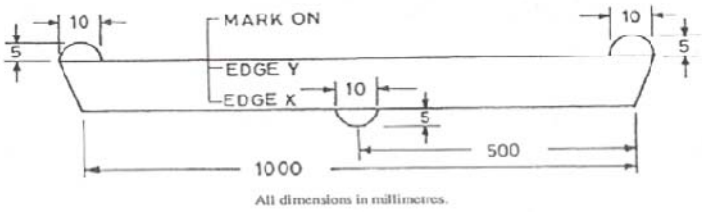


FIG. 5 STRAIGHTNESS TEST

Item No.10:
Making holes in manhole with repairing complete

The hole to be done in manhole not exceeding pipe size. After connecting the pipe to manhole, it is to be repaired with cement. The work is to be carried out as per the instructions from engineer-in-charge.

The rate for this item will be paid per hole basis.

Item No.11:
Breaking of Paver road (except for road works)

Removing Bitumen Paver surface with any thickness and using mechanical power breaker or manually whichever site engineer suggests. Agency / Contractors should not use JCB / Hydro breaker without site engineer's pre approval.

It will be the sole responsible of agency to repair any extra paver / road damages at it's own cost. Excavated material / Bitumen surface shall be disposed at following site as Notified by RMC and as directed by the engineering in charge.

1. Beside Kotharia Police Station near Stone Quarry
2. All Quarry areas of Raiya Smart City
3. TP Scheme No.10, FP-87, Dhebar Road (South), Atika Area, Nr. PGVCL Office
4. TP Scheme No.23, FP-23, Nr. IOC Godown, Morbi Road
5. TP reservation plot at Samrat industrial Area, Bh. ST Workshop
6. TP Scheme No.9, FP-5, Nr. Raiyadhar Garbage Station
7. TP Scheme No.20, FP-35, Bh. Pradhuman Green
8. TP Scheme No.28 (Mavdi), FP-46/A, Nr. GETCO Circle
9. TP Scheme No.12, FP-38/A and 39/B, Nr. Lijjat Papad, Kothariya Nationla Highway

If the contractor fails to dispose the excavated stuff as specified, penalty will be imposed by Rajkot Municipal Corporation as per the Notification for C&D waste.

No Payment shall be made for breaking of excess bitumen surface and removal of the same.

Payment shall be made on Sq.mt bases.

Item No.12 and 13:
Dismantling Cement concrete of Foundation Or Flooring

1. The work shall consist of removing, as herein after set forth; existing culverts, bridges, pavement, kerbs and other structures like guards- rails, fences, utility poles, manholes, catch basins, inlets, etc. Which are in place but interfere with the new construction or are not suitable to remain in place and of salvaging and disposing of the resulting materials and back-filling the resulting trenches and pits.

2. Existing culverts, bridges, pavements and other structures which are within the work area and which are designated to be removed, shall be removed up to the limits and extent specified in the drawings or as indicated by the Engineer-in-charge.

3. Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and other work to be left intact.

4. All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.

5. The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the serviceable materials to be salvaged, the part of structure to be retained and any other properties or structures nearby.

6. Unless otherwise specified, the superstructure portion of culverts / bridges shall be entirely removed and other parts removed to below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlying of adjacent material if required in connection with the dismantling of the structures shall be incidental to this item.

7. Where existing culverts / bridges are to be extended or otherwise incorporated in the new work only such part or parts of the existing structure shall be removed as are necessary to provide a proper connection to the new work. The connecting edges, shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Reinforcing bars which are to be left in place so as to project into new work as dowels or ties shall not be injured during removal of concrete.

8. Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes.

9. Steel structures shall unless otherwise provided be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawing or directed by the Engineer-in-charge that structure is to be removed in a condition suitable for re-erection, all members shall be match marked by the contractor with white lead paint before dismantling. End pins, nuts, loose, plates, etc. shall be similarly marked to indicate their proper location. All pins, pin holes and machined surfaces shall be painted with a mixture of white lead and tallow and loose parts shall be securely wired to adjacent members or packed in boxes.

10. Timber structures shall be removed in such a manner as to avoid damages to such timber or lumber as is designated by the Engineer -in- charge to be salvaged.

11. In removing pavements, kerbs, gutters, and other structures, like guard rails, fences, manholes, catch, basins, inlets etc. where portions of the existing construction are to be left in the finished work, the same shall be removed to an existing joint or cut and chipped to a true line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be

made to provide for proper grades and corresponding with the new work as directed by the Engineer-in-charge.

12. All concrete pavements base course in carriageway and shoulders etc. designated for removal shall be broken to pieces whose volumes shall not be exceed 0.02 cubic meter and, stockpiled at designated locations if the material is to be used later or otherwise arranged for disposal as directed.

13. Where directed by the engineer-in-charge holes and depressions caused by dismantling operations shall be backfilled with excavated or other approved material and thoroughly compacted in line with surrounding area.

14. All materials obtained by dismantling shall be the property of Government. Unless otherwise specified, materials having any salvage value shall be placed in neat stack of like material within the right-of- way as directed by the Engineer-in-charge, for which contractor will remain responsible for its safe custody and preservation for 60 days after recording measurements of the salvaged material.

15. Pipe culverts that are removed shall be cleared and neatly piled on the right-of-way at points designated by the Engineer-in-charge.

16. Structural steel removed from old structure shall, unless otherwise specified or directed be stored in a neat and presentable manner on blocking in locations suitable for loading. Structures or portions thereof which are specified in the contract for re-erections shall be stored in separate piles.

17. Timber of lumber from old structures which is designated by the Engineer-in-charge as materials to be salvaged shall have all nuts and bolts removed from and shall be stored in neat piles in locations suitable for loading.

18. All the products of dismantling operations which in the opinion of the Engineer-in-charge cannot be used or auctioned shall be disposed as directed, within 100 meters.

19. The work of dismantling structure shall be paid for in units indicated below by taking measurement before and after, as applicable;

i)	Dismantling brick / stone / concrete (Plain and reinforced) masonry	Cubic Meter
ii)	Dismantling flexible and cement	Cubic Meter

	concrete pavement	
iii)	Dismantling steel structure	Ton
iv)	Dismantling timber structure	Cubic Meter
v)	Dismantling pipes, guard rails, kerbs, gutters and fencing	Linear Meter
vi)	Utility poles	No.s
vii)	Removal of flooring – CC Precast Tiles / Shahbadi ladi / tiles flooring	Sqr. Mtr
viii)	Removal of road divider strip	No.s

20. The contract unit rates for the various items of dismantling shall be for payment in full for carrying out the required operations including full compensation for all labor, materials, tools equipment, safeguard and incidentals necessary to complete the work. These will also include excavation and backfilling where necessary and for handling, salvaging, pilling and disposing of the dismantled material within all lifts and up to a lead of 100 meters.

Addl / Asst. Engineer R.M.C. | **Dy.Ex.Engineer R.M.C.** | **CITY ENGINEER R.M.C.**

Signature of Contractor

ADDITIONAL CONDITIONS

1. The contractor shall have to provide his own level instrument for this work.

2. Lowering, laying and jointing works of all the pipelines shall have to be carried out by using Sight Rails and Boning Staves.

3. Work is required to be carried out in residential area where all the services like water supply, sullage water pipeline, telephone / electric cable are existing. Under the circumstances, prior to starting the work agency shall have to excavate the trenches manually for up to 1 mt. depth. During the course of execution, all the services shall have to be maintained by the agency and any damage to any services or property, the agency shall have to get it repair at their cost.

4. For excavation of trench, use of JCB machine will not be permitted directly on the top surface of the roa After excavation up to minimum 1.00 mt. depth from road surface or existing ground level, same shall have to be carried out manually or by using Breaker and after locating underground services like; water supply pipeline, water connection lines, pipe gutters, telephone cables, electric cables etc., and thereafter upon taking the prior approval of the Engineer-In-Charge, the excavation can be carried out by using JCB machine.

5. Rajkot Municipal Corporation shall recommend to the competent authority to give Controlled Blasting License to the contractor for carrying out excavation in hard rock. In case of blasting license not permissible from the competent authority in some places then excavation is to be done by using wedges and hammers, chiseling, breakers, pneumatic tools, etc. Also in case where blasting license is permitted but even then if there is no possibility of carrying out the blasting for whatsoever reason, the excavation is to be done by using Wedges and hammers, chiseling, breakers, pneumatic tools etc. No extra payment shall be made for excavation to be carried out in any of the above mentioned both the situations.

6. Excavation in soft rock and hard rock shall have to be carried out only by Chiseling, Breaker (pneumatic tools) etc., as far as possible. If excavation is not possible in terms of above and if excavation is required to be carried out with the help of blasting then the same shall have to be carried out only after taking prior approval and necessary license for blasting from the competent authority.

7. In case of excavation not possible manually or by chiseling in

certain place(s) as well as if blasting is also not possible due to various reasons i.e. to avoid damage to nearby water pipeline, pipe gutter, telephone cables / Duct, Raw houses / week buildings / narrow street etc., then the excavation by blasting will not be permitte Under these circumstances, excavation shall have to be carried out only by Breaker (pneumatic tools) as per the instructions of the Engineer-In- Charge. No extra payment will be made for such type of excavation done by using Breaker. The rate for excavation shall be paid as per the rate of related item mentioned in Schedule-B.

8. The safety of the trenches is the prime important factor. Along the trenches on both the side, a hump of excavated stuff of minimum height 3 to 5 ft shall have to be provided till the work is got complete However, where there is no defined road, in such area, the fencing/ lighting etc., requires to be provided as per clause 1.1.15. Sign Board shall have to be provided at required locations, so that there will not be any fatal accident.

9. Regarding the width of excavation, as (a) it is difficult to carry out the vertical trench excavation, (b) possibility of sliding the soil, and (c) uneven excavation trench width in case of blasting. In this connection, for every 1.5 mt lift if there is less width upto 5 cm at the bottom then the top width of excavated trench, it shall be considered as per the specified trench width or actual trench width carried out at the ground level by the contractor whichever is less. If excavation is carried out more than the specified width then the payment will be made only for the specified width of excavation. For mode of measurement for excavation, the width of excavation will be considered as given at the time of line out by engineer-in-charge or actual width done whichever is less.

10. The pipes shall be with ISI mark whereas that of manhole frame and cover shall be confirming to relevant IS.

11. After entering into an agreement, the agency shall have to finalize the agency for supply of the material like pipes, manhole / house connection chamber frame and covers etc., and the name of manufacturer / supplier should immediately be informed to Rajkot Municipal Corporation so that Rajkot Municipal Corporation can also expedite the manufacturer / supplier for the material. If necessary, Rajkot Municipal Corporation will visit and inspect the factory. During the inspection, if Rajkot Municipal Corporation is not satisfied then the contractor shall have to procure the material from other manufacturer(s).

12. While the work in progress, there is possibility of change in

drainage line routes according to the site conditions. Under these circumstances, the contractor shall have to carry out the work accordingly, for which, no extra payment shall be made in such situations. Over and above, the decision of Engineer-in-charge for change in drainage line routes shall be final and binding to the contractor.

13. The quantity of various items mentioned in the schedule-B is liable to increase or decrease up to any extent. Under the circumstances, the contractor shall have to carry out the work accordingly without any rate escalation. Rajkot Municipal Corporation will not entertain any dispute in this regar

14. In excavation, the decision regarding classification of strata shall rest with the Engineer-In-Charge and his decision in this regards shall be final and binding to the Contractor.

15. The rates are inclusive of dewatering, if require

16. Regarding water supply for hydro / flow testing, necessary water, power, labour etc. required for the necessary test shall be arranged by the contractor at his own cost.
17. During construction activity, proper care must be taken for labour safety and must follow the provisions of the Labour Laws.
18. Testing of the material like; Brick, Sand, Aggregate etc. should have to be tested periodically as suggested by the engineer- in-charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.

19. In case of any ambiguity found in specifications / drawings etc. the engineer-in-charge is empowered to take necessary decision for rectification and same shall be final and binding to the contractor.

20. The contractor shall have to get registered under ESI (Employer's State Insurance)

21. Act and obtain ESI Registration number if the number of workers are 10 Nos. or more. Also, the agency shall have to give all the benefits to the workers as available under the ESI Act. The agency should follow all the rules and regulations of ESI Act as per prevailing norms.

22. The contractor will be responsible to avail P F Code as per the prevailing Circular of Government for the employees on work. The required documents regarding deduction of P F shall have to be submitted by the contractor to the competent authority.
23. For this project works Third Party Inspection (TPI) is mandatory.

The TPI agency will be appointed by Rajkot Municipal Corporation and remittance of charges @ 0.70% of contract value for the same is to be borne by the agency, which will be deducted from the contractor's bill.

24. Rajkot Municipal Corporation at its discretion employs services of PMC / Third party inspection agency for quality control. The contractor shall fulfill the entire requirement related to quality control as instructed by TPI / RMC at no extra cost.

25. The restoration work for the excavation done is to be carried out immediately as per the instructions of engineer in charge. The excess material shall have to be disposed with no extra cost at the site specified by engineer-in-charge.

26. Agency intending to carry out excavation has to will be able to carry out excavation / digging only after prior intimation through “Call before U Dig” mobile application.

CITY ENGINEER
Rajkot Municipal Corporation

Signature of Contractor

BILL OF QUANTITIES AND PRICE

The Bill of quantities consists of following sections :

CIVIL WORKS:

Civil works requires following:

Excavation of Trenches

- ✓ Providing, supplying, lowering, laying, jointing, testing and commissioning of various dia. distribution & street service DI pipeline with DI Specials network as per the detailed specifications shown in Vol-II.
- ✓ Bedding for pipes with selected murrum
- ✓ Support of piping system, Thrust blocks of RCC in various concrete etc.
- ✓ Refilling the pipeline trenches with proper ramming
- ✓ All required necessary items as directed by engineer in charge.

The bill of quantities forms the most important part of the e-tender documents. The supply, lowering laying jointing, erection testing and commissioning of pipeline which form a part of total works are indicated in the schedules separated include in the documents. The e-tendering contractors shall price of this document.

Performance testing and commissioning:

The bill of quantities, general conditions of contractor and the specifications which from an integral part of this contractor shall be read in conjugation.

The bill of quantities, general conditions of contractor and the specifications which from an integral part of this contractor shall be read in conjugation.

Payment for different items shall be paid on % (percentage) above or below quoted by the contractor online in the given price bid. However for any extra items to be carried out with permission of engineer in charge rates will be decided by the Rajkot Municipal Corporation as per GC-70 wherever not specified in the tender.

Whenever manufacturer is separate and contractor for lowering, laying, joining and testing is separate, the principal contractor shall enter in to an agreement with DI pipes & DI Specials manufacturer for satisfactory manufacturing as per the relevant code of practice, testing, transporting, stacking & testing after laying at site as per RMC requirement.