RAJKOTMUNICIPALCORPORATION

e-TenderNo.RMC/ENGG/EZ/22-23/

BidDocumentsFor

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, 9th ATTEMPT)

Volume-II
Technical Specifications & Drawings

MilestoneDatesfore-tenderingisasunder	
1. Downloading of e-Tender documents	30/01/2024 To 16/02/2024 up to 11.00Hrs.
2. Pre-bid meeting in the O/o City Engineer atEAST ZONE	09/02/2024at 11:00hrs
3. Online submission of e – Tender	16/02/2024up to 18.00 Hrs.
4. Physicalsubmission ofEMD, Tender fee and other documents required as per FinancialandExperiencecriteriabyRegd. Post. A.D./ Speed Post ONLY	20/02/2024up to 18.00 Hrs.
5. Openingof technical bid	21/02/2024at 11.00 Hours onwards
6.Verificationofsubmitteddocuments(EMD, e - Tender fee, etc.)	22/02/2024at 11.00 Hours onwards
7.Agencytoremainpresentinpersonalong with original documents for verification	22/02/2024between 11.00 to 16.00Hours
8. Openingof Price Bid (If possible)	23/02/2024at 11.00 Hours onwards
9. Bid Validity	180 Days
For further details, pre-qualificationcriteria etc.visit www.rmc.nprocure.com	

2022-23

CITY ENGINEER
RAJKOTMUNICIPAL CORPORATION
ZAVER CHAND MEGHANI BHAVAN
EAST ZONE OFFICE, BHAVNAGAR
MAIN ROAD, RAJKOT-
360003(GUJARAT)

TECHNICAL SPECIFICATIONS

CONTENT

::TECHNICAL SPECIFICATIONS::

A.GENERAL

1. SCOPEOFCONTRACT:

Theworkentitledcompriseofexcavationoftrencheswithshoring and strutting wherever required bailing out water wherever necessary,layingofpipes,jointingincludingsupplyofmaterialand materialrequiredfor jointing,testingasperspecifications, Construction of appurtenances such as brick Masonry / RCC chambersetc.asperthetypedesign specified entirelyofthe specificationofvariousworksstipulatedinthee-Tender.The work includessupplyofDI K-7 pipesISIMarkedandwhichshallhaveto be supplied at site or Municipal store by the contractor at specifiedandshowninschedule"B".Othermateriallikecementetc shall havetosuppliedbythecontractorfromopenmarket.

The scopeofworkscomprisesthefollowing:

- ☐ Carryingoutnecessarytopographicalsurveyandgeotechnical investigations
- ☐ Excavation of pipe trenches in soil, soft rock, hardrock, WBMandconcreteroads,Dismantling of paver block includingdewatering etc. complete.
- ☐ SupplyingandLayingofDIpipeswithallspecialsalongthe routeasperthenetworkmap
- ☐ Jointing of pipes withexisting pipes (wherever required) with all required accessories and specials
- ☐ obtainingstatutoryapprovalfromgovernmentbodies.
- ☐ Contractor shallplanandaccordinglyphase the supply of itemsaccordingtohisrequirement tobestutilizetheavailable storagespaceatsite.
- ☐ ProvidingandfixingsluicevalvesScourvalvesandAirValves on theexistingaswellasnewpipeline,asspecifiedinrelevant datasheets,detailedtechnicalspecifications,particular technical specificationsand BOQ.
- ☐ Providingpipebedding asperthe requirements.
- ☐ Backfillingofpipetrenchwithselectedsoilimmediately after erectionofpipe excludingpipejoints.
- ☐ Encasingofundergroundpipelinesasperspecifications.
- ☐ Hydrotestingofpipeline insegments.
- ☐ Backfillingofpipe trenchatpipejoints.
- ☐ Construction of RCC Sluice/ Butterfly Valve Chambers/RCC Thrust blocks/Saddles/Anchorblocks.Thetypicaldrawingsforvariousstructures are enclosed in Biddrawingsfor reference.
- ☐ Reinstatement of WBM, Tar and Concrete Roadsafter layingandtestingofpipeline.
- ☐ Demolishingoldstructuresintherouteofpipeline,ifrequire
- ☐ Flushingofentirepipelinewithcleanwateratleast for24hours.

- ☐ Testingand commissioning.
- ☐ Preparationofas-builtdrawings.

2. e-TENDERPRICE:

Theratesquoted inthebillofquantitiesshallcovereverything necessary forthedueandcompleteexecutionoftheworkaccording tothedrawingsandothercondition andstipulations ofthecontract includingspecifications oftheevident,intendandmeaningofallor eitherofthemoraccordingtocustomaryusageandforperiodical andfinalinspectionandtestandproofoftheworkineveryrespect and for measuring, numbering or weighingthe same, including settingoutandlayingorfixinginpositionandtheprovisionofall materials,power,tools,rammers,labour,tackle,platforms with impervious lapped joints for scaffolding, rangingroads,straight edged,canteringandboxing,wedges,moulds,templates, posts, straight rods, straight edged, cantering and boxing, wedges, moulds,templates,posts, straight rails, boning staves strutting, barriers, fencing lighting pumpingapparatus,temporary arrangementforpassageoftrafficaccess topremises and continuanceto drainagewatersupplyand lighting(ifinterrupted by contractor's work) temporary sheds, painting, varnishing, polishingestablishment forefficientsupervision andstating arrangementsfortheefficientprotectiveoflifeandpropertyandall requisiteplant andmachineryofeverykin

Thecontractor shallkeepeveryportionoftheworkclearof accumulationfromtimetotimeandshallleaveeveryportionofthe workclean,clear,perfectandattheconclusionofwhole,providing attheirowncostallsuch materialimplement,appliancesandlabour astheEngineerinchargemayrequiretoproveifittobeso.

3. COMPLETIONSCHEDULE:

The contract period shall be as prescribedin tender document, fromthedateofnoticetoproceedi.eWorkOrder.TheContractor shallsubmithiscompletionschedule andtheprogramofworks togetherwiththise-Tenderinconformitywithcompletionschedule giveninthedocuments.

4. Packing andHandling:

4.1. Necessarycareshallbetakenandrequiredpackingshallbe providedtoavoiddamage topipebarrelsandtheedgesofthe pipeendsintransit.

4.2. Wherethegoodsarerequiredtobedispatchedat Railwayrisk, specialpackingasperIRCArulesareabsolutely necessary, whichwould bepayablebythecontractorhimself.

4.3. Thecontractorshallusepropertyhandlingequipmentorfollow suitablestandardhandlingmethod for**DIpipes&DISpecials** as approved by the Engineer-in- charge to unload the materials at the deliverysite to prevent damageto the goods.

4.4. ThecontractorshalltakeallcareforTransportation&supply of HCconnections itemstobesuppliedwithitsstandardhandling process,storedatsiteunderhisstore/thedelivery siteto preventdamagetothegoods.

5. GENERALTECHNICALGUIDELINE:

5.1. Alltheitemsoccurringintheworkandasfoundnecessary duringactualexecution shall be carried out in the best workman likemanneras perspecificationsandthewritten orderoftheEngineer incharge

5.2. ExtraClaiminrespectofextraworkshallbeallowedonlyif such work is ordered to be carried out in writing by the Engineerin charge

5.3. The contractor shall engage a qualified Engineer for the Execution ofworkwhowillremainpresentforallthetimeon siteandwillreceiveinstructionsandordersfromtheEngineer inchargeorhisauthorizedrepresentative. Theinstructionand ordersgiventothecontractorrepresentativeonsiteshallbe consideredasitgiventothecontractorhimself.

5.4. Theworkorderbookasprescribedshallbemaintainedonthe siteoftheworkbythecontactorandthecontractor shallsign theorders givenbytheinspectingoffersandshallcarryout themproperly.

5.5. Quantitiesspecifiedinthee-Tendermayvaryatthetimeof actualexecutionandthecontractor shallhavenoclaimfor compensationonaccountofsuchvariation

5.6. UnexcavatedlengthsshallbeleftwhereverrequiredandsodirectedbytheEngineer inchargeduringthecurrency ofthe contractandshallbetackle Ifrequired, beforecompletionof work.

5.7. Diversion of road, if necessary, shall be providedandmaintained during the currency of the contract by thecontractorathis cost.

5.8. FiguredDimensionsofdrawingshallsupersedemeasurements byscale, specialdimensions ordirectionsinthespecifications shallsupersedeallotherdimensions.

5.9. All levels are given on drawings and the contractor shall beresponsible totakeregularlevelontheapprovedalignment beforeactually starting the work. The levels shall be commencetotheG.T.S. levelsandshallbegotapprovedfrom theEngineerin charge

5.10. Ifthearrangementoftemporarydrainageisrequiredtobe madeduring any work of this Contract, this shall be made by theContractorwithoutclaminganyextracost.

6. CLASSIFICATIONOFSTRATA:

6.1. All materialsencounteredinexcavationwill be classified inthe followinggroupsirrespectiveofmodeofexcavating the materialsandthedecisionoftheEngineerinchargeinthis

regardshallbefinalandbindingtothecontractor.

6.2. Soils:
Soilsofallsorts,silt,sand,gravel,softmurrum, stiffclay, kunkarandothersoftexcavation notcoveredintheitems mentionedhereunder.

6.3. HardMurrum:
HardMaterialscomprisingofallkindsofdisintegrated rockor shaleorindurateconglomerate interspersedwithboulders, weatheredanddecomposedrock which could be removed with pick, bar,shove,wedgesandhammers, thoughnot withoutsomedifficulties.

6.4. Soft–Rock:
Thisshallincludeallmaterials whichisrockbutwhichdoesnot need blasting and can be removed with a pick bar, wedges,pavementbreakers,pneumatictools etc.

6.5. HardRock:
Thisshallincluderockaccusinginmassorboulderswhichneed blasting,thiswillalsoincluderocktoberemovedbychiseling oranyothermethodwhereblastingis notpermissible.

7. Theratesareinclusiveofdewatering,ifrequire

8. Regardingwatersupplyforhydrotesting,necessarywater,power, labour,etc.requiredfornecessarytestshallbearrangedbythecontractorathisowncost.

9. Duringconstructionactivity,propercaremustbetakenforlabour safetyandmustfollowtheprovisionsoftheLabourlaws.

10. TMTbarsofFe-500shouldbeconfirming toIS:1786.Theapproved makesshallbeTATA,SAIL,Vizag,Gallent,Electrotherm orother equivalentmakeasapprovedbyengineer-in-charge.

11. CementshallbeordinaryPortlandcementconformingtoIS:269, IS:8112orIS:12269 forallthe worksaspertheinstructions of engineer-incharge. Theapproved makesshallbeAmbuja,Ultratect, LOTUS,Siddhi,Sanghi,HathiorasperISconfirming.

12. MinimumCementcontentfortheworkshouldbeasperattached circularNo.RMC/C/Vigi.(Tech)/231dt.11/03/2022.

13. TestingofthematerialslikeBrick,Sand,Aggregate,Reinforcement steel,etc.shouldhavetobetestedperidiocallyassuggested bythe Engineer-in-charge atGovernmentapprovedmaterialtesting Laboratory andtestingchargesforthesamehastobebornebythe contractor.

14. Incaseofanyambiguityfoundininspections/drawingsetc,the decisionofengineer-in-charge shallbefinalandbindingtothe 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 sieve	Percentage by weight passing	I. S. Sieve Designation through sieve.	Percentage by weight passing
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 through sieve	Percentage by weight passing	I. S. Sieve Designation through sieve.	Percentage by weight passing
4.75 mm	100	600 Micron	40 - 85
2.36 mm	100	300 Micron	5 - 50
1.18 mm	75 - 100	150 Micron	0 - 10

M-4 STONE GRIT :

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

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

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

I. S. Sieve Designation	Percentage passing through sieve	I. S. Sieve Designation	Percentage Passing through sieve
12.50	100%	4.75	0.20%
10.00	85 - 100%	2.36	0.25%

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

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

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

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

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

TABLE

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

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

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

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

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

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

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

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

M-6 CEMENT MORTAR:

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

6.2 Proportion of Mix :

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

6.3 Preparation of Mortar:

6.3.1 In hand mixed mortar cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogenous mixture of uniform colour is obtaine Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as 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 of overburnt brick bats shall not be allowe

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. The shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

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

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

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

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

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.

DETAILTECHNICALSPECIFICATIONS

ItemNo.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.

ItemNo.2:

Excavation for pipe line trenches for water supply, manhole etc. all with shoring and struilng 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

Excavationforpipelinetrencheswithshoring,strutting,bailingorpumping outwateredfromtrencheswhenevernecessaryofrequiredlength,widthand depthincluding extraexcavationsforsocketsandallsafetymeasuresand provisionssuchassiterailsfencing,lighting,watchingincludingrefillingthe trenchesinlayersincludingrammingandremovingtheexcavatedstaffwith90mlead andclearingthesiteetc.asstipulatedinthetenderspecification completebeforestartingworkandaftercompletion ofworkforallliftsandsoil strataasspecified

a) Inallsortsofsoilsoftmurmur,hardmurrum,boulders,macadamand asphaltroadsincludingbreakingoflimeandcementmasonryandlime concrete.
b) Insoftrock,cementconcrete,hardrockandcuttingofcementconcrete and R.C.C.ofanyproportion,etc.withcontrolledblastingandorchiseling whicheverisnecessaryandfeasibleas requiredbysiteconditions.
c) Inhardrock

1.1 Clearingofsites:

1.1.1 Thesiteatwhichthepipelineistolaidandthearearequiredforsetting outandother operations shall be cleared of all obstructions, loose stones,andrubbishofallkinds;stumpsoftrees,brushwoodaswellas alltreesshallberemovedasdirecte Therootsshallbeentirelygrubbed up.

1.1.2 Theproductsoftheclearingstobestackedinsuchaplaceandinsuch amanner.Asdirectedby the Engineer-in-charge.

1.1.3 Insiteclearing,alltreesnotspeciallymarkedforpreservation,bamboos junglewoodand brushwoodshallbecut downandtheirrootsgrubbedup. Allwoodandmaterialsfromtheclearings hallbethepropertyof corporationandshallbearrangedasdirectedbytheEngineer-in-charge or his authorized agent. The materials found to be useful by the Engineer-in-chargeshallbeconveyedandproperlystackedasdirected

withinthespecifiedlimit.Unlessmaterialswillbe burntorotherwise disposedoffasdirected

1.1.4 Allholesorhollows, whetheroriginallyexistingorproducedbydiggingup roots,shallbecarefullyfilledupwithearth,wellrammedand leveled off,asmaybedirectedshallnotbepaidfor.Thecontractorshallget approvalofdesignofshoring.Theshoringshallbeofsufficientstrengthto resistsidepressureand ensuresafetyfromslipsand blows andtoprevent damagetowork andpropertyandinjurytopersons.Itshallberemoved asdirected afterallthetheitemsofworkforwhichitisrequiredare complete

1.1.5 Protection:

1.1.5.1 Thefoundationpitsandtrenches,etcshallbestronglyfencedandred lightSignalsshallbekeptatnightin chargeofwatch-mantoprevent accidents. Sufficientcareandprotectivemeasureshallbetakentosee thattheexcavationshallnotaffectordamagetheadjoiningstructures. Thecontractorshallbeentirelyresponsibleforanyinjurytolifeand damagetothepropertiesetc.Necessaryprotectionworksuchasguide ropes,crossingplaces,barricades,thecontractorathisowncostshall providecautionboardsetc.

1.6 ClassificationofStrata:

1.6.1 Thedecisionregardingclassificationofstratashallrestwiththe Engineer- in-Chargeandhisdecisionshallbefinalandbindingtothecontractor.

1.6.2 Allthematerialsencounteredintheexcavationshallbeclassifiedas describedin2.0ofgeneralspecifications.

1.7 Dewatering:

1.7.1 Unlessspeciallyprovidedforasaseparateiteminthecontract,therate ofexcavationwouldincludebailingorpumpingoutallwatermetwithinexcavationorwhic hmay accumulateintheexcavationduringthe progressoftheworkeither,by percolation,seepage,springs,rainor anyothercauseanddivertingsurfaceflowifany,byearthenbundsor byothermeans.Thebundsshallberemoved assoon astheworkis complete

1.7.2 Unless specially provided as a separate item of contract, pumping of water fromfoundationpit,trenchesetcshallbecarriedoutbythe contractorathiswoncostandheshallarrangeforrequirednumbersof dewatering pumpingsetsfortheabovework.He shalltakeprecautionto preventanydamagetothefoundation trenches,concreteormasonryor anyadjacentstructure.Theexcavationshallbekeptfreefromwaterby the contractor (1) during inspection and measurement (2) When concreteand/ormasonryworkareinprogressandtilltheconstruction workreachesabovethenaturalwaterleveland(3)tilltheEngineer–in– chargeconsidersthatthemortarissufficientlyset.Therateshallbe paidforcum.ofexcavation.

1.8 ExcavationinRock:

1.8.1 BlastingwithGunPower:
Blastingoperationsshallbecarriedoutwiththepriorpermissionandin the presence of the Engineer – in – charge or his authorized representative andduringfixedtimehoursoftheday.Allsafety precautionssuchasprovidingsafetynylonnettingetc.shallbecarried outasperinstructionsoftheEngineer–in– charge.

Reddangerflagsshallbeprominentlydisplayedandallthepeople, except thosewhohaveactuallytolightthefusemustbe awaytoasafedistance, notlessthan200meters.

Allfusesshallbecuttothelength requiredbeforebeinginsertedintothe holes.

The numberof charges to be fired and the actual numberof shots heardshallbecomparedandthepersonresponsiblemustsatisfyhimself byexaminationthatallthechargeshaveexplodedbeforeworkpeople are permitted to approachthe scene. Thewithdrawal of a charge which has not exploded shall under no circumstances bepermitted, butthetamping andchargeshallbefloodedwithwaterandthehole markedinadistinguishingmanner.Thenextholetobefiredshallbeat adistanceofabout500mmfromtheold holeandfiredintheusual way.

Thecontractororanyofhiscompetentauthorizedpersonshallbein chargeoftheblastingoperationsandshallbeheldresponsible forstrictly observingthesafetyrules,particularlyapplicabletoblastingoperations,in additiontoothersafetyrules.

Inblastingrockswithdynamite,thefollowing generalprinciplesshallbe observeIngeneral,thefollowingdiameterofdrillsshallbe usedfor differentdepth ofboreholes:

From1–2metres	25mmdiameter
From2–3metres	37–50mmdiameter
From3–4.75metres	50–60 mmdiameter

Theboreholeshouldgenerallybenotmorethan1.3mdeepandthedistance apartshouldbefromoneandhalftotwicethedepth.

Cracksandfissuresintherocktobe blastedshallbe carefullystudiedto ascertainthebestportionforththeboreholes.Chargeshallalwaysbeplacedina roundpieceofrock,ifpossible notnearerthan30mmfromthe crack.

Rulesforblastingwithdynamiteandotherhighexplosives

Theperson-in-chargemustshowthatheisthoroughlyacquaintedwithall blastingoperationsandthatheunderstandstherulesherewithlaiddown.He willbeheldresponsibleforanyaccidentthatmayoccur.

Boreholesmustbeofsuchsizesthatthecartridgecaneasilypassdownthem. Thepositionofallholestobedrilledmustbemarkedoutwithwhitepaintand theperson–in– chargemusttakeparticularnoteofthesepositions.

Thedrillingoperationbeingfinished,theperson–in–chargemustmakea

secondinspectionandsatisfyhimselfthattheboreholesmarkedoutbyhim havebeendrilleTheperson –in–chargemustpreareallchargesnecessary forboreholes.

Onlytenholesmaybeloadedandfixedatonetimeandthechargesshould befixedsimultaneouslyasfaraspracticable.Boreholesmustbethoroughly clearedbeforea cartridgeisinserted.

Theloadingistobedonebytheperson–in–chargehimselfandtheposition ofthechargeholescarefullynotedbyhim.Woodentampingrodsonlytobe usedincharginghole(notpointedbutcylindricalthroughout,onecartridgeat atimemustbeinsertedandgentlypressedwiththetampingroImmediatelybeforefiringb last,duewarningmustbegivenand theperson–in–chargemustseethatall thelabourershaveretiredtosafety.

Thesafetyfuseofthechargedholesaretobelightedinthepresenceofthe person–in–charge,whomustseethatthefusesoftheholeschargedhaveproperly igniteAftertheblast,theperson–in–chargemustcarefullyinspectthe workandsatisfyhimselfthatall thecharges haveexplode

1.8.2 Misfires:

Misfiresareasourceofgreatdanger,ifitissuspectedthatpartoftheblast failedtofireorisdelayed,allowsufficienttimetoelapsebeforeenteringthedangerzone. Whenfuseandblasting capsareused,asafetime,atleastofan hourshouldbeallowed

None of the drillers are to work near this hole until the two following separationshavebeendonebytheperson–in– charge.

(a) Theperson–in–chargeshouldverycarefully extractthetampingwitha wooden scrapper and withdraw the fuse with the primer and detonator attached,afterwhichafreshprimeranddetonatorwithfuseshouldbeplacedin thisholeandfiredor.

The hole may be cleared of 300mm of tamping and the direction then ascertainedbyplacingastickinthehole.Anotherholemaythenbedrilled150mmawayan dparalleltoit,theholetobethenchargedandfireThe person–in–chargeshallalsoatoncereporttotheEngineer–inchargeall casesofmisfire,thatcauseofthesameandwhatstepshavebeen takenin connectionherewith.

Precautionsagainstmisfire:

Thesafetyfuseshouldbe cutinanobliquedirectionwithaknife.

Allsawdustmustbeclearedfromtheinsideofthedetonator thiscanbedone byblowingdownthedetonatorandtappingtheopenenNoinstrumentshall beinsertedintothe detonatorforthispurpose.

Afterinsertingthefuseinthedetonator,itshallbefixedby meansofnippers.

Ifthereiswaterpresent, oriftheboreholesbedamp,thejunctionofthefuse anddetonatormustbemadewatertightby meansofgrease,whiteorlea

Thedetonatorshouldbeinsertedintothecartridge,sothataboutonethirdof thecoppertubeisleftexposedoutsidetheexplosives.Thesafetyfuseoutside thedetonator,shouldbenecessarilytiedinpositioninthecartridge.Water prooffuseonlytobeusedinthedampboreholes,orwhenwaterispresentin thebore-holes.

Ifamisfirehasbeenfoundtobeduetodefectivefusedetonatorordynamite, thewholequantityorboxfrom whichthedefectivearticlewasusedshallbe rejected.

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

It shall be the contractor's responsibilities to arrange proper storage of explosivesandobtainrequiredpermission fromconcernedauthorities.No separatepaymentwillbemadeforthe above.

Therefillingwillgenerallyrefertorefillingoftrenchesuptogroundlevelwith excavatedstuff.Fillingmaterialsshallbefromexcavatedstuff.

Excavatedstufftobeusedshallbeclearedofallrubbish,largesizestones, brickbatsetc.Bigclodsshallbebrokendowntoasize of50mmorless.

Refilling:

Afterthe pipeshavebeenlaidandjointedandthechambersareconstructed andassoonasthejointshavebeeninspectedandpassedbytheEngineer-in-charge,thepipelinehasbeentestedforwatertightness,andafterallconcrete workthoroughlysetthetrenches shallbefulfilledwiththematerialstakenthere from.Inrefillingthetrenches,theutmostcareshallbeexercisedsoasnotto disturb,break or damage the jointed pipes. over and around every pipe, the finest selectedmaterialshallbeput.Nolumpsofrockearthorother materialaroundthepipeorbethrownintothe trenchesuntilthe same has beenbrokentospecifiedsizeandpipescoveredbythefinematerialabove referredto. Theselectedfinematerialshallbecarefullyplaced nexttothe permanentworkandwellpackedandwellrammedinlayersof150mmfora depthofatleast300mmoverthetopofthepipe.Theremaining ofthe excavationshallbefilledinwiththebestandmostsuitableportionsofthe excavatedmaterialinlayersofnotmorethan600mmdeep,eachlayershall be thoroughly rammedbefore the nextlayeris placeOne manshallbeemployedforhandrammingforevery30mofrefillingupto thelevelof300mmoverthetopofthepipe.Surplussoilshallbepiledon topof thefillingtotheextentpossibleforexpectedsubsidence. Allroadmaterialsto fromacompactneatsurface.Thesurfaceofthefilledintrenchshallbehand rolledby a handrollerweighingnotless the ½ tones as directedby the Engineer-in-charge.

The contractorshall maintainall refillingand surfacesuntil reinstateThe contractorshallresponsibleforclaimsarisingfromaccidentsduetosubsidence orinadequatemaintenanceorimproperlyrefillingwork.

Thecontractorshallberesponsibleforanysettlementduringthedefectsliability

periodincludingmonsoonandthesameshallberefilledwithstuffbroughtfrom outside,ifnecessary.

Where excavated material is not considered suitable for refilling by the Engineer-in-charge,theContractor will be requiredto cart selectedsurplus excavatedmaterialsinplaceofunsuitablematerials.Thecontractormayalso beinstructed tosupplysuitablegranularorotherhardfillingmaterialforusein refilling.Suchimportedfillingmaterial shallbepaidforattheratesgivenin the Billofquantities.

Nopaymentshallbemadeforcartingawaysurplusmaterialarising either becauseofrejectionofexcavatedmaterialforrefillingorbecauseofsurplus material.

Measurement:
Thecontractor's shallbeforthe**unitof onecubicmeter** ofthequantity excavated limited to the dimensions and provisions specified in the specificationsoras directedbytheEngineer-in-charge.Theextraexcavation toprovideforjointingpipes,shoringetc.willnotbepaidfor.Theratesshall includecleaningandclearingthetrenchsitebycuttinggrass,shrubsandtreesofgirth(circumference)notexceeding10feetandremovingtheirobstructing rootsin thetrenchcleaningthesite,settingoutworksaspersanctionedplans, provideshoring,excavationand removalof all materialfromtrenches.

(a) Excavationsuptodepthof1.5M

ThetrenchsectionistobeprovidedwithMax.widthODofpipe+250mm to300mmeithersides.DepthoftrenchshallbeminimumBedding+ODofpipe+0.60mt.coverabovethetopofpipe.(For100mmdiapipe).Depthoftrench shallbeminimumBedding+ODofpipe+1.0mt.cover abovethetopofpipe. (ForOtherdia pipe).

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

DismantlingWork:

1. Theworkshallconsistofremoving,ashereinaftersetforth;existing culverts,bridges,pavement,kerbsandotherstructureslikeguards-rails,fences,utilitypoles,manholes,catchbasins,inlets,etc.Whichareinplacebutinterfere withthenewconstructionorarenotsuitableto remaininplaceandofsalvaginganddisposing of the resulting materials and back-fillingtheresultingtrenchesandpits.

2. Existingculverts,bridges,pavementsandotherstructureswhichare withinthe work area and which are designated to be removed,shall be removeduptothelimitsandextentspecifiedinthedrawingsorasindicatedbytheEngineer-in-charge.

3. Dismantling and removal operations shall be carried outwithsuch equipmentandinsuchamannerastoleaveundisturbed,adjacent pavement, structures and other work to be leftintact.

4. Alloperationsnecessaryfortheremovalofanyexistingstructurewhichmightendangernewconstructionshallbecompletedpriortothestartofnewwork.

5. Thestructuresshallbedismantledcarefullyandtheresultingmaterialssoremovedasnottoc auseanydamagetotheserviceablematerialsto besalvaged, the part of structure toberetainedandanyotherpropertiesorstructuresnearby.

6. Unlessotherwisespecified, the superstructure portion ofculverts/bridgesshallbeentirelyremovedandotherpartsremoved to below the groundlevelorasnecessarydependinguponthe interferencethey causetothenewconstruction.Removalofoverlyingofadjacent materialifrequiredinconnectionwith thedismantling ofthestructures shall be incidentaltothisitem.

7. Whereexistingculverts/bridgesareto be extended orotherwiseincorporatedinthenewworkonlysuchpartorpartsof the existing structure shall be removed as are necessarytoprovidea proper connection to the new work. The connectingedges, shall be cut, chipped and trimmed to the required linesandgradeswithoutweakeningor damaginganypartofthestructuretobe retained. Reinforcing bars which are to be left inplaceso as to project into new work as dowels or ties shall not beinjuredduringremovalofconcrete.

8. Pipeculvertsshallbecarefullyremovedinsuchamannerastoavoiddamagetothepipes.

9. Steelstructuresshallunlessotherwiseprovidedbecarefullydismantledinsuchamannerast oavoiddamagetomembersthereof.Ifspecifiedin thedrawingor directedbytheEngineer-in-charge that structure is to be removed in a condition suitable for re-erection,allmembersshallbematchmarkedbythecontractorwithwhite lead paint before dismantling. End pins, nuts, loose, plates, etc.shall be similarly marked to indicate their proper location. Allpins,pinholesandmachined surfacesshallbepaintedwithamixtureofwhiteleadandtallowand loose parts shall besecurelywiredtoadjacentmembersorpackedin boxes.

10. Timberstructuresshall be removed in such a manner astoavoid damages to such timber or lumber as is designated by theEngineer-in-chargetobesalvaged.

11. Inremovingpavements,kerbs,gutters,andotherstructures,likeguard rails, fences, manholes, catch, basins, inlets etc.whereportionsofthe existingconstruction are to be leftin thefinished work, thesameshallberemovedtoanexistingjointorcutandchippedtoatrueline with a faceperpendiculartothesurfaceoftheexistingstructure.Sufficientremovalshallbemadeto provideforpropergradesandcorrespondingwiththenewworkasdirectedbytheEngineer-in-charge.

12. Allconcretepavementsbasecourseincarriagewayandshouldersetc. designatedforremovalshallbebrokentopieceswhosevolumesshall not be exceed 0.02cubicmeterand,stockpiledatdesignated locations if the materialis to be used later or otherwisearrangedfordisposalas directed.

13. Wheredirectedbytheengineer-in-chargeholesanddepressionscausedbydismantlingoperationsshallbe backfilled withexcavatedorotherapprovedmaterialandthoroughlycompactedinlinewithsurroundin garea.

14. AllmaterialsobtainedbydismantlingshallbethepropertyofGovernment. Unlessotherwisespecified,materialshavinganysalvage value shall be placed in neat stack of like material within theright-of-wayasdirectedbytheEngineer-in-charge,forwhichcontractor will remain responsible for its safe custody andpreservationfor60daysafterrecordingmeasurementsofthesalvagedmaterial.

15. Pipeculvertsthatareremovedshallbeclearedandneatlypiledontheright-of-wayatpointsdesignatedbytheEngineer-in-charge.

16. Structuralsteelremovedfromoldstructureshall,unlessotherwisespecified or directed be stored in a neat and presentable manner onblocking in locations suitable for loading. Structures or portions thereofwhich are specified in the contract for re-erections shall be stored inseparatepiles.

17. Timberoflumber from old structures which is designatedby the Engineer-in-chargeasmaterialstobesalvagedshallhaveallnutsand boltsremoved from and shall be stored in neat piles inlocationssuitableforloading.

18. Allthe products ofdismantling operations which intheopinionof theEngineer-in-charge cannotbe used orauctionedshall bedisposedasdirected,within100meters.

19. The work of dismantling structure shall be paid for in units indicatedbelowbytakingmeasurementbeforeandafter,asapplicable;

i) Dismantlingbrick/stone/concreteCubicMeter(Plainandreinforced)masonry
ii) Dismantlingflexibleandcement CubicMeterconcretepavement
iii) Dismantlingsteelstructure Ton
iv) Dismantlingtimberstructure CubicMeter
v) Dismantlingpipes,guardrails,kerbs,guttersandfencingLinearMeter
vi) Utilitypoles Nos.

vii) Removaloffflooring –CCPrecastTiles/Shahbadiladi/tilesflooringSqr.Mtr
viii) Removalofroaddivider strip No.s
ix) RemovalofInterlockingPaving Block Sqr.Mtr

ItemNo.1a:

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

Oncompletionofthepipelayingoperationsinanysection,foralengthofabout100mandwhilefurtherworkisstillinprogress,refillingoftrenchesshallbestartedbytheContractorwithaviewofrestrictingthelengthofopentrenches.PipelayingshallcloselyfollowtheprogressofTrenchExcavationandtheContractorshallnotpermitunreasonablyexcessivelengthsoftrenchexcavationtoremainopenwhileawaitingtestingofthepipeline.IftheEngineerconsidersthattheContractorisnotcomplyingwithanyoftheforegoingrequirements,hemayprohibitfurthertrenchexcavationuntilheissatisfiedwiththeprogressoflayingandtestingofpipesandrefillingoftrenches.Theexcavatedmaterialnearestto thetrenchshallbeusedfilling.Careshallbetakenduringbackfilling,nottoinjureordisturbthepipes,jointsorcoating.Fillingshallbecarriedoutsimultaneouslyonbothsidesofthepipessothat

unequalpressuredoesnotoccur.Walkingorworkingonthecompletedpipelineunlessthetrenchhasbeenfilledtoheightofatleast 30cmoverthetopof thepipe exceptasmay benecessary for tamping etc.,duringbackfillingwork.

Theremainingportionofthetrenchmaybefilledinwithamixtureofhardandsoftmaterialfreefromboulдersandclodsofearthlargerthan150mminsizeifsufficientquantityofgoodearthandmurrumarenotavailable.Thetrenchshallberefilledsoastobuilduptotheoriginalgroundlevel,keepingdueallowanceforsubsequentsettlementlikelytotakeplace.Thetop300mmlayerorfertileagriculturalsoilshallbekeptasideduringexcavationandshallbelaidinlayersneargroundlevelduringrefilling.

Topreventbucklingofpipeshellofdiameters1200mmandabove,pipesshallbestruttedfrominsidewhiletheworkofrefillingisinprogress,forwhichnoseparatepaymentshallbemade.

Struttingshallbedonebymeansofstrongspidershavingatleast6armswhichshallbesufficientlystifftoresistalldeformation.Spidersshallbeprovidedatamaximumintervalof2m&shallbeweldedinsuchawaythatinternalcoatingdoesnotgetburnt.

TheEngineershall,atalltimes,havepowerstodecidewhichportionoftheexcavatedmaterialsshallbeforfillingandinwhichportionofthesiteandinwhatmanneritshallbesouse

IfanymaterialremainsassurplusitshallbedisposedofasdirectedbytheEngineer,whichincludesloading,unloading,transportingandspreadingasdirectedwithinallleaIftheContractorfailstoremovetheearthfromsitewithin7daysaftertheperiodspecifiedinawrittennotice,theEngineermayarrangetocarryoutsuchworkattheContractor'sriskandcostormayimposesuchfineforsuchomissionashemaydeemfit.Particularcareshallbetakentokeepthetrenchdryduringtheentirerefillingoperation.

If suitable materialforrefillingisnot availableforexcavationtheContractorshallbringearth,murrumofapprovedqualityasdirectedbytheEngineer.

Nomechanicalplantotherthanapprovedcompacting equipment shall runoveroroperatewithinthetrenchuntilbackfillinghasreacheditsfinallevelortheapprovaloftheEngineerhasbeenobtained
Subsidenceinfillingin:Shouldanysubsidencetakeplaceeitherinthefillingofthetrenchesornearaboutitduringthemaintenanceperiodof24monthsfromthecompletionoftheContractWorks,theContractorshallmakegoodthesameathisowncostortheEngineermaywithoutnoticetotheContractor,makegoodthesameinanywayandwithanymaterialthathemaythinkproper,attheexpenseoftheContractor.TheEngineermayalso,ifheanticipatesoccurrenceofanysubsidence,employpersonstogivehimtimelynoticeofthenecessityofmakinggood thesame,and the expenseson thisaccountshallbe charged to theContractor.

MeasurementandPayment

PaymentofrefillingshallbemadeonCubicmeterbasis.

ItemNo.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

Thisitemincludes:

Note:WhereverInternationalStandardsorIndianstandards/specificationsarementioned,theirequivalent orhigherstandards/specificationsarealsoacceptableSupplyandDeliveryofDuctile IronPipe asper IS:8329-2000 or itslatestrevisionoramendmentsifanyincludingjointingmaterialasEPDMringasperIS5382-1985andISO:4633-1996oritslatestrevisionoramendmentsifanyStandards

Thefollowingstandards,specificationsandcodesarepartofthisspecification.Inallcases,the latestrevisionoftheincludingallapplicableofficialamendmentsandrevisionsshallbereferred to.Incaseofdiscrepancybetweenthisspecificationandthosereferredtoherein,thisspecification shallgovern.

- ✓ ISO:10803-1997Designmethodforductileironpipes
- ✓ IS:8329-2000CentrifugallyCast(spun)ductileironpressurepipesforwater,gasandsewage
- ✓ ISO:2531-1991Ductileironpipes,fittingsandaccessoriesforpressurepipelines.
- ✓ ISO:4179-1985 Ductile iron pipes for pressure and non pressure-Centrifugal
- ✓ cementmortarlining-Generalrequirements.
- ✓ IS:8112Specificationfor43GradeordinaryPortlandcement.
- ✓ BS:3416Bitumenbasedcoatingsforcoldapplication,suitableforuseincontactwithpotable water.
- ✓ ISO:8179-1995Ductileiron pipes-Externalcoating-Part-1 MetallicZincwithfinishinglayer.
- ✓ IS:638Sheetrubberjointingandrubberinsertionjointing.
- ✓ ISO:4633-1996Rubberseals-Jointrings.
- ✓ IS:5382-1985SpecificationforRubbersealingringsforgasmains, water
- ✓ mainsandsewers.
- ✓ AWWA C600 Installation of ductile iron water mains and theirappurtenances.

1.0 InternalDiameter:
Thenominalvaluesoftheinternaldiametersofpipe,expressedinmillimetersareapproximatelyequaltothenumberindicatingtheirnominalsizesDN.

2.0 Length:
Theworkinglengthofsocketandspigotpipesshallbe5m,5.5m,or6metres.

3.0 Thickness:
Thewallthicknessofpipe'e'inmmshallbecalculatedasafunctionofthenominaldiameterbythefollowingequationwithminimumof5mm

e=K(0.5+0.001DN)

where:e=wallthicknessinmm,DN=thenominaldiameter,K=thewholenumbercoefficient

4.0 EPDMRubberGasket:
RubberGasketshallbesuitablyforPush-on-Joint.
Thespigotendsshallbesuitablychamferedorroundedofftofacilitatesmoothentryof

pipeinthesocketfittedwiththerubbergasketRubberGasketshallconfirmtoIS5382-1985andISO:4633-1996itslatestrevisionoramendmentsifany

5.0 SamplingCriteria:
Samplingcriteriaforvarioustests,unlessspecifiedinIS8329-2000,shallbeaslaiddowninIS11606.Mechanicaltest,BrinellHardnesstest,Hydrostatictestetcareshallbeasper IS8329-2000

6.0 TolerancesonExternalDiameter:
Thenominal external diameter(DE) ofthe spigot endofsocketandspigotpipesandwhenmeasuredcircumferentiallyusingadiametertapeshallconfirmtotherequirementsspecifiedasfollow.Thepositivetoleranceis+1mmandappliestoallthicknessclassesofpipes.Themaximumnegativetoleranceoftheexternaldiameterarespecifiedasfollow:

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 ToleranceonOvality:
Pipesshallbeasfaraspossiblecircularinternallyandexternally.Thetoleranceforout-or-roundnessofthesocketandspigotendsisgivenbelow:

NominalDiameterin	AllowableDifferenceBetweenMinorAxisand
80to300	1.0
350to600	1.7
700	2.0
750to800	2.4
900to1000	3.5

8.0 Toleranceinthickness
Thetoleranceonwallthickness(e)andtheflangethickness(b)ofthepipesshallbeasbelow:

Dimensions	Toleranceinmm
Walthickness(e	-(1.3+0.001DN)1)
Flangethickness(	+(2+0.05b)&-

9.0 Coating
Pipeshallbedeliveredinternallyandexternallycoated.
ExternalCoating:Pipeshallbemetalliczinccoatedandafterthatitshallbegivenafinishinglayerofbituminouspaintasper IS-8329-2000ZinccoatingshallcomplywithIS:8329/EN545/ISO8179.Onlymoltenzincspraycoatingshallbeacceptable.Theaveragemassofsprayedmetalshallnotbelessthan13

0g/sqmwithalocalminimumof110g/sqm.
Bitumenovercoatshallbeofnormalthicknessof70micronsunlessotherwisespecified
ItshallbeacoldappliedcompoundcomplyingwiththerequirementsofBS3416TypeII suitablefortropicalclimatesfactoryappliedpreferablythroughanautomaticprocess.
Damagedareasof coating shallberepaintedonsiteafter removinganyremainingloosecoatingandwirebrushinganyrustedareasofpipe.
Internallining:InternallypipeshallbePortlandCementmortarlined(asperIS-8329-2000).Themortarshallcontainbymassatleastonepartofcementto3.5partofsanAllpipesandfittingsshallbeinternallylinedwithcementmortarusinghighspeedcentrifugalprocessinaccordancewithIWO4179/IS8329.Cementmortarliningshallbeapplieda tthepipemanufacturingshopinconformitywiththeaforesaidstandards.Noadmixturesnthemortarshallbe
usedwithouttheapprovaloftheEngineer.Thesandtocementproportionofsandifjustifiedbythesieveanalysis.
Pipeliningshallbeinspectedonsiteandanydamageordefectiveareasshallbemadegood tothesatisfactionoftheEngineer.
Liningshallbeuniforminthicknessallalongthepipe.Theminimumthicknessoffactory appliedcementmortarliningshallbeasperIS:8329Annex-BorISO4179.Thisisgivenbelow.

NominalPipeSize(mm	Nominalliningthickne
Upto300	3
350-600	5
700-1200	6
1400-2000	9

10.0 Joint
JointingofDIpipesandfittingsshallbepush-ontypePush-on-joints
TheContractorshallsourcethepush-on-jointgasketsonlyfromthepipemanufactures.Inturnthepipemanufacturershallsupplyatleast10%additionalquantityofgasketsoverandabovetherequirementtotheContractoratnoextracost.
Thegasketusedforjointsshallbesuitablefornaturalandpurifiedwaterconveyance.InjointingDIpipesandfittings,theContractorshalltakeintoaccountthemanufacturer'srecommendationsas
tothemethodsandequipmentstobeusedinassemblingthejoints.InparticulartheContractorshallensurethatthespigotendofthepipetobejointedissmoothandhasbeen properlychamfered,sothatoncetherubberringiscorrectlypositionedbeforethejoint ismade,doesnotgetdamagedbyfrictionorsharpedges
ofthespigotChamfer.Therubberringsandtherecommendlubricantshallbeobtained onlythroughthepipemanufacturer.
Rubberringbundlesformeverylotshallcarrywiththemmanufacturerstestcertificate forthefollowingmechanicalproperties.

1. Hardness
2. Tensilestrength
3. Compressionset
4. Acceleratedagaintest
5. Waterabsorptiontest
6. Stressrelaxationtest

Rubber ringsshallbeclearlylabeled inbundles toindicate the typeofring,thetypeofjoint,thesizeofthepipewithwhichthey

aretobeused,themanufacturer'snameandtrademark,themonthandyearof manufactureandtheshelflife.

11.0 TestingofPipe:
ThemaintestamongotherstobeconductedshallbeasperIS:8329-2000orwithitslatestrevision/amendments.

[a] MechanicalTests
MechanicaltestsshallbecarriedoutduringmanufactureofpipesasspecifiedintheStandards.Thefrequencyandsamplingoftestsforeachbatchofpipesshallbeinaccordancewith IS11606-1986.Thetestresultssoobtainedforallthepipesandfittingsofdifferentsizesshallbesubmittedto Engineer.Themethodfortensiletestsandtheminimumtensilestrengthrequirementforpipesandfittingsshallbeasper IS;8329/EN545forpipesandIS:9523/EN545forfittings.

[b] BrinellHardnessTest
ForcheckingtheBrinellhardnessthetestshallbecarriedoutonthetestringorbarscutfromthepipesusedfortheringtestandtensile testinaccordancewithIS:1500.ThetestshallcomplywiththerequirementsspecifiedinIS:1500/ISO6506.

[c] Re-tests
Ifanytestpiecerepresentingalotfailsinthefirstinstance,twoadditionaltestsshallbemadeontestpiecesselectedfromtwootherpipesfromthesamelot.Ifboththetestresultssatisfythespecifiedrequirementsthelotshallbeaccepte Shouldeitheroftheseadditionaltestpiecesfalltopassthetest,thelotshallbeliableforrejection.

[d] Flow Testshall bedonein twostage:

Stage 1
Pipelineshallbelaidbyrestingthepipelineonsupports atjoints. Thepipeline andalljointsofpipesshall bemade thoroughlysound andwater tightandanyjointwhichmay beobservedtobeleakyshallbeimmediately corrected.Thusafter satisfactory flowtestsandbeddingshallbefillpipelineafterlaying pipe line. Therefilling oftrenchshall becarriedoutthenafter.

Stage 2
Aftertotal laying&refillingoftrenches,flow testshall becarriedout againforparticularsectionoflengthassuggested byengineerin charge.

12.0 QualityAssurance
ThemanufacturershallhavealaiddownQualityAssurancePlanforthemanufactureoftheproductsofferedwhichshallbesubmittedalongwiththetenders.

MARKING:
Themethodsofmarkingallthepipestobedeliveredunderscopeofcontractshallensurethatalltheinformationwillremainlegibleevenaftertransportation,storageinopenspaceetc.Ingeneralthelegibleandindeliblemarkinguponthegoodsshallindicatethefollowings;

i) Certificationmarkoneachpipe.
ii) Manufacturersbrandnameand/ortrademark.

iii) Purchasersmarkas"RMC"beinscribe
iv) Theoutsidediameterandpressurerating.
v) Batchnumberorlotnumber.
vi) Inspector'smarkoneachpipe

INSPECTION

InspectionofpipesandspecialswillbecarriedoutbyExecutiveengineerorhisrepresentativeagencyappointedbyRMC.AlltheexpenditureforinspectionshallbebornebythecontractorexceptinspectionchargesifanyincaseofinspectionagencyappointedbyRMCshallbepaidbyRMC.

PAYMENT

The paymentshall 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 unlaid pipesof 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.

ItemNo.4:

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

Thepipes&jointsshallbeprocured,suppliedbytheContractoratworksiteathisowncost.Everycareshallbetakenincartingthemtosite.Duringtransportationanydamageshallbeoccurringtopipesforfittingsthereplacementof pipesgivenbythecontractorathisowncost.

Thetrenchesshallbewellleveledsothatpipesarelaidevenlyamongthem.ThepipesshallbefixedwithintworubberringstobesuppliedbydepartmentattheplaceshowninscheduleA,if directedbytheEngineer-in-chargeormentionedin itemofscheduleB.Thespecificationfortitanjointsi.e.RubberRingsshallbeasperdetailsspecificationmaterialsection.

Thecontractorshallmakehisownarrangementforobtainingpermissionforstoring&stackingofpipesetc.fromlandboardswhethertheyareGovernment,MunicipalLocalBodiesorPrivatelandowner.

Everypipesbeforeloweringintothetrenchesshallbegotcheckedandthoroughlycleanedandthebedsofthetrenchesshallbeproperlygradedandleveledasrequiredontheline,without anyclaimforextracostwhetheritisrequireThepipeshallbecarefullyloweredintothetrencheswiththehelpofasuitabletypeofchainpulleyblocks,whichshallfirstbeapprovedbytheEngineer-in-
Charge.Eachpipeshallbeproperlyjackedandthespigotperfectlyfixedintothesocket.Nojointingoperationshallbestartedunlessthegradientslevelsareapprovedbytheengineer-in-Chargeorhisrepresentatives.

Thepipesshallbelaidcompleteincenterlinerangedaccuratelybymeansofastringattached

tobothmarkedcenterofsiterailsandnodeviationshallbepermissiblewithoutthepermissionofEngineer-in-Charge.Thepipeshallbelaidinreasonablydrytrenchesandnocircumstancesonslushybedding.

Thepipesshallbebrushedbeforeloweringanylayingorremoveanysoilordirtetc.thatmayhaveaccumulate

Theinsidesocketandoutsideofthespigot-shallbecarefullycleaneThepipeshallbeloweredcarefullywithsocketandtowardandtheflowofwaterorup tilloras directedandspigot and shouldbecarefullyinsertedinto thesocket andthespaceshallbefilledwiththejoint.

TESTINGOFWATERPIPES:

AftereachsectionofthepipelinehasbeencompleteditshallbetestedforwatertightnessbeforebeingcoveredThecontractorshallathisowncostfillupwaterinpipelineandgivennecessaryhydraulictestsectionbysectionandthepipelineshallstandthepressurewhichshallstandthepressurewhichshallexceedtheworkingpressureby

(a)50%ofthehighestpressureinthesection.
(b)30mwhicheverislesswithoutshowinganyleakageorsweating anywhereinthepipesjointsspecialsvalvesetc.itanydefectarefoundthecontractorshallbemadegoodthesameathisowncost.

Anyleakingjointsshallbemadegoodandabovetestpressureintobeloweredgraduallyaftersatisfactorytestis&over.

RMC/ OWNERwillnotbeabletoprovidewaterfortestingofthepipelines&watercontainersoftheproject.Thisshallhavetobemanagedbythecontractorathiscostsandrisk.

ThehydraulictestshallbegivenagainifconsiderednecessarybytheExecutiveEngineerorhisrepresentativetoshowthatnofurtherleakagesorsweatingisthere.Thecontractorshallhavetomakenecessaryarrangementsforwatertestingaswellaspluggingtheopeningofpipesetc.asdirectedwithoutclaimingany extracost. Thepipelinesshallbekeptfilledwithwaterforaworklinesshallbekeptfilledwithwaterforaweekortillitissituatedfortestingisdone.

If thepipelinesarelaidindetachedsanctioned&notincontinuouslengthduetoanyreasonssuchasnon-availabilityofspecialsorduetoobstacleetc.Thecontractorshallseethatnoendofpipeslengthiskeptopen-endsareimmediatelycoveredupeitherbysuitableblankflangeorcapslugorbymeansofdoublelayergunnybagsclothestiedproperlybymildsteelwirewithoutanyclaimforextra-cost.
Therateshallbepermeterofpipelinelaidincludingallspecialsandfittingjointlyetc.Cuttingandwasteshallnotbepaidseparately.Thelengthshallbemeasurednotonthestraightlinean

dcurvesalongthecenterlineoverthepipeandspecialscorrectupto1cm.

MethodOfMeasurementOfPipes:

Themeasurementshallberecordedinrunningmeterofpipelengthlaidalongcenterlineorax isofpipeline..

Nopaymentshallbemadeforoverlapsetc.

ThepaymentshallbepaidaftercompletionofwholeitemasmentionedinpricebidonRunnin gMeterbasis.

ModeofPayment:Paymentrestrictedto70%oncompletionoflaying& jointing &30%on givinghydraulic test.

ItemNo.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,supplyanddeliveryofDuctileIronFlangeSocketspigotbends,tees,reducersoranyotherspecialsasperBS-EN-545/1995class-AseriesK-12suitableforusewithDIpipesmanufacturedasperIS8329/1994deliveryofspecialsistobemadetositeofworksincludingalltaxes,loading,unloading,carting,stacking,insurance,inspectioncharges,Octroietc.completewithinternalcementmortarliningwithEPDMrubbergaskets.

B) Manufacture,supplyanddeliveryof flanges,Tee,bends,tailpiece,reducers,airvalveraiserpipesoranyotherspecialssuitableforusewithDIpipesanddeliveryof specialsistobe madeto site of worksanywhere in Gujarat includingalltaxes,loading,unloading,carting,stacking,insurance,inspectioncharges,Octroietc.complete.

C) Manufacture,supplyanddeliveryofCIDjointswithRubberRingsofStandardqualityoranyotherspecialssuitableforusewithI.pipesanddeliveryofspecialsistobemadetositeofworksanywhereinGujaratincludingalltaxes,loading,unloading,carting,stacking,insurance,inspectioncharges,Octroietc.complete

D) DISpecialswithalltypesofdiameterssuitableofK9gradepipeswithinnercementmortallining.ThenecessaryDISpecialsrequiredduringthelowering&lyingofDuctileIronPipeshallbesuppliedbytheagencyandshallbeasperstandardspecification.

E) ItshallbeofbestqualityasperrequirementRateshallbeincludingloading,

F) unloading,carting,insuranceandlaborchargeetc.complete.

PAYMENT

Thepaymentshallbemadeonkg.basis.

ModeofPayment:Paymentrestrictedto70%oncompletionoflaying& jointing &30%on givinghydraulic test.

ItemNo.6:

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

Afrer 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 ve stacked at the location specified by the engineer in charge at no extra cost.

If the contractor fail 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 carted by the contractot within specified limit including loading transporting spreading.

MODE OF MEASUREMENT AND PAYMENT:

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

ItemNo.7:

Providing and supplying lSI mark Cl / 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 departmentalstores, stacking etc. complete(kirloskar brand)

DesignFeatures

SluicevalveshallconformtoIS14846(ISIMarked).Exceptpumphouse,thesevalvesaretobeinstalledinvalvechamber.Allvalvesofpumphouseandrisingmainsshallbenon-risingstemtype.

Thevalvesshallbefreefromsharpprojections,whicharelikelytocatchandholdstringymaterials.Valvesshallclosewithclockwiserotationofthehandwheel.Thedirectionofclosingandopeningshallbemarkedonthehandwheel.

Necessaryjoiningmaterialsviz.bolts,nuts,washers,packingetc.shallbeprovidedbythecontractorathiscost.Thevalvesshallbefixedsoastohaveaxisperfectlyhorizontal. If required the contractor shall also carry out drilling of holes ofappropriatediameterinflangesinrequirednumbers.Ahandwheelshallbeprovidedforemergencyoperation.Thehandwheeldriveshallbemechanicallyindependent.Thevalvedesignshalltakecareofthepressuredropacrossthevalvediscincaseofpartialopeningofthevalveandshalltakecareoftheerosionandcavitationeffectonthebodyanddiscduringsuchoperation.Valve(s)subjectedtobackpressureshallhavethevalveseat,discandtheoperatorsuitablydesignedtoensuretrouble-freeoperation.Theshaftdiametershalltakeintoconsideration,themaximumtorquerequiredforthevalveoperation,themaximumdifferentialpressureacrossthevalvediscwhenthevalveisclosedandtheshockloadduetoaccidentalclosureofthevalvedisc.The discshall be designedformaximum differentialpressureacrossthevalveaswellastheshockloadduetoaccidentalclosureofthevalve.Discdesignshallofferminimumheadloss.Discshallalsoofferminimumresistancetoflow.Discshapeshallbecontoure.Valveseatsshallbeofadesignthatpermitsremovalandreplacementatsiteandshallbesecurelyclampedonthebodyordiscofthevalve.Seatmaterialshallbesuitablefortheoperatingconditionsandhandlingfluidandmaybesuitablyreinforced,ifrequire.Theseatdesignshallpermiteasyremovalforreplacementpurposeswithouttheneedforremovingthevalvefromtheline.Nodepositedorweldedseatringspermitte.Thevalvebearingsshallbeof'self-lubricated'typeandshallnothaveanyharmfuleffectduetohandling flui Adjustable thrustbearing(s)shallbeprovidedtohold the valvediscsecurely in thecenterof thevalveseat.

EachSluiceValveshallbeprovidedwithahandwheelformanualoperation.FortheValveslocatedatinaccessibleposition,itshallbeprovidedwithextensionspindleandfloorstandorhandlever/roundchaintofacilitatemanualoperation.

HydrostaticTest

Eachvalvebodyshallbesubjectedtohydrostatictest(BodyandSeat)asperIS14846.Forvalve ssubjectedtobackpressurecondition,leakagetestshallbecarriedoutonbothsidesofthedisc.

PerformanceTest

Eachvalvecompletewithoperatorshallbeshopoperatedatleastthree(3)timesfromfullyclos edtofullyopenconditionsandreverse,holdatintermediatepositionsundernoflowcondition,t oprovetheworkabilityoftheassembly.

PositivematerialIdentification(PMITest)

PMItestshallbecheckedatrandomforStainlesssteelparts.

TestCertificates
WhenspecifiedbyOwner,themanufacturershallissueatestcertificateconfirmingthattheval veshavebeentestedinaccordancewiththisstandardandstatingtheactualpressuresandmed iumusedinthetest.

Marking

Marking shall becast integralon the body or on aplate securely attached tothe bodyfor‘DN’size,‘PN’rating,HeatNumberandSerialnumber.

Painting

Each valve shall bedrained, cleaned,prepared and suitableprotected with2 coatsofredoxideandthenblackbituminouspaintforminimumof150micronDFTonsurfacesb eforedispatch.

ElectricActuator

Eachactuatorshallbeadequatelysizedtosuittheapplicationandbecontinuouslyratedtosuitt hemodulatingcontrolrequireThegearboxshallbeoilorgreasefilled,andcapableofinstallatio ninanyposition.Alloperatingspindles,gearsandheadstocksshallbeprovidedwithadequatep ointsforlubrication.Thevalveactuatorshallbecapableofproducingnotlessthan1½times therequiredvalvetorqueandshallbesuitableforatleast15minutescontinuousoperation.

Theactuatorstartersshallbeintegrallyhousedwiththeactuatorinrobustlyconstructedandtot allyenclosedweatherproofhousing.Themotorstartershallbecapableofstartingthemotorun derthemostseverereconditions.Thestarterhousingshallbefittedwithcontactsandterminalsfo rpowersupply,remotecontrolandremotepositionalindication,andshallalsobefittedwithinte rnalheaterssoastoprovideprotectionagainstdamageduetocondensation.

Eachstartershallbeequippedasfollows:i.A.C.electricmotor.ii.Reductiongearunit.iii.Torqu eswitchmechanismcompletewithsetoftorqueswitches.iv.Limitswitchmechanismcomplete withsetoflimitswitches.v.Handwheelformanualoperation.vi.Hand-autochangeoverleverwithsuitablelockingarrangement.vii.Localcontrolswitch/pushbutto nsviii.415V/240VACcontroltransformer.

Theactuatorshallbesuitableforoperationintheclimateconditionsandpowersupplyconditio

nsgiveninthespecification.Theactuatorshallbecapableofproducingnotlessthan1½timethe maximumrequiredtorqueandshallbesuitableforatleast15minutescontinuousoperation.Al llocalcontrolsshallbeprotectedbyalockablecover.

Datasheet:

SLUICEVALVE/GATEVALVE					
Sr No	**Component**	**PN-1.0/1.6**	**PN-2.0**	**PN-2.5**	**PN-4.0**
1	Body	CIIS210Gr.FG260	ASTMA216Gr.W	ASTMA216Gr.W	ASTMA216Gr.WCB/ASTMA351Gr
2	Bonnet	CIIS210Gr.FG260	ASTMA216Gr.WCB	ASTMA216Gr.WCB	ASTMA216Gr.WCB/ASTMA351Gr.CF8
3	Wedge	CIIS210Gr.FG260	ASTMA217Gr.CA15	ASTMA217Gr.CA15	ASTMA217Gr.CA15
4	Gland	CIIS210Gr.FG260	ASTMA216Gr.W	ASTMA216Gr.W	ASTMA216Gr.WCB/ASTMA351Gr
5	Stem	SS410	SS410	SS304	SS316
	BodyRing/We				
7	Gland Packing	Jute and Hemp	Graphoil Filler	Graphoil Filler with SS 304 wire winding	Graphoil Filler with SS 304 wire winding
8	NutBolts	Carbonsteel	ASTMA320GrL7andASTMA194Gr4	ASTMA320GrL7andASTMA194Gr4	ASTMA320GrL7andASTMA194Gr4
9	WedgeNutandStemNut	IS318GrLTB-2	SS304	SS304	SS304
10	HandWheel	CastIron	CastSteel	CastSteel	CastSteel/SS

11	FlangeEnd	IS1538	ASME/ANSIB16. 5Class 150	ASME/ANSIB16. 5Class 300	ASME/ANSIB16. 5Class 400

Modeof measurementandpayment:

Themeasurement shallbetaken**pernumberofsluicevalve**ofspecifiedsize. Theratewillbe**pernumber**fittedinapipeline.
5%amountshallbewithheldforhydraulictestandsameshallbereleased aftersatisfactoryhydraulictest.

ItemNo.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,LayingandJointingofSluicevalve

(i) Castirondoubleflangedsluicevalve/butterflyvalveswithtwotailpiecessuitabletopipeshallbesuppliedbytheboardandtheyshallbecartedbythecontractorathisowncostfromthedepartmentalstoreoranyotherstoreasdirecteTherateshallincludeloading, unloadingandstackingatsite.

(ii) Thesluicevalve/butterflyvalvesandtailpiecesshallbeexaminedbeforelayingforcracksandotherflows.Theyshallbeundamagedinallrespect.

(iii) Thesluicevalves/butterflyvalvesshallbeoperatedbeforelaying.

(iv) Allgritsandforeignmaterialsshallberemovedfromtheinsideofthevalvesbeforeplacing.

(v) Allthefourfacesshallbethoroughlycleanedandcoatedwithathinlayerofmineralgrease.

(vi) Thetighteningofglandshallbecheckedwithapairofinside-calipers.Clearancebetweenthetopofstuffingboxandtheundersideoftheglandshall beuniformallthesides.

2.0 JOINTINGMATERIAL

2.1 Thecontractorshallprovideallnecessaryjointingmaterialssuchasnutsbolts,rubber packingwhitezincjuteleadwooletc.

2.2 Alltoolsandplantrequiredforinstallationofsluicevalveshallbeprovidedbythecontractor.

2.3 Alljointingmaterialsshallbenotapprovedfromtheengineer-in-chargebeforeus

2.4 ThenutandboltsshallconformtoItemNoMSP-19ofspecificationofmaterials.

2.5 Therubberpackingshallconfirmallspecificationsasnarratedin ItemNoMSP-20ofspecificationsofmaterials.

3.0INSTALLATION

3.1 Thesluicevalve/butterflyvalveshallbeloweredintothetrenchcarefully,sothatnopartisdamagedduringloweringoperation.

3.2 Ifnecessarytailpiecesshallbefittedwithsluicevalvefirstoutsidethetrenchandthenloweredintothetrench.

3.3 Therubberpackingshallbethreeplyandofapprovedthickness.Thepackingshallbeoff

ulldiameteroftheflangewithnecessaryholesandthesluice/butterflyvalvebore.Itsh allbeevenatboththeinnerandouteredges.

3.4 Theflangefacesthoroughlygrease

3.5 Ifflangefacesarenotfree,thecontractorshallusethinfibersofleadwool.

3.6 After placingthepacking,nutsandboltsshallbeinsertedandtightenedto makethejoint.

3.7 Thevalveshallbetightlyclosedwhenbeinginstalledtopreventanyforeignmaterialsfr omgettinginbetweentheworkingpartsofthevalve.

3.8 Eachflangeboltshallbetightenedalittleatatimetakingcaretotightendiametricallyop positeboltsalternatively.

3.9 Thesluicevalve/butterflyvalveshallbeinstalledinsuchawaythatitsspindleshallrema inintrulyverticalposition.

3.10 Theotherendoftailpieceshallbefittedwithpipessothatcontinuouslinescanwork.

3.11 Extraexcavationrequiredforfacilityofloweringandfixingsluicevalveshallnotbepaid for.

4.0TESTING

4.1 Afterinstallationofsluicevalve/butterflyvalvethesameistestedto11/2timesofitstes tpressure.

4.2 The joints sluice valve/butterfly valve shall withstand the test pressure ofpipelines.

4.3 Defectsnoticedduringtestandoperationofsluicevalveshallberectifiedbythecontracto rathisowncostwithoutanyextraclaimtotheentiresatisfactionoftheEngineer-in-charge.

5.0MODEOFMEASURMENTANDPAYMENT

5.1 Themeasurementshallbetakenpernumberofsluicevalve/butterflyvalveofspecifieds ize.

5.2 Therateshallbepernumberfittedinapipeline as per schedule of payment.

5.3 Fornon-testingofvalve30%oftheratequotedshallbewithheldtilltestingisgiven.

ItemNo.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 confirming to ASTM-D-1785 in required length as per site condition and as directed by Engineer in charge AndLabour 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)

TECHNICALSPECIFICATIONSFORCOMPRESSIONFITTINGS
90DEGCOMPRESSIONELBOWWITHMETALINSERT

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,NutandThrustRingwillbeinjectionmoldedfromPolypropylene andUV stabilizedbody&thrustringblackincolour,Nutblueincolour.LipgasketsinFood safeRubber(NBR) blackcolour musthaveaconicalshapeoninsideofgasketforeasy insertionof pipe &withtwolips on bottomto guaranteegood sealing.Use of O ringnot permittedClampring material willbePolyacetal (POM) whitecoloredandshallnotbe connectedtothrustring.Malethreadedpartwillbemadeof SS304.

Theproductwillbetestedasperbelow

Typetest	**Standard**
Dimensionsofthethreads	ISO7/1
Tightnessofthejoints	ISO3458
Tightnessofthejointswhensubjectedtobending	ISO3503
Resistancetopull-out	ISO3501
Internalunder-pressuretest	ISO3459
Longtermpressuretest	ISO/DIS14236

90DEGCOMPELBOWwithCOMPRESSIONJOINTBOTHENDS
TheCompressionElbowswillhavecompressionendsinbothsides,sothatPEpipescan beconnectedatbothends.Pressureratingwillbe PN16.

Body,NutandThrustRingwillbeinjectionmoldedfromPolypropylene andUV stabilizedbody&thrustringblackin colour,Nutblueincolored.LipgasketsinFoodsafe Rubber (NBR)blackcolour musthaveaconicalshapeoninside ofgasketforeasy insertionof pipe &withtwolips on bottomto guaranteegood sealing.Use of O ringnot permittedClampring material willbePolyacetal (POM) whitecoloredandshallnotbe connectedtothrustring.

Theproductwillbetestedasperbelow

Typetest	**Standard**
Dimensionsofthethreads	ISO7/1
Tightnessofthejoints	ISO3458
Tightnessofthejointswhensubjectedtobending	ISO3503
Resistancetopull-out	ISO3501
Internalunder-pressuretest	ISO3459
Longtermpressuretest	ISO/DIS14236

FEMALETHREADEDADAPTERwithMETALOFFTAKE

OneendoftheFemaleadaptor withmetalofftakewillbewithfemalethreads& otherendwillhavecompression fittingsuitabletoconnecttoPEpipe.TheTaper malethreadswillbepressuretight. Pressureratingwillbe PN16.
Body,NutandThrustRingwillbeinjectionmoldedfromPolypropylene andUV stabilizedbody &thrustringblackincolor,Nutblueincolor.LipgasketsinFoodsafe Rubber

(NBR)blackcolormusthaveaconicalshapeoninsideofgasketforeasy insertionof pipe &withtwolips on bottomto guaranteegood sealing.Use of O ringnot permittedClampringmaterialwillbePolyacetal(POM)whitecolouredandshallnot beconnectedtothrustring.Femalethreadedpartwillbemadeof SS304.

Theproductwillbetestedasperbelow

Typetest	Standard
Dimensionsofthethreads	ISO7/1
Tightnessofthejoints	ISO3458
Tightnessofthejointswhensubjectedtobending	ISO3503
Resistancetopull-out	ISO3501
Internalunder-pressuretest	ISO3459
Longtermpressuretest	ISO/DIS14236

Thepipeandfittingshallbelowered,laidandjointusingelectro-fusionprocessand hydraulictestingshallbe doneasspecifiedaboveinelectro-fusionfitting.

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 Vaccum.
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

Anysoilwhichgenerallyyieldstotheapplicationofpickaxesandshovels,phawaras rakesoranysuchordinary excavating implementororganicsoil,gravel,siltandturf loam,clay,peatetc.fall underthiscategory.

Clearing the site

Thesiteonwhichthestructure istobebuiltshallbecleared,andallobstructions,loose stone,materials andrubbishofallkind,bush,woodandtreesshallbe removed as directed.ThematerialssoobtainedshallbepropertyoftheGovernmentandshallbe conveyedandstackedasdirectedwithin50m.leadTherootsofthetreescominginthe sidesshallbecutandcoatedwithahotasphalt.
Therateof sideclearanceisdeemedto be includedin the rateof earthworkforwhichno extrawillbepaid.

Setting out

Afterclearingthesite,thecentrelineswillbegivenbytheEngineerincharge. The contractorshallassumefullresponsibilityforalignment,elevationanddimensionof eachandallpartsforthework. Contractorshallsupplylabours,materials,etc.required forsettingoutthereference marksandbenchmarksandshallmaintainthemaslongas requiredanddirected

Excavation

Theexcavationinfoundationshallbecarriedoutintruelineandlevelandshallhavethe widthanddepthasshowninthedrawingsorasdirected.Thecontractorshalldothe necessaryshowingandshuttingor providingnecessaryslopesto asafeangle,athis own cost.Thepaymentforsuchprecautionary measuresshallbepaidseparatelyifnot specified.Thebottomoftheexcavatedareashallbeleveledbothlongitudinallyand transferelyasdirectedbyremovingandwateringasrequireNoearthfillingwillbe allowedforbringing ittolevel,ifbymistakeoranyotherreasonexcavations ismade deeperorwider thanthatshown ontheplanordirected.Theextradepthorwidthshall bemadeupwithconcreteofsameproportionasspecifiedforthefoundationconcreteat

thecostofthecontractor. Theexcavationupto1.5m.depthshallbemeasuredunder thisitem.

Disposal of the excavated stuff

Theexcavatedstuffof theselectedtypeshallbe usedin fillingthetrenchesandplinthor levellingthegroundinlayersincludingrammingandwateringetc.
Thebalanceoftheexcavatedquantityshallberemovedbythecontractorfromthesite ofworktoaplaceasdirectedwithleadupto50m. andalllift.

Dismalting of asphalt /metal road

Underthisitemcontractor shalldemolishexistingasphaltorWBM/CCpavementmet withduringlayingpipe.

Onlyareaofpavementintercepted inpipelayingshallbedemolished.Ifexcessareais demolishedsameshallbereinstatedbythe contractor.

Demolishedmateriallikeasphaltpavementlumpandmetalshallbestackedseparately asdirectedbytheEngineerincharge.

Workdonetotheextentofrequirementforlayingofdrainand asperspecificationsshall bemeasuredinsq.m.andpaidatthetenderrate.
Mode of measurements and payment

Thedescriptionofeachitemshall,unlessotherwisestated,beheldtoincludewhere necessary,conveyance,anddelivery,handling,unloading,storing,fabrication, hoisting, alllabourforfinishingtorequired shapeandsize,setting,fittinginposition,straight, cuttingandwaste,returnofpackingsetc.

Thelengthshallbemeasuredonrunningmetrebasisoffinishedwork. Thelengthshall betakenalong the centre lineofthepipeandfittings. Thepipesfixed towalls, ceiling, floorsetc.shallbemeasuredandpaidunderthisitem.

Alltheworkshallbemeasuredindecimalsystemasfixedinitsplace,subjectto tolerancegivenbelowunlessotherwisestate

(i) Dimensionsshallbemeasuredtothenearest0.01metre.
(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 consequentwaste.
In caseoffittingofunequalbore,thelargestboreshallbemeasuredforthetest.
Testingofpipelines,fittingsandjointsincludeforprovidingallplantandappliances necessaryforobtainingaccesstotheworktobetestedandcarryingoutthetests.
Therateincludesalltheelectro-fusionfittingssuchasfemaleadopter,elbow,bend, reducer,couplingetc. requiredforthewatermeterconnection.

Therateshallbeforaunitofonerunningmetre.

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:

Strapsaddlesshallbesuitable forCI/DI pipesofnominalsize60mmto300mmwith nominaloutletconnectionsizefrom½",¾"&1" BSPfemalethread

Thebodyshallbe**Resicoat®epoxy**coatedwiththickness>250 micronasperGSK standard&EN14901. Thesaddlesshallbesingletypeuptopipesizesof NB300and serviceoutletof½",¾" and1"BSPfemalethread

Fastenersshallbeofthreadednut-bolt-washertype.Nut-boltsofsize1/2"(M12)shall beused.

SaddlestrapshallbewithNBRprotectionrubber.

Thesealingbetween thesaddleandmainsshallbeobtainedbyusingaprofiled elastomeric sealmatching tothecurvature ofthepipe.ThesealshallbeofNBR elastomerictype,suitableforallpotablewaterapplications.

Theclamp saddlesshallbesuitableforonlinetappingwithspatula&drilling tool, maximumworkingpressuresupto**16**bars.

Material and Design Specifications

Saddlebody:DIGGG40with**Resicoat® epoxy**(forcorrosionprotection offittings) coating withlength172mm,width75mm,height67mm&threaddepth24.5mm.The bodyshallhaveretainingcavity housing forinternalandexternalretentionofthe elastomeric seal.Sealingshallbeachievedbypressureexertedbythebodywhile fasteningthesaddlestraps&bodyonthepipe.
Saddlestrap:Saddlestrapsshallbemadeofstainless**steel304grade,gauge16&width40m m** topreventcorrosion overthelongservicelife&shouldbewithnoweld jointtoavoidinconsistencyofstrength.
StrapProtectionRubber:NBRUVprotectedElastomeric (rubber)shallbesuchthat noneoftheStainlessSteelStrapisindirectcontactwiththepipe. Itshallensureafirm nonslipgripmountingonthepipeduetoexternalloading.
Saddleseal: ItshallbevirginrubberNBRClass70complying withEN682-2002.It shallbe of type pressureactivatedhydro-mechanicaldesign. Itshallbecontouredgasket toprovideapositiveinitialsealwhichincreaseswithincreaseinthelinepressure. Gasketshallbe,withtheoutletsectionhavingo-ringcontactingthesaddlebody.

Nuts–Bolts-Washer:StainlessSteelType304,NCrolledthread,Tighteningtorque for½"(M12)nut-bolt:14-15kgm.

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 ½" (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) 15mmdia. (ii) 25mmdia. (iii) 40mmdia. (iv) 50mmdia.

Thebrassferruleshallbe bestqualityandmakeasapprovedbyEngineer-in-charge.

Theworkshallbecarriedoutingoodworkmanshipmannerasdirectedbythe Engineer-in-chargewithproperfixingof ferruleasrequire

ItemNo.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

Anchorageinthe formofathrustblockateachdeflection in the horizontaland/or in vertical alignmentofthepipelineshall beprovidedasperthedesignrequirementsto resistanyunbalancedpressureatthebends.Gravitytype thrustblocksshallbeprovided athorizontal andverticaldeflectionsinthe pipeline,whichshallbedesignedaccordingto thetestpressureandthesoilconditionsatthe siteofthethrustblock.Beforedesigning the thrust blocks the Contractor shall assessthe stabilityofthe soil considering erosion due to wind and water. The general guidelinesto be followed for providing and designing of thrust blocks shall be as under:

Thethrust blocksmaynotberequired forbendanglesupto5%. However, necessarycalculationsshallbesubmittedbytheContractorforapprovalby Employer to establishthatthe thrustshall be takencare bypipe itselfandthat it is safe not to havethe thrust block.

The thrustshall be designed according tothe field test pressure of thepipe.

For above groundpipelines,thrustblocks shall be designed to take 100% thrust.

Forburiedpipelines,thrust blocksoncontinuous pipelinesectionsshallbe designedconsidering50%thrusttobetakenbyblockandbalancebypipeas per CPHEEOmanual.

Forburiedpipelines,thrustblocksnearvalvechambersand/oranyother dismantlingjoints shall be designed to take 100%thrust.

In rockthepassive pressure of rock shall be considered for thrust block design

ThethrustblocksshallbeofconcreteM20,castin-situ,withminimumsurface reinforcementof5kg/m2.Noformworkisrequiredtobeusedforconstruction ofthrustblocksinburiedconditions, unlessdesiredbythe Contractor.The calculationsforthedimensioningandtheshapeofthe thrustblocksshall be approved by the Employer.

Anchorblocksshallalsobelocatedwhereverthereisatransitionbetweenabove groundandburiedpipelines.All suchanchor blocksshallhaveflexible jointsat either end to allowfor small amounts ofsettlementto occur.

TheContractorshallconstructthethrustblocksasearlyintheprogramofwork asispractical,andatleastsixmonthspriortoinstallationoftheaboveground pipelineinordertoreducetheriskofsettlementimposingadditionalloadson thepipelinesupports.Allthrustblocksaretobecompletedoneachsection before the sectional hydraulic testing is conducted.

Wherepossible,thebaseofthethrustblockshallbecastagainstsolidrockin ordertopreventany settlement.Anymaterial overlying the rockshall be excavatedandreplacedwithclass M15mass concrete.Intheeventofnorock being encountered, the base of the thrust block shall be cast against undisturbedground.Anyground, whichintheEmployeropinionisunsuitable, shall be excavated andreplaced with classM15mass concrete.

1.0 Materials:

Watershallconformto M-1,cementshallconformto M-2,Sandshallconformto M-4,GritshallconformtoM-8.Gradedstoneaggregate20mm,nominalsize shall conform to M-12.

2.0 General:

2.1 The concrete mix is not required to be designed by preliminary tests. The proportionofconcretemixshallbe1:1:2(1Cement:1coarsesand:2graded stone aggregate) 20 mm nominal size) byvolume.
Concreteworkshall have exposedconcrete surface or asspecified inthe item.

2.2 The designation ordinary M-100, M-150, M-200, M-250 specified as per IS correspondapproximatelyto1:3:6,1:2:4,1:1$^{1}/_{2}$:3 and1:1:2nominalmixof ordinary concrete byvolume respectively.

2.3 The ingredients required for ordinary concrete containing one bag of cement of 50 Kg by weight(0.0342Cu.M) fordifferent proportions of mix shall be as under:

Grade of concrete	Total quantity of dry aggregate by volumeper50kgs of cement to be takenasthesumof individualvolumeof 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	Generally1.2forfine aggregate to coarse aggregate by volume but subject to an upperlimitof1:1.1/2 and lower limit 1:3	34 Litres 32 Litres 30 Litres 27 Litres

2.4 Thewatercementratioshallnotbemorethanspecifiedintheabovetable.The cementconcreteofthemixspecifiedintheTableshallbeincreasedifthe quantityof waterinmixhastobeincreasedtoovercomethedifficultiesof placementsandcompactionsothatwatercementratiospecifiedonthetableis not exceeded.

2.5 Workabilityoftheconcreteshallbecontrolledbymaintainingawatercement ratiothatisfoundtogiveaconcretemix whichisjustsufficientwettobe placed and compacted without difficulty with the means available.

2.6 Themaximumsizeofcoarseaggregateshallbeaslargeaspossiblewithinthe limitsspecifiedbutinnocasegreaterthanonefourthofminimumthicknessof the member, providedthat the concrete can be placed without difficulty so as to surround all reinforcementthoroughly and tofill the corners of theform.

2.7. Forreinforcedconcretework,coarseaggregateshavinganominalsizeof20mm, are generally considered satisfactory.

2.8 Forheavilyreinforcedconcretemembersasinthecaseofribsmainbeams,the nominal maximum sizeof coarse aggregate should usually be restricted to 5 mm, lessthantheminimumthedistancebetweenthemainbars,or5mmlessthan the minimum cover tothe reinform or whichever is smaller.

2.9 Wherethereinforcementiswidelyspacedasinsolidslabs,limitationsofsizeof the aggregate may not be so important, and the nominal maximum size may sometimesbe as greater as orgreater thanthe minimum cover.

2.10 Admixturemaybeusedinconcreteonlywithapprovalofengineer-in-charge basedupon theevidencethatwith the passageoftime,neitherthecompressive strengthof concreteisreducednorare otherrequisitequalitiesofconcreteand steel impaired bytheuse of such admixtures.

3.0 Workmanship:

3.1 Proportioning:

Proportioning shall be done byvolume,exceptcementwhichshall bemeasured in terms of bags of 50 kg. weight the volumeof one such bagbeing taken as 0.0342 cu.metre.Boxesofsuitablesizeshallbe used formeasuringsandaggregate.the

sizeofboxes(internal)shall be35x 25cms,and40cmsdeepwhilemeasuring the aggregateand sand the boxes shall be filled withoutshaking rammingor hammering.Theproportioningofsandshall beonthebasisofitsdry volumeand incase ofdamp sand, allowancesfor bulkageshall be made.

3.2 Mixing:

3.2.1 Forallwork,concreteshallbemixedinamechanicalmixerwhichalongwith other accessories shallbe keptin firstclass working conditionand so maintained throughout theconstruction.Measuredquantityofaggregate,sand andcement requiredforeachbatchshallbe poured intothedrumofthemechanical mixer while itis continuouslyrunning.After about halfa minute ofdry mixing measured quantity of water required for each batchofconcrete mixshall be added gradually and mixing continued for another one and a half minute. Mixing shall be continued till materials are uniformly distributed and uniform colorof the entire mass is obtained and eachindividual particle ofthe coarse aggregate shows complete coating of mortarcontaining its proportionate amount of cement.In no case shall the mixingbe done for less than2 minutes afterall ingredients have been put into the mixer.

3.2.2 Whenhandmixingispermittedbytheengineer-in-chargeforsmalljobsorfor certainotherreasons,itshallbedone onthe smoothwatertightplatformlarge enough to allow efficient turning over the ingredients of concrete before and after addingwater.Mixingplatform shallbesoarrangedthatnoforeignmaterial gets mixedwithconcretenordoesthemixing waterflowout. Cementinrequired numberofbagsshallbeplacedinauniformlayerontopofthemeasured quantityof fineandcoarseaggregate,whichshallalsobespreadinalayerof uniformthicknesson themixingplatform.Drycoarseandfineaggregateand cementshallthenbemixedthoroughlybyturningovertogetamixtureto uniform color.Specified quantityofwatershall thenbeaddedgraduallythrougha rosecanandthemassturnedovertillamixofrequiredconsistencyisobtained. Inhandmixingquantityofcementshall beincreased by10 percent above that specified.

3.2.3 Mixerswhichhavebeenoutofuseformorethan30minutesshallbethorough cleanedbeforeputting inanewbatch. Unlessotherwiseagreedtobythe engineer-in-chargethefirstbatchofconcreteformthemixtureshallcontainonly two thirds of normal quantity of coarse aggregate. Mixing plant shall be thoroughlycleaned before changing from onetype of cement toanother.

3.3 Consistency:

3.3.1 Thedegreeofconsistencywhichshalldependuponthenatureoftheworkand themethodsofvibrationofconcrete,shallbedeterminedbyregularslumptests inaccordancewithIS1199-Latestedition.Theslumpof10mmto25mmshall be adoptedwhen vibrators are used and 80 mm whenvibrators are notused.

3.4 Inspection:

3.4.1 Contractor shall give the engineer-in-charge due notice before placing any concreteintheformstopermithimtoinspectandacceptthefalseworkand formsastotheirstrength,alignment,andgeneralfinenessbutsuch inspection shallnotrelievethe contractor ofhisresponsibilityforthesafetyofmen, machinery,materials and for results obtained. Immediately beforeconcreting, all forms shall be thoroughly cleaned.

3.4.2 Centering design and its erectionshall be got approved from theengineer-in-charge.Onecarpenterwithhelpershallinvariablykeptpresentthroughoutthe periodofconcreting. Movementoflaborandotherpersonsshallbetotally prohibitedforreinforcementlaidinposition.Foraccessto differentpartssuitable mobile platformsshallbe providedso that steel reinforcementinpositionis not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast andtiedtothereinforcement.Timber,kapachi or metal pieces shallnotbe used for this purpose.

3.5. Transporting and Laying:

3.5.1 Themethodoftransportingandplacingconcreteshallbeasapproved.Concrete shallbesotransportedandplacedthatnocontamination,segregationorlossof itsconstituentmaterialtakesplace.All formworkshallbecleanedandmadefree fromstanding water dust, showor iceimmediately beforeplacing ofconcrete.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 Concretingshallproceedcontinuouslyoverthearebetweenconstructionjoints. Freshconcreteshallnotbe placedagainstconcretewhichhasbeeninpositionfor morethan30minutes unlessapropercontractionjointisformed.Concreteshall be compacted inits final positionwithin 30 minutes of its discharge from the mixer.Expertwhereotherwiseagreedto bytheengineer-in-chargeconcreteshall bedepositedinhorizontal layerstoacompacteddepth ofnotmorethan 0.45 meterwheninternalvibratorsareused andnotexceeding0.30meterinallother cases.

3.5.3Unlessotherwiseagreedtoby theengineer-in-charge,concrete shallnot be droppedintoplacefromaheight exceeding2meters.Whentrunkingorchutes areusedtheyshallbekeptcloseandusedin sucha way astoavoidsegregation. Whenconcretinghastoberesumedona surfacewhich hashardeneditshallbe roughenedsweptclean,thoroughlywettedandcoveredwitha13 mmthicklayer ofmortar composedofcementandsandinthe same ratio asintheconcrete mix itself.This13 mm layer ofmortarshall be freshlymixedand placed immediately beforeplacingof newconcrete.Whereconcretehasnotfullyhardenedalllaitance shall be removed by scrubbing the wet surface with wire of bristlebrushes care being taken to avoid dislodgementofanyparticles of coarse aggregate.The surfaceshall thenbethoroughlywettedall freewaterremovedand then coated withneatcementgroutthefirstlayerofconcretetobeplacedonthissurface shallnotexceed150mminthicknessand shallbewellrammedagainstoldwork particular attention being given to corners andclose spots.

3.5.4 Allconcreteshallbecompactedtoproduceadensehomogenousmasswiththe assistanceofvibratorsunlessotherwisepermittedby theengineer-in-chargefor exceptionalcasessuchasconcretingunderwaterwherevibratorscannotbe used.Sufficientvibratorsinserviceableconditionshallbekeptatsitesothat spareequipmentisalwaysavailableintheeventofbreakdowns.Concreteshall bejudgetobecompactedwhen themortarfillsthespacesbetweenthecoarse aggregateandbegins tocreamupto formanevensurfacemixture.During compaction,it shall be observedthatneedle vibratorsarenotapplied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

3.6 Curing:

Immediatelyaftercompaction, concreteshallbe protectedfromweatherincluding rainrunningwatershocksvibrationtrafficrapidtemperaturechangesfrostand dryingoutprocess.Itshallbecoveredwithwetsackinghassianorothersimilar absorbent material approvedsoonaftertheinitialsetandshall bekept continuously wet for a period of not less than 14 days from the date of placement.Masonaryworkoverfoundationconcretemaybestartedafter48 hoursofits layingbutcuringof concreteshall becontinuedforaminimumperiod of 14 days.

3.7 Samplingandtesting of concrete:

3.7.1.SamplesfromfreshconcreteshallbetakenasperIS1199-Latestedition,and cubes shallbe made cured and tested at 7days of 28 days as per requirements in accordancewithIS516 -Latestedition.Arandomsamplingprocedureshall be adoptedtoensurethateachconcretebatchshallhaveareasonablechanceof being tested i.e.the sampling should be spreadoverthe entireperiodof concreting andcoverallmixingunits. The minimumfrequencyofsamplingof concrete ofeach gradeshall be inaccordancewith 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 orpart thereof		

NOTE:-Atleastonesampleshallbetakenfrom eachshift.Tentestspecimensshallbe madefromeachsamplefivefortestingat7daysandthe remainingfiveat28 days.Thesamplesofconcreteshall be takenoneachdaysoftheconcretingas perabovefrequency. Thenumber ofspecimensmaybesuitablyincreasedas 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.Theaveragestrengthofthegroupofcubescastforeachdayshallnotbeless thanthespecifiedcubestrengthof150Kg/Cm^2 at28days.20%ofthecubes castforeachdaymay havevaluelessthan thespecifiedstrength.Suchconcrete shall be classified as belonging tothe appropriatelower grade.Concrete madein accordance with theproportiongivenfor a particulargradeshallnot, however,be placedin ahighergradeon thegroundthatthetest strength arehigherthanthe minimum specified.

3.8 Stripping:

3.8.1. Theengineer-in-chargeshallbeinformedinadvancebythecontractorofhis intentiontostriketheformwork.While fixingthetimeforremoval ofform,due considerationshall begivento local conditions,character ofthe structure,the weatherandotherconditionsthatinfluencethesetting ofconcrete andofthe materials used in the mix. In normal circumstances (generally where temperaturesareabove20^{0}C)andwhereordinaryconcreteisused,formsmay be struck after expiry ofperiods specified belowfor respective item ofwork.

StrippingTime:
Innormalcircumstancesandwhereordinarycementisusedformsmaybestruck after expiry of following periods:

a) Side ofwalls,columns and vertical faces of beams - 24to 48hours.
b) Beam softish(props.left under) - 7 days
c) Removal of props slabs:
   i) Slabs spanning upto4.5m - 7days
   ii) Spanning over 4.5 m - 14days
d) Removal of props for beams and arches
   i) Spanning upto 6 m - 14days
   ii) Spanning over 6 m - 21days

3.8.2.Allformworkshallberemovedwithoutcausinganyshockorvibrationaswould damagetheconcrete.Beforethesoffitandstrutsandstrutsareremoved,the concrete surface shall be gradually exposed, where necessary in order to ascertainthatconcretehassufficientlyhardened.Centeringshallbegradually anduniformlyloweredinsuchamannerastopermittheconcretetotake stresses due to its ownweightuniformlyand gradually.Where internal metal ties arepermitted,theyor theirremovablepartsshallbe extracted withoutcausing anydamagetothe concreteandremaining holesfilledwithmortar.No permanentlyembeddedmetalpartshallhave less25mmcoverto the finished concretesurface.Whereitisintendedtore-usetheform work,itshallbecleaned andmadegoodtothesatisfactionof the engineer-in-charge.Afterremovalof 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.Immediatelyaftertheremovalofforms,allexposedboltsetc.passingthrough thecement concretememberandusedforshutteringoranyotherpurposeshall becutinsidethecementconcrete member toadepthof atleast25mbelowthe surfaceoftheconcrete andtheresultingholesbefilledbycementmortar.Allfins cussed by form joints, all cavitiesproduced by the removal of formties and all otherholesanddepressions,honeycombspots,brokenedgesorcornersand otherdefects,shall bethoroughly cleaned, saturated withwaterand carefully pointedandrenderedtruewithmortarofcementandfineaggregatemixedin proportionsusedinthegradeofconcrete thatisbeingfinishedandofasdry consistency asispossibletouse. Considerable pressureshall beappliedinfilling and pointing to ensurethroughfilling inall voids.Surfaces whicharepointed shall bekeptmoistforaperiodof24hours.If pockets /honeycombs inthe opinionof the engineer-in-charge are of such an extent or character as to affect the strengthofthestructurematteriallyortoendangerthelifeofthe steel reinforcement,hemaydeclaretheconcretedefectiveandrequiretheremoval and

replacement of theportions ofstructure affected.

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

(i) Incaseofbeamandslabconstruction,sufficientnumberofprecastcoverblocks incementmortar1:2(1cement:2coarsesand)about4x4cms.sectionand ofthicknessequalto thespecifiedcovershallbeplacebetween thebarsand shuttering astosecureandmaintaintherequisitecoverofconcreteoverthe reinforcement.Incaseofcantileveredordoublyreinforcebeamsorslabs,the- mainreinforcingbars shallbeheldinpositionbyintroducingchainspacersor supports bars at 1.0.to1.2 metres centers.

(ii) Incaseofcolumnsandwalls,theverticalbarsshallbekeptinpositionbe meansoftimbertemplatesslotesaccuratelyoutinthem,thetemplatesshall be removed after concreting has been done below it. The bars Ray also suitably tied bymeans ofannealed steel wires to theshutteringto maintain positionduringconcreting.

1.2. Allbars,projectingformpillars,Columnsbeams,slabsetc,towhichotherbars andconcreteareto beattachedorboundedtolateron,shallbeprotected with a coat of thin neat cement grout, if the bars are not likely to be incorporatedwithsucceedingmassofconcretewithinthefollowing10days, Thiscoatofthinneatcementshallberemovedbeforeconcreting.

4.0. Modeofmeasurements&payment.

4.1. Theconsolidatedcubicalcontentsofconcrete,workasspecifiedinitemshall be measured. The concrete laid in excess of sections shown on drawing or as directedshallnotbemeasured.Nodeductionshallbemadefor (a) Endsofdis- simmilarmaterialssuchasjoints,beams,posts,girders,rafters, purlinetrusses,corbelsandstepsetc.upto500sq.cm.insection, (b) Openingupto0.1Sq.M.

4.2. The rate includes cost ofall materials labour,tools and plantrequited for missing,placinginposition,vibrating and compacting,finishing,asdirected. curingandallotherincidentalexpensesforproducingconcreteofspecified strength.Therateexcludesthecostofformwork.

4.3 Therate shallbe foraunitofonecubicmeter.

ItemNo.11:

Providing and supplying C.I. Temper proof Air valves with Isolation Sluice valve ss 304 Float gun metal- nozzle of approved make & qualily 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

TemperproofairvalveconfirmingtoAWWAC512,havingoutletforadmissionandreleaseofbulkvolumeofairduringemptyingandfillingofthepipeline.Theballsealedorificeshallalwaysremainopenwhileairisexhaustingandisimmediatelyclosedwhen Waterrisesinthechamber,liftstheballandsealstheorifice.

Itshallalsoensurethattherearenorecessesorpockets,sheltering,escapingairforthelargeorifice(lowpressure)balltodropintowhenthevalveopen.Turbulentairatthetimeoffillingofpipeshallnotcirculateinsuchcavitiesandcausetheballtoblownintowhenthevalveisopen.

Turbulentairatthetimeoffillingofpipeshallnotcirculateinsuchcavitiesandcausetheballtoblowni ntothedischargingairstreams,blowingthevalveshutprematurely.Theconeangleofthelowerpr essurechambershallbesuchthatevenatthecriticalvelocityofallairescapeat300m/sec.

Thetotalimpactforceontheballislessthanthesuctionforceontheangulararеabetweentheballan dthecone.Thedesignofthevalveshouldbesuchastoallowmaximumfreeairdischargeatvariousp ressuredifferentials.

Thelowpressurecovershallbemassiveanddesignedtowithstandfulloperatingthrustinworking Conditions.Theseatringshallbeheldsecurelyinplaceunderthelowpressurecoverbyajointsuppo rtringtopreventitfromsaggingwhentheballisnotsealingtheorifice.

Testing

Allvalvesshallhydrostaticallytestedbythemanufacturerbeforedispatch.Thepressureshallbe obtained without any significanthydraulicshock.Testingshallbecarriedonbeforeapplicationofpaint.Thereshallbeno airentrappedwithinthepartofthevalvessubjectedtotestpressure.TestpressureasperAWWAC 512orAPI598.

PositivematerialIdentification(PMITest)

PMItestshallbecheckedatrandomforStainlesssteelparts.

TestCertificates

WhenspecifiedbyOwner,themanufacturershallissueatestcertificateconfirming that the valves have been tested in accordance with thisstandardandstatingtheactualpressuresandmediumusedinthetest.

Marking

Markingshallbecastintegralonthebodyoronaplate securelyattachedtothebodyfor‘DN’size,‘PN’rating,HeatNumberandSerialnumber.

Painting

Eachvalveshallbedrained,cleaned,preparedandsuitableprotectedwith2coatsofredoxideandt henblackbituminouspaintforminimumof150micronDFTonsurfacesbeforedispatch.

Datasheet:

TAMPERPROOFAIRVALVE				
SrN	**Component**	**PN-1.0**	**PN-1.6**	**PN-2.0**
1	Body	CIIS210Gr.FG26	CIIS210Gr.FG26	ASTMA216Gr.WCB
2	Cover	CIIS210Gr.FG26	CIIS210Gr.FG26	ASTMA216Gr.WCB
3	Float	SS410	SS304	SS304
4	Seat	EPDM	EPDM	EPDM
5	FloatGuide	SS410	SS304	SS304
6	Orifice	SS410	SS304	SS304
7	Gasket	EPDM	EPDM	EPDM
8	NutBolt	Carbonsteel	Carbonsteel	StainlessSteel
9	FlangeEnd	IS1538	IS1538	ASME/ANSIB16.5Class15

ErectionofAirvalveriser
1.0SUPPLYOFMATERIAL

1.1 G.I.HDpipeshallbesuppliedandcartedbythecontractor.Therateshallincludeloading,unloadingandstackingatsite.
1.2 TheG.I.HDpipeshallbeexaminedbeforeerectingforcracksandotherflows.

Theyshallbeundamagedinallrespect.

1.3 TheG.I.HDpipeshallbeproperlycheckedbeforeerecting.
1.4 AllgritsandforeignmaterialsshallberemovedfromtheinsideofG.I.HDpipebeforeerecting.
1.5 Allthefacesofpipeshallbethoroughlycleaned

2.0JOINTINGMATERIAL
2.1 Thecontractorshallprovideallnecessaryjointingmaterialssuchasnutsbolts,rubberpackingwhitezincjuteleadwooletc.
2.2 Alltoolsandplantrequiredforinstallationofsluicevalveshallbeprovidedbythecontractor.
2.3 Alljointingmaterialsshallbeapprovedfromtheengineer-in-chargebeforeuse
2.4 ThenutandboltsshallconformtoItemNoMSP-19ofspecificationofmaterials.
2.5 Therubberpackingshallconfirmallspecificationsasnarratedin ItemNoMSP-20ofspecificationsofmaterials.

SpecificationsforAirRiserforPipelineareasunder:
TheworkofairvalverisershallbecarriedasperdrawingattachedColumn/FootingsforAirriserpipeshallbecarriedoutincementconcreteM-200usingtrapmetalasperinstructionsandworkmanshipoftheengineeringincharge.MaterialsandworkmanshipshallbegiveninconcretesectionThereinforcementasperISStandardandspecifications.TheitemAirValveraisingincludesthecostofprovidingandlayingcementconcreteM-200baseMSclamps,GIH.pipe,M.S.flange,nut,bolts,rubberpackingandcementconcretecolumninM-200etc.complete.
The payment for Air valve shall be on number basis.

ItemNo.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.

Eachboltshallbe tightenedalittleat atimetakingcaretotighten diametrically opposite holes alternatively.

Testing:
The air valve shall be tested during the 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 mmdia. (ii)32mmdia. (iii) 50mmdia. (iv) 63mmdia.

TheU PVCballValveswillhaveCompressionendon onesidetoconnectPEPipesand femalethreading ontheothersideforconnectingBSPthreadedfittingsorpipes.The productshallconfirmtoISO4422-4Standards andpressure ratingwillbePN16.The productshouldbesuitableforuseindrinkingwaterforhumanconsumption.

Body,NutandThrustRingwillbeinjectionmoldedfromPolypropylene andUV stabilizedbody &thrustringblackincolor,NutblueincolorLipgaskets/ORingin FoodsafeRubber (NBR)blackcolormusthaveaconicalshapeoninsideofgasketfor easyinsertionofpipe&withtwolipsonbottomtoguaranteegoodsealing.UseofO ringnotpermittedClampringmaterialwillbePoly acetal(POM)whiteclouoredand shallnotbeconnectedto thrustring.
TheCompression Fittings&UPVCBallValvesfordrinkingwaterapplicationsshould haveundergonetypetestbyWRc-NSF,U.K.accordingtoBS6920andacertificate fromeitherWRc-NSForWRAS(WaterRegulationsAdvisory Scheme)shouldbe availableevidencingthisfact.

Thepaymentshallbemadeaspernumberbasis.

ItemNo.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 jummed 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.

ItemNo.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 2)	-	Code of practice for steel tubular scaffolding.

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 (Parts I and III)	-	Safety code for scaffolds and ladders.
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 (Part 1 to 28)	-	Method of measurement of building and engineering works.
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 find 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 or 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 ¼th 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 contract 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** by 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 for 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 place 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 use 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 allowe In their placed bolts passing through sleeves shall be use 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 or moisture.

For liquid retaining structures sleeves shall not be provided for through bolts or shall through bolts be removed if provide 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 stressed arising during the construction perio

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 fixe 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 achieve
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 place
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 continuos sprays or ponded water or continuously saturated coverings of sacking, canvas, hessain 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 recorde 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 teste The total drop in surface level over a period for seven day 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 perio 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 even 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 remove 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 partisan	0.44
b)	General mix	25 mm and over but less than 50 mm	One part Portland cement to 2 partisan	0.53
c)	Stiff mix	50 mm and over	One part Portland cement to 3 partisan	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, constructiontools, 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.

a) Properties of constituent materials;
b) Characteristic compressive strength;
c) Specified mix proportions;
d) Minimum cement content;
e) 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 take 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 require

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 upto 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 Requirementsfor 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/m^3 with a maximum 20 mm size aggregate and 360 kg/m^3 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 chequerred 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 : Date :

Project : Structure :

Contractor : Max. Aggregate size slump : mm/ mm/

Drg. NO. : Start/ Completion Time :

Concrete Grade : 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	Embeded 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 :

1. Each item to be checked & signed by the respective engineers.
2. Item 8 to 13 (Both inclusive) to be filled by only engineers of the client.
3. Each pour to have separate cards in triplicate one each for client & site office.
4. 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 be 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/cm^2. 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 additional 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 empeare to the recommendations of the manufacturers of the electrode being use The arc length, voltage and empeare 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 atleast 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 war page 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 remove

Safety Precautions

(a) Operators of welding and cutting equipment shall be protected from the rays of the arc flame gloves and by helmet, hand shields, or goggles equipped with suitable filter lenses.
(b) Closed space shall be ventilated properly while welding is being gone 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 specification.

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 expect 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, buckets 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 corrossion 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 strainghened 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 untill completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placeTo 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

CITYENGINEER
RajkotMunicipalCorporation

SignatureofContractor

BILLOF QUANTITIESANDPRICE

The Bill ofquantitiesconsistsoffollowingsections:

CIVILWORKS:

Civil worksrequiresfollowing:

Excavationof Trenches

- ☐Providing, supplying, lowering, laying, jointing, testing and commissioningof variousdia. distribution &streetserviceDIpipeline withDISpecialsnetworkasperthedetailedspecifications showninVol- II.
- ☐ Beddingforpipeswithselectedmurrum
- ☐ Supportofpipingsystem,Thrustblocksof RCCin variousconcreteetc.
- ☐ Refillingthe pipelinetrencheswithproperramming
- ☐ All requirednecessaryitemsasdirectedbyengineerincharge.

Thebillofquantitiesforms themost importantpart ofthee-tenderdocuments. Thesupply,loweringlayingjointing,erection testingandcommissioningof pipeline whichformapartoftotalworksareindicated intheschedules separatedincludeinthedocuments. Thee-tenderingcontractorsshallpriceof this document.

Performancetestingand commissioning:

Thebillofquantities, generalconditions ofcontractorandthespecifications whichfromanintegralpartof this contractorshallbereadinconjugation.

Thebillofquantities, generalconditions ofcontractorandthespecifications whichfromanintegralpartof this contractorshallbereadinconjugation.

Paymentfordifferentitemsshallbe paidon %(percentage) aboveorbelow quotedbythecontractor onlineinthegivenpricebid.However foranyextra itemstobecarriedoutwithpermission ofengineerinchargerateswillbe decidedbytheRajkotMunicipal Corporation asperGC-70 wherevernot specifiedin the tender.

Whenevermanufacturerisseparateandcontractorforlowering,laying,joining andtestingisseparate, theprincipal contractor shallenterintoanagreement withDIpipes&DISpecialsmanufacturerforsatisfactorymanufacturingasper therelevantcodeofpractice,testing,transporting, stacking&testingafter layingat site as perRMCrequirement.

ADDITIONAL CONDITIONS

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

2. Lowering, laying and jointing works of all the pipelines shall have to be

carried out by using Sight Rails and Boning Staves.

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

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

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

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

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

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 regar

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

15. The rates are inclusive of dewatering, if require

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

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

18. Testing of the material like; Brick, Sand, Aggregate etc. should have to be tested periodically as suggested by the engineer- in- charge at Government approved material testing Laboratory and testing charges for the same has to be borne by the contractor.

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

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

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

22. The contractor will be responsible to avail P F Code as per the prevailing Circular of Government for the employees on work. The required documents regarding deduction of 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.

CITYENGINEER
RajkotMunicipalCorporation

SignatureofContractor