

RAJKOT MUNICIPAL CORPORATION

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



Bid Documents For

PROVIDING, LOWRING, LAYING, JOINTING, TESTING AND COMMISSIONING DI PIPELINE DISTRIBUTION NETWORK AND CONSTRUCTION OF 5 LAC LITRES CAPACITY ESR FOR MANCHHANAGAR AREA IN WARD NO.5 (UNDER AMRUT 2.0, 8th ATTEMPT)

Volume-II Technical Specifications & Drawings

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2021

Milestone Dates for e-tendering is as under

1. Downloading of e-Tender documents	07/12/2023 To 04/1/2024 up to 11.00 Hrs.
2. Pre-bid meeting in the O/o City Engineer at EAST ZONE	19/12/2023 at 11:00 hrs
3. Online submission of e - Tender	04/01/2024 up to 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	08/01/2024 up to 18.00 Hrs.
5. Opening of technical bid	09/01/2024 at 11.00 Hours onwards
6. Verification of submitted documents (EMD, e - Tender fee, etc.)	10/01/2024 at 11.00 Hours onwards
7. Agency to remain present in person along with original documents for verification	10/01/2024 between 11.00 to 16.00 Hours
8. Opening of Price Bid (If possible)	12/01/2024 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
ZAVAR CHAND MEGHANI BHAVAN
EAST ZONE OFFICE, BHAVNAGAR
MAIN ROAD, RAJKOT-
360003(GUJARAT)**

TECHNICAL SPECIFICATIONS

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:: 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 DI K-7 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.

The scope of works comprises the following:

- ☐ Carrying out necessary topographical survey and geotechnical investigations
- ☐ Excavation of pipe trenches in soil, soft rock, hard rock, WBM and concrete roads, Dismantling of paver block including dewatering etc. complete.
- ☐ Supplying and Laying of DI pipes with all specials along the route as per the network map
- ☐ Jointing of pipes with existing pipes (wherever required) with all required accessories and specials
- ☐ obtaining statutory approval from government bodies.
- ☐ Contractor shall plan and accordingly phase the supply of items according to his requirement to best utilize the available storage space at site.
- ☐ Providing and fixing sluice valves, Scour valves and Air Valves on the existing as well as new pipeline, as specified in relevant datasheets, detailed technical specifications, particular technical specifications and BOQ.
- ☐ Providing pipe bedding as per the requirements.
- ☐ Backfilling of pipe trench with selected soil immediately after erection of pipe excluding pipe joints.
- ☐ Encasing of underground pipelines as per specifications.
- ☐ Hydro testing of pipeline in segments.
- ☐ Backfilling of pipe trench at pipe joints.
- ☐ Construction of RCC Sluice/ Butterfly Valve Chambers/RCC Thrust blocks/ Saddles/ Anchor blocks. The typical drawings for various structures are enclosed in Bid drawings for reference.
- ☐ Reinstatement of WBM, Tar and Concrete Roads after laying and testing of pipeline.
- ☐ Demolishing old structures in the route of pipeline, if require

- ☐ Flushing of entire pipeline with clean water at least for 24 hours.
- ☐ Testing and commissioning.
- ☐ Preparation of as-built drawings.

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 kin

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 contractor and the contractor shall sign the orders given by the inspecting officers 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 commensurate 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 accussing 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 require
- 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-500 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 Rajkot 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 avoided

It shall generally comply with the provisions of I. S. 383-1970. Unless special stone of particular quarried is mentioned Grit special stone of particular quarries is mentioned 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			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 change 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 conform to specification M-2, sand shall conform 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 obtained. 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 directe

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 or overburnt brick bats shall not be allowed

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

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. They 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 :

$$\left(9'' \times \frac{4\frac{3}{4}''}{4} \times \frac{2\frac{3}{4}''}{4} \right) 225 \times 110 \times 75 \text{ mm.}$$

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 permitte
- 13.7 As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoide
- 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:

Dismantling Cement concrete of Foundation Or Flooring

since this project area having plain CC road hence excavation for pipeline trench can be carried out after dismantling the existing CC road and the payment will be made for unit of Cu. M.

Item No.2:

Excavation for pipe line trenches for water supply, manhole etc. all with shoring and struiling if required as per required gradient and line including safety provisions using site rails and stacking excavated stuff including up to all required lead cleaning the site etc.complete for all lifts and strata as specified

0 to 1.5 mt depth.

---do--- in all sorts of soil,soft murrum, hard murrum, boulders and mecadam road

---do--- In soft rock ,Hard rock

Excavation for pipe line trenches with shoring, strutting, bailing or pumping out watered from trenches whenever necessary of required length, width and depth including extra excavations for sockets and all safety measures and provisions such as site rails fencing, lighting, watching including refilling the trenches in layers including ramming and removing the excavated staff with 90m lead and clearing the site etc. as stipulated in the tender specification complete before starting work and after completion of work for all lifts and soil strata as specified

- a) In all sorts of soil soft murmur, hard murrum, boulders, macadam and asphalt roads including breaking of lime and cement masonry and lime concrete.
- b) In soft rock, cement concrete, hard rock and cutting of cement concrete and R.C.C. of any proportion, etc. with controlled blasting and or chiseling whichever is necessary and feasible as required by site conditions.
- c) In hard rock

1.1 Clearing of sites :

- 1.1.1 The site at which the pipe line is to laid and the area required for setting out and other operations shall be cleared of all obstructions , loose stones, and rubbish of all kinds ; stumps of trees, brushwood as well as all trees shall be removed as directe The roots shall be entirely grubbed up.
- 1.1.2 The products of the clearings to be stacked in such a place and in such a manner. As directed by the Engineer-in-charge.
- 1.1.3 In site clearing, all trees not specially marked for preservation, bamboos jungle wood and brush wood shall be cut down and their roots grubbed up. All wood and materials from the clearing s hall be the property of corporation and shall be arranged as directed by the Engineer-in-charge or his authorized agent. The materials found to be useful by the Engineer-in-charge s hall be conveyed and properly stacked as directed within the specified limit.

Unless materials will be burnt or otherwise disposed off as directed

- 1.1.4 All holes or hollows, whether originally existing or produced by digging up roots, shall be carefully filled up with earth, well rammed and leveled off, as may be directed shall not be paid for. The contractor shall get approval of design of shoring. The shoring shall be of sufficient strength to resist side pressure and ensure safety from slips and blows and to prevent damage to work and property and injury to persons. It shall be removed as directed after all the items of work for which it is required are complete
- 1.1.5 Protection:
 - 1.1.5.1 The foundation pits and trenches, etc shall be strongly fenced and red light Signals shall be kept at night in charge of watch-man to prevent accidents. Sufficient care and protective measure shall be taken to see that the excavation shall not affect or damage the adjoining structures. The contractor shall be entirely responsible for any injury to life and damage to the properties etc. Necessary protection work such as guide ropes, crossing places, barricades, the contractor at his own cost shall provide caution boards etc.
- 1.6 Classification of Strata :
 - 1.6.1 The decision regarding classification of strata shall rest with the Engineer- in-Charge and his decision shall be final and binding to the contractor.
 - 1.6.2 All the materials encountered in the excavation shall be classified as described in 2.0 of general specifications.
- 1.7 Dewatering :
 - 1.7.1 Unless specially provided for as a separate item in the contract, the rate of excavation would include bailing or pumping out all water met with in excavation or which may accumulate in the excavation during the progress of the work either, by percolation, seepage, springs , rain or any other cause and diverting surface flow if any, by earthen bunds or by other means. The bunds shall be removed as soon as the work is complete
 - 1.7.2 Unless specially provided as a separate item of contract, pumping of water from foundation pit, trenches etc shall be carried out by the contractor at his own cost and he shall arrange for required numbers of dewatering pumping sets for the above work. He shall take precaution to prevent any damage to the foundation trenches, concrete or masonry or any adjacent structure. The excavation shall be kept free from water by the contractor (1) during inspection and measurement (2) When concrete and/or masonry work are in progress and till the construction work reaches above the natural water level and (3) till the Engineer – in – charge considers that the mortar is sufficiently set. The rate shall be paid for cum. of excavation.
- 1.8 Excavation in Rock :
 - 1.8.1 Blasting with Gun Power:

Blasting operations shall be carried out with the prior permission and in the presence of the Engineer – in – charge or his authorized representative and during fixed time hours of the day. All safety precautions such as providing safety nylon netting etc. shall be carried out as per instructions of the Engineer – in – charge.

Red danger flags shall be prominently displayed and all the people, except those who have actually to light the fuse must be away to a safe distance, not less than 200 meters.

All fuses shall be cut to the length required before being inserted into the holes.

The number of charges to be fired and the actual number of shots heard shall be compared and the person responsible must satisfy himself by examination that all the charges have exploded before work people are permitted to approach the scene. The withdrawal of a charge which has not exploded shall under no circumstances be permitted, but the tamping and charge shall be flooded with water and the hole marked in a distinguishing manner. The next hole to be fired shall be at a distance of about 500mm from the old hole and fired in the usual way.

The contractor or any of his competent authorized person shall be in charge of the blasting operations and shall be held responsible for strictly observing the safety rules, particularly applicable to blasting operations, in addition to other safety rules.

In blasting rocks with dynamite, the following general principles shall be observe In general, the following diameter of drills shall be used for different depth of boreholes:

From 1 – 2 metres	25 mm diameter
From 2 – 3 metres	37 – 50 mm diameter
From 3 – 4.75 metres	50 – 60 mm diameter

The borehole should generally be not more than 1.3m deep and the distance apart should be from one and half to twice the depth.

Cracks and fissures in the rock to be blasted shall be carefully studied to ascertain the best portion forth the boreholes. Charge shall always be placed in a round piece of rock, if possible not nearer than 30mm from the crack.

Rules for blasting with dynamite and other high explosives

The person - in- charge must show that he is thoroughly acquainted with all blasting operations and that he understands the rules herewith laid down. He will be held responsible for any accident that may occur.

Boreholes must be of such sizes that the cartridge can easily pass down them. The position of all holes to be drilled must be marked out with white paint and the person – in – charge must take particular note of these positions.

The drilling operation being finished, the person – in – charge must make a second inspection and satisfy himself that the boreholes marked out by him

have been drilled. The person – in – charge must prepare all charges necessary for boreholes.

Only ten holes may be loaded and fixed at one time and the charges should be fixed simultaneously as far as practicable. Boreholes must be thoroughly cleared before a cartridge is inserted.

The loading is to be done by the person – in – charge himself and the position of the charge holes carefully noted by him. Wooden tamping rods only to be used in charging holes (not pointed but cylindrical throughout, one cartridge at a time must be inserted and gently pressed with the tamping rod. Immediately before firing blast, due warning must be given and the person – in – charge must see that all the labourers have retired to safety.

The safety fuse of the charged holes are to be lighted in the presence of the person – in – charge, who must see that the fuses of the holes charged have properly ignited. After the blast, the person – in – charge must carefully inspect the work and satisfy himself that all the charges have exploded.

1.8.2 Misfires:

Misfires are a source of great danger, if it is suspected that part of the blast failed to fire or is delayed, allow sufficient time to elapse before entering the danger zone. When fuse and blasting caps are used, a safe time, at least of an hour should be allowed.

None of the drillers are to work near this hole until the two following separations have been done by the person – in – charge.

- (a) The person – in – charge should very carefully extract the tamping with a wooden scrapper and withdraw the fuse with the primer and detonator attached, after which a fresh primer and detonator with fuse should be placed in this hole and fired or.

The hole may be cleared of 300mm of tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 150mm away and parallel to it, the hole to be then charged and fired. The person – in – charge shall also at once report to the Engineer – in charge all cases of misfire, that cause of the same and what steps have been taken in connection herewith.

Precautions against misfire:

The safety fuse should be cut in an oblique direction with a knife.

All saw dust must be cleared from the inside of the detonator this can be done by blowing down the detonator and tapping the open end. No instruments shall be inserted into the detonator for this purpose.

After inserting the fuse in the detonator, it shall be fixed by means of nippers.

If there is water present, or if the boreholes be damp, the junction of the fuse and detonator must be made water tight by means of grease, white or lead

The detonator should be inserted into the cartridge, so that about one third of the copper tube is left exposed outside the explosives. The safety fuse outside the detonator, should be necessarily tied in position in the cartridge. Water proof fuse only to be used in the damp boreholes, or when water is present in the bore-holes.

If a misfire has been found to be due to defective fuse detonator or dynamite, the whole quantity or box from which the defective article was used shall be rejected.

Storage of materials for blasting shall be as per regulations/stipulations of the concerned authorities.

It shall be the contractor's responsibilities to arrange proper storage of explosives and obtain required permission from concerned authorities. No separate payment will be made for the above.

The refilling will generally refer to refilling of trenches up to ground level with excavated stuff. Filling materials shall be from excavated stuff.

Excavated stuff to be used shall be cleared of all rubbish, large size stones, brick bats etc. Big clods shall be broken down to a size of 50 mm or less.

Refilling :

After the pipes have been laid and jointed and the chambers are constructed and as soon as the joints have been inspected and passed by the Engineer-in-charge, the pipe line has been tested for water tightness, 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 pipe, the finest selected material shall be put. No lumps of rock earth or other material 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, each layer shall be thoroughly rammed before the next layer is place One man shall be employed for hand ramming for every 30m of refilling up to the level of 300mm over the top of the pipe. 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 surface of the filled in trench shall be hand rolled by a hand roller weighing not less the ½ tones as directed by the Engineer- in-charge.

The contractor shall maintain all refilling and surfaces until reinstate The contractor shall responsible for claims arising from accidents due to subsidence or inadequate maintenance or improperly refilling work.

The contractor shall be responsible for any settlement during the defects liability period including monsoon and the same shall be refilled with stuff brought from outside, if necessary.

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.

No payment shall be made for carting away surplus material arising either because of rejection of excavated material for refilling or because of surplus material.

Measurement:

The contractor's shall be for the **unit of one cubic meter** of the quantity excavated limited to the dimensions and provisions specified in the specifications or as directed by the Engineer-in-charge. The extra excavation to provide for jointing pipes, shoring etc. will not be paid for. The rates shall include cleaning and clearing the trench site by cutting grass, shrubs and trees of girth (circumference) not exceeding 10 feet and removing their obstructing roots in the trench cleaning the site, setting out works as per sanctioned plans, provide shoring, excavation and removal of all material from trenches.

(a) Excavations up to depth of 1.5M

The trench section is to be provided with Max. width OD of pipe + 250 mm to 300mm either sides. Depth of trench shall be minimum Bedding + OD of pipe + 0.60mt. cover above the top of pipe. (For 100mm dia pipe). Depth of trench shall be minimum Bedding + OD of pipe + 1.0mt. cover above the top of pipe. (For Other dia pipe).

The payment of excavation will be given considering bottom width of the pipe trench & as per actual.

Dismantling Work:

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 Cubic Meter (Plain and reinforced) masonry
 - 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 Nos.
 - vii) Removal of flooring – CC Precast Tiles / Shahbadi ladi / tiles flooring Sqr. Mtr
 - viii) Removal of road divider strip No.s
 - ix) Removal of Interlocking Paving Block Sqr. Mtr

Item No.1a:

Refilling the pipeline trenches including ramming, watering, consolidating disposal of surplus stuff as directed at any lead as directed by Engineer in charge.

On completion of the pipe laying operations in any section, for a length of about 100m and while further work is still in progress, refilling of trenches shall be

started by the Contractor with a view of restricting the length of open trenches. Pipe laying shall closely follow the progress of Trench Excavation and the Contractor shall not permit unreasonably excessive lengths of trench excavation to remain open while awaiting testing of the pipeline. If the Engineer considers that the Contractor is not complying with any of the foregoing requirements, he may prohibit further trench excavation until he is satisfied with the progress of laying and testing of pipes and refilling of trenches. The excavated material nearest to the trench shall be used filling. Care shall be taken during backfilling, not to injure or disturb the pipes, joints or coating. Filling shall be carried out simultaneously on both sides of the pipes so that unequal pressure does not occur. Walking or working on the completed pipeline unless the trench has been filled to height of at least 30cm over the top of the pipe except as may be necessary for tamping etc., during backfilling work.

The remaining portion of the trench may be filled in with a mixture of hard and soft material free from boulders and clods of earth larger than 150mm in size if sufficient quantity of good earth and murrum are not available. The trench shall be refilled so as to build up to the original ground level, keeping due allowance for subsequent settlement likely to take place. The top 300mm layer or fertile agricultural soil shall be kept aside during excavation and shall be laid in layers near ground level during refilling.

To prevent buckling of pipe shell of diameters 1200mm and above, pipes shall be strutted from inside while the work of refilling is in progress, for which no separate payment shall be made.

Strutting shall be done by means of strong spiders having at least 6 arms which shall be sufficiently stiff to resist all deformation. Spiders shall be provided at a maximum interval of 2m & shall be welded in such a way that internal coating does not get burnt.

The Engineer shall, at all times, have powers to decide which portion of the excavated materials shall be for filling and in which portion of the site and in what manner it shall be so use

If any material remains as surplus it shall be disposed of as directed by the Engineer, which includes loading, unloading, transporting and spreading as directed within all lea If the Contractor fails to remove the earth from site within 7 days after the period specified in a written notice, the Engineer may arrange to carry out such work at the Contractor's risk and cost or may impose such fine for such omission as he may deem fit. Particular care shall be taken to keep the trench dry during the entire refilling operation.

If suitable material for refilling is not available for excavation the Contractor shall bring earth, murrum of approved quality as directed by the Engineer.

No mechanical plant other than approved compacting equipment shall run over or operate within the trench until backfilling has reached its final level or the approval of the Engineer has been obtained Subsidence in filling in : Should any subsidence take place either in the filling of the trenches or near about it during the

maintenance period of 24 months from the completion of the Contract Works, the Contractor shall make good the same at his own cost or the Engineer may without notice to the Contractor, make good the same in any way and with any material that he may think proper, at the expense of the Contractor. The Engineer may also, if he anticipates occurrence of any subsidence, employ persons to give him timely notice of the necessity of making good the same, and the expenses on this account shall be charged to the Contractor.

Measurement and Payment

Payment of refilling shall be made on Cubic meter basis.

Item No.3:

Providing and supplying D.I. K-7 pipes for following nominal bore diameter with internal cement mortar lining including all taxes, insurance, transportation, freight charges, octroi. inspection charges, loading, unloading, conveyance to departmental stores, stocking etc. complete. (IS 8329-2000)

(i) 100 mm to 500 mm Diameter

This item includes:

Note: Wherever International Standards or Indian standards / specifications are mentioned, their equivalent or higher standards / specifications are also acceptable Supply and Delivery of Ductile Iron Pipe as per IS:8329-2000 or its latest revision or amendments if any including jointing material as EPDM ring as per IS 5382- 1985 and ISO: 4633-1996 or its latest revision or amendments if any Standards

The following standards, specifications and codes are part of this specification. In all cases, the latest revision of the including all applicable official amendments and revisions shall be referred to. In case of discrepancy between this specification and those referred to herein, this specification shall govern.

- ✓ ISO: 10803-1997 Design method for ductile iron pipes
- ✓ IS:8329-2000 Centrifugally Cast (spun) ductile iron pressure pipes for water, gas and sewage
- ✓ ISO:2531-1991 Ductile iron pipes, fittings and accessories for pressure pipelines.
- ✓ ISO:4179-1985 Ductile iron pipes for pressure and non pressure-Centrifugal
- ✓ cement mortar lining - General requirements.
- ✓ IS:8112 Specification for 43 Grade ordinary Portland cement.
- ✓ BS:3416 Bitumen based coatings for cold application, suitable for use in contact with potable water.
- ✓ ISO:8179-1995 Ductile iron pipes-External coating-Part-1 Metallic Zinc with finishing layer.
- ✓ IS:638 Sheet rubber jointing and rubber insertion jointing.
- ✓ ISO:4633-1996 Rubber seals-Joint rings.
- ✓ IS:5382-1985 Specification for Rubber sealing rings for gas mains, water
- ✓ mains and sewers.
- ✓ AWWA C600 Installation of ductile iron water mains and their appurtenances.

- 1.0 Internal Diameter:
The nominal values of the internal diameters of pipe, expressed in millimeters are approximately equal to the number indicating their nominal sizes DN.
- 2.0 Length:
The working length of socket and spigot pipes shall be 5 m ,5.5 m, or 6 metres.
- 3.0 Thickness:
The wall thickness of pipe 'e' in mm shall be calculated as a function of the nominal diameter by the following equation with minimum of 5 mm

$$e = K(0.5 + 0.001 \text{ DN})$$
where : e = wall thickness in mm, DN = the nominal diameter, K = the whole number coefficient
- 4.0 EPDM Rubber Gasket:
Rubber Gasket shall be suitably for Push-on-Joint.
The spigot ends shall be suitably chamfered or rounded off to facilitate smooth entry of pipe in the socket fitted with the rubber gasket Rubber Gasket shall confirm to IS 5382-1985 and ISO : 4633-1996 its latest revision or amendments if any
- 5.0 Sampling Criteria:
Sampling criteria for various tests, unless specified in IS 8329-2000, shall be as laid down in IS 11606. Mechanical test, Brinell Hardness test, Hydrostatic test etc are shall be as per IS 8329-2000
- 6.0 Tolerances on External Diameter:
The nominal external diameter (DE) of the spigot end of socket and spigot pipes and when measured circumferentially using a diameter tape shall confirm to the requirements specified as follow. The positive tolerance is +1 mm and applies to all thickness classes of pipes. The maximum negative tolerance of the external diameter are specified as follow:

DN	Nominal	Positive Tolerance	Negative Tolerance
80	98	+1	-2.2
100	11	+1	-2.8
125	14	+1	-2.8
150	17	+1	-2.9
200	22	+1	-3.0
250	27	+1	-3.1
300	32	+1	-3.3
350	37	+1	-3.4
400	42	+1	-3.5
450	48	+1	-3.6
500	53	+1	-3.8
600	63	+1	-4.0

- 7.0 Tolerance on Ovality:
Pipes shall be as far as possible circular internally and externally. The tolerance for out-of-roundness of the socket and spigot ends is given below:

Nominal Diamete	Allowable Difference Between Minor Axis
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80 to 300	1.0
350 to 600	1.7
700	2.0
750 to 800	2.4
900 to 1000	3.5

8.0 Tolerance in thickness

The tolerance on wall thickness (e) and the flange thickness (b) of the pipes shall be as below:

Dimensions	Tolerance in mm
Wal thickness	- (1.3 + 0.001 DN
Flange thickness	+ (2+0.05b) & -

9.0 Coating

Pipe shall be delivered internally and externally coated.

External Coating: Pipe shall be metallic zinc coated and after that it shall be given a finishing layer of bituminous paint as per IS - 8329-2000 Zinc coating shall comply with IS:8329/EN 545/ ISO 8179. Only molten zinc spray coating shall be acceptable. The average mass of sprayed metal shall not be less than 130 g/sqm with a local minimum of 110 g/sqm.

Bitumen overcoat shall be of normal thickness of 70 microns unless otherwise specified It shall be a cold applied compound complying with the requirements of BS 3416 Type II suitable for tropical climates factory applied preferably through an automatic process. Damaged areas of coating shall be repainted on site after removing any remaining loose coating and wire brushing any rusted areas of pipe.

Internal lining: Internally pipe shall be Portland Cement mortar lined (as per IS - 8329-2000). The mortar shall contain by mass at least one part of cement to 3.5 part of san All pipes and fittings shall be internally lined with cement mortar using high speed centrifugal process in accordance with IWO 4179/IS 8329. Cement mortar lining shall be applied at the pipe manufacturing shop in conformity with the aforesaid standards. No admixtures n the mortar shall be used without the approval of the Engineer. The sand to cement proportion of sand if justified by the sieve analysis.

Pipe lining shall be inspected on site and any damage or defective areas shall be made good to the satisfaction of the Engineer.

Lining shall be uniform in thickness all along the pipe. The minimum thickness of factory applied cement mortar lining shall be as per IS: 8329 Annex-B or ISO 4179. This is given below.

Nominal Pipe Size	Nominal lining
Up to 300	3
350-600	5
700-1200	6
1400-2000	9

10.0 Joint

Jointing of DI pipes and fittings shall be push-on type Push-on-joints

The Contractor shall source the push-on-joint gaskets only from the pipe manufactures. In turn the pipe manufacturer shall supply at least 10% additional quantity of gaskets over and above the requirement to the Contractor at no extra cost.

The gasket used for joints shall be suitable for natural and purified water conveyance. In jointing DI pipes and fittings, the Contractor shall take into account the manufacturer's recommendations as to the methods and equipments to be used in assembling the joints. In particular the Contractor shall ensure that the spigot end of the pipe to be jointed is smooth and has been properly chamfered, so that once the rubber ring is correctly positioned before the joint is made, does not get damaged by friction or sharp edges of the spigot Chamfer. The rubber rings and the recommend lubricant shall be obtained only through the pipe manufacturer.

Rubber ring bundles from every lot shall carry with them manufacturers test certificate for the following mechanical properties.

1. Hardness
2. Tensile strength
3. Compression set
4. Accelerated aging test
5. Water absorption test
6. Stress relaxation test

Rubber rings shall be clearly labeled in bundles to indicate the type of ring, the type of joint, the size of the pipe with which they are to be used, the manufacturer's name and trade mark, the month and year of manufacture and the shelf life.

11.0 Testing of Pipe:

The main test among others to be conducted shall be as per IS:8329-2000 or with its latest revision/amendments.

[a] Mechanical Tests

Mechanical tests shall be carried out during manufacture of pipes as specified in the Standards. The frequency and sampling of tests for each batch of pipes shall be in accordance with IS 11606-1986. The test results so obtained for all the pipes and fittings of different sizes shall be submitted to Engineer. The method for tensile tests and the minimum tensile strength requirement for pipes and fittings shall be as per IS:8329/EN 545 for pipes and IS:9523/EN 545 for fittings.

[b] Brinell Hardness Test

For checking the Brinell hardness the test shall be carried out on the test ring or bars cut from the pipes used for the ring test and tensile test in accordance with IS:1500. The test shall comply with the requirements specified in IS:1500/ISO 6506.

[c] Re-tests

If any test piece representing a lot fails in the first instance, two additional tests shall be made on test pieces selected from two other pipes from the same lot. If both the test results satisfy the specified requirements the lot shall be accepted. Should either of these additional test pieces fail to pass the test, the lot shall be liable for rejection.

[d] Flow Test shall be done in two stage:

Stage 1

Pipe line shall be laid by resting the pipe line on supports at joints. The pipeline and all joints of pipes shall be made thoroughly sound and water

tight and any joint which may be observed to be leaky shall be immediately corrected. Thus after satisfactory flow test sand bedding shall be fill pipe line after laying pipe line. The refilling of trench shall be carried out then after.

Stage 2

After total laying & refilling of trenches, flow test shall be carried out again for particular section of length as suggested by engineer in charge.

12.0 Quality Assurance

The manufacturer shall have a laid down Quality Assurance Plan for the manufacture of the products offered which shall be submitted along with the tenders.

MARKING :

The methods of marking all the pipes to be delivered under scope of contract shall ensure that all the information will remain legible even after transportation, storage in open space etc. In general the legible and indelible marking upon the goods shall indicate the followings;

- i) Certification mark on each pipe.
- ii) Manufacturers brand name and/or trademark.
- iii) Purchasers mark as "RMC" be inscribe
- iv) The outside diameter and pressure rating.
- v) Batch number or lot number.
- vi) Inspector's mark on each pipe

INSPECTION

Inspection of pipes and specials will be carried out by Executive engineer or his representative agency appointed by RMC. All the expenditure for inspection shall be borne by the contractor except inspection charges if any in case of inspection agency appointed by RMC shall be paid by RMC.

PAYMENT

The payment shall be on RMT basis.

Mode of Payment : Payment restricted to 70% on receipt of material at project site, 20% payment on lowering, laying, jointing, refilling and disposal of surplus stuff, 10% payment on hydraulic testing and commissioning of project. Payment for 2 Km. of unlaied pipes of each diameter except 100 mm dia. will be paid on receipt at site. Payment for 100 mm dia. Pipe up to 5 Km. will be paid on receipt at site.

Item No.4:

Lowering, laying and jointing C. I. S & S Spun pipes suitable for Tyton joints / Mortar lined I. Pipes of various classes with CI / MS specials of following diameters in proper position, grade and alignment as directed by Engineer-in-charge including hydraulic testing etc. comp.

The pipes & joints shall be procured, supplied by the Contractor at work site at his own cost. Every care shall be taken in carting them to site. During transportation any damage shall be occurring to pipes for fittings the replacement of pipes given

by the contractor at his own cost.

The trenches shall be well leveled so that pipes are laid evenly among them. The pipes shall be fixed within two rubber rings to be supplied by department at the place shown in schedule A, if directed by the Engineer-in-charge or mentioned in item of schedule B. The specification for titan joints i.e. Rubber Rings shall be as per details specification material section.

The contractor shall make his own arrangement for obtaining permission for storing & stacking of pipes etc. from land boards whether they are Government, Municipal Local Bodies or Private land owner.

Every pipes before lowering into the trenches shall be got checked and thoroughly cleaned and the beds of the trenches shall be properly graded and leveled as required on the line, without any claim for extra cost whether it is require The pipe shall be carefully lowered into the trenches with the help of a suitable type of chain pulley blocks, which shall first be approved by the Engineer-in-Charge. Each pipe shall be properly jacked and the spigot perfectly fixed into the socket. No jointing operation shall be started unless the gradients levels are approved by the Engineer-in-Charge or his representatives.

The pipes shall be laid complete in centerline ranged accurately by means of a string attached to both marked center of site rails and no deviation shall be permissible without the permission of Engineer-in-Charge. The pipe shall be laid in reasonably dry trenches and no circumstances on slushy bedding.

The pipes shall be brushed before lowering any laying or remove any soil or dirt etc. that may have accumulate

The inside socket and outside of the spigot-shall be carefully cleane The pipe shall be lowered carefully with socket and toward and the flow of water or up till or as directed and spigot and should be carefully inserted into the socket and the space shall be filled with the joint.

TESTING OF WATER PIPES:

After each section of the pipeline has been completed it shall be tested for water tightness before being covered The contractor shall at his own cost fill up water in pipe line and given necessary hydraulic test section by section and the pipe line shall stand the pressure which shall stand the pressure which shall exceed the working pressure by

(a) 50% of the highest pressure in the section.

(b) 30m whichever is less without showing any leakage or sweating anywhere in the pipes joints specials valves etc. it any defect are found the contractor shall be made good the same at his own cost.

Any leaking joints shall be made good and above test pressure in to be lowered gradually after satisfactory test is & over.

RMC/ OWNER will not be able to provide water for testing of the pipelines &

water containers of the project. This shall have to be managed by the contractor at his costs and risk.

The hydraulic test shall be given again if considered necessary by the Executive Engineer or his representative to show that no further leakages or sweating is there. The contractor shall have to make necessary arrangements for water testing as well as plugging the opening of pipes etc. as directed without claiming any extra cost. The pipelines shall be kept filled with water for a work lines shall be kept filled with water for a week or till it is situated for testing is done.

If the pipe lines are laid in detached sanctioned & not in continuous length due to any reasons such as non-availability of specials or due to obstacle etc. The contractor shall see that no end of pipes length is kept open-ends are immediately covered up either by suitable blank flange or cap slug or by means of double layer gunny bags clothes tied properly by mild steel wire without any claim for extra-cost. The rate shall be per meter of pipe line laid including all specials and fitting jointly etc. Cutting and waste shall not be paid separately. The length shall be measured not on the straight line and curves along the center line over the pipe and specials correct up to 1 cm.

Method Of Measurement Of Pipes:

The measurement shall be recorded in running meter of pipe length laid along center line or axis of pipe line..

No payment shall be made for overlaps etc.

The payment shall be paid after completion of whole item as mentioned in price bid on Running Meter basis.

Mode of Payment : Payment restricted to 70 % on completion of laying & jointing & 30% on giving hydraulic test.

Item No.5:

Manufacture, Supply & Delivery of Ductile Iron Flange socket spigot bends, tees, reducers or any other specials as per BS-EN-545/1995 Class-A series K12 suitable for use with I. Pipes manufactured as per IS:8329/1994 delivery of specials is to be made to RMC/ OWNER store or site of works any where in Gujarat including all taxes, loading, unloading, carting. stacking, insurance, inspection charges, octroi etc. complete.

- A) Manufacture, supply and delivery of Ductile Iron Flange Socket spigot bends, tees, reducers or any other specials as per BS-EN-545 / 1995 class-A series K-12 suitable for use with DI pipes manufactured as per IS 8329/1994 delivery of specials is to be made to site of works including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, Octroi etc. complete with internal cement mortar lining with EPDM rubber gaskets.
- B) Manufacture, supply and delivery of flanges, Tee, bends, tail piece, reducers, air valve raiser pipes or any other specials suitable for use with DI pipes and delivery of specials is to be made to site of works anywhere in Gujarat including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, Octroi etc. complete.
- C) Manufacture, supply and delivery of CID joints with Rubber Rings of Standard quality or any other specials suitable for use with I. pipes and delivery of specials is to be made to site of works anywhere in Gujarat including all taxes, loading, unloading, carting, stacking, insurance, inspection charges, Octroi etc. complete
- D) DI Specials with all types of diameters suitable of K9 grade pipes with inner cement mortal lining. The necessary DI Specials required during the lowering & lying of Ductile Iron Pipe shall be supplied by the agency and shall be as per standard specification.
- E) It shall be of best quality as per requirement Rate shall be including loading,
- F) unloading, carting, insurance and labor charge etc. complete.

PAYMENT

The payment shall be made on kg. basis.

Mode of Payment : Payment restricted to 70 % on completion of laying & jointing & 30% on giving hydraulic test.

Item No.6:

Removal of excavated stuff and laying within the sites specified in notification as ditected by engineer-in-charges

After refilling the pipe / chamber trenches by the excavated stuff in 15 cm thick layer, including ramming , watering and consolidating up to possible extent as specified in excavation & refilling item, the surplus stuff shall be disposed off at the following sites as directed within the prescribed limits of notification as directed by the engineering in

charge

1. Beside kothariya police station near stone quarry
2. All quarry areas of raiya smart city

The excavated material of back cotton soil should be stacked at the location specified by the engineer in charge at no extra cost.

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.

After refilling surplus earth shall have to be carted by the contractor within specified limit including loading transporting spreading.

MODE OF MEASUREMENT AND PAYMENT:

The rate shall be per cubic meter of truck – body basis

Item No.7:

Providing and supplying ISI mark CI / D/F Sluice Valves as per IS:14846 (Latest Edition) of following class and diameter including all taxes. insurance. transportation, freight charges, octroi, inspection charges. loading, unloading. conveyance to departmental stores, stacking etc. complete(kirloskar brand)

Design Features

Sluice valve shall conform to IS 14846 (ISI Marked). Except pump house, these valves are to be installed in valve chamber. All valves of pump house and rising mains shall be non-rising stem type.

The valves shall be free from sharp projections, which are likely to catch and hold stringy materials. Valves shall close with clockwise rotation of the hand wheel. The direction of closing and opening shall be marked on the hand wheel.

Necessary joining materials viz. bolts, nuts, washers, packing etc. shall be provided by the contractor at his cost. The valves shall be fixed so as to have axis perfectly horizontal. If required the contractor shall also carry out drilling of holes of appropriate diameter in flanges in required numbers. A hand wheel shall be provided for emergency operation. The hand wheel drive shall be mechanically independent. The valve design shall take care of the pressure drop across the valve disc in case of partial opening of the valve and shall take care of the erosion and cavitation effect on the body and disc during such operation. Valve(s) subjected to back pressure shall have the valve seat, disc and the operator suitably designed to ensure trouble-free operation. The shaft diameter shall take into consideration, the maximum torque required for the valve operation, the maximum differential pressure across the valve disc when the valve is closed and the shock load due to accidental closure of the valve disc. The disc shall be designed for maximum differential pressure across the valve as well as the shock load due to accidental closure of the valve. Disc design shall offer minimum head loss. Disc shall also offer minimum resistance to flow. Disc shape shall be contoured. Valve seats shall be of a design that permits removal and replacement at site and shall be securely clamped on the body or disc of the valve. Seat material shall be suitable for the operating conditions and handling fluid and may be suitably reinforced, if required. The seat design shall permit easy removal for replacement purposes without the need for removing the valve from the line. No deposited or welded seat rings permitted. The valve bearings shall be of 'self-lubricated' type and shall not have any harmful effect due to handling fluid. Adjustable thrust bearing(s) shall be provided to hold the valve disc securely in the center of the valve seat. Each Sluice Valve shall be provided with a hand wheel for manual operation. For the Valves located at inaccessible position, it shall be provided with extension spindle and floor stand or hand lever / round chain to facilitate manual operation.

Hydrostatic Test

Each valve body shall be subjected to hydrostatic test (Body and Seat) as per IS 14846. For valves subjected to back pressure condition, leakage test shall be carried out on both sides of the disc.

Performance Test

Each valve complete with operator shall be shop operated at least three (3) times from fully closed to fully open conditions and reverse, hold at intermediate positions under no flow condition, to prove the workability of the assembly.

Positive material Identification (PMI Test)

PMI test shall be checked at random for Stainless steel parts.

Test Certificates

When specified by Owner, the manufacturer shall issue a test certificate confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test.

Marking

Marking shall be cast integral on the body or on a plate securely attached to the body for 'DN' size, 'PN' rating, Heat Number and Serial number.

Painting

Each valve shall be drained, cleaned, prepared and suitable protected with 2 coats of red oxide and then black bituminous paint for minimum of 150 micron DFT on surfaces before dispatch.

Electric Actuator

Each actuator shall be adequately sized to suit the application and be continuously rated to suit the modulating control require The gearbox shall be oil or grease filled, and capable of installation in any position. All operating spindles, gears and head stocks shall be provided with adequate points for lubrication. The valve actuator shall be capable of producing not less than 1½ times the required valve torque and shall be suitable for at least 15 minutes continuous operation.

The actuator starters shall be integrally housed with the actuator in robustly constructed and totally enclosed weatherproof housing. The motor starter shall be capable of starting the motor under the most severe conditions. The starter housing shall be fitted with contacts and terminals for power supply, remote control and remote positional indication, and shall also be fitted with internal heaters so as to provide protection against damage due to condensation.

Each starter shall be equipped as follows: i. A.C. electric motor. ii. Reduction gear unit. iii. Torque switch mechanism complete with set of torque switches. iv. Limit switch mechanism complete with set of limit switches. v. Hand wheel for manual

operation. vi. Hand-auto changeover lever with suitable locking arrangement. vii. Local control switch / push buttons viii. 415 V / 240 V AC control transformer.

The actuator shall be suitable for operation in the climate conditions and power supply conditions given in the specification. The actuator shall be capable of producing not less than 1½ time the maximum required torque and shall be suitable for at least 15 minutes continuous operation. All local controls shall be protected by a lockable cover.

Datasheet:

SLUICE VALVE/GATE VALVE					
Sr No	Component	PN-1.0/1.6	PN-2.0	PN-2.5	PN-4.0
1	Body	CI IS 210 Gr. FG260	ASTM A216 Gr.	ASTM A216 Gr.	ASTM A216 Gr. WCB/ ASTM
2	Bonnet	CI IS 210 Gr. FG260	ASTM A216 Gr. WCB	ASTM A216 Gr. WCB	ASTM A216 Gr. WCB/ ASTM A351 Gr. CF8
3	Wedge	CI IS 210 Gr.	ASTM A217 Gr. CA15	ASTM A217 Gr. CA15	ASTM A217 Gr. CA15
4	Gland	CI IS 210 Gr. FG260	ASTM A216 Gr.	ASTM A216 Gr.	ASTM A216 Gr. WCB/ ASTM
5	Stem	SS 410	SS 410	SS304	SS 316
	Body				
7	Gland Packing	Jute and Hemp	Graphoil Filler	Graphoil Filler with SS 304 wire winding	Graphoil Filler with SS 304 wire winding
8	Nut Bolts	Carbon steel	ASTM A320 Gr L7 and ASTM A194 Gr 4	ASTM A320 Gr L7 and ASTM A194 Gr 4	ASTM A320 Gr L7 and ASTM A194 Gr 4
9	Wedge Nut and Stem Nut	IS 318 Gr LTB-2	SS 304	SS 304	SS 304
10	Hand Wheel	Cast Iron	Cast Steel	Cast Steel	Cast Steel/SS

11	Flange End	IS 1538	ASME/ANSI B16.5 Class 150	ASME/ANSI B16.5 Class 300	ASME/ANSI B16.5 Class 400
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Mode of measurement and payment:

The measurement shall be taken **per number of sluice valve** of specified size. The rate will be **per number** fitted in a pipe line.

5% amount shall be withheld for hydraulic test and same shall be released after satisfactory hydraulic test.

Item No.8:

Lowering, laying and jointing in position following C. I./ D/F Reflux valves, Butterfly valves, Sluice valves and Air valves including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete.

Lowering, Laying and Jointing of Sluice valve

- (i) Cast iron double flanged sluice valve/butterfly valves with two tail pieces suitable to pipe shall be supplied by the board and they shall be carted by the contractor at his own cost from the departmental store or any other store as directed. The rate shall include loading, unloading and stacking at site.
- (ii) The sluice valve/butterfly valves and tail pieces shall be examined before laying for cracks and other flaws. They shall be undamaged in all respect.
- (iii) The sluice valves/butterfly valves shall be operated before laying.
- (iv) All grits and foreign materials shall be removed from the inside of the valves before placing.
- (v) All the four faces shall be thoroughly cleaned and coated with a thin layer of mineral grease.
- (vi) The tightening of gland shall be checked with a pair of inside-calipers. Clearance between the top of stuffing box and the underside of the gland shall be uniform all the sides.

2.0 JOINTING MATERIAL

- 2.1 The contractor shall provide all necessary jointing materials such as nuts bolts, rubber packing white zinc jute lead wool etc.
- 2.2 All tools and plant required for installation of sluice valve shall be provided by the contractor.
- 2.3 All jointing materials shall be not approved from the engineer-in-charge before use.
- 2.4 The nut and bolts shall conform to Item No MSP-19 of specification of materials.
- 2.5 The rubber packing shall conform all specifications as narrated in Item No MSP-20 of specifications of materials.

3.0 INSTALLATION

- 3.1 The sluice valve/butterfly valve shall be lowered in to the trench carefully, so that no part is damaged during lowering operation.
- 3.2 If necessary tail pieces shall be fitted with sluice valve first outside the trench and then lowered in to the trench.
- 3.3 The rubber packing shall be three ply and of approved thickness. The packing

- shall be of full diameter of the flange with necessary holes and the sluice/butterfly valve bore. It shall be even at both the inner and outer edges.
- 3.4 The flange faces thoroughly grease
 - 3.5 If flange faces are not free, the contractor shall use thin fibers of lead wool.
 - 3.6 After placing the packing, nuts and bolts shall be inserted and tightened to make the joint.
 - 3.7 The valve shall be tightly closed when being installed to prevent any foreign materials from getting in between the working parts of the valve.
 - 3.8 Each flange bolt shall be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively.
 - 3.9 The sluice valve/butterfly valve shall be installed in such a way that its spindle shall remain in truly vertical position.
 - 3.10 The other end of tail piece shall be fitted with pipes so that continuous lines can work.
 - 3.11 Extra excavation required for facility of lowering and fixing sluice valve shall not be paid for.

4.0 TESTING

- 4.1 After installation of sluice valve/butterfly valve the same is tested to 1 1/2 times of its test pressure.
- 4.2 The joints sluice valve/butterfly valve shall withstand the test pressure of pipelines.
- 4.3 Defects noticed during test and operation of sluice valve shall be rectified by the contractor at his own cost without any extra claim to the entire satisfaction of the Engineer-in-charge.

5.0 MODE OF MEASUREMENT AND PAYMENT

- 5.1 The measurement shall be taken per number of sluice valve/butter fly valve of specified size.
- 5.2 The rate shall be per number fitted in a pipe line as per schedule of payment.
- 5.3 For non-testing of valve 30% of the rate quoted shall be withheld till testing is given.

Item No.9:

Providing & Supplying House Connection piping ASTM Providing & Supplying House service connection from distribution main to property limit, including (1) Providing DI strap saddle with packing & bolts- nuts 1 No. (2) Brass Ferule long Thread (ASTM-D-2466) -1Nos. (3) Providing Brass (metal) inserted Female Thread Adaptor as per ASTM-D-2466 - 3 nos. (4) u-PVC Union -Soc. with EPDM O-Ring seal SH-40 as per ASTM-D-2466. (5) Providing u PVC white pipe of Schedule-40 class conforming to ASTM-D-1785 in required length - 5.0 m. approx. (6) Providing coupling ASTM-D-2466 Sch-80 about 04 nos. for jointing the pipes (7) u PVC Ball valve as per ASTM-D-2466 with one side compression and another side female threaded - 1 no. (8) Providing 90 degree Elbow - 3 nos. of standard ASTM-D-2466. (9) PVC Adhesive solution 50 ml. The work shall be done as per detailed specifications & as per drawings complete with all lead & lift and as directed by the Engineer in charge. (Without cost of watermeter) (including all brass & upvc fixtures for water meter)

The item includes providing, supplying to site U-PVC white pipe of Schedule-40 class conforming to ASTM-D-1785 in required length as per site condition and as directed by Engineer in charge And Labour for fixing DI Strap Saddle, Tapping ferrule, fixing of u-PVC

pipe HSC with fitting upto Consumer 1. Excavation in soil, SM & HM & Refilling = 0.70 m³.
2. Removal Existing GI HC & handaling over to house hold 3. Drilling the hole suitable size in plint with drill machine 4. Drilling the required hole with special tool in DI pipeline including threading in the DI pipe body taking care of in side lining 5. Fixing the long body ferule with service saddle on street DI pipe including ferule to be inserted in DI pipe material and should be at least remain 5 to 7 mm projected in to water section area with required all fitting like washer packing and bolt-nuts. 6. Dismantling floor in the courtyard of house with removal of excavated stuff. 7. Laying jointing with std PVC Adhesive solution & fixing all with DI Strap saddle standard pipes approx 5 m. & fittings as per Standard Drawing 8. Testing the HC for leakage test (including water meter fixing)

TECHNICAL SPECIFICATIONS FOR COMPRESSION FITTINGS

90 DEG COMPRESSION ELBOW WITH METAL INSERT

One end of the Metal threaded compression Elbow will be with Taper male threads & other end will have compression fitting suitable to connect to PE pipe. The Taper male threads will be pressure tight. Pressure rating will be PN16.

Body, Nut and Thrust Ring will be injection molded from Polypropylene and UV stabilized body & thrust ring black in colour, Nut blue in colour. Lip gaskets in Food safe Rubber (NBR) black colour must have a conical shape on inside of gasket for easy insertion of pipe & with two lips on bottom to guarantee good sealing. Use of O ring not permitted. Clamp ring material will be Polyacetal (POM) white colored and shall not be connected to thrust ring. Male threaded part will be made of SS 304.

The product will be tested as per below

Type test	Standard
Dimensions of the threads	ISO 7/1
Tightness of the joints	ISO 3458
Tightness of the joints when subjected to	ISO 3503
Resistance to pull-out	ISO 3501
Internal under-pressure test	ISO 3459
Long term pressure test	ISO/DIS 14236

90 DEG COMP ELBOW with COMPRESSION JOINT BOTH ENDS

The Compression Elbows will have compression ends in both sides, so that PE pipes can be connected at both ends. Pressure rating will be PN 16.

Body, Nut and Thrust Ring will be injection molded from Polypropylene and UV stabilized body & thrust ring black in colour, Nut blue in colored. Lip gaskets in Food safe Rubber (NBR) black colour must have a conical shape on inside of gasket for easy insertion of pipe & with two lips on bottom to guarantee good sealing. Use of O ring not permitted. Clamp ring material will be Polyacetal (POM) white colored and shall not be connected to thrust ring.

The product will be tested as per below

Type test	Standard
Dimensions of the threads	ISO 7/1
Tightness of the joints	ISO 3458
Tightness of the joints when subjected to	ISO 3503
Resistance to pull-out	ISO 3501
Internal under-pressure test	ISO 3459
Long term pressure test	ISO/DIS 14236

FEMALE THREADED ADAPTER with METAL OFFTAKE

One end of the Female adaptor with metal off take will be with female threads & other end will have compression fitting suitable to connect to PE pipe. The Taper male threads will be pressure tight. Pressure rating will be PN16.

Body, Nut and Thrust Ring will be injection molded from Polypropylene and UV stabilized

body & thrust ring black in color, Nut blue in color. Lip gaskets in Food safe Rubber (NBR) black color must have a conical shape on inside of gasket for easy insertion of pipe & with two lips on bottom to guarantee good sealing. Use of O ring not permitted Clamp ring material will be Polyacetal (POM) white coloured and shall not be connected to thrust ring. Female threaded part will be made of SS 304.

The product will be tested as per below

Type test	Standard
Dimensions of the threads	ISO 7/1
Tightness of the joints	ISO 3458
Tightness of the joints when subjected to	ISO 3503
Resistance to pull-out	ISO 3501
Internal under-pressure test	ISO 3459
Long term pressure test	ISO/DIS 14236

The pipe and fitting shall be lowered, laid and joint using electro-fusion process and hydraulic testing shall be done as specified above in electro-fusion fitting.

Or

Compression fittings used for House service connection comply as per ISO 14236

Material of Construction

Compression fittings material shall confirm to ISO14236.Clause -5.

A .Body-Polypropylene

b. Nut / Cap –Polypropylene.

c. Clip Ring-POM (Acetylic resin)

d. Packing bush- Polypropylene

e. "O" ring – NBR

f. Threaded metal inserts –SS 304 with BSP Threads

Pressure testing

The pressure rating of compression fittings as per clause 8 of ISO 14236 which shall be PN16

Dimensions:

The Dimension of compression fittings shall be as per clause 7.1 of ISO 14236

Performance requirements

The compression fittings shall be tested as per ISO 14236. Following Test methods shall be performed

Clause 8.2.1 -Leak tightness under internal pressure.

Clause 8.2.2 -Resistance to Pull out.

Clause 8.2.3 -Leak tightness under Internal Vacuum.

Clause 8.2.4 -Long term Pressure Test for Leak tightness for assembled joint

Clause 8.3.2.1 -MRS Value as per ISO 9080

Clause 8.3.3.1 -Resistance to Internal pressure.

Effects on Quality of Water

The Compression fittings for intended for conveyance of Potable water for Human consumption to be tested to comply with BS 6920 specifications in any of the laboratories like DVGW / KIWA / SPGN / WRc –NSF and certificate of compliance to be produced for the following parameters :

- a. Odour & Flavour of Water.
- b. Appearance of Water.
- c. Growth of Micro Organism
- d.Extraction of substances that may be of concern to Public Health (Cyto Toxicity)
- e. Extraction of Metals.

For clear identification of the water services, the nuts of the fittings should be coloured blue while the body to be black. All fittings with threaded ends should be with BSP threads.

Excavation

General

Any soil which generally yields to the application of pickaxes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel, silt and turf loam, clay, peat etc. fall under this category.

Clearing the site

The site on which the structure is to be built shall be cleared, and all obstructions, loose stone, materials and rubbish of all kind, bush, wood and trees shall be removed as directed. The materials so obtained shall be property of the Government and shall be conveyed and stacked as directed within 50 m. lead The roots of the trees coming in the sides shall be cut and coated with a hot asphalt.

The rate of side clearance is deemed to be included in the rate of earthwork for which no extra will be paid.

Setting out

After clearing the site, the centre lines will be given by the Engineer in charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts for the work. Contractor shall supply labours, materials, etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed

Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary showing and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transferely as directed by removing and watering as require No earth filling will be allowed for bringing it to level, if by mistake or any other reason excavations is made deeper or wider than that shown on the plan or directed. The extra depth or width shall

be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation upto 1.5 m. depth shall be measured under this item.

Disposal of the excavated stuff

The excavated stuff of the selected type shall be used in filling the trenches and plinth or levelling the ground in layers including ramming and watering etc.

The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead upto 50 m. and all lift.

Dismalting of asphalt / metal road

Under this item contractor shall demolish existing asphalt or WBM / CC pavement met with during laying pipe.

Only area of pavement intercepted in pipe laying shall be demolished. If excess area is demolished same shall be reinstated by the contractor.

Demolished material like asphalt pavement lump and metal shall be stacked separately as directed by the Engineer in charge.

Work done to the extent of requirement for laying of drain and as per specifications shall be measured in sq.m. and paid at the tender rate.

Mode of measurements and payment

The description of each item shall, unless otherwise stated, be held to include where necessary, conveyance, and delivery, handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting in position, straight, cutting and waste, return of packings etc.

The length shall be measured on running metre basis of finished work. The length shall be taken along the centre line of the pipe and fittings. The pipes fixed to walls, ceiling, floors etc. shall be measured and paid under this item.

All the work shall be measured in decimal system as fixed in its place, subject to tolerance given below unless otherwise state

- (i) Dimensions shall be measured to the nearest 0.01 metre.
- (ii) Area shall be worked out to the nearest 0.01 sq.metre.
All measurements of cutting shall unless otherwise stated be held to include the consequent waste.
In case of fitting of unequal bore, the largest bore shall be measured for the test.
Testing of pipe lines, fittings and joints include for providing all plant and appliances necessary for obtaining access to the work to be tested and carrying out the tests.
The rate includes all the electro-fusion fittings such as female adopter, elbow, bend, reducer, coupling etc. required for the water meter connection.

The rate shall be for a unit of one running metre.

Providing, supplying and fixing Ductile Iron strap saddle inclusive of of all taxes, insurance, transportation, freight charge, inspection charges etc. complete as per the detailed specification.

DI Strap Saddle required for providing house service connections on DI/CI mains.

General specification:

Strap saddles shall be suitable for CI/DI pipes of nominal size 60 mm to 300 mm with nominal outlet connection size from 1/2", 3/4" & 1" BSP female thread

The body shall be **Resicoat® epoxy** coated with thickness >250 micron as per GSK standard & EN14901. The saddles shall be single type upto pipe sizes of NB 300 and service outlet of 1/2", 3/4" and 1" BSP female thread

Fasteners shall be of threaded nut-bolt-washer type. Nut-bolts of size 1/2" (M12) shall be used.

Saddle strap shall be with NBR protection rubber.

The sealing between the saddle and mains shall be obtained by using a profiled elastomeric seal matching to the curvature of the pipe. The seal shall be of NBR elastomeric type, suitable for all potable water applications.

The clamp saddles shall be suitable for online tapping with spatula & drilling tool, maximum working pressures upto **16** bars.

Material and Design Specifications

Saddle body: DI GGG40 with **Resicoat® epoxy** (for corrosion protection of fittings) coating with length 172 mm, width 75 mm, height 67 mm & thread depth 24.5mm. The body shall have retaining cavity housing for internal and external retention of the elastomeric seal. Sealing shall be achieved by pressure exerted by the body while fastening the saddle straps & body on the pipe.

Saddle strap: Saddle straps shall be made of stainless **steel 304 grade, gauge 16 & width 40mm** to prevent corrosion over the long service life & should be with no weld joint to avoid inconsistency of strength.

Strap Protection Rubber: NBR UV protected Elastomeric (rubber) shall be such that none of the Stainless Steel Strap is in direct contact with the pipe. It shall ensure a firm non slip grip mounting on the pipe due to external loading.

Saddle seal: It shall be virgin rubber NBR Class 70 complying with EN 682-2002. It shall be of type pressure activated hydro-mechanical design. It shall be contoured gasket to provide a positive initial seal which increases with increase in the line pressure. Gasket shall be, with the outlet section having o-ring contacting the saddle body.

Nuts – Bolts- Washer: Stainless Steel Type 304, NC rolled thread, Tightening torque for 1/2" (M12) nut-bolt: 14-15 kg m.

OR

Specifications for Clamp Saddle for Service Connections

General Specifications :

Clamp saddles for service connection from water distribution mains shall be of wrap around design, wide skirt and wide straps support, which shall reinforce the pipe while providing excellent stability to the saddle.

Clamp Saddles for service connections shall be of fastened strap type with threaded outlet for service connection.

The service connection threading sizes shall be conforming to IS: 554

Clamp saddles shall be suitable for DI pipes of nominal size 3" (NB 80) to 12" (NB 300) with nominal service connection size from ½" (NB 15), ¾" (NB 20), 1" (NB 25), 1 ¼" (NB 32), 1 ½" (NB 40) and 2" (NB 50).

The straps shall be elastomer coated (insulated) type for firm grip on pipe as well as to protect the coating on the pipe and to insulate the un-identical metals. The saddles shall be single strap type upto pipe sizes of NB 600 and service outlet of ½", ¾" and 1".

The saddles shall be double strap type for pipe sizes above NB 600 or when the service outlet is 1 ¼", 1 ½" or 2".

Fasteners shall be of threaded nut-bolt-washer type. Nut-bolts of size ½" (M12) shall be used for saddles of size up to 4" (NB 100) and Nut-bolts of size 5/8" (M16) shall be used for saddles of size 6" (NB 150) and above.

The sealing between the saddle and mains shall be obtained by using a profiled elastomer seal matching to the curvature of the pipe.

The seal shall be of elastomer type, suitable for all potable water applications.

The Material of construction of the body, straps, fasteners etc. shall be of a non corrosive material such as engineering plastic (PE/PP) or stainless steel or a combination of both.

The design of the saddle body should be such that, the service connection outlet metal insert shall project out towards pipe side and align with the hole drilled on the pipe to ensure positive locking against rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

The clamp saddles shall be suitable for maximum working pressures upto 10 bars.

Material and Design Specifications:

Saddle Body:	Non corrosive Engineering Plastic body moulded with Stainless steel threaded metal insert for tapping outlet. Also, the stirrup metal plate shall be duly embedded in the plastic body, except at the place of nut-bolt lugs. Threading size and dimensions shall conform to IS: 554. The body shall have retaining cavity housing for internal and external retention of the elastomeric seal. Sealing shall be achieved by pressure exerted by the body while fastening the saddle straps & body on the pipe.
Saddle Strap:	Saddle straps shall be made of stainless steel 304 grade to prevent corrosion over the long service life.

Strap Insulation: Elastomeric (rubber) insulation / lining shall be such that none of the Stainless Steel Strap is in direct contact with the pipe. It shall ensure a firm non slip grip mounting on the pipe to prevent the saddle from rocking or creeping on the pipe, as might be caused by vibration, pressure or excessive external loading.

Saddle Seal: It shall be virgin rubber SBR Grade 30 / NBR (NSF 61 approved). It shall be of type pressure activated hydro-mechanical design. It shall be contoured gasket to provide a positive initial seal which increases with increase in the line pressure. Gasket shall be gridded mat, with tapered ends, with the outlet section having o-ring contacting the saddle body multiple o-rings contacting the pipe, preferably with a Stainless steel reinforcing ring insert moulded to prevent expansion under pressure.

Nuts-Bolts- washer: Stainless Steel Type 304, NC rolled thread, Tightening torque for 1/2" (M12) nut-bolt: 14-15 kg.m and for 5/8" (M 16) nut-bolt: 21-23 kg.m

Providing and fixing brass ferrule of approved make of following sizes inclusive of all taxes, insurance, transportation etc. complete.

(i) 15 mm dia. (ii) 25 mm dia. (iii) 40 mm dia. (iv) 50 mm dia.

The brass ferrule shall be best quality and make as approved by Engineer-in-charge.

The work shall be carried out in good workmanship manner as directed by the Engineer-in-charge with proper fixing of ferrule as require

Item No.10:

Providing and casting in situ C.C. in grade M-15 (approx. corresp. to prop. 1:2:4) (proportions as per mix design or as per Table 9 of IS456 2000 in masses by weigh batching) using granite, quartzite trap metal of size 6 mm to 20 mm for RCC work, including scaffolding centering, form work, needle vibrated consoildation, curing comp. up to 6 meter depth or height (excluding cost of reinforcement and neat finishing) with centering and shuttering / deshuttering etc. comp for structure for other than water retaining. (with form work)

Thrust Block

Anchorage in the form of a thrust block at each deflection in the horizontal and/or in vertical alignment of the pipeline shall be provided as per the design requirements to resist any unbalanced pressure at the bends. Gravity type thrust blocks shall be provided at horizontal and vertical deflections in the pipeline, which shall be designed according to the test pressure and the soil conditions at the site of the thrust block. Before designing the thrust blocks the Contractor shall assess the stability of the soil considering erosion due to wind and water. The general guidelines to be followed for providing and designing of thrust blocks shall be as under:

The thrust blocks may not be required for bend angles up to 5%. However, necessary calculations shall be submitted by the Contractor for approval by Employer to establish that the thrust shall be taken care by pipe itself and that it is safe not to have the thrust block.

The thrust shall be designed according to the field test pressure of the pipe.

For above ground pipelines, thrust blocks shall be designed to take 100% thrust.

For buried pipelines, thrust blocks on continuous pipe line sections shall be designed considering 50% thrust to be taken by block and balance by pipe as per CPHEEO manual.

For buried pipelines, thrust blocks near valve chambers and/or any other dismantling joints shall be designed to take 100% thrust.

In rock the passive pressure of rock shall be considered for thrust block design

The thrust blocks shall be of concrete M20, cast in-situ, with minimum surface reinforcement of 5 kg/m². No formwork is required to be used for construction of thrust blocks in buried conditions, unless desired by the Contractor. The calculations for the dimensioning and the shape of the thrust blocks shall be approved by the Employer.

Anchor blocks shall also be located wherever there is a transition between above ground and buried pipelines. All such anchor blocks shall have flexible joints at either end to allow for small amounts of settlement to occur.

The Contractor shall construct the thrust blocks as early in the program of work as is practical, and at least six months prior to installation of the above ground pipeline in order to reduce the risk of settlement imposing additional loads on the pipeline supports. All thrust blocks are to be completed on each section before the sectional hydraulic testing is conducted.

Where possible, the base of the thrust block shall be cast against solid rock in order to prevent any settlement. Any material overlying the rock shall be excavated and replaced with class M15 mass concrete. In the event of no rock being encountered, the base of the thrust block shall be cast against undisturbed ground. Any ground, which in the Employer opinion is unsuitable, shall be excavated and replaced with class M15 mass concrete.

1.0 Materials:

Water shall conform to M-1, cement shall conform to M-2, Sand shall conform to M-4, Grit shall conform to M-8. Graded stone aggregate 20 mm, nominal size shall conform to M-12.

2.0 General:

- 2.1 The concrete mix is not required to be designed by preliminary tests. The proportion of concrete mix shall be 1:1:2 (1 Cement: 1 coarse sand: 2 graded stone aggregate) 20 mm nominal size) by volume.
Concrete work shall have exposed concrete surface or as specified in the item.
- 2.2 The designation ordinary M-100, M-150, M-200, M-250 specified as per IS correspond approximately to 1:3:6, 1:2:4, 1:1¹/₂:3 and 1:1:2 nominal mix of ordinary concrete by volume respectively.
- 2.3 The ingredients required for ordinary concrete containing one bag of cement of 50 Kg by weight (0.0342 Cu.M) for different proportions of mix shall be as under:

Grade of concrete	Total quantity of dry aggregate by volume per 50 kgs of cement to be taken as the sum of individual volume of fine and coarse aggregates, max.	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 Kgs of cement maximum
M-100 (1:3:6) M-150 (1:2:4) M-200 (1:1 ¹ / ₂ :3) M- 250 (1:1:2)	300 Litres 220 Litres 160 Litres 100 Litres	Generally 1.2 for fine aggregate to coarse aggregate by volume but subject to an upper limit of 1:1.1/2 and lower	34 Litres 32 Litres 30 Litres 27 Litres

- 2.4 The water cement ratio shall not be more than specified in the above table. The cement concrete of the mix specified in the Table shall be increased if the quantity of water in mix has to be increased to overcome the difficulties of placements and compaction so that water cement ratio specified on the table is not exceeded.
- 2.5 Workability of the concrete shall be controlled by maintaining a water cement ratio that is found to give a concrete mix which is just sufficient wet to be placed and compacted without difficulty with the means available.
- 2.6 The maximum size of coarse aggregate shall be as large as possible within the limits specified but in no case greater than one fourth of minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.
- 2.7. For reinforced concrete work, coarse aggregates having a nominal size of 20 mm, are generally considered satisfactory.
- 2.8 For heavily reinforced concrete members as in the case of ribs main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5 mm, less than the minimum the distance between the main bars, or 5 mm less than the minimum cover to the reinform or whichever is smaller.
- 2.9 Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal maximum size may sometimes be as greater as or greater than the minimum cover.
- 2.10 Admixture may be used in concrete only with approval of engineer-in-charge based upon the evidence that with the passage of time, neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixtures.

3.0 Workmanship:

3.1 Proportioning:

Proportioning shall be done by volume, except cement which shall be measured in terms of bags of 50 kg. weight the volume of one such bag being taken as 0.0342 cu.metre. Boxes of suitable size shall be used for measuring sand aggregate. the

size of boxes (internal) shall be 35 x 25 cms, and 40 cms deep while measuring the aggregate and sand the boxes shall be filled without shaking ramming or hammering. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowances for bulmage shall be made.

3.2 Mixing:

- 3.2.1 For all work, concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Measured quantity of aggregate, sand and cement required for each batch shall be poured into the drum of the mechanical mixer while it is continuously running. After about half a minute of dry mixing measured quantity of water required for each batch of concrete mix shall be added gradually and mixing continued for another one and a half minute. Mixing shall be continued till materials are uniformly distributed and uniform color of the entire mass is obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.
- 3.2.2 When hand mixing is permitted by the engineer-in-charge for small jobs or for certain other reasons, it shall be done on the smooth water tight platform large enough to allow efficient turning over the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material gets mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture to uniform color. Specified quantity of water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 percent above that specified.
- 3.2.3 Mixers which have been out of use for more than 30 minutes shall be thorough cleaned before putting in a new batch. Unless otherwise agreed to by the engineer-in-charge the first batch of concrete from the mixture shall contain only two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

3.3 Consistency:

- 3.3.1 The degree of consistency which shall depend upon the nature of the work and the methods of vibration of concrete, shall be determined by regular slump tests in accordance with IS 1199 - Latest edition. The slump of 10 mm to 25 mm shall be adopted when vibrators are used and 80 mm when vibrators are not used.

3.4 Inspection:

- 3.4.1 Contractor shall give the engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment, and general fineness but such inspection shall not relieve the contractor of his responsibility for the safety of men, machinery,

materials and for results obtained. Immediately before concreting, all forms shall be thoroughly cleaned.

- 3.4.2 Centering design and its erection shall be got approved from the engineer-in-charge. One carpenter with helper shall invariably kept present throughout the period of concreting. Movement of labor and other persons shall be totally prohibited for reinforcement laid in position. For access to different parts suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber, kapachi or metal pieces shall not be used for this purpose.

3.5. Transporting and Laying:

- 3.5.1 The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work shall be cleaned and made free from standing water dust, snow or ice immediately before placing of concrete. No concrete shall be placed in any part of the structure until the approval of the engineer-in-charge has been obtained.
- 3.5.2 Concreting shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer. Except where otherwise agreed to by the engineer-in-charge concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.
- 3.5.3 Unless otherwise agreed to by the engineer-in-charge, concrete shall not be dropped in to place from a height exceeding 2 meters. When trunking or chutes are used they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened it shall be roughened swept clean, thoroughly wetted and covered with a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted all free water removed and then coated with neat cement grout the first layer of concrete to be placed on this surface shall not exceed 150 mm in thickness and shall be well rammed against old work particular attention being given to corners and close spots.
- 3.5.4 All concrete shall be compacted to produce a dense homogenous mass with the assistance of vibrators unless otherwise permitted by the engineer-in-charge for exceptional cases such as concreting under water where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the event of breakdowns. Concrete shall be judged to be compacted when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface mixture. During compaction, it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and

reinforcement.

3.6 Curing:

Immediately after compaction, concrete shall be protected from weather including rain running water shocks vibration traffic rapid temperature changes frost and drying out process. It shall be covered with wet sacking hassian or other similar absorbent material approved soon after the initial set and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonary work over foundation concrete may be started after 48 hours of its laying but curing of concrete shall be continued for a minimum period of 14 days.

3.7 Sampling and testing of concrete:

3.7.1. Samples from fresh concrete shall be taken as per IS 1199 - Latest edition, and cubes shall be made cured and tested at 7 days of 28 days as per requirements in accordance with IS 516 - Latest edition. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with following:

Quantity of concrete in the Work	No.of samples	Quantity of concrete in the work.	No.of samples
1-5 cmt	1	16-30 cmt	3
6-15 cmt	2	31-50 cmt	4
51 and above	4 ± one additional for each additional 50 m or part thereof		

NOTE:- At least one sample shall be taken from each shift. Ten test specimens shall be made from each sample five for testing at 7 days and the remaining five at 28 days. The samples of concrete shall be taken on each days of the concreting as per above frequency. The number of specimens may be suitably increased as deemed necessary by the engineer-in-charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

3.7.2. The average strength of the group of cubes cast for each day shall not be less than the specified cube strength of 150 Kg/Cm^2 at 28 days. 20% of the cubes cast for each day may have value less than the specified strength. Such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the proportion given for a particular grade shall not, however, be placed in a higher grade on the ground that the test strength are higher than the minimum specified.

3.8 Stripping:

- 3.8.1. The engineer-in-charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time for removal of form, due consideration shall be given to local conditions, character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. In normal circumstances (generally where temperatures are above 20⁰C) and where ordinary concrete is used, forms may be struck after expiry of periods specified below for respective item of work.

Stripping Time:

In normal circumstances and where ordinary cement is used forms may be struck after expiry of following periods:

- | | | |
|----|--|-------------------|
| a) | Side of walls, columns and vertical faces of beams | - 24 to 48 hours. |
| b) | Beam soffits (props. left under) | - 7 days |
| c) | Removal of props slabs: | |
| | i) Slabs spanning upto 4.5 m | - 7 days |
| | ii) Spanning over 4.5 m | - 14 days |
| d) | Removal of props for beams and arches | |
| | i) Spanning upto 6 m | - 14 days |
| | ii) Spanning over 6 m | - 21 days |

- 3.8.2. All form work shall be removed without causing any shock or vibration as would damage the concrete. Before the soffit and struts and struts are removed, the concrete surface shall be gradually exposed, where necessary in order to ascertain that concrete has sufficiently hardened. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal ties are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less 25 mm cover to the finished concrete surface. Where it is intended to re-use the form work, it shall be cleaned and made good to the satisfaction of the engineer-in-charge. After removal of work and shuttering, the City Engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality.

- 3.8.3. Immediately after the removal of forms, all exposed bolts etc. passing through the cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be filled by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in proportions used in the grade of concrete that is being finished and of as dry consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which are pointed shall be kept moist for a period of 24 hours. If pockets / honeycombs in the opinion of the engineer-in-charge are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of structure affected.

(a) the bars shall be kept in position by the following methods :

- (i) In case of beam and slab construction, sufficient number of precast cover blocks in cement mortar 1 :2 (1 cement : 2 coarse sand) about 4 x 4 cms. section and of thickness equal to the specified cover shall be place between the bars and shuttering as to secure and maintain the requisite cover of concrete over the reinforcement. In case of cantilevered or doubly reinforce beams or slabs, the main reinforcing bars shall be held in position by introducing chain spacers or supports bars at 1.0. to 1.2 metres centers.
 - (ii) In case of columns and walls, the vertical bars shall be kept in position be means of timber templates slotes accurately out in them, the templates shall be removed after concreting has been done below it. The bars Ray also suitably tied by means of annealed steel wires to the shuttering to maintain position during concreting.
- 1.2. All bars, projecting form pillars, Columns beams, slabs etc, to which other bars and concrete are to be attached or bounded to later on, shall be protected with a coat of thin neat cement grout, if the bars are not likely to be incorporated with succeeding mass of concrete within the following 10 days, This coat of thin neat cement shall be removed before concreting.

4.0. Mode of measurements & payment.

- 4.1. The consolidated cubical contents of concrete, work as specified in item shall be measured. The concrete laid in excess of sections shown on drawing or as directed shall not be measured. No deduction shall be made for (a) Ends of dis-similar materials such as joints, beams, posts, girders, rafters, purline trusses, corbels and steps etc. upto 500 sq.cm. in section, (b) Opening upto 0.1 Sq. M.
- 4.2. The rate includes cost of all materials labour, tools and plant requited for missing, placing in position, vibrating and compacting, finishing, as directed. curing and all other incidental expenses for producing concrete of specified strength. The rate excludes the cost of form work.
- 4.3 The rate shall be for a unit of one cubic meter.

Item No.11:

Providing and supplying C.I. Temper proof Air valves with Isolation Sluice

valve ss 304 Float gun metal- nozzle of approved make & quality of following class and diameter including all taxes. insurance. transportation, freight charges, octroi, Inspection charges, loading. unloading, conveyance to departmental stores. stacking etc. complete.

General

Temper proof air valve confirming to AWWA C 512, having outlet for admission and release of bulk volume of air during emptying and filling of the pipeline. The ball sealed orifice shall always remain open while air is exhausting and is immediately closed when Water rises in the chamber, lifts the ball and seals the orifice.

It shall also ensure that there are no recesses or pockets, sheltering, escaping air for the large orifice (low pressure) ball to drop into when the valve open. Turbulent air at the time of filling of pipe shall not circulate in such cavities and cause the ball to blown into when the valve is open.

Turbulent air at the time of filling of pipe shall not circulate in such cavities and cause the ball to blown into the discharging air streams, blowing the valve shut prematurely. The cone angle of the lower pressure chamber shall be such that even at the critical velocity of all air escape at 300 m/sec.

The total impact force on the ball is less than the suction force on the angular area between the ball and the cone. The design of the valve should be such as to allow maximum free air discharge at various pressure differentials.

The low pressure cover shall be massive and designed to withstand full operating thrust in working Conditions. The seat ring shall be held securely in place under the low pressure cover by a joint support ring to prevent it from sagging when the ball is not sealing the orifice.

Testing

All valves shall hydrostatically tested by the manufacturer before dispatch. The pressure shall be obtained without any significant hydraulic shock. Testing shall be carried on before application of paint. There shall be no air entrapped within the part of the valves subjected to test pressure. Test pressure as per AWWA C512 or API 598.

Positive material Identification (PMI Test)

PMI test shall be checked at random for Stainless steel parts.

Test Certificates

When specified by Owner, the manufacturer shall issue a test certificate confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test.

Marking

Marking shall be cast integral on the body or on a plate securely attached to the body for 'DN' size, 'PN' rating, Heat Number and Serial number.

Painting

Each valve shall be drained, cleaned, prepared and suitable protected with 2 coats of red oxide and then black bituminous paint for minimum of 150 micron DFT on surfaces before dispatch.

Datasheet:

TAMPER PROOF AIR VALVE				
Sr	Component	PN- 1.0	PN-1.6	PN-2.0
1	Body	CI IS 210 Gr.	CI IS 210 Gr.	ASTM A216 Gr. WCB
2	Cover	CI IS 210 Gr.	CI IS 210 Gr.	ASTM A216 Gr. WCB
3	Float	SS 410	SS 304	SS 304
4	Seat	EPDM	EPDM	EPDM
5	Float Guide	SS 410	SS 304	SS 304
6	Orifice	SS 410	SS 304	SS 304
7	Gasket	EPDM	EPDM	EPDM
8	Nut Bolt	Carbon steel	Carbon steel	Stainless Steel
9	Flange End	IS 1538	IS 1538	ASME/ANSI B16.5 Class

Erection of Air valve riser**1.0 SUPPLY OF MATERIAL**

- 1.1 G.I. HD pipe shall be supplied and carted by the contractor. The rate shall include loading, unloading and stacking at site.
- 1.2 The G.I. HD pipe shall be examined before erecting for cracks and other flows.

They shall be undamaged in all respect.

- 1.3 The G.I. HD pipe shall be properly checked before erecting.
- 1.4 All grits and foreign materials shall be removed from the inside of G.I. HD pipe before erecting.
- 1.5 All the faces of pipe shall be thoroughly cleaned

2.0 JOINTING MATERIAL

- 2.1 The contractor shall provide all necessary jointing materials such as nuts bolts, rubber packing white zinc jute lead wool etc.
- 2.2 All tools and plant required for installation of sluice valve shall be provided by the contractor.
- 2.3 All jointing materials shall be approved from the engineer-in-charge before use
- 2.4 The nut and bolts shall conform to Item No MSP-19 of specification of materials.
- 2.5 The rubber packing shall confirm all specifications as narrated in Item No MSP-20 of specifications of materials.

Specifications for Air Riser for Pipeline are as under:

The work of air valve riser shall be carried as per drawing attached Column/ Footings for Air riser pipe shall be carried out in cement concrete M-200 using trap metal as per instructions and workmanship of the engineering in charge. Materials and workmanship shall be given in concrete section." The reinforcement as per IS Standard and specifications. The item Air Valve raising includes the cost of providing and laying cement concrete M-200 base MS clamps, GI H. pipe, M.S. flange, nut, bolts, rubber packing and cement concrete column in M-200 etc. complete. The payment for Air valve shall be on number basis.

Item No.12:

Lowering, laying and jointing in position following CI / D/F Reflux valves, Butterfly valves, Sluice valves and Air valves including cost of all labour, jointing material, including nut bolts and giving satisfactory hydraulic testing, etc. complete.

FIXING OF AIR VALVE:

Fixing of cast iron air valve including loading, unloading carting from store to site, drilling and treading, wherever necessary including all jointing materials testing etc. complete.

The air valve shall be opened out cleaned and greased and checked properly before fixing. Before fixing the air valve shall be observed for any damage during transit.

Jointing Materials:

The contractor shall provide all jointing materials such as G.I. Nipple, M.S. Clamps, nuts, bolts grease white zinc, rubber packing etc.

All tools and plant required for fixing air valves shall be provided by the contractor.

All the jointing materials shall be got approved from the Engineer-in-charge before use. The nuts and bolts shall conform to latest I.S.S

The rubber packing shall be of good quality and approved by the engineer-in- charge of the work. It shall be three ply of approved thickness. The packing shall be of full diameter of flange with necessary holes and control valve bore. It shall be of even thickness of both inner and outer edges.

M.S. clamps shall be in two semi-circular pieces out of two coupling welded, suitable to the threads and size of single acting air valve.

Fittings:

The air valve shall be lowered into the trench, carefully, so that no part is damaged during lowering operation.

Double acting air Valve

The flanges of the air valve and tail pieces or pipe shall be properly cleaned and greased or applied with white zinc.

The rubber packing of approved quality and of required size shall be inserted on faces of air valve.

If flange faces are not true the contractor shall use thin fiber of lead wool at his own cost.

After placing the rubber packing the nuts and bolts shall be inserted and tightened evenly on all sided properly.

Each bolt shall be tightened a little at a time taking care to tighten diametrically opposite holes alternatively.

Testing:

The air valve shall be tested during the testing of the pipe line. The joints and air valve shall be water tight.

During test if the joint or air valve, found leaking, the same shall be re- done to the entire satisfaction of Engineer-in-charge.

Mode of measurement of payment:

The measurement shall be size wise per number and payment shall be made per number of valve fitted.

30 percent of amount shall be withheld for hydraulic test and shall be released after satisfactory hydraulic test.

In case of zero velocity valves, Air cushion valves & pressure relief valves shall be tested while running of the pipe line.

The measurement shall be taken for number of valve of specified size 30% Amount shall be withheld for hydraulic test and same shall be released after satisfactory hydraulic test.

Providing, supplying and fixing U PVC ball Valves with compression end on one side to connect PE Pipes and female threading on the other side for connecting BSP threaded fittings or pipes. The product shall confirm to ISO 4422-4 Standards. The rate shall be inclusive of all taxes, insurance, transportation etc. complete.

(i) 20 mm dia. (ii) 32 mm dia. (iii) 50 mm dia. (iv) 63 mm dia.

The U PVC ball Valves will have Compression end on one side to connect PE Pipes and female threading on the other side for connecting BSP threaded fittings or pipes. The product shall confirm to ISO 4422-4 Standards and pressure rating will be PN 16. The product should be suitable for use in drinking water for human consumption.

Body, Nut and Thrust Ring will be injection molded from Polypropylene and UV stabilized body & thrust ring black in color, Nut blue in color Lip gaskets / O Ring in Food safe Rubber (NBR) black color must have a conical shape on inside of gasket for easy insertion of pipe & with two lips on bottom to guarantee good sealing. Use of O ring not permitted Clamp ring material will be Poly acetal (POM) white coloured and shall not be connected to thrust ring.

The Compression Fittings & U PVC Ball Valves for drinking water applications should have undergone type test by WRc-NSF, U.K. according to BS 6920 and a certificate from either WRc-NSF or WRAS (Water Regulations Advisory Scheme) should be available evidencing this fact.

The payment shall be made as per number basis.

Item No.13: Cutting of DI pipe line

Pipe cutting

For the installation of bends, branches and valves pipelines require pieces of pipes of varying lengths, the exact length can only be determined on the site and one must be able to cut of the pipes easily ,quickly and safely.

Cutting machines

Today abrasive disc cutters with various kinds of power supply are use to cut ductile iron pipes. These cutters are powered by electric or compressed air connections or they can be driven indirectly by internal combustion engines. Many of the abrasive disc cutters in the market can be fitted with both abrasive cut off discs for cutting and with roughing discs for rounding off the cut edges. If only one machine is available on site then should be suitable for both types of discs.

STAGES IN CUTTING OPERATION

the pipe should be placed on level ground or on square timbers in such a way that during cutting, the cutting disc does not become jammed and the remaining pipe wall does not prematurely break away.

Making: a line marked all around the pipe facilitates a straight cut. The line is simply drawn along a still band which is band around the pipe.

Cutting: using the cutting disc, the ductile iron and cement mortar pipe wall is cut through completely at one point. The pipe is then cut along the marked line in a single operation.

Rounding off : for jointing into sockets of the push on type, the new spigot and must be chamfered as the original spigot and . only then the spigot and can be correctly inserted in the socket without damaging the gasket or pressing it out of its seat. A roughing disc is used for chamfering.

Re coating : subsequently the bare metal surface should be recoated with zinc rich paint and a finishing layer of bitumen.

Marking the insertion depth : before assembling the joint, lines should be marked on the new spigot, showing the correct insertion depth of the spigot end in the socket.

Item No.14:

Providing , supplying and fixing M. S. Specials plain fittings like, bends, tees, reducers or any other specials as per site condition and as directed by Engineer in charge.

Ms special should be made per required dimension and shaped with excellent welding work so that no leakage will take place during testing time and other necessary work should be carried out as per directions by Engineer in charge etc. complete the payment will be measured in kg.

General Technical Specifications for CONCRETE WORKS**SCOPE**

This Specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete; form work; requirements in regard to the quality, storage, bending and fixing of reinforcement; grouting as well as mode of measurement and payment for complete works.

It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all work shall have to be carried out in accordance with the relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by Engineer from time to time. The decision of Engineer as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on Contractor and no claim whatsoever will be entertained on this account.

APPLICABLE CODES AND SPECIFICATIONS

The following specifications, standards and codes, including all official amendments / revisions and other specifications and codes referred to therein, should be considered a part of this specification. In all cases the latest issue / edition / revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

Code for Materials

- | | | |
|----|-----------------------------|---|
| 1. | IS : 269 | - Specification for 33 grade ordinary portland cement |
| 2. | IS : 455 | - Specification for portland slag cement |
| 3. | IS : 1489
(Part 1 and 2) | - Specification for portland pozzolana cement |
| 4. | IS : 8112 | - Specification for 43 grade ordinary portland cement. |
| 5. | IS : 12330 | - Specification for sulphate resisting portland cement |
| 6. | IS : 383 | - Specification for coarse and fine aggregates from natural sources for concrete. |
| 7. | IS : 432
(Part 1 and 2) | - Specification for mild steel and medium tensile steel bars and hard drawn steel wires for concrete reinforcement. |

- | | | |
|-----|------------|---|
| 8. | IS : 1786 | - Specification for high strength deformed steel bars and wires for concrete reinforcement. |
| 9. | IS : 1566 | - Specification for hard drawn steel wire fabric for concrete reinforcement. |
| 10. | IS : 9103 | - Specification for admixtures for concrete. |
| 11. | IS : 2645 | - Specification for integral cement water proofing compounds. |
| 12. | IS : 4990 | - Specification for plywood for concrete shuttering work. |
| 13. | IS : 12269 | - Specification for 53 grade ordinary portland cement. |

Code for Material Testing

- | | | |
|----|------------------------------|--|
| 1. | IS : 4031
(Parts 1 to 15) | - Methods of physical tests for hydraulic cement. |
| 2. | IS : 4032 | - Methods of chemical analysis of hydraulic cement. |
| 3. | IS : 650 | - Specifications for standard sand for testing of cement. |
| 4. | IS : 2430 | - Methods for sampling of aggregates for concrete. |
| 5. | IS : 2386
(Parts 1 to 8) | - Methods of test for aggregates for concrete. |
| 6. | IS : 3025 | - Methods of sampling and test (physical and chemical) water used in industry. |
| 7. | IS : 6925 | - Methods of test for determination of water soluble chlorides in concrete admixtures. |

Code for Materials Storage

- | | | |
|----|-----------|--|
| 1. | IS : 4082 | - Recommendations on stacking and storing of construction materials at site. |
|----|-----------|--|

Code for Concrete Mix Design

- | | | |
|----|------------------|---|
| 1. | IS : 10262 | - Recommended guidelines for concrete mix design. |
| 2. | SP : 23
(S&T) | - Handbook on Concrete Mixes. |

Code for Concrete Testing

- | | | |
|----|-----------|---|
| 1. | IS : 1199 | - Method of sampling and analysis of concrete. |
| 2. | IS : 516 | - Method of test for strength of concrete |
| 3. | IS : 9013 | - Method of making, curing and determining compressive strength of accelerated cured concrete test specimens. |
| 4. | IS : 8142 | - Method of test for determining setting time of concrete by penetration resistance. |
| 5. | IS : 9284 | - Method of test for abrasion resistance of concrete. |
| 6. | IS : 2770 | - Methods of testing bond in reinforced concrete. |

Code for Equipment

1. IS : 1791 - Specification for batch type concrete mixers.
2. IS : 2438 - Specification for roller pan mixer.
3. IS : 4925 - Specification for concrete batching and mixing plant.
4. IS : 5892 - Specification for concrete transit mixer and agitator.
5. IS : 7242 - Specification for concrete spreaders.
6. IS : 2505 - General Requirements for concrete vibrators : Immersion type.
7. IS : 2506 - General Requirements for screed board concrete vibrators.
8. IS : 2514 - Specification for concrete vibrating tables.
9. IS : 3366 - Specification for pan vibrators.
10. IS : 4656 - Specification for form vibrators for concrete.
11. IS : 11993 - Code of practice for use of screed board concrete vibrators.
12. IS : 7251 - Specification for concrete finishers.
13. IS : 2722 - Specification for portable swing weigh batchers for concrete (single and double bucket type).
14. IS : 2750 - Specification for steel scaffoldings.

Codes of Practice

1. IS : 456 - Code of practice for plain and reinforced concrete.
2. IS : 457 - Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
3. IS : 3370 (Parts 1 to 4) - Code of practice for concrete structures for storage of liquids.
4. IS : 3935 - Code of practice for composite construction.
5. IS : 2204 - Code of practice for construction of reinforced concrete shell roof.
6. IS : 2210 - Criteria for the design of reinforced concrete shell structures and folded plates.
7. IS : 2502 - Code of practice for bending and fixing of bars for concrete reinforcement.
8. IS : 5525 - Recommendation for detailing of reinforcement in reinforced concrete works.
9. IS : 2751 - Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
10. IS : 9417 - Specification for welding cold worked bars for reinforced concrete construction.
11. IS : 3558 - Code of practice for use of immersion vibrators for consolidating concrete.
12. IS : 3414 - Code of practice for design and installation of joints in buildings.
13. IS : 4326 - Code of practice for earthquake resistant design and construction of building.
14. IS : 4014 (Part 1 and - Code of practice for steel tubular scaffolding.

- 2)
15. IS : 2571 - Code of practice for laying in-situ cement concrete flooring.
16. IS : 7861 - Code of practice for extreme weather concreting.
(Part – 1) - Recommended practice for hot weather concreting.
(Part – 2) - Recommended practice for cold weather concreting.

Code for Construction safety

1. IS : 3696 - Safety code for scaffolds and ladders.
(Parts I and III)
2. IS : 7969 - Safety code for handling and storage of building materials.
3. IS : 8989 - Safety code for erection of concrete framed structures.

Code for Measurement

1. IS : 1200 - Method of measurement of building and engineering works.
(Part 1 to 28)
2. IS : 3385 - Code of practice for measurement of Civil Engineering works.

GENERAL

Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve Contractor of any of his responsibilities. All materials which does not conform to this specification shall be rejected.

Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes / standards shall generally be used, other materials may be used after approval of the Engineer and after establishing their performance suitability based on previous data, experience or tests.

MATERIALS

Cement

Unless otherwise specified or called for by the Engineer, cement shall be Ordinary Portland cement (latest edition)/SRC for entire work.

Where Portland pozzolana or slag cement are used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.

Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from Engineer.

Cement which is not used within 90 days from its date of manufacture shall be tested at a laboratory approved by Engineer and until the results of such tests are found satisfactory, it shall not be used in any work.

Aggregates (General)

General

"Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete (vide BIS 456 & BIS 383) and conforming to tests as per BIS 2386 (Part I to VI).

"Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve.

All fine and coarse aggregates proposed for use in the works shall be subject to the Engineer-in-Charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-charge.

Aggregates shall consist of crushed stone from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, durable against weathering, or limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mix design" and preliminary tests on concrete specified later. The aggregates shall be brought from the source as mentioned in Volume-I Clause C.1.39.

Sampling and testing

Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to Engineer-in-charge in advance of the work, for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by the contractor.

Storage of aggregates

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign material and earth during storage and while heaping the materials shall be avoided. The aggregates must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be piled in layers not exceeding 1.20 m in height to prevent coning or segregation. Each layer shall cover the entire area of stock pile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

Specific Gravity

Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be use

Fine Aggregate

Fine aggregate shall consist of natural or crushed sand conforming to IS 383 conforming to tests as per IS 2386 part I to IV. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities / strength/ durability of concrete.

Screening and Washing : Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.

Foreign Material limitations : The percentage deleterious substances in sand delivered to the mixer shall not exceeding the following :

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron IS sieve	3.0	15.0
2	Shale	1.0	--
3	Coal and Lignite	1.0	1.0
4	Clay Lumps	1.0	1.0

Gradation : Unless otherwise directed or approved by the Engineer-in-charge, the grading of sand shall be within the limits indicated hereunder.

IS : Sieve Designation	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
10 mm	100	100	100	100
4.75 mm	99 – 100	90 – 100	90 – 100	95 – 100
2.36 mm	60 – 95	75 – 100	85 – 100	95 – 100
1.18 mm	30 – 70	55 – 90	75 – 100	90 – 100
600 microns	15 – 34	35 – 59	60 – 79	80 – 100
300 microns	5 – 20	8 – 30	12 – 40	15 – 50
150 microns	0 – 10	0 – 10	0 – 10	0 – 15

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 microns IS sieve, by total amount not exceeding 5%, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to grading zone IV shall not be use Mix designs and preliminary tests shall show its suitability for producing concrete of specified strength and workability.

Fineness Modulus

The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.35 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by 100.

Coarse Aggregate

Coarse aggregate for concrete, except as noted above, shall conform to IS 383 and IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

Screening and Washing : Crushed rock shall be screened and or washed for the removal of dirt or dust coating, if so requested by the Engineer-in-charge.

Grading

Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits :

IS Sieve Size (mm)	Percentage passing for single sized aggregate of normal size					Percentage passing for graded aggregate of normal size			
	40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
63	100	--	--	--	--	--	--	--	--
40	85–100	100	--	--	--	95–100	100	--	--
20	0–20	85–100	100	--	--	30–70	95–100	100	100
16	--	--	85–100	100	--	--	--	90–100	--
12.5	--	--	--	85–100	100	--	--	--	90–100
10	0 – 5	0–20	0–30	0–45	85–100	10–35	25–55	30–70	40–85
4.75	--	0–5	0–5	0–10	0–20	0–5	0–10	0–10	0–10
2.36	--	--	--	--	0–5	--	--	--	--

The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability of concrete. The maximum size of coarse aggregate shall be 40 mm for M7.5 and M10 and 20 mm for M15 to M20 concrete, or as directed by the Engineer-in-charge or specified otherwise. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than $\frac{1}{4}$ th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. for heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover reinforcement whichever is smaller.

Foreign material limitations

The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following :

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron IS sieve	3.0	3.0
2	Coal and lignite	1.0	1.0
3	Clay lumps	1.0	1.0
4	Soft fragments	3.0	--

Water

Water used for both mixing and curing shall conform to IS : 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be use

Reinforcement

Reinforcement bars shall conform to IS : 432, IS : 226 or IS : 1786 and the welded wire fabric to IS : 1566 as shown or specified on the drawings. Only T.M.T. bars as for specification will be followed.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty dust or any other substance that will destroy or reduce bon

If permitted by Engineer, welding of reinforcement shall be done in accordance with IS ; 2751 or IS : 9417 as applicable.

Admixtures

Plasticizer, water-reducing add mixture and concrete water proofer shall conform to IS : 9103 and integral water proofing admixtures to IS : 2645. Dosage of plasticizer used in concrete work shall be 300 ml / 50 kg of cement. Manufacturer must comply ISO-9002 specifications.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of Engineer based upon evidence that with the passage of time neither the compressive strength nor its durability is reduce An admixture's suitably and effectiveness shall be verified by trial mixes with the other material used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedment.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

Wastage

No wastage allowance for cement and steel shall be considered and paid for.

SAMPLES AND TESTS

All materials used for the works shall be tested before use.

Manufacturer's test certificate shall be furnished, for each batch of cement / steel and when directed by Engineer samples shall also be got tested by the Contractor in a laboratory approved by Engineer at no extra cost to Client. However, where material is supplied by Client, all testing charges shall be borne by Client; but transportation of material samples to the laboratory shall have to be done by Contractor at no extra cost.

Sampling and testing shall be as per IS : 2386 under the supervision of Engineer. The cost of all tests, sampling etc. shall be borne by Contractor.

Water to be used shall be tested to comply with requirement of IS : 456.

Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be use If directed the admixture shall be got tested and approved laboratory at no extra cost.

STORING OF MATERIALS

All material shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS : 4082 shall be complied with.

Contractor will have to make his own arrangements for the storage of adequate quantity of cement even if cement is supplied by Client. Cost of such rejected cement, where cement is supplied by Client, shall be recovered at issue rate or open market rate which ever is higher. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by Engineer. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order or receipt.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground / water. Each type and size shall be stacked separately.

CONCRETE

General

Concrete grade shall be as designated on drawings. In concrete grade M15, M20, M25 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS : 456. Concrete in the works shall be "**Design Mix Concrete**" or "**Normal Mix Concrete**". All concrete works of **grade M5**,

M7.5 and M10 shall be Nominal whereas all other grades, M15 and above, shall be Design Mix Concrete.

Design Mix Concrete

Mix Design and Testing

For Design Mix Concrete, the mix shall be designed according to IS : 10262 and SP: 23 to provide the grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS : 456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For water retaining structures, the mix shall also result in water-tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

Unless otherwise specifically mentioned, the minimum cement content for Design Mix Concrete shall be as given below.

Grade of Concrete	Minimum Cement Content in Kg/Cu.m of concrete
M15	290
M20	360
M25	380
M30	410
M35	425

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventually and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

It shall be Contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to Engineer at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS : 516 shall comply with the requirements of IS : 456.

Grade of Concrete	Minimum Compressive Strength (N/Sq.mm at 7 days)	Specified compressive strength (N/Sq.mm at 28 days)
M 15	10.0	15.0
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0

A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer is given below :

Structure / Member	Slump in millimeters	
	Maximum	Minimum
Reinforced foundation walls and footings	75	25
Plain footings, caissons and substructure walls	75	25
T.G. and massive compressor foundations	50	25
Slabs, beams and reinforced walls	100	25
Pumps and miscellaneous equipment foundations	75	25
Building columns	100	25
Pavements	50	25
Heavy mass construction	50	25

Batching and Mixing of Concrete

Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water cement ratio specified shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

Arrangement should be made by Contractor to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of Engineer. Sampling and testing of strength and workability of concrete shall be as per IS : 1199, IS : 516 and IS : 456.

Nominal Mix Concrete

Mix Design and Testing

Mix design and preliminary tests are not necessary for Nominal mix Concrete. However works tests shall be carried out as per IS : 456. Proportions for Nominal Mix Concrete and **water / cement ratio may** be adopted as per Table 3 of IS : 456. However it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

Batching and Mixing Concrete

Based on the adopted nominal mixes, aggregates and cement shall be measured by weight.

FORM WORK

Form work shall be all inclusive and shall consist of but not limited to shores, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, falsework, wedges etc.

The design and engineering of the formwork as well as its construction shall be the responsibility of Contractor. However, if so desired by Engineer the drawings and calculations for the design of the formwork shall be submitted to Engineer for approval.

Formwork shall be designed to fulfill the following requirements :

- a) Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.
- b) Made of suitable materials.
- c) Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits.
- d) Capable of withstanding without deflection the worst combination of self weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
- e) Capable of easily striking without shock, disturbance or damage to the concrete.
- f) Soffit forms capable of imparting a camber if require
- g) Soffit forms and supports capable of being left in position if require
- h) Capable of being cleaned and / or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.

The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip form may be used with the approval of Engineer. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, work holes, warps and other surface defects. Joints between formwork and formwork and between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.

The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.

Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of Engineer. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.

Permanent formwork shall be checked for its durability and capability with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.

Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair

the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.

For liquid retaining structures sleeves shall not be provided for through bolts or shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.

Where specified or shown on drawings, all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size.

Forms for substructure may be omitted when, in the opinion of Engineer, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations shall be slightly larger, as directed by Engineer, than that required as per drawing to compensate for irregularities in excavation.

The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.

The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for a column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side limit the drop of concrete to 1.0 m or as directed by Engineer. The Contractor shall temporarily and securely fix items to be cast in (embedments / inserts) in a manner that will not hinder the striking of forms or permit loss of grout.

Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty form work, shall be entirely removed and formwork corrected prior to placement of new concrete at the cost of the Contractor.

The striking time for formwork shall be determined based on following requirements :

- a) Development of adequate concrete strength;
- b) Permissible deflection at time of striking form work;
- c) Curing procedure employed – its efficiency and effectiveness;
- d) Subsequent surface treatment to be done;
- e) Prevention of thermal cracking at re-entrant angles;
- f) Ambient temperature; and
- g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).

Under normal circumstances (generally where temperatures are above 20 Deg. C) forms may be struck after expiry of the time period given in IS : 456, unless directed otherwise by Engineer. For portland pozzolona / slag cement the stripping time shall be suitably modified as directed by the Engineer. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not undergo excessive deformation and resist surface damage and any stresses arising during the construction period.

Reinforcement Workmanship

Reinforcing bars supplied bent or in coils shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg. C. Local warming may be permitted if steel is kept below 100 Deg. C.

All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings / schedules or as directed by Engineer.

Re-bending or straightening incorrectly bent bars shall not be done without approval of Engineer.

Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.

Binding wire shall be 16 gauge soft annealed wire. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

Substitution of reinforcement, laps / splices not shown on drawing shall be subject to Engineer's approval.

TOLERANCES

Tolerance for formed and concrete dimensions shall be as per IS : 456 unless specified otherwise.

Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

PREPARATION PRIOR TO CONCRETE PLACEMENT

Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets etc. provide

All arrangements formwork, equipment and proposed procedure, shall be approved by Engineer. **The Contractor shall maintain separate Pour Card for each pour as per the format enclosed** and shall produce before commencement of concreting to Engineer-in-charge.

TRANSPORTING, PLACING AND COMPACTING CONCRETE

Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

In all cases concrete shall be deposited as nearly as practicable directly in its final position. To avoid segregation concrete shall not be rehandled or caused to flow. For locations where direct placement is not possible and in narrow forms. The Contractor shall provide

suitable drops and 'Elephant Trunks'. Concrete shall not be dropped from a height of more than 1.0 m as stipulated in clause 13.8.13.

Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and shall never be allowed to fall freely through the water.

While placing concrete the Contractor shall proceed as specified below and also ensure the following :

- a) Continuously between construction joints and predetermined abutments.
- b) Without disturbance to forms or reinforcement.
- c) Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.
- d) Without dropping in a manner that could cause segregation or shock.
- e) In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.
- f) Do not place if the workability is such that full compaction cannot be achieved.
- g) Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the lining progressively as concrete is placed.
- h) If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.
- i) Ensure that there is no damage or displacement to sheet membranes.
- j) Record the time and location of placing structural concrete.

Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set. Over vibration shall be avoided.

Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by Engineer. The slump shall be held to the minimum necessary for conveying concrete by this method. When concrete is to be pumped concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

Except when placing with slip forms, each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as determined by Engineer. Concrete shall be protected against damage until final acceptance.

MASS CONCRETE WORKS

Sequence of pouring for mass concrete works shall be as approved by Engineer. The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

CURING

Curing and protection shall start immediately after the compaction of the concrete to protect it from :

- (a) premature drying out, particularly by solar radiation and wind;
- (b) leaching out by rain and flowing water;
- (c) rapid cooling during the first few days after placing;
- (d) high internal thermal gradients;
- (e) low temperature of frost;
- (f) vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

All concrete, unless directed otherwise by Engineer, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of sacking, canvas, hessian or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

Where a curing membrane is directed to be used by the Engineer, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be got approved from the Engineer before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

Extra precautions shall be exercised in curing concrete during cold and hot weather.

CONSTRUCTION JOINTS AND KEYS

Construction joints will be as shown on the drawing or as approved by Engineer. Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approved of Engineer.

Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as directed by Engineer.

Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing / hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical joints and a 15 mm thick layer of cement sand mortar for horizontal layers, the ratio of cement and sand being the same as in the concrete mix.

When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this a layer of concrete not exceeding 150 mm thickness shall

be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

FOUNDATION BEDDING

All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy area shall be cleaned out and back filled with either soil cement mixture, lean concrete or clean sand compacted as directed by Engineer. The surfaces of absorptive soils shall be moistened.

Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

FINISHES

General

The formwork for concrete works shall be such as to give the finish as specified. The Contractors shall make good as directed any unavoidable defects consistent with the type of concrete and finish specified; defects due to bad workmanship (e.g. damaged or misaligned forms, defective or poorly compacted concrete) will not be accepted. The Contractor shall construct the formwork using the correct materials and to meet the requirements of the design and to produce finished concrete to required dimensions, plumbs, planes and finishes.

Surface finish Type F1

This type of finish shall be for non-exposed concrete surface against which back fill or concrete is to be place The main requirement is that of dense, well compacted concrete. No treatment is required except repair of defective areas, filling all form tie holes and cleaning up of loose or adhering debris. For surfaces below grade which will receive waterproofing treatment the concrete shall be free of surface irregularities which could interfere with proper and effective application or waterproofing material specified for use.

Surface finish Type F2

This type of finish shall be for all concrete work which will be exposed to view upon completion of the job. The appearance shall be that of a smooth dense, well-compacted concrete showing the slight marks of well fitted shuttering joints. The Contractor shall make good any blemishes.

Surface finish Type F3

This type of finish shall be for concrete work which will be exposed to view but to give an appearance of smooth, dense, well-compacted concrete with no shutter marks, stain free and with no discoloration, blemishes, arrises, air holes etc. Only lined or coated plywood with very tight joints shall be used to achieve this finish. The panel size shall be uniform and as large as practicable. Any minor blemishes that might occur shall be made good by Contractor.

Integral cement finish on concrete floor

In all cases where integral cement finish on a concrete floor has been specified, the top layer of concrete shall be screened off to proper level and tamped with tamper having conical projections so that the aggregate shall be forced below the surface. The surface shall be finished with a wooden float and a trowel with pressure. The finish shall be continued till the concrete reaches its initial set. No cement or cement mortar finish shall be provided on the surface. Where specified, a floor hardener as approved by the Engineer shall be supplied and used as recommended by the manufacturer.

REPAIR AND REPLACEMENT OF UNSATISFACTORY CONCRETE

Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be brought to the notice of Engineer who may permit patching of the defective areas or reject the concrete work.

All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

Rejected concrete shall be removed and replaced by Contractor at no additional cost to Client.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as directed by the Engineer.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the Engineer as to the method of repairs to be adopted shall be final and binding on the Contractor and no extra claim shall be entertained on this account. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as directed by Engineer.

VACUUM DEWATERING OF SLABS

Where specified floor slabs, either on grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum

processing, floating and trowelling as per equipment manufacturers recommendation. The equipment to be used shall be subject to Engineer's approval.

HOT WEATHER REQUIREMENTS

Concreting during hot weathers shall be carried out as per IS : 7861 (Part – I)

Adequate provisions shall be made to lower concrete temperatures which shall not exceed 40 Deg. C at the time of placement of fresh concrete.

Where directed by Engineer, Contractor shall spray non-wax based curing compound of unformed concrete surfaces at no extra costs.

COLD WEATHER REQUIREMENTS

Concreting during cold weather shall be carried out as per IS : 7861 (Part-II).

The ambient temperature during placement and upto final set shall not fall below 5 Deg. C. Approved antifreeze / accelerating additives shall be used where directed.

For major and large scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the formwork and its insulation and stripping period shall be closely monitored.

LIQUID RETAINING STRUCTURES

The Contractor shall take special care of concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

The minimum level of surface finish for liquid retaining structures shall be type F2. All such structures shall be hydro-teste

The Contractor shall include in his price of hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipelines etc.

Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement / epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer. All such rectification of the Client / Engineer at no extra cost to the Client.

TESTING CONCRETE STRUCTURES FOR LEAKAGE

Hydro-static test for water tightness shall be done at full storage by Engineer, as described below :

In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period of seven days shall be taken as an indication of the water tightness of the structure. The Engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account weather the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

Each compartment / segment of the structure shall be tested individually and then all together.

For structures such as pipes, tunnels etc. the hydro-static test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

OPTIONAL TESTS

If Engineer feels that the materials i.e. cement, sand coarse aggregates, reinforcement and water are not in accordance with the specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer, as per relevant IS Codes. Client shall pay only for the testing of material supplied by the Client, otherwise Contractor shall have to pay for the tests. Transporting of all material to the laboratory shall however be done by the Contractor at no extra cost to Client.

In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, Engineer reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. All these tests shall be carried out by Contractor at no extra cost to the Client. Alternatively Engineer also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work at the cost of Contractor.

If the structure is certified by Engineer as having failed, the cost of the test and subsequent dismantling / reconstruction shall be borne by Contractor.

The quoted unit rates / prices of concrete shall be deemed to provide for all tests mentioned above.

GROUTING

Grout shall be provided as specified on the drawings. The proportion of standard Grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. Surface to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted, shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by ENGINEER. The grout proportions shall be limited as follows :

	Use	Grout Thickness	Mix Proportions	W/C Ratio (max.)
a)	Fluid mix	Under 25 mm	One part Portland cement to one part sand	0.44
b)	General mix	25 mm and over but less than 50 mm	One part Portland cement to 2 part sand	0.53
c)	Stiff mix	50 mm and over	One part Portland cement to 3 part sand	0.53

Non Shrink Grout

Non-shrink grout where called for in the Schedule of Quantities or specified on the drawings shall be provided in strict accordance with the manufacturer's instructions/specifications on the drawings.

INSPECTION

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of Engineer. Materials rejected by Engineer shall be expressly removed from site and shall be replaced by Contractor immediately at no extra cost to Client.

CLEAN-UP

Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood etc. resulting from the work shall be removed and the premises left clean.

ACCEPTANCE CRITERIA

Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

- Properties of constituent materials;
- Characteristic compressive strength;
- Specified mix proportions;
- Minimum cement content;
- Maximum free-water / cement ratio;

- f) Workability;
- g) Temperature of fresh concrete;
- h) Density of fully compacted concrete;
- i) Cover to embedded steel;
- j) Curing;
- k) Tolerances in dimensions;
- l) Tolerances in levels;
- m) Durability;
- n) Surface finishes;
- o) Special requirements such as :
 - i) water tightness;
 - ii) resistance to aggressive chemicals
 - iii) resistance to freezing and thawing
 - iv) very high strength
 - v) improved fire resistance
 - vi) wear resistance
 - vii) resistance to early thermal cracking

The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding of the Contractor.

For work not accepted, the Engineer may review and decide whether remedial measures are feasible so as to render the work acceptable. The Engineer shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor. Nothing extra shall become payable to the Contractor by the Client for executing the remedial measures.

MODE OF MEASUREMENT AND PAYMENT

The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts, etc. shall be entertained unless separately provided for in the schedule of quantities. No extra claim shall also be entertained due to change in the number, position and / or dimensions of holes, slots or openings, sleeves, inserts or on account of any increased lift, lead of scaffolding etc. All these factors should be taken into consideration while quoting the unit rates. Unless provided for in the Schedule of Quantities the rates shall also include fixing insets in all concrete work, whenever required.

Payments for concrete will be made on the basis of unit rates quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.100 of a sq.m in areas where concrete is measured in sq.m and 0.010 cu.m where concrete is measured in cu.m. Where no such deduction for concrete is made, payment for shuttering work provided for such holes, pockets, etc. will not be made. Similarly the unit rates for concrete work shall be inclusive or exclusive of shuttering as provided for in the Schedule of Quantities.

Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned up to the underside of slab / beams.

The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including setting mortar, provision of lifting arrangement etc. complete. Reinforcement and inserts shall be measured and paid for separately under respective item rates.

Only the actual quantity of steel embedded in concrete including laps as shown on drawings or as approved by Engineer shall be measured and paid for, irrespective of the level or height at which the work is done. The unit rates for reinforcement shall include lap chairs, spacer bars etc.

Where the formwork is paid for separately, it shall be very clearly understood that payment for formwork is inclusive of formwork, shuttering, shoring, propping scaffolding etc. complete. Only the net area of concrete formed (shuttered) shall be measured for payment.

SPECIFICATIONS FOR ESR ON EPC BASIS

1 Design Submissions

- 1.1 Complete detailed design calculations of foundations and superstructure together with general arrangement drawings and explanatory sketches shall be submitted to EMPLOYER. Separate calculations for foundations or superstructures submitted independent of each other shall be deemed to be incomplete and will not be accepted by EMPLOYER.
- 1.2 The design considerations described hereunder establish the minimum basic requirements of plain and reinforced concrete structures, masonry structures and structural steel works. However, any particular structure shall be designed for the satisfactory performance of the functions for which the same is being constructed. The Contractor shall also take care to check the stability of partly completed structures.

2 Design Standards

- 2.1 All designs shall be based on the latest Indian Standard (I.S.) Specifications or Codes of Practice. The design standards adopted shall follow the best modern engineering practice in the field based on any other international standard or specialist literature subject to such standard reference or extract of such literature in the English language being supplied to and approved by EMPLOYER. In case of any variation or contradiction between the provisions of the I.S. Standards or Codes and the specifications given along with the submitted tender document, the provision given in this Specification shall be followed.
 - 2.1.1 All reinforced concrete structural design shall generally conform to the following publications of the Indian Standards Institution :

I.S. 456	Code of Practice for plain and reinforced concrete
I.S. 875	Code of Practice for design loads for buildings and structures (Part 1 to 5)
I.S. 3370	Code of Practice for concrete structures for the storage of liquids (Part I to IV)
I.S. 1893	Criteria for earthquake resistant design of structures
I.S. 2974	Code of Practice for design and construction of machine foundations (Part 1 to 4)
I.S. 2309	Code of Practice for projection of building and allied structure against lightening
 - 2.1.2 All structural steel design shall generally conform to the following publications of the Indian Standards Institution :

I.S. 800:	Code of Practice for general construction in steel
I.S. 806:	Code of Practice for use of steel tubes in general building construction

3 Design Life

The design life of all structures and buildings shall be 60 years.

4 Design Loading

The structure shall be designed to resist the worst combination of the following loads / stresses under test and working conditions; these include dead load, live load, wind load, seismic load, stresses due to temperature changes, shrinkage and creep in materials, impact load and other specific loads.

4.1 Dead Load

This shall comprise all permanent construction including walls, floors, roofs, partitions, stairways, fixed service equipment etc.

The following minimum loads shall be considered in design of structures :

- | | | | |
|-------|---|---|--|
| (i) | Weight of water | : | 9.81 kN/m ³ |
| (ii) | Weight of soil (irrespective of strata available at site and type of soil used for filling etc). However, for checking stability against uplift, actual weight of soil as determined by field test shall be considered. | : | 20.00 kN/m ³ |
| (iii) | Weight of plain concrete | : | 24.00 kN/m ³ |
| (iv) | Weight of reinforced concrete | : | 25.00 kN/m ³ |
| (v) | Weight of brickwork (exclusive of plaster) | : | 22.00 N/m ² per mm thickness of brickwork |
| (vi) | Weight of plaster to masonry surface | : | 15.00 N/m ² per mm thickness |
| (vii) | Weight of granolithic terrazzo finish or rendering screed, etc. | : | 24.00 N/m ² per mm thickness |

4.2 Live Load

Live loads shall be in general as per I.S. 875. However, the following minimum loads shall be considered in the design of structures:

- | | | | |
|-------|--|---|-------------------------|
| (i) | Live load on roofs (accessible) | : | 50 kN/m ² |
| | (Non-accessible) | : | 0.75 kN/m ² |
| (ii) | Live load on floors supporting equipment such as pumps, blowers, compressors, valves, etc. | : | 10.00 kN/m ² |
| (iii) | Live load on all other floors walkways, stairways and platforms. | : | 5.00 kN/m ² |

In the absence of any suitable provisions for live loads in I.S. Codes or as given above for any particular type of floor or structure, assumptions made must receive the approval of EMPLOYER prior to starting the design work. Apart from the specified live loads or any other load due to material stored, any other equipment load or possible overloading during maintenance or erection / construction shall be considered and shall be partial or full whichever causes the most critical condition.

4.3 Wind Load

Wind loads shall be as per I.S. 875.

4.4 Earthquake Load

This shall be computed as per I.S. 1893. An importance factor (Min. 5) appropriate to the type of structure shall be considered for design of all the structures.

5 Joints

- 5.1 Movement joints such as expansion joints, complete contraction joints, partial contraction joints and sliding joints shall be designed to suit the structure. However, contraction joints shall be provided at specified locations spaced not more than 7.5 m in both right angle directions for all walls and rafts.
- 5.2 Expansion joints of suitable gap at suitable intervals not more than 30 m shall be provided in all walls, floors and roof slabs of water retaining structures.
- 5.3 Construction joints shall be provided at right angles to the general direction of the member. The locations of construction joints shall be decided on convenience of construction. To avoid segregation of concrete in walls, horizontal construction joints are normally to be provided at every 2-m height. PVC waterstops of 150 mm width shall be used for walls and 230 mm width for base slabs.
- 5.4 Expansion joints for non liquid retaining structures shall be provided as per IS 3414.

6 Design Conditions

- 6.1 All liquid containing structures shall be designed for the following conditions :
 - (i) liquid depth to be considered up to full height of wall and no relief due to soil pressure from other side to be considered.
 - (ii) structure empty condition (i.e., empty of liquid, any material, etc.) : full earth pressure with saturation and surcharge pressure wherever applicable, to be considered.
 - (iii) partition wall between dry sump and wet sump : to be designed for full liquid depth up to full height of wall.
 - (iv) partition wall between two compartments : to be designed as one compartment empty and other full for both the directions.
 - (v) structures shall be designed for uplift in empty conditions with no live load with the appropriate water table.
 - (vi) walls shall be designed under operating conditions to resist earthquake forces from earth pressure mobilisation and dynamic water loads.

- (vii) underground or partially underground structures shall also be checked against stresses developed due to any combination of full and empty compartments with appropriate ground/uplift pressures from below to base slab. A minimum factor of 2 shall be ensured against uplift or floatation.

7 Foundations

- (i) The minimum depth of foundations for all structures, equipment, buildings and frame foundations and load bearing walls shall be as per IS 1904.
- (ii) Maximum safe bearing capacity of soil strata shall be taken as indicated in geotechnical reports.
- (iii) Care shall be taken to avoid the foundations of adjacent buildings or structure foundations, either existing or not within the scope of this Contract. Suitable adjustments in depth, location and sizes may have to be made depending on site conditions. No extra claims for such adjustments shall be accepted by EMPLOYER.
- (iv) Special attention is drawn to danger of uplift being caused by the ground water table. All underground structural slab shall be designed for uplift forces due to ground water pressure.
- (v) Where there is level difference between the natural ground level & the foundations of structure or floor slabs, this difference shall be filled up in the following ways:
 - In case of non-liquid retaining structures the natural top soil shall be removed till a firm strata is reached (minimum depth of soil removed shall be 500 mm.) and the level difference shall be made up by compacted backfill as per specifications. However the thickness of each layer shall not exceed 150 mm. The area of backfilling for floor slabs shall be confined to prevent soil from slipping out during compaction. The safe bearing capacity of this well compacted backfilled soil shall not exceed 100 kN/sq.m.
 - In case of liquid retaining structures, the natural top soil shall be removed as described above and the level difference shall be made up with Plain Cement Concrete (1:5:10)

8 Design Requirements for ESR

- 8.1 The following are the design requirements for all reinforced or plain concrete structures :
 - a) Capacity of the container of the tank shall be the volume of the water it can store between the designed full supply level (F.S.L.) and lowest supply level (L.S.L.) i.e. the level of the lip of the outlet pipe. Due allowance shall be made for 20 mm thick plastering the tank from inside, while calculating the capacity of the tank.
 - b) Height of the staging or height of the tower shall be the vertical difference between L.S.L. of the tank and the average ground level at the site of tank.
 - c) Dead storage shall be the storage capacity of water below L.S.L. depth of dead storage shall be the vertical distance between the top outlet level and wash out level. The washout pipe level shall be at the lowest portion of the container.

- d) Minimum depth of water for dead storage shall be 100 mm even for flat bottom slab and not more than 300 mm for inlet i.e bottom dome slab type tank.
- e) All blinding and leveling concrete shall be a minimum 150 mm thick in concrete grade 1:3:6.
- f) All structural reinforced concrete for water retaining structures shall be of a minimum M30 grade with a maximum 20 mm aggregate size for footings and base slabs and with a maximum 20 mm aggregate size for all other structural members. The structures shall have to be designed as per IS : 3370 (Part I-IV).
- g) The reinforced concrete for water retaining structures shall have a minimum cement content of 410 kg/m³ with a maximum 20 mm size aggregate and 360 kg/m³ with a maximum 40 mm size aggregate as per IS : 3370 (Part I-IV).
- h) The minimum reinforcement for water retaining structures in each direction should be 0.35% of cross section. The minimum clear cover to all reinforcement including stirrups and links shall be 50 mm for all water retaining structures.
- i) All pipes & conduits laid below the structural plinth & road works shall be embedded in reinforced concrete of grade M15 of minimum thickness 150 mm.
- j) Approved quality water proofing compound (chloride free) shall be added during concreting of all liquid containing structure in the proportions specified by manufacturer or 2 % by weight of cement whichever is higher.
- k) If limit state design method is adopted, as per IS 3370-latest revision, at serviceability load maximum stress in reinforcement shall not exceed 0.8fy (where fy is characteristic strength of reinforcement)
- The wall and floor panels shall be poured in sequential order with a minimum time gap of 4 days.

The following minimum thickness shall be used for different reinforced concrete members, irrespective of design thickness for elevated service reservoir :

Sr. No.	Concrete Component	Thickness/Size
	Top Dome / Roof Slab	100 mm
2.	Bottom Dome / Bottom Slab	150 mm
3.	Conical Wall/Slant	250 mm
4.	Vertical Wall	Av. 200 mm
5.	Walkway Platform	125 mm
6.	Column Diameter	500 mm
7.	Supporting Shaft Thickness	200 mm
8.	Top Ring beam	250 x 250 mm or equivalent area
9.	Bottom Ring beam	450 x 600 mm or equivalent area
10.	Middle Ring beam	400 x 400 mm or equivalent area

- Beam projections inside container will not be allowed.

The depth of foundation shall be as per the geo-technical report.

9 Materials in General

- 9.1 The term "materials" shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment and plant of every kind to be supplied by the Contractor for incorporation in the Works.
- 9.2 Except as may be otherwise specified for particular parts of the works the provision of clauses in "Materials and Workmanship" shall apply to materials and workmanship for any part of the works.
- 9.3 All materials shall be new and of the kinds and qualities described in the Contract and shall be at least equal to approved samples.
- 9.4 As soon as practicable after receiving the order to commence the Works, the Contractor shall inform EMPLOYER of the names of the suppliers from whom he proposes to obtain any materials but he shall not place any order without the approval of EMPLOYER which may be withheld until samples have been submitted and satisfactorily teste The Contractor shall thereafter keep EMPLOYER informed of orders for and delivery dates of all materials.
- 9.5 Materials shall be transported, handled and stored in such a manner as to prevent deterioration, damage or contamination failing which such damaged materials will be rejected and shall not be used on any part of the Works under this contract.

10 Samples and Tests of Materials

- 10.1 The Contractor shall submit samples of such materials as may be required by EMPLOYER and shall carry out the specified tests directed by EMPLOYER at the Site, at the supplier's premises or at a laboratory approved by EMPLOYER. EMPLOYER may appoint separate third party inspection for the material testing to ensure the quality of the work. The Contractor shall replace the defective material as an outcome of these tests.
- 10.2 Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by EMPLOYER.
- 10.3 The Contractor shall give EMPLOYER seven days' notice in writing of the date on which any of the materials will be ready for testing or inspection at the supplier's premises or at a laboratory approved by EMPLOYER. Representative of EMPLOYER shall attend the test at the appointed place within seven days of the said date on which the materials are expected to be ready for testing or inspection according to the Contractor, failing which the test may proceed in his absence unless instructed by EMPLOYER to carry out such a test on a mutually agreed date in his presence. The Contractor shall in any case submit to EMPLOYER's Representative within seven days of every test such number of certified copies (minimum six) of the test results as EMPLOYER may require.

- 10.4 Approval by EMPLOYER as to the placing of orders for materials or as to samples or tests shall not prejudice any of EMPLOYER's powers under the Contract.
- 10.5 The provisions of this clause shall also apply fully to materials supplied under any nominated sub-contract.

11 Standards

- 11.1 Materials and workmanship shall comply with the relevant Indian Standards (with amendments) current on the date of submission of the tender.
- 11.2 Where the relevant standard provides for the furnishing of a certificate to EMPLOYER, at his request, stating that the materials supplied comply in all respects with the standard, the Contractor shall obtain the certificate and forward it to EMPLOYER.
- 11.3 The specifications, standards and codes listed below are considered to be part of this Bid specification. All standards, specifications, codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions.
- 11.4 In case of discrepancy between the Bid Specification and the Standards referred to herein, the Bid Specification shall govern.

a) Materials

IS : 269	Specification for 33 grade ordinary Portland cement
IS : 383	Specification for coarse and fine aggregates from natural sources for concrete
IS : 428	Specification for distemper, oil emulsion, colour as required
IS : 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement (Parts 1 & 2)
IS : 455	Specification for Portland slag cement
IS : 458	Specification for precast concrete pipes(with and without reinforcement)
IS : 650	Specification for standard sand for testing of cement
IS : 651	Specification for salt glazed stoneware pipes and fittings
IS : 777	Specification for glazed earthenware tiles
IS : 808	Specification for dimensions for hot rolled steel beam, column, channel and angle sections
IS : 814	Specification for covered electrodes for manual metal arc welding of Carbon and Carbon Manganese steel
IS : 1003	Specification for timber paneled and glazed shutters(Parts 1 & 2)
IS : 1038	Specification for steel doors, windows and ventilators
IS : 1077	Specification for common burnt clay building bricks
IS : 1398	Specification for packing paper, water proof, bitumen laminated
IS : 1489	Specification for Portland pozzolana cement (Parts 1 & 2)
IS : 1566	Specification for hard drawn steel wire fabric for concrete reinforcement
IS : 1580	Specification for bituminous compounds for water proofing and caulking purposes

IS : 1786	Specification for high strength deformed steel bars and wires for concrete reinforcement
IS : 1852	Specification for rolling and cutting tolerances for hot rolled steel products
IS : 1948	Specification for aluminium doors, windows and ventilators
IS : 1977	Specification for structural steel (ordinary quality)
IS : 2062	Specification for steel for general structural purposes
IS : 2185	Specification for concrete masonry units (Parts 1 & 2)
IS : 2202	Specification for wooden flush door shutters (Parts 1 & 2)
IS : 2645	Specification for integral cement water proofing compounds
IS : 2750	Specification for steel scaffoldings
IS : 2835	Specification for flat transparent sheet glass
IS : 3384	Specification for bitumen primer for use in waterproofing and damp roofing
IS : 3502	Specification for steel chequered plates
IS : 4021	Specification for timber door, window and ventilator frames
IS : 4350	Specification for concrete porous pipes for under drainage
IS : 4351	Specification for steel door frames
IS : 4990	Specification for plywood for concrete shuttering work
IS : 8112	Specification for 43 grade ordinary Portland cement
IS : 9862	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and chlorine resisting
IS : 10262	Recommended guidelines for concrete mix design
IS : 12269	Specification for 53 grade ordinary Portland cement
IS : 12330	Specification for sulphate resisting Portland cement
IS : 12709	Glass fibre reinforced plastics (GRP) pipes, joints and fittings for use for potable water supply

b) Tests

IS : 516	Method of test for strength of concrete
IS : 1182	Recommended practice for radiographic examination of fusion welded butt joints in steel plates
IS : 1199	Methods of sampling and analysis of concrete
IS : 2386	Methods of test for aggregates for concrete(Parts 1 to 8)
IS : 2720	Methods of test for soils (Parts 1 to 39)
IS : 3025	Methods for sampling and test (physical and chemical) for water and wastewater (Parts 1 to 44)
IS : 3495	Method of test for burnt clay building bricks(Parts 1 to 4)
IS : 3613	Acceptance tests for wire flux combination for submerged arc welding
IS : 4020	Methods of tests for wooden flush doors Type tests
IS : 4031	Methods of physical tests for hydraulic cement (Parts 1 to 15)
IS : 5807	Method of test for clear finishes for wooden furniture (Parts 1 to 6)
IS : 7318	Approval tests for welders when welding procedure approval is not required (Parts 1 and 2)

c) Codes of Practice

IS :456	Code of practice for plain and reinforced concrete
IS : 783	Code of practice for laying of concrete pipes
IS : 800	Code of practice for general construction in steel

IS : 806	Code of practice for use of steel tubes in general building construction
IS : 816	Code of practice for use of metal arc welding for general construction in mild steel
IS : 817	Code of practice for training and testing of metal arc welders
IS : 875	Code of practice for design loads (other than earthquake) for building structures(Parts 1 to 5)
IS : 1081	Code of practice for fixing and glazing of metal (steel and aluminum) doors, windows and ventilators
IS : 1172	Code of practice for basic requirements for water supply, drainage and sanitation
IS : 1477	Code of practice for painting of ferrous metals in buildings (Parts 1&2)
IS : 1597	Code of practice for construction of stone masonry (Parts 1 &2)
IS : 1742	Code of practice for building drainage
IS : 1893	Criteria for earthquake resistant design of structures
IS : 2065	Code of practice for water supply in buildings
IS : 2212	Code of practice for brickwork
IS : 2338	Code of practice for finishing of wood and wood based materials (Parts 1 & 2)
IS : 2394	Code of practice for application of lime plaster finish
IS : 2395	Code of practice for painting, concrete, masonry and plaster surfaces (Parts1 & 2)
IS : 2470	Code of practice for installation of septic tanks (Parts 1 & 2)
IS : 2502	Code of practice for bending and fixing of bars for concrete reinforcement
IS : 2571	Code of practice for laying in situ cement concrete flooring
IS : 2595	Code of practice for radiographic testing
IS : 2751	Recommended practice for welding of mild steel plain and deformed bars for reinforced construction
IS : 2974	Code of practice for design and construction of machine foundations (Parts 1 to 4)
IS : 3114	Code of practice for laying of Cast Iron pipes
IS : 3370	Code of practice for concrete structures for the storage of liquids (Parts 1 to 4)
IS : 3414	Code of practice for design and installation of joints in buildings
IS : 3558	Code of practice for use of immersion vibrators for consolidating concrete
IS : 3658	Code of practice for liquid penetrant flaw detection
IS : 3935	Code of practice for composite construction
IS : 4000	Code of practice for High strength bolts in steel structures
IS : 4014	Code of practice for steel tubular scaffolding (Parts 1 & 2)
IS : 4111	Code of practice for ancillary structures in sewerage system (Parts 1-4)
IS : 13920	Code of practice for laying of glazed stoneware pipes
IS: 4326	Code of practice for Earthquake Resistant Design and Construction of Buildings
IS : 4353	Recommendations for submerged arc welding of mild steel and low alloy steels
IS : 5329	Code of practice for sanitary pipe work above ground for buildings
IS : 5334	Code of practice for magnetic particle flaw detection of welds
IS : 5822	Code of practice for laying of welded steel pipes for water supply

- IS : 7215 Tolerances for fabrication of steel structures
- IS : 9595 Recommendations for metal arc welding of carbon and carbon manganese steels
- IS : 10005 SI units and recommendations for the use of their multiples and of certain other units

d) Construction Safety

- IS : 3696 Safety code for scaffolds and ladder (Parts 1 & 2)
- IS : 3764 Safety code for Excavation work
- IS : 7205 Safety code for erection of structural steel work

12 Orientation

- 12.1 The works shall be laid out within the confines of the Site in order to interface to the existing infrastructure of roadways and inlet and outlet pipe work. Underground services requiring to be relocated in order to accommodate the proposed site layout shall, with the approval of EMPLOYER, be relocated by the Contractor.

13 Structures

- 13.1 The works shall generally comply with the following EMPLOYER's requirements unless otherwise specified elsewhere.

For ESR

1. All internal surfaces finish inside the container shall have 20 mm thick cement plaster with water proofing compound in CM 1:3, 15 mm thick cement plaster with water proofing compound on ceiling of top dome and 15 mm thick cement plaster in CM 1:3 without water proofing compound on Container Mini shaft and valve chamber etc.
2. All external surface shall be paint with two coats of weather proof exterior emulsion paint.
3. Staircase shall be with precast / cast in situ steps.
4. All staircases shall be provided with 40 NB / 25 mm dia. GI B-class pipe hand railing for protection.
5. Railing shall be provided on Walk way Platform inside container on inner & outer both the faces.
6. Bird Screen arrangement shall be provided on staircase near Walkway platform to prevent the entry of birds from staircase.

CONCRETE POUR CARD

Client :

Project :

Contractor :

Drg. NO. :

Concrete Grade :

Date :

Structure :

Max. Aggregate size slump : mm/ mm/

Start/ Completion Time :

Mixing Time :

Sr. No.	Item		Contractor's Rep. Signature	Engineer's Signature	Remarks
1	Centre lines Checked				
2	Form work and Staging checked for Accuracy, Strength & finish				
3	Reinforcement Checked				
4	Cover to Reinforcement Checked				
5	Verified test certificate for cement / steel		Yes / No	Yes / No	
6	Adequacy of Materials / Equipment		Yes / No	Yes / No	
7	Embedded Parts checked (Location and Plumb)	Civil			
		Mechanical			
		Electrical			

Pour Authorised site Engineer

8	Soffit(S) and pour top (T) levels checked before (B) and after (A) from removal (Only of Beams of over 1 M. span & Important structures link T.G etc.)	S(B) S(A)	T(B) T(A)	
9	Construction joint location & time (If not as per Drawing)			
10	Cement Consumption in Kgs.			
11	Numbers of cubes and identification mark			
12	Test cube results (7 Days / 28 Days)			
13	Concrete Condition on Form removal	Very Good/ Good / Fair / Poor		

Engineer-in-Charge**PMC/TPI****Contractor****Notes :**

- Each item to be checked & signed by the respective engineers.
- Item 8 to 13 (Both inclusive) to be filled by only engineers of the client.
- Each pour to have separate cards in triplicate one each for client & site office.
- Under remarks indicate deviations from drawings & specifications congestion in reinforcement if any unusual occurrences such as failure of equipment sinking of supports / props, heavy rain affecting reasonable. Poor compaction improper curing other deficiencies observations etc.

MATERIALS : STRUCTURAL STEEL

All structural steel shall comply with the requirements of IS 226-1961 and structural steel work IS 1915-1962 specifications for structural steel.

Steel for Pins and Rollers

Rolled steel pins and rollers, shall comply with requirements of the IS specifications appropriate for the work. Steel casting for cast steel pins shall conform to grade 1 or 3 of IS 1030-1956 specifications for steel casting (for general engineering purposes as appropriate).

Bolts and Nuts

Mild steel for bolts and nuts when tested shall comply with IS 1608-1960 and shall have tensile strength of not less than 2500 Kg/cm². Plain washers shall be made of steel.

Welding Electrode

Mild steel electrodes shall comply with requirements of IS 814-1957 specification for covered electrodes for metal arc welding of mild steel.

Workmanship

All work shall be in accordance with the drawings and shall satisfy IS specification No. 1915-1961. Care shall be taken to ensure that all parts in assembly fit accurately together. Notes or specifications on the drawings supplied by the Engineer-in-Charge/consulting Engineer, are to be constructed as superseding or cancelling any clause of this specifications with which they conflict. On all drawings dimensions shown in figures shall be acted in preference to measurement by scale.

Straightening

All structural steel members and parts shall have straight edges. All straightening shaping and levelling etc. shall be done by pressure only and not by hammering. All joggles and knees shall be formed by pressure and where practicable in making these, the metal shall not be cut and welded.

Cutting

All structural steel parts where required shall be sheared, cropped sawn or flame cut and ground accurately to the required dimensions and shape.

Bolts Holes

The diameter of bolts holes shall be 1.5 to 2.0 mm. larger than the nominal diameter of bolt. All holes for bolts shall be drilled unless permitted by Engineer-in-Charge for punching the holes. Care shall be taken, such as surrounding material is not deformed or damaged in case of punching the hole is allowed

Welding

Welding of steel conforming to relevant IS specifications shall be in accordance with general requirements of metal arc welding. In addition to general requirement, the following care shall be taken :-

- (a) The welding shall be positioned for downward welding wherever practicable.
- (b) The welding current shall conform with respect of voltage and amperage to the recommendations of the manufacturers of the electrode being used. The arc length, voltage and amperage shall be suited to the thickness of material, type of groove and other circumstances of the work.
- (c) The surface to be welded and surrounding material for a distance of at least 155 mm shall be free from scale, dirt, grease, paint, heavy rust or other surface deposit.
- (d) Members to be welded shall be held in correct position by holes, clamps, wedges, jigs or other suitable devices or by tack welding until welding has been completed, such fastening as may be used shall be adequate to ensure safety. Suitable allowance shall be made for warpage and shrinkage.
- (e) Tack welds located where the final welds will later be made shall be subject to the same quality requirements as final welds. Defective and broken tack welds shall be removed before final welding.
- (f) Fusion faces shall be made or cut by shearing, chipping, machining or by gas cutting.
- (g) Exposed faces of welds shall be made reasonably smooth and regular so as to conform as closely as practicable to design requirements and shall not be of less than the required cross section.
- (h) Finished welds and adjacent parts shall be protected with clean boiled linseed oil after all slag has been removed.

Safety Precautions

- (a) Operators of welding and cutting equipment shall be protected from the rays of the arc flame by gloves and by helmet, hand shields, or goggles equipped with suitable filter lenses.
- (b) Closed space shall be ventilated properly while welding is being done therein.
- (c) Welders should be provided with such staging as will enable them to perform the welding operation. For site welding shelter should be provided to protect welders and the parts to be welded from the weather.

The Constructor shall employ a competent welding supervisor to ensure that the standard of workmanship and the quality of materials comply with requirements laid in these specifications.

The Constructor shall provide free access to the representative of Engineer-in-Charge/Consulting Engineer to the work being carried out at all reasonable times and facilities shall be provided so that during the course of welding he may be able to inspect any layer of weld metal. He shall be at liberty to reject any material that does not conform to the terms of the specifications and to require any defective welds to be cut out and welded. The representative of the Engineer-in-Charge/Consulting Engineer shall be notified in advance of any welding operations.

Inspection and testing of welds shall be done as laid down in IS 822 and IS 11017.

No welder shall be employed in any position except those who are fully qualified to welding. Qualification for welders shall be as laid down in IS 812.

Joints

All steel work intended to be bolted together must be in contact over the whole surface. Joints which have to take compressive stress and the ends of all stiffeners shall meet truly over the whole of the butting surface.

Assembling

All member shall be so arranged that they can be accurately assembled, without being unduly packed, strained or forced into position and when built shall be true and free from twist kinks, buckles or open joints between component pieces. Work shall be kept properly bolted together and no drifting shall be allowed except for the purpose of drawing assembled sections together in accuracy's in matching of holes may be corrected But drifting to enlarge holes is prohibited. Failure in any of the above respect will involve the rejection of defective members.

Mode of Measurement and Payment

Measurement of this item shall be as per IS 1200(Part VIII) - 1974 or as per its latest revision so far as applicable.

The contract rate shall be suitable for unit of one metric tonne of structural steel.

MATERIALS : REINFORCEMENT

Specification for TMT bars reinforcement

Scope of work : The scope of work consists of providing and laying mild steel reinforcement and TMT Fe-500 reinforcement for RCC works of various components of the structure. This may be Tiscon or any other approved manufacturer branch and corrosion resistant steel bars approved by the Engineer-in-charge. This includes cuttings, bending, binding, placing, with all equipments and labour required for the work as directed by the Engineer in charge, RMC, Rajkot and all operations covered within the intent and purpose of the specification.

Bending of Reinforcement : Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision) Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer in charge, RMC, Rajkot using a proper bar bender, operated by hand or power to attain proper radii of bends. Bars shall not be bent or straightened in a manner that will cause injury to the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending.

The bending of the TMT bars shall be carried out as per the following :

Sr. No.	Operation	Size	TMT Fe-500
1	Bend	Upto 22 mm dia.	3d
		Over 22 mm dia.	4d
2	Rebend	Upto 10 mm dia.	4d
		Over 10 mm dia.	5d

Placing of Reinforcement :

All reinforcing bars shall be accurately placed in the exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm. in size and conforming to IS : 280 and by using stays blocks or metal chairs, spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation over the work. All devices used for positioning shall be of noncorrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or wooden blocks shall not be use Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices.

Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already place To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout. In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed upto a level just below them. Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm

and conforming to IS : 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as possible, bars of full length shall be use In case this is not possible, overlapping of bars shall be done as directed by the Engineer in charge, RMC, Ahmedabad When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight in eight shape around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

Welding of Bars Welding of TMT bars can be permitted if specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section, not more than 33 per cent of the rods are welded No pre-warming or post heat treatment is necessary. Interpass temperature should be limited to 200°C with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned property. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work. Welded pieces of reinforcement shall be teste Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer in charge, RMC, Ahmedabad

The TMT bars shall be tested for any or all of the following tests as directed by the Engineer-in-charge.

- (1) Alternate immersion test
- (2) Salt spray test
- (3) Atmospheric exposure test
- (4) Sluphur dioxide test
- (5) Potentio dynamic test

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.

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 road. 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

3certain 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 regard
14. In excavation, the decision regarding classification of strata shall rest with the Engineer-In-Charge and his decision in this regard 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 PF 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. agency is to be deputed by RMC and payment is to be deducted from R.A bill of executing agency.
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

