TAMILNADU WATER SUPPLY AND DRAINAGE BOARD

NAME OF WORK Providing new pipe line in lieu of the existing pipeline laid the proposed Railway over bridge along the Trichy – Kallanai Road – near LC248 under Tiruchirappalli - Srirangam Underground works including Maintenance of the component for one year at free of cost

TECHNICAL BID

CHIEF ENGINEER, EASTERN REGION THANJAVUR

TECHNICAL SPECIFICATIONS

Name and Address of contractor ;-

Whether the Bid document Down loaded or Direct Purchase ;-

Certified that the Bid Document containing **pages**

SIGNATUR OF CONTRACTOR

Index

I. Materials

All materials required for the works shall be procured and supplied by the contractor himself. The materials shall be of good quality and conforming to relevant BIS. The materials which are classified for ISI marking should be supplied with ISI marking only.

1. Cement and Steel

1.1 The entire quantity of cement and steel required for the work will be procured by the contractor. The

contractor is responsible for all transport and storage of the materials and shall bear all related cost.

The Employer shall be entitled at any reasonable time to examine the cement and steel supplied by the

contractor.

1.2 The cement procured by the contractor shall comply with the requirements of IS 269/ 1976 with the latest revision thereof for ordinary Portland cement and IS 8112/ 1989 with the latest revision thereof for 43 grade ordinary Portland cement. It shall be of the best normal setting quality unless specially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. Each bag shall bear ISI Certification mark and as per specification no.10 of TNBP volume I.

1.3 The steel bars shall comply with the requirements set forth in the IS 432 Part I, IS 1139, IS 1786 as the case may be with the latest revision thereof and the test as described for ultimate tensile strength, bond test and elongation tests.

All reinforcing steel shall be clean and free from oil, grease, loose scales or rust or other coatings of

any character which would reduce or destroy the bed. Each band containing the bars shall bear the ISI

Certification mark.

1.4 The cement/ steel shall be tested in nearby laboratories of Polytechnic or Engineering College by the Employer. Two samples should be taken by the Engineer in charge in the presence of the contractor or his authorised representatives or the technical personnel employed by the Contractor as in the agreement. The contractor shall without extra cost provide samples and co-operate in the testing of the cement/ steel. One sample shall be got tested and the other

sample shall be retained by making clear identification in the sample by the Engineer in charge so as to identify at a later date. The cost of such test shall be borne by the contractor.

1.5 All cement shall be procured in bags and shall be stored in a dry place for which the contractor shall be responsible. Consignment of bagged cement shall be properly stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in approximately in the chronological order in which it is received, but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be used unless it has been re-tested at the expenses of the contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 180 days from the date of initial sampling shall be rejected.

1.6 Cement which has become caked or perished shall on no account be used on the works and shall be rejected. Although the Engineer may have passed any consignment, he shall however have the power at the subsequent time to reject such consignment if he finds that any deterioration in the quality thereon has taken place.

1.7 A record of the quantity of cement/ steel procured with the name of dealer, bill number and date shall be maintained by the contractor. This should be produced for examination by the Engineer in charge at any time. The age of the cement shall be reckoned from the date of manufacture and it shall be verified by the Engineer in charge.

1.8 The rejected consignment of cement and steel should be removed from the site within two days.

2. Aggregates

2.1 Sand for use in masonry and plaster works shall confirm to relevant specification in TNBP (specification No. 7) and I.S.2116/ 1985, I.S. 1542/ 1977.

2.2 The coarse and fine aggregates for concrete shall confirm to I.S.383/ 1970 and as specified in the relevant clauses of I.S.456/ 1978. Other aggregates free from deleterious materials shall be used at the concurrence and approval of the Engineer after sufficient tests have been carried out at the contractor's cost.

2.3 The maximum quantities of deleterious materials in the aggregates, as determined in accordance with I.S. 2386 (Part II)/ 1963 shall not exceed the limits given in table I of I.S. 383. Unless otherwise specified all coarse aggregate in RCC shall be graded aggregate of 20mm nominal size. All aggregates shall be stored in hard impervious surface to ensure exclusion of all foreign materials and as per IS 4082/ 1977 and specification no.5 of TNBP volume I.

3. Water required for Construction

3.1 The water used in the construction shall be of potable quality and shall be tested at the contractor's cost. The contractor has to make his own arrangements at his cost for water required for construction, testing, filling, etc., either from local bodies or from elsewhere, by paying the charges directly and arranging tanker etc., as per necessity. No claim for extra payment on account of non availability of water nearby or extra lead for bringing water shall be entertained. All required piping arrangements and pumping if required for water shall be made by the contractor at his cost. Water for mortar, mixing and curing of concrete shall be free from harmful matter or other substances that may be deleterious to concrete or steel and taken from a source approved by the Engineer. Ground water for mixing and curing shall confirm to the provisions in the class 4.3 of IS 456/ 1978.

4. Admixtures

Only where a beneficial effect is produced shall any admixture be used and that too after test has been carried out to convince the Engineer that no harmful effect will be produced by the use of such admixture and after approval by the Engineer. The admixture shall confirm to IS 9103/ 1972.

5. Form Work and Centring

5.1 Steel/ wooden form centring shall be used. If wooden form work is used, it shall consist of planks not less than 40mm thick and strong props. This shall be provided complying with clause 10 of IS 456/ 1978 and specification no. 30.8 of TNBP. The timber for form works shall be best hard wood and got approved by the Engineer in charge. This shall be deemed to be included in the items of contract even otherwise specified.

6. Separator (Cover Block)

6.1 For bottom cover of beams, slabs etc., separators of pre cast cement mortar blocks of suitable size with wire embedment as directed shall be used and tied to the reinforcement. Between layers of reinforcements, separators consisting of pieces of bars of suitable diameter shall be used. The required cover shall be provided as per clause 24-4 of IS 456/ 1978.

7. Pipes, Specials and Valves

7.1 General

7.1.1 All types of pipes required for the works should be of good quality confirming to relevant BIS and should be procured from reputed manufacturer or his authorised dealer. Each pipe should bear the trade mark of the manufacturer, the nominal diameter, class weight, batch number and the last two digits of the year of manufacture suitably and legibly marked on it. The Engineer shall have the right to conduct any test to ascertain the quality of the pipes supplied by the contractor. The contractor should make all necessary

arrangements for testing the pipes. All the charges and expenses towards the testing shall be borne by the contractor. The materials which are classified for ISI marking should be supplied with ISI marking only.

7.1.2 If on examination of any sample from any portion of the supply, the material is found to be sub standard and not fully in accordance with the relevant specification, the entire consignment shall be rejected. In case of doubt whether the materials conform to the specification or not, the decision of the Executive Engineer shall be final.

7.2 C.I. pipes

7.2.1 CI pipes shall be procured from the reputed manufacturer and the pipe shall conform to IS 1536/1976 or IS 1537/1976. The pipes shall bear ISI mark. The test certificate furnished by the manufacturer should be produced

7.3 AC pressure pipes

7.3.1 AC pressure pipes procured by the contractor shall strictly conform to IS 1592/1989 and as amended from time to time and the pipes should bear ISI marking. The CID joints should conform to ISS 8794/1988 and as amended from time to time. The AC couplers together with rubber rings for jointing the pipes should properly suit the AC pipes and withstand the same test pressure as the AC pipes. The test certificate issued by the manufacturer should be produced. The pipes shall be subjected to third party inspection also and the test certificate showing the inspection agency should also be produced.

7.3.2 The Engineer shall have the right to test pipes for the quality wherever felt necessary. All charges incurred in testing the pipes shall be borne by the contractor.

7.4 PVC Pipes

7.4.1 The unplasticized PVC rigid pipes shall strictly conform to IS 4985/1988 and as amended from time to time and shall carry ISI marking in every pipe.

7.4.2 The contractor should procure the PVC rigid pipes from a reputed manufacturer

7.4.3 The contractor should furnish the test certificate issued by the manufacturer

7.4.4 The manufacturer's test certificate and third party inspection certificate should be produced by the contractor for the pipes used in the works

7.4.5 In addition to third party inspection, wherever felt necessary, the Engineer shall have the power to test the PVC pipes for its quality such as specific gravity, impact strength at 0^0C, internal hydraulic pressure test, diameter, thickness etc. in TWAD Board laboratory.

7.4.6 The PVC pipe joints shall be with solvent cement of good quality, conforming to IS 14182/1994

7.4.7 The Engineer in charge, shall verify, in addition to the test certificate, whether the pipes are as per BIS, by visual examination, diameter, weight, wall thickness flexibility, colour etc.

7.4.8 All the PVC specials required for use in conjunction with PVC pipes, should be got approved by the Engineer-in –charge.

7.4.9 GI pipes

7.4.10 GI pipes should be procured by the contractor form reputed manufacturer or from their authorised dealer of reputed manufacturer and should conform to IS 1239/ part I, namely the inner and outer diameter, length and weight. The pipes which are found to be not conforming to relevant specification shall be rejected by the Engineer-in-charge.

7.5 CI D/F pipes

7.5.1 The CI/D/F pipes procured for use in the work should conform to the relevant BIS specification and suitable for use in the work.

7.6 Valves

7.6.1 The contractor should procure reputed make of sluice valves, scour valves, reflux valves and air valves from the manufacturer or his authorised dealer and they should conform to the relevant BIS specification and suitable for use in the work. The valves shall bear ISI marks.

7.7 CI/PVC/GI Specials and Fittings

7.7.1 The specials and fittings should be in conformity of the relevant BIS specification

7.8 Testing of Pipes

7.8.1 The manufacturer test certificate/third party inspection certificate should be produced by the contractor for the pipes used in the work. The engineer shall have the right to test the pipes, wherever felt necessary for its quality. All testing charges should be borne by the contractor.

7.8.2 Testing of materials to be used in works, for the quality of finished items shall generally be done by the contractor at his own cost in the laboratory approved by the Employer by providing requisite materials, transport of test specimen and other assistance required thereof.

II CIVIL WORKS

I. General

1.1 Tamilnadu Building practice (TNBP) shall be strictly followed for carrying out different items of the work for which no standard specifications are available and no alternate specification have been given under the description of works

1.2 Where any provision of the TNBP is repugnant to or at variance with any provision under BIS or description of work, technical specification and conditions of contract, the provisions, of the latter shall be deemed to supersede the provision of the TNBP.

2. Earth work

2.1 Specification

Tamilnadu Detailed Building Practice (specification No.23 to the extent applicable) shall be followed for earthwork excavation.

2.2 Conveyance

The excavated earth, blasted rubble etc., shall be conveyed and deposited in the departmental lands within 150m of plant site and as directed by the Engineer in charge.

2.3 Stacking

Where the location of the work is such and does not permit the deposition of excavated earth while digging trenches for laying pipes, the excavated earth should be conveyed to a convenient place and deposited there temporarily, as directed by the Engineer-in charge. Such deposited soil shall be re-conveyed to the site of work for the purpose of refilling of trenches, if it is suitable for refilling. The unit rate for trench work of excavated and refilling shall include the cost of such operation.

2.4 Disposal of Surplus Earth

The excavated soil which is surplus to that required for refilling and after allowing for settlement will have to be removed, spread and sectioned at places shown on the site during execution for purpose of widening or levelling the road. Sectioning is to be done as detailed in TNBP. It is to be understood that no extra payment, will be made for this and the unit rate for trench work of excavation and refilling shall include the cost of removal of surplus earth to disposal site approved by the Engineer-in-charge, its spreading and sectioning at the bidder's expense.

2.5 Shoring, strutting and Bailing at water

The Rate for excavation of trench work shall include charge of shoring, strutting, bailing out water wherever necessary and no extra payment will be made for any of these contingent

works. While bailing, care should be taken to see that the bailed out water is properly channelised to floe away without stagnation or inundating the adjoining road surfaces and properties.

3. Concrete

3.1 Specification

Concrete for use in the works shall generally comply with TNBP (specification No.30) and the relevant BIS. The concrete mix shall be in specified proportions satisfying the maximum aggregate size, water cement ratio and required cube strength and workability as per IS 456-1978.

Such concrete must be adequately vibrated to form solid mass without voids. The entire concreting works should be done only with the prior approval and in the presence of Engineer in change.

3.2 Mixing of Concrete

The concrete shall be proportioned as far as cement and aggregates are considered by volume. The amount of water required being measured either by weight or volume the adjustments must be made to frequent intervals at the discretion of the Engineer or his assistant to account for the moisture content of the aggregates. The mixing operation shall be performed only in a mechanical concrete mixer and shall continue until the whole batch of uniform consistency and colour. The mixing of concrete shall be done in accordance with clause 8 and 9 of IS 456-1978.

3.3 Transporting , Placing and Compacting Concrete

3.3.1 Transportation, placing and compaction of concrete mix by mechanical vibrators shall be done in accordance with clause 12 of IS 456-1978. It is imperative that all concreting operations be done rapidly and efficiently with minimum re-handling and adequate manpower shall there fore be employed to ensure this.

3.3.2 The forms shall be first cleaned and moistened before placing concrete.

3.3.3 The mix should not be dropped from such a height as it may cause segregation and air entertainment. When the mix is placed in position, no further water shall be added to provided easier workability.

3.3.4 No concrete mix shall be used for the work if it has been left for a period exceeding its initial setting time before being deposited and vibrated into its final position in the member.

3.3.5 While one concrete is being placed in position it shall be immediately spreaded and ramped sufficiently and suitable to attain dense and complete filling of all spaces between

and around the reinforcement and in to the corners of form work for ensuring a solid mass entirely free from voids.

3.3.6 Construction joints required in any of the structural members shall be provided generally complying with clause 12.4 of IS 456-1978 and as directed by the Engineer in charge. The efficiency of tempering and consolidation will be judged by complete absence of air pockets, voids and honey combing after removal of form works.

3.4 Curing

3.4.1 Curing shall be done to avoid excess shrinkage or harmful effort to the members generally complying with clause 12.5 of IS 456-1978

3.4.2 The method adopted shall be effective and any special method used must be approved by the Engineer and be subject to complete supervision.

3.4.3 Any deficiency in concreting such as cracking, excessive honeycombing, exposure of reinforcement or other fault which entail replacement of the defective part by fresh concrete and whatsoever remedy reasonable required without hampering the structural safely and architectural concept, all at the cost of contractor.

3.5 Removal of Form Work

Removal of form work shall be done as per TNBP and BIS and as directed by the engineer in such a manner that no damage is caused to the structures. The striping time shall not be less than that indicated in clause 10.3 of IS 456-1978.

3.6 Testing of Concrete

3.6.1 During the course of construction works, preparation of test specimens, curing and casting of concrete shall be done in accordance with IS 1199 and IS 516 to ascertain the strength requirements and acceptance criteria indicated in IS 456-1978. The contractor shall provide all apparatus, labour and arrange to test the cubes at his own cost at the test laboratory decided by the Employer.

3.6.2 In addition to the above tests, any other test which may if desired by the Engineer in charge be carried out from time to time as per relevant specifications at the cost of contractor. In case the concrete does not meet the strength required, all corrective measures shall be taken at once at the contractor's cost.

3.6.3 The inspection and testing of structures shall be done in accordance with clause 16 of IS 456-1978.

4. Masonry

4.1 All masonry works such as Random Rubble / Coarse Rubble/ Brick work must be done as per TNBP specification and Bid schedule specification.

5. Plastering

5.1 Plastering would be 12 mm, 20mm and 25mm thick cement plaster either plain or water proof as may be specified.

5.2 The plastering items shall be executed in thickness and cement mortar of proportion as detailed in respective item in the BOQ. Similarly the plastering shall be either ordinary or water proof as specified in respective item in the BOQ.

5.3 In case of water proof plaster standard and approved water proofing compound shall be mixed in cement mortar in required percentage as directed and then the plaster is applied.

5.4 The finishing shall be either smooth or rough as may be directed by the Engineer unless otherwise specifically mentioned in the BOQ.

5.5 NEERU finish wherever directed by the Engineer shall be done at no extra cost.

5.6 Curing and watering shall be done as directed and plaster shall be in alignment and level. Any substandard work is liable to be rejected and shall have to be re-done at contractors cost. Sand to be used shall be of approved quality only. Cost of all scaffolding shall be included in the rates quoted in the BOQ.

6 Flooring

40mm thick cement concrete 1:2:4 shall be provided for flooring. The size of metal shall not be more than 12mm and it shall be properly graded. A thin coat of very fine plaster shall be provided on top to give a smooth finish. The marking of false grooves to surfaces as directed includes the cost of labour.

7. Doors and Windows

7.1 Sizes shown on drawings are clear openings in masonry and not the shutter's size. These sizes shown on drawings are, therefore, inclusive of required frame sizes and doors, windows, etc., and shall be manufactured, accordingly. If sizes bigger than shown in drawings are manufactured, as instructed specifically in writing they shall be measured and paid for accordingly.

7.2 The work shall be executed as per the size of frame thickness of shutter type viz. Plan planked, glazed, etc., and fixture, etc., as described in tender item. Iron bars for windows and ventilators are to be provided if specifically mentioned in the tender item at Contractor's cost. Specifications in TNBP shall be applicable.

7.3 The design of shutters and quality of wood shall be got approved form the Engineer-in-charge before manufacture. The CW/TW to be used for woodwork shall be uniform in substance straight, free from large deed knots, flows flanks. The work shall be done as per specification of TNBP latest edition. The joints shall be perfect.

7.4 Part of wood embedded in masonry shall be painted with the tar. The frames of doors, windows, ventilators, etc., shall have proper hold-fasts embedded in masonry

7.5 Whenever iron bar is to be provided as per tender item the rate thereof is included in tender item. The painting shall be done as prescribed in tender item. No painting, however, shall be permitted till the woodwork is approved by the Engineer-in-charge.

7.6 Any substandard work not confirming to the specifications are liable to be outright rejected and

7.7 Executive Engineer's decision in such cases shall be final and binding on the Contractor

7.8 The mode of measurement shall be on area units as mentioned in B0Q.

8. Painting

8.1 The work shall be carried out as per the description of the tender item and as directed by Engineer-

8.2 in-charge. It shall be white washing, distempering and/or snowcem painting. Shade and make shall be as directed by the Engineer and for decorative purpose, Engineer may ask for different shades to be provided for different components or different parts of the same component which the Contractor shall have to do within his tendered rate only at no extra cost to the Employer. Cost of priming coat as directed, scaffolding, etc., shall be included in the tender rate. The work shall be executed as per the specifications of TNBP for painting. In general, all items of works must be done as per TNBP specifications and bid schedule specifications.

III. PIPE LAYING WORKS

1. General

1.1 The earthwork for the pipe laying work shall generally confirm to the details given below.

Sl.No.	Dia of Pipe in millimetre	Depth of Bottom of pipe below ground level in centimetre	Width of trench at bottom in centimetre
1	PVC pipe Upto 140	105	60
2	For other Pipe Upto 150	105	75
3	200	110	80
4	250	120	80
5	300	135	80
6	350	145	90
7	400	155	90
8	450	170	100
9	500	185	100
10	600	205	110
11	700	230	120
12	750	245	125

1.2 Wherever necessary, sand cushioning for the bed shall be given as per IS Standards and as directed by the Engineer in charge. The pipe should be laid true to the alignment line and grade wherever necessary, appropriate bends should be used. The pipes laid must be jointed properly and carefully by using approved type of jointing materials.

1.3 After the pipes are laid and jointed, the pipelines are to be subjected to hydraulic pressure test as detailed in the relevant BIS specification for various types as indicated below.

A.C. pressure pipes	..	Clause 2 of IS 6530/ 1972
Cast in iron pipes	..	Clause 6 of IS 3114/ 1985
PSC. pipes	..	Clause 2 of IS 783/ 1985
PVC pipes	..	Clause 2 of IS 7634/ 1975

In portion of pipe line, where the pipes have developed cracks or sweating, such pipes with jointing materials shall be removed and re-laid with new pipes at the contractor's cost and the

pipe line shall be re-tested to the entire satisfaction of the Engineer in charge. No extra payment will be made on this account. The bidder has to make his own arrangements for the procurement of the required equipments for testing pipes which shall be subjected to such test as the Engineer-in-charge deems fit to the ensure the accuracy of the gauge.

1.4 Refilling shall be done with proper compaction with excavated earth. In no case the contractor shall be allowed to refill the trenches in hard excavated portion to be refilled by the boulders or excavated stuffs. This portion of trench shall be refilled by the soft strata from excavated stuff from distance place at no extra cost. The refilling shall be done in 15cm thick layers duly watering and compacting each layer. The refilling may be done upto a height of 20 to 30cm than the natural ground level to allow that sinking afterwards. If the refilling gets sunk below the natural ground level at anytime till the completion of the work, the contractor at his cost should make good the refilling to the required level as may be directed by the Engineer in charge.

1.5 In case of pipe trenches, the Engineer may reduce the width of trench wherever a hard strata is met with, if he feels adequate and just sufficient to lay the pipe line in order to reduce the hard rock quantity. In such case the contractor will be paid as per the actual measurement.

1.6 If the work is in a residential area, the contractor should carry out the excavation carefully to avoid collapse of any structure.

1.7 Valves shall be provided with valve pits with proper cover to bear the loads coming on it as per bid documents and departmental drawings and specification. Public fountains, Fire hydrants shall be provided as per type design and specification.

1.8 Adequate protective measures should be taken against surge pressure. Zero velocity valves and air cushion valves should be provided at the appropriate places. Thrust blocks and anchor blocks should be provided at all the bends and appropriate places.

1.9 Water required for testing the pipeline shall be arranged by the contractor at his cost.

2. **Laying Cast Iron pipes**

2.1 The laying and jointing of case iron pipes shall be carried out as follows :

Before laying the pipes, the contractor shall carefully brush them to remove any soil, stones or other materials which may be therein. An even and regular bed having been prepared and joint pit excavated to form a process under the socket of each pipe of no greater depth and width than to enable the pipe jointing to be properly done. Each pipe shall then be carefully lowered and placed singly in the trench and shall rest in the solid ground for a distance of not less than two thirds of its entire length. In places where the soil is not hard, cement concrete bed blocks or timber piles have to be provided under the pipes if directed by the Engineer in charge.

2.2 **Pipes not Truly Laid**

Any pipe or pipes laid, which on inspection are found to diverge from the true lines and levels shall be removed and re-laid to the true lines and levels and the old jointing properly cleared off the pipes and fresh joints made by the contractor at his expense. Any pipes damaged in removal shall be replaced by the contractor at his cost.

2.3 Cutting of C.I. Pipes

Where necessary and as ordered by the Engineer in charge, the Contractor shall cut the pipes and fix and joint common collars for jointing spigot ends. The cut ends of the pipe shall be made truly at right angles with the axis of the pipe.

2.4 Covering up Open Ends

The contractor shall take particular care to ensure that the apertures and open ends of pipes are carefully covered whenever the workmen are not actually employed therein.

2.5 Jointing of C.I. Pipes

The trench must be kept quite dry during jointing unless in any particular case the Engineer permits laying of the pipe in wet conditions. Plain spigot and socket pipes shall be joined as follows.

a) Lead Joints

Generally lead joints shall be used for all sizes. In the case of 100mm pipes, cement joints may be used if specified in which case for every ten cement joints, one lead joint shall be used. Provision of lead joints shall also be made at street crossings, at closing joints and for all specials and as determined by the Engineer depending upon the site condition.

The spigot of the pipe must be forced well home into its socket and must be centred, so that the joint may be of even thickness all round. As many laps of white hemp spun yarn as may be needed to leave the space required for the lead shall be driven to the bottom of the socket without being forced through the joint into the pipe but carefully driven home with a caulking tool. The proper depth of each joint shall be tested before running the lead by passing completely round it a wooden gauge, notched out to the correct depth of lead, the notch being held close against the face of the socket. The joints shall then be run with molten lead in sufficient quantity so that after being caulked solid, the lead may project 3mm beyond the face of the socket against the outside of the spigot but must be flush with the outside edge of the socket.

For pouring lead in the joints, a ring of hemp rope covered with clay shall be wrapped around the pipe at the end of the socket leaving an opening at the top of the socket into which the lead can be

poured. The hemp rope shall be supported by clay packing so as to withstand the operation of lead pouring.

The lead used shall be carefully skimmed of all scale, when melted in a cast iron pot or patent melting machine. Sufficient lead shall then be taken by a ladle and run hot into the joint, and the joint filled at one running. The joint shall then be caulked when cool by a suitable caulking tool and a 2kg hammer and the joint left neat and smooth.

The weight of lead and hemp which shall be used in each joint shall be in conformity with the table given below or as specified by the Engineer.

Quantity of lead and spun yarn for different sizes of pipes

Nominal size of pipe in mm	Lead/ joint In Kg	Depth of Lead joint in mm	Spun Yarn per Joint in Kg
80	1.8	45	0.10
100	2.2	45	0.18
125	2.6	45	0.20
150	3.4	50	0.20
200	5.0	50	0.30
250	6.1	50	0.35
300	7.2	55	0.48
350	8.4	55	0.60
400	9.5	55	0.75
450	14.0	55	0.95
500	15.0	60	1.00
600	19.0	60	1.20
700	22.0	60	1.35
750	25.0	60	1.45
800	31.5	65	1.53
900	35.0	65	1.88
1000	41.0	65	2.05
1100	46.0	65	2.40
1200	50.0	70	2.60
1500	66.5	75	2.80
8 Inches	4.54	2.00 Inches	0.29
9 “	5.10	2.00”	0.31

Nominal size of pipe in mm	Lead/ joint In Kg	Depth of Lead joint in mm	Spun Yarn per Joint in Kg
10 “	5.67	2.00 “	0.34
12 “	6.58	2.00 “	0.48
14 “	9.30	2.50 “	0.63
15 “	9.98	2.50 “	0.68
16 “	10.66	2.50 “	0.74
18 “	14.06	2.50 “	0.95
20 “	16.33	2.50 “	1.04
21 “	17.92	2.50 “	1.08
24 “	20.41	2.50 “	1.21
27 “	23.13	2.50 “	1.33
30 “	25.86	2.50 “	1.46
33 “	28.35	2.50 “	1.65
36 “	31.58	2.50 “	2.40

Note

The quantities of lead and spun yarn given in the table are provisional and variation of 20 percent is permissible.

b) Flanged Joints

Flanged joint should be made by painting the facing of the flange with white lead freely and bolting up evenly on all sides. A thin fibre of lead wool may be very useful in making the joints water tight where facing of the pipes is not true.

When packing must be used, it should be of rubber insertion of approved thickness. The packing should be of the full diameter of the flange with proper pipe hole and bolt holes cut out evenly on both the inner and outer edges. Where the flange is not fully faced, the packing may be of the diameter of the packing strip only. Proper placing of the packing should be checked before another pipe is joined on.

c) Cement Joints

The cement for the joints shall confirm to IS 269/ 1996 specification for ordinary, rapid hardening and low heat portland cement.

Cement and water taken in proportion 8 : 1 by weight shall be thoroughly mixed. The mixture shall be such that when it is tightly compressed by hand into a ball and the ball is broken into two pieces the break shall be clean. If the hand becomes water stained, it has to be considered that the

water is excessive. If there is evidence of crumbling in the break, water added is less than required. The cement mixture shall ring with metallic sound while caulked.

Cement which has been wet for more than one hour or which had undergone initial set shall not be used for jointing.

Making the joints

When new pipes are laid close ahead of a newly made cement joint, the disturbance caused during the forcing home of the pipe ends into the sockets during the adjustment of the pipe to proper alignment may damage the new joint. To avoid this damage, jointing shall be done only when there are atleast six pipes laid to the final grade and alignment ahead of the joint to be made. Starting at the bottom of the joint the joint space shall be filled with wetted cement and caulked. The remaining joint space shall than be refilled with cement and caulked until the joint is practically flush with the face of the socket. The mixture shall be thoroughly compacted to make a water tight joint.

No water shall be allowed to touch the joint until the initial set had taken place. Immediately after initial set has taken place, the joint shall be covered with wet burlap, or other approved wet materials to ensure complete hydration of the cement. No water shall be allowed into the pipe until the elapse of 12 hours after the last joint in the line is made. Filling the pipe with water without pressure after this interval will be beneficial to curing of the joint.

d) Rubber Ring Joints

In the case of rubber ring joints or push on joints, the groove and the socket shall be thoroughly cleaned before inserting the rubber gasket. While inserting the gasket it shall be made sure that it faces the proper direction and that it is correctly seated in the groove. After cleaning dirt or foreign materials from the plain end, lubricant shall be applied in accordance with the pipe manufacturer's recommendations.

The contractor shall make sure that the plain end is beveled as square as sharp edges may damage or dislodge the gasket and cause a leak. When the pipe is cut at site, the plain end shall be beveled with a heavy file or grinder to remove all sharp edges.

The plain end of the pipe shall be pushed into the socket of the pipe and while pushing, the pipe shall be kept straight. If any deflections are to be made in the alignment, it may be made after the joint is assembled. A timber header shall be used between the pipe and crow bar or jack to avoid damage to the pipe while the plain end of the pipe is pushed into the socket either with a crow bar or jack, or level pullet.

2.6 Fixing Sluice Valve

The sluice valves to be fixed on the pipelines shall be examined, cleaned and placed in the positions as shown in the drawings. The valves shall be placed on the pipe line and valve chambers constructed according to drawings. The depth at which the valve is to be laid and the dimensions of concrete and masonry shall be varied when necessary under the orders of the Engineer.

As the pipes in some instances may be required to be fixed at a less depth than will permit the top of the valve spindle being below the level of the road (but this may only be in cases where the position of the valve is to one side of the metalloid road) the walls of the valve chamber shall in such cases be carried upto such height at may be ordered, and the chamber shall have such covering as the Engineer may direct.

The valve shall be supported in the valve chamber so that no stress or strain occurs in the flange or other joints of the valve.

The valve shall be carefully protected from slime or dust by a suitable mat or gunny covering and the pit itself shall be cleared of all unwanted material.

2.7 Fixing Scour Valve

Scour valves shall be fixed at places shown in the drawings or as directed by the Engineer, and the scour connections from the main shall be carried out completely as per drawings.

2.8 Fixing Air Valve

Air valves shall be fixed at the summits of pipe lines or at places may be directed by the Engineer. The air valve connections etc, shall be carried out as per drawing.

2.9 Interconnection Work

The interconnection work between the existing main and proposed main to be laid under this contract shall proceed from the new main to the existing main. Before actually proceeding with the interconnection work, the contractor shall make ready necessary tools and plants required for the work at site, such as pumpsets, shoring materials etc., He shall also keep ready at site necessary pipes, specials, valves if any required for the work. The contractor shall keep necessary skilled workmen of sufficient strength at site and once the work is commenced, the entire interconnection work shall proceed without interruption by engaging labour for carrying out the work on a continuous basis both day and night till the work is completed. The work shall be executed as per programme drawn up by the Engineer and shall be completed within the time ordered by the Engineer, for each individual interconnection. The work shall be carried out under the direction of the Engineer from the beginning to end.

Laying of Specials, valves (except straight pipes from the branch of the new main to the connecting point in the existing main) including conveying specials etc., from the stores or site stacking, excavation, timbering, pumping out water from the trenches, lowering, aligning, jointing specials and valves cutting the existing mains, baling out water, inserting the necessary branches, jointing, testing, refilling etc., shall comprise as one unit of work and will be paid at the lump-sum rate quoted in the schedule for interconnections.

2.10 Works to be left water tight

The contractor shall construct the pipes chambers and all other works so that they shall be water tight. Should any leakage appear, it shall be made good by him at his expense by removing and reconstructing the portions of the work so affected or by other method which will render the work thoroughly water tight to the satisfaction of the Engineer.

2.11 Cleaning of Mains

During the execution of the work the contractor shall keep the interior surface of the mains free from cement, brick, soil or other superfluous matter and shall hand over the mains perfectly clean and free from deposit on completion.

2.12 Masonry Chambers

Chambers for sluice vales, inspection, scour valves, air valves shall be constructed on the pipes in the positions as shown in the drawings or in such positions as the Engineer may direct. The work shall be done strictly in accordance with the detailed drawings or as ordered by the Engineer. The excavation shall be made lower than necessary to admit of the earth being properly timbered. The bottom of the excavation shall be properly levelled, rammed and a bed of concrete laid thereon. When the concrete has sufficiently set the building of the brick walls shall then be proceeded with and all iron work fixed in as the building proceeds. The inside of all chambers shall be plastered with cement mortar 20mm thick and the outside with cement mortar 12mm thick. The chamber shall be topped with pre-cast R.C.C. Slabs 1:2:4 or cast iron surface box of valve cover as ordered by the Engineer. The surface box or valve cover shall be fixed on the top of the R.C.C. slab by a layer of cement mortar and sides of the surface box or valve cover covered over with cement concrete. Where pipes pass through walls of chambers relieving arches shall be turned neatly over the upper half of the pipes or R.C.C. lintels shall be provided to avoid load of the walls transmitted to the pipes. Cast Iron steps shall be built in each chamber as the work proceeds one being inserted to every 4 courses of brick work, horizontal distance centre to centre of each row being 30 cms. The contractor shall include in his rate for brick work cost for fixing steps, frame, cover etc., for completing all chambers in accordance with the drawings and with the above specifications.

2.13 **Testing of Main –Hydrostatic Test**

After laying and jointing the pipes and specials, the pipe lines shall be tested for hydrostatic pressure in such length as may be specified by the engineer. The test pressure shall be equal to 50% or such other higher percent as may be specified in excess of the pressure the pipe will have to withstand subsequently subject to a minimum test pressure of 7 kg/sq.cm in the case of lead joints. However in the case of cement joints, the joints may be tested to a minimum test pressure 3.5 kg/sq.cm.

If cement joints show seepage or slight leakage, such joints shall be cut out and replaced as directed by the Engineer and the test repeated. The Contractor shall make his own arrangements to procure, necessary equipments, apparatus etc,. required for testing and shall provide necessary labour for filling with water the length of pipes to be tested, fixing all apparatus and for carrying on the testing operations until the length of pipes, specials and connections are finally passed by the Engineer. The length to be tested shall be provided with two blank flanges fastened on in the usual manner by collar bands and bolts to the end pipes or if the length to be tested shall have a sluice value at each end, such blank flanges may dispensed with. The length of pipes to be tested shall first be filled in with water from a higher section of pipes already laid or with clean water shall be arranged at the contractor's expense with the approval of the Engineer. Before the actual testing pressure is applied any air which has lodged in the length of pipes to be tested shall be got rid of, by screwing on at the highest part of the length of pipes or temporary air valve, or, by opening a temporary stop-cock or by other mean as the Engineer may direct.

The test pressure shall then be applied to the length of pipes under test by a hand or powered hydraulic test pump. The connection of the test pump to the length of pipes shall either be at the union connection provided at a blank flange or shall be at a temporary stop sock or fountain connections as the Engineer may in the circumstances direct. The actual test shall be made by pumping water into the length of pipes under test, until the test pressure as specified above has been reached on the pressure gauge.

The test pressure shall be maintained for one hour or for such other period of time as may set by the Engineer and each joint will be inspected. While the pressure is on, the pipes should be struck smartly with a 2 kg hammer. When a flange joint is found to be leaking, care shall be taken that while tightening up the flanges, the neighbouring joints are not affected .If the length of pipe line under test is found to be satisfactory and no leaks or sweatness are found at the pipe joints or at the joints of specials and connections then this length of pipe line will be passed by the Engineer.

But should any pipe, joint, special or connection be found to sweat or leak, the contractor shall make good at his cost such defective joint and the length of pipe line shall be re-tested by the Engineer until all pipes, joints, specials and connection are found to be satisfactory.
If any pipe or special leaks or bursts, the damaged portion shall be removed and new pipes or specials shall be laid and jointed at the contractor's cost.

2.14 Restoring Road Surface

The surface of the road or ground shall be finished off to the proper level with the same kind of material as the surface consisted of before the excavation commenced except in the case of superior roads and tarred roads in which case the surfaces should be finished off with water bound macadam surface. Should any settlement occur after refilling is completed and upto the end of the period of maintenance, it shall be made good at once and the surface restored to the satisfaction of the authority under whose jurisdiction such road or ground may be, all at the cost of the contractor.

2.15 Collection of Rubbish

The contractor shall, at his cost, on the completion of the work remove all water and all materials or rubbish of every description which may have been collected in the works and find a deposit thereof and anything which my have collected within the works, during the period maintenance shall also removed before the works are finally accepted by the Employer.

3.1. Laying and Jointing of PVC Pipes

a) PVC Pipes

The PVC pressures pipes for water supply and distribution shall conform to IS 4985/ 1988.

b) Laying of PVC Pipes (IS 7634/ 1975)

The trench bottom should be carefully examined and should be free from hard objects, such as flints, rock projections or tree roots etc. The bedding for the pipes should be
brought to an even finish providing uniform support for the pipes over their length and pipes laid directly on the trench bottom. In other case the trench should be cut correspondingly deeper and the pipes laid on a prepared under bedding which may be drawn from the excavated material if suitable. As a rule trenching should not be carried out too far ahead of pipe laying. The trench should be kept as narrow as practicable but must allow adequate room for jointing pipes and placing and compacting the back fill. Mains should be laid with a cover of not less than 1m measured from the top of the pipes to the surface of the ground. Mains which might be brought

under roadways by future widening schemes should be so laid that the eventual cover will not be less than 1m.

c) Jointing of PVC Pipes

The jointing of PVC pipes are done either by using Solvent Cement Joint or rubber ring joint.

The solvent cement used for jointing should be of the quality as specified in IS 14182/ 1994. The spigot and socket ends of the pipes should be cleaned and roughened with emery paper. If the ends are grossly contaminated, they should be cleaned with Acetone or Methyl Alcohol. The solvent cement should be thickly applied on the spigot end and thinly in the socket. For larger sizes the first coat should be allowed to dry and a second coat applied. The spigot is then pushed into the socket and the excess cement wiped off at once with piece of cloth or rag. The joint should not be disturbed for atleast 5 minutes. The pipe should not be subjected to working pressure for 24 hours after jointing.

i) Rubber Ring Joint

The pipes for rubber ring joints are supplied with both ends chamfered. A mark should be made at a distance from the pipe end equal to half the length of the coupler. The inner side of the coupler ring and the chamfered end of the pipe should be clean and dry. The 'O' ring is then slipped into the coupler. The ring and the chamfered end of the pipe are lubricated with a lubricant. The coupler and the pipe should be carefully aligned and should be truly coaxial. The coupler is then pushed home into the pipe or the pipe is pushed into the coupler to make the joint.

4. Disinfection of Mains

Upon completion of a newly laid main or when repairs to an existing pipe are made, the main shall be disinfected as directed by the Engineer.

The mains shall be flushed prior to dis-infection except when the tablet method is used. After initial flushing, the hypo chlorite solution shall be applied to the water main with mechanically or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solution may be fed with a hand pump .In the case of mains of a large diameter, water from the existing distribution system or other approved source of supply shall be made to flow at a constant measured rate into the newly laid pipe line. The water shall receive a dose of chlorine also fed at a constant measured rate. The two rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at not less than 300 mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column of 'Slug' of chlorinated water that will as it passes along the line expose all interior surfaces to a

concentration of at least 300 mg/l. for atleast 3 hours. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect the appurtenances.

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the mains is not higher than the generally prevailing in the system or less than 1 mg/l.

After final flushing and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriological quality and shall show the absence of coliform organisms. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. When the samples are satisfactory, the main shall be placed in service.

V. LAYING AND JOINTING OF PIPES

5.1 General

The specification for laying and jointing shall generally conform with IS : 783 – 1985.

5.2.Earth work excavation

5.2.1 General

Before commencing the work and also during the progress of the work, the contract shall give notice to the concerned authorities viz., the Panchayats, the Municipalities, the Railways, the Electricity Board, the Telegraph Department, the Traffic Department attached to the Police and other Departments or Companies, as may be required to the effect that the work is being taken up in a particular locality and that necessary diversion of traffic may be arranged for. The contractor shall co-operate with the department concerned and provide for necessary barricading of roads, protection to existing underground cables, etc. met with during the excavation of trenches. The contractor shall also provide at his own expense watch and light during the day and the night and put required notice towards such as "Caution" "Road Closed for Traffic" etc. He should also provide and maintain at his own expense the necessary supports for underground cables, etc. to afford the best protection to them in consultation with the authorities in charge of the properties and to their best satisfaction.

5.2.2 Trench excavation

The width and depth of excavation of trench shall be as per relevant BIS. The rate for excavation shall include charges for shoring, strutting, bailing and pumping water whenever necessary and no extra payment shall be made for any of these contingent works.

Excavation and refilling for the socket hollows shall be paid for as excavation and refilling for trenches in soil of appropriate classification. The supply of river sand required for refilling should be paid for separately if provided in BOQ as separate item.

The contractor shall deposit the surplus earth if any from trench work at proper place as may be directed by the Engineer and no extra rates shall be paid.

Wherever earthern road or gravel road is cut for the laying of pipes, the contractor shall restore the surface after the pipes and specials are laid and

jointed with available materials to the satisfaction of the Engineer without extra cost either for cutting or relaying. The clause shall not apply to the cutting of concrete or macadam or brick surfacing or black top roads. The pipes shall be laid to correct levels and

gradients, as may be directed by the Engineer, after fixing the sight rails as in Clause No. 106 of TNBP without extra cost.

If the floor of the trench is other than rock, hard clay or boulders, the floor shall be rounded to fit the curve of the pipe to form an even bedding for the pipe for a width equal to half the outer diameter of the pipe.

If the floor of the trench is in rock, hard or clay which will otherwise not provide uniform support for the pipe, the floor shall be excavated below the proposed bottom level of the pipe to a depth of 20cm and the trench

shall be refilled with approved soil or river sand as may be directed by the Engineer and properly compacted to a level of 10cm above bottom of the pipe. If river sand is used for refilling, the sand shall be paid for separately if provided in BOQ as a separate item.

5.3 HARD ROCK

"Rock requiring blasting" shall exclude all rock such as soft rock, disintegrated rock, small boulders, all of which can be removed either with pick axe or craw bards and shall apply to rocks of different kinds when cannot be removed by any of these means. In case of difference of opinion, the Engineer's decision as to which rock shall be considered as "rock requiring blasting" shall be final.

Refilling of the trench in reaches where the excavation is in rocky soil shall be with approved soil which is surplus from trench work operations elsewhere along the alignment or which shall be obtained from new borrow pits.

It is to be distinctly understood that if surplus soil from trench work elsewhere along the alignment is used no extra payment shall be paid for conveyance of the soil to the refilling site; no payment will be made for any excess earth brought to site and it shall be disposed off by the contractor at his own cost. Hard rock which is blasted and removed will be measured and paid for on stack measurements with a percentage deduction of 40% for voids. The stacking shall be as directed by the Engineer.

5.4 Lowering pipes and jointing of pipes and specials

5.4.1 Laying and jointing shall be in accordance with Clause 9.1, IS:783-1985 for laying of concrete pipes. All pipes and fittings shall be carefully handled and lowered into the trench by means of mobile cranes. Any other method of handling shall be got approved by the Executive Engineer concerned. The pipes and specials should be handled by flat rubber bolts. Iron chain or iron crow bards should not be used under any circumstances for handling the pipes and specials at any state. The sockets shall face opposite to the direction of flow of water in the pipe. Pipes shall be normally laid so that the spigot end

enters the socket of the last pipe that is, socket faces and direction of laying. The socket and spigot ends of pipe shall be cleaned of all extraneous matter especially clay or grease. Rubber ring shall be clean and dry.

5.4.2 Pipes shall be laid true to the lines and grades given on the plans. The rubber rings shall be kept evenly positioned on the spigot groove, and when satisfied that pipe and ring are correctly positioned, the pipe shall be forced right home to the full depth of the joint. Inside the joint, the two pipe ends shall be in close proximity.

5.4.3 Baling or pumping out of water from trench including shoring, strutting and removing slush while laying, jointing and testing shall be done by the contractor at his expense.

5.5 Special Fittings

5.5.1 Special fittings have to be located at the exact chainage as shown on plans. It might entail in the necessity of laying short pipes in specified length. The number of gaps should be got approved by the Executive Engineer concerned.

5.5.2 Jointing between the special and pipe shall be done with rubber rings.

5.5.3 The construction of all anchor blocks at bends, 'Y's and Tees shall be done by the contractor. It shall be his responsibility to check for the adequacy of the anchor block.

5.6 Testing pipes on position

5.6.1 The finished pipe line shall be tested in convenient sections between stop valves. The test gap and short reaches which could not be tested simultaneously as a continuous reach due to circumstances prevailing during execution may be subjected to the pipe line static pressure or maximum working pressure plus surge pressure which may be created during testing the short reaches and test gap whichever is higher as the case may be. The Executive Engineer's decision regarding the test pressure at field for the above test gap and short reaches will be final. When testing the pipe line hydraulically, the line shall be filled completely with water and kept filled for a week. The pressure shall then be increased gradually to full test pressure and maintained at this pressure for one hour. In testing pipe lines, a seepage allowance of 2.5 litres per kilo metre per hour per centimetre diameter of the pipe shall be permissible.

5.6.2 Joint Testing

When testing the finished pipe line hydraulically after filling the pipe line section under test with water it shall be left under operating pressure for a certain length of period which will depend upon initial permeability, absorption movement of the pipe line under pressure and the quantity of air trapped. More water shall be pumped from a calibrated container

until the required test pressure is reached, the test pressure shall be maintained throughout the test by means of continued pumping using a pressure relief valve. The excess water coming from the relief valve shall be returned to the calibrated container. The rate of loss of water from the container shall be determined at regular intervals The pipe line is satisfactory provided the successive measurements show a diminishing quantity.

An allowance of 3.00 litres per millimetre diameter of pipe per kilometre of pipe line per day per each 30 metre head of pressure applied shall be allowed.

The field test pressure to be imposed should be not less than the greatest of the following.

a) 1 ½ times the maximum sustained operating pressure;
b) 1 ½ times the maximum pipe line static head; and
c) Sum of the maximum sustained operating pressure or the maximum pipeline static pressure and the maximum calculated surge pressure.

Subject to a maximum equal to the works test pressure for any pipes and fittings incorporated in the pipeline. However, the line test pressure, in no case, shall exceed the hydrostatic proof test pressure. Pressure gauges shall be inserted at both ends of the line and test so that leakage can be precisely calculated.

5.7 Back Filling Trenches

5.7.1 The initial back fill shall be of selected materials suitable for tamping under the pipes and down at the sides. Earth shall be placed by hand in 7.5cm layers and rammed well until the backfill materials reaches 15cm above the crown line of the pipe. Mechanical rammers may also be used.

5.7.2 The remainder of the trench shall be filled carefully with ordinary excavated material without rock and rammed property.

5.7.3 Refilling can be done leaving the joints portion exposed, after laying.

5.8 River crossings

5.8.1 All the supporting structure for pipeline to be taken above M.F.L. (Maximum Flood Level) in river. The contractor shall furnish detailed drawings showing the type of bedding needed to support the pipe.

Railway Crossings

Required permission for laying, jointing and testing the pipeline across the railway lines will be obtained by the Employer. The contractor will carry out the work according to the specifications and stipulations made by the Railway authorities.

5.9 Road Crossings

Wherever pipeline has to cross roads or cart tracks, it shall be done through a culvert or bridge, wherever necessary.

5.10 Distance Indicators

The employer shall supply and fix indicators at all points of change of direction, at all valves and at every one kilometre intervals along the pipeline. Indicators shall consist of 10cm x 10cm pre-cast concrete posts 1.25 metre length set 0.75metre into the ground and painted white above ground level. The description shall be written in blue at one face of the pre-cast post.

5.11 Drawings

The drawings are only indicative. The site conditions will only be the governing factor for manufacture, laying and payment.

VI. MAINTENANCE PERIOD

1. It is the sole responsibility of the contractor to maintain the entire component successfully for the maintenance period of .....**12.**.... months.
2. The following measures are to be taken essentially by the contractor.

- Necessary maintenance crew with supervisory staff shall be deployed. The staff pattern proposed by the contractor for the maintenance of the completed project should be got approved by the Employer one month before the issue of completion certificate. The entire strength of maintenance crew with the supervisory personnel should be available from the first day of the maintenance period.
- The contractor should keep all spares required for replacements at the head works, pumping main, distribution system, pumpsets etc. readily available to ensure uninterrupted water supply to the beneficiaries.
- All the equipments that goes out of order during the course of the maintenance period shall be rectified/ replaced immediately to ensure uninterrupted water supply. IF any equipment/ machinery is found to be defective either due to manufacture or due to unsatisfactory maintenance, the same should be replaced by the contractor at his cost.
- The contractor is responsible for the incidence of any theft, malpractice etc. within the project area during the maintenance period and the contractor shall keep the Employer indemnified.
- During the period of maintenance, all costs towards labour, spares, consumables, chemicals, repairs and renewals shall be on to the account of the contractor.
- The electrical energy charges payable to TNEB during the maintenance period shall be borne by the Employer.
- Complete quality service shall be ensured by the contractor during the maintenance period.
- Necessary log books indicating the quantity of water pumped, and maintenance carried out and repairs attended with details of spares changed shall be maintained by the contractor on a day to day basis and produced to the Engineer in charge whenever called for

VIII. REFERENCE TO SPECIFICATIONS/ CODE OF PRACTICE

DESCRIPTION	BIS NO.
Ordinary Portland Cement (33 Grade)	269 – 1976
43 Grade Ordinary Portland Cement	8112 – 1989
Pozzolona Portland Cement	1489 – 1991
Hydrophobic Portland Cement	8043 – 1978
Rapid Hardening portland Cement	8041 – 1990
Low Heat Portland Cement	12600 – 1989
Standard sand for testing of cement	650 – 1966
Methods of Test for Pozzolonic Materials	1727 – 1967
Methods of sampling and test for water & waste water (Physical & chemical)	3025 – 1984(Part 1 to 37)
Methods of Sampling hydraulic Cement	3535 – 1986
Methods of Physical tests for hydraulic cement	4031 – 1988(1 to 14)
Methods of chemical analysis for hydraulic cement	4032 – 1985
Aggregates coarse & Fine from Natural resources For concrete.	383 – 1970&4082/1977
Sand for Masonry Mortar	2116 – 1965&1542/1977
Methods of tests for aggregates for concrete	2386 - 1963(Part 1 to 8)
Part I – Particle size and shape	2386 – 1963(Part – I)
Part II – Estimation of deleterious Materials & Organic impurities	2386 – 1963(part – II)
Part III – Soundness	2386 – 1963(part – III)
Methods for sampling of aggregates for concrete	2430 – 1986
Specifications for test sieves Part – I – Wire cloth test Sieves	460 – 1978 (Part – I)
Common Burnt clay building bricks	1077 – 1976
Mild Steel and Medium tensile steel bars and hard	
Drawn steel wire, concrete reinforcement, Part – I – Mild steel & medium tensile steel Bars Part – II – Hard drawn steel wire	432 – 1982
High Strength deformed steel bars and wires for Concrete	1786 – 1985

DESCRIPTION	BIS NO.
reinforcement	
High Tensile Steel for PSC Pipes	1784 – 1986(Part 1)
Bending and flexing of bars for concrete reinforcement	2502 – 1969
Recommendations for detailing of reinforcement In reinforced concrete works	5525 – 1969
Method for tensile testing of steel wire	1521 - 1972
Method of test for determining modulus of plasticity	2854 – 1964
Glossary of terms relating to cement concrete	6461 – 1972(Part 1 to 12)
Methods of test for strength of concrete	516 – 1959
Methods of sampling and analysis of concrete	1990 – 1959
Methods of testing bond in reinforced concrete Pull out test	2770 – 1967
Methods of test for permeability of cement Mortar and concrete	3085 – 1965
Methods of test for splitting tensile strength of concrete cylinders	5816 – 1970
Methods of tests for determining setting time of concrete by penetration resistance	8142 – 1976
Code of practice for construction of Pile foundations (concrete piles) Driven cast-in-situ concrete piles Bored cast –in-situ piles Driven pre-cast concrete piles Bored pre-cast concrete piles	 2911 (Part I) Sec – 1 – 1979 Sec – 2 – 1979 Sec – 3 – 1979 Sec – 4 – 1984
Code of practice for construction of raft foundation	2950 – 1981
Design Aids for reinforced concrete	SP 16 – 1980
Explanatory Hand Book on codes for earthwork Engineering	SP 22 – 1982
Explanatory Hand Book on IS Code 456 – 1976	SP 24 – 1983
Hand Book on causes and prevention of cracks In buildings	SP 25 – 1984
Hand Book on concrete reinforcement & detailing	SP 34 – 1987
Brick Masonry	2212 – 1962
Construction of Stone Masonry	1957 – 1967
Asbestos cement pressure pipes	1592 – 1989

DESCRIPTION	BIS NO.
Concrete pipes with and without reinforcement	458 – 1988
P.S.C. Pipes (including fittings)	784 – 1978
Methods of tests for concrete pipes	458 – 1988&3597 – 1985
Materials for M.S. Specials	226 – 1976 &2062 – 1980
Specifications for M.S. Specials for P.S.C. Pipes	
Specifications for Steel cylinders reinforced Concrete pipes	1916 – 1989
Methods of tests of concrete pipes	3597 – 1985
Specials for steel cylinders reinforced concrete pipes	3597- 1985
Cast iron specials for asbestos cement pressure pipes for water, gas & sewage	5531 – 1988
Methods of test for asbestos cement products	5913 – 1989
Dimensional requirement for rubber sealing rings For CID joints in asbestos cement pipes	10292 – 1988
Centrifugally Cast (Spun) Iron pressure pipes for Water, gas and sewage Including fittings	1536 – 1989
Specifications for Centrifugally Cast (Spun) D.I. Pipes for water, Gas and Sewage.	8329 – 1990
D.I. Fittings for pipes for water, gas & seweage	9523 – 1980
Dimensional requirements of rubber gaskets for Mechanical joings and push on joints for the use with C.I.D.I.Pipes.	12820 – 1986
C.I. Specials for Mechanical and push on flexible joints for pressure pipe lines for water, gas & sewage	13382 – 1992
Horizontally cast iron double flanged pipes for water, Gas and sewage	7181 – 1986
Cast iron fittings for pressure pipes for water, gas And sewage	1538 – 1976(part 1 to 24)
Cast iron detachable joints for use with Asbestos Cement pressure pipes	8794 – 1988
Rubber rings for jointing C.I. Pipes, R.C.C. Pipes & AC. Pipes	5382 – 1969
Rubber rings for jointing P.S.C. pipes	5382 – 1985

DESCRIPTION	BIS NO.
Rubber rings for jointing AC pipes with AC couplings	10292 – 1985
Pig Lead (caulking lead)	782 – 1978
Hemp yarn	6587 – 1966
Rubber Insertion to be used in jointing CIDF pipes	638 – 1979
Bolts & Nuts to be used in jointing CIDF pipes	1363 – 1967
Unplasticized PVC pipes for potable water supplies	4985 – 1988
Injection moulded PVC socket fittings with Solvent cement joints for water supplies	7834 – 1987 (Part 1 to 8)
Fabricated PVC fittings for potable water supplies	10124 – 1988 (part 1 to13)
Methods of test for unplasticized PVC pipes for potable water supplies	12235 – 1986 (Part 1 to 11)
Sluice valves for water works purposes	14846/2000
Surface boxes for sluice valves	3950 – 1979
Manhole covers for sluice valves	1726 – 1974
Laying of Asbestos Cement Pressures Pipes	6530 – 1972
Laying of Concrete pipes	783 – 1985
Laying of Cast – Iron Pipes	3114 – 1985
Laying of PSC pipes	126 of APSS & 783 – 1985
Laying of DI Pipes	12288 – 1987
Laying and jointing of unplasticized PVC pipes	7634 – 1975 (Part 3)
Batch type concrete mixer	1791 – 1968
Sheep foot roller	4616 – 1968
Safety code for excavation works	3764 – 1966
Safety code for scaffolds and ladders part – I Scaffolds Part II – Ladders	3696 – 1966 (Part I) 3696 – 1966 (Part – II)
Safety code for piling and other deep foundations	5121 – 1969

DESCRIPTION	BIS NO.
Safety code for working with construction machinery	7293 – 1974
Tamil Nadu Building Practice	Volume – I Volume – II
Government of India Manual on Water Supply and Treatment	May 1999(Revised)
Gravel for packing	4091 – 1967
Hard drawn Steel Wire	1785 – 1983 (Part I and II)
Structural Steel	226 – 1975
Hard rolled mils steel for concrete	1139 – 1966
Hard drawn Steel Wire	1566 – 1982
American Society for Testing of Materials	
British Standard	2494 – 1955Part I
Welding Electrodes	814 – 1970
Steel Sheets	225 – 1975
Guniting	7322 – 1994
Welded Joints	3589 – 19667& 2041 – 62
Tensile Test	223 – 1950
Mechanical and Electrical Works	
Turbine Pump	1710 – 1972
Submersible Pump	8030 – 1976
Submersible Motor	9283 – 1979
Earthing	3043 – 1966
Transformer	1180 – 1964
Generator	2253 – 4722

VIII. PERFORMANCE BANK GUARANTEE(UNCONDITIONAL)

To

……..(Name of Employer)

…….(address of Employer)

WHEREAS ……(name and address of contractor)(hereinafter called "the contractor ") has undertaken ,in pursuance of Contract No……dated to execute…….

(name of contract and brief description of Works)(hereinafter called "the Contract"):

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish with a Bank Guarantee by a recognized bank for he sum specified therein as security for compliance with his obligations in accordance with the Contract:

AND WHEREAS the contractor has requested us to give the Bank Guarantee

AND WHEREAS we have agreed to give the contractor such a Bank Guarantee unconditionally and irrevocably to guarantee as obligator and not as mere surety, all the payments to the……

NOW THEREFORE whereby affirm that we are the Guarantor and responsible to you ,on behalf of the Contractor, upto a total of…….

(amount of Guarantee)……(amount in words), such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you unconditionally and irrevocably upon your first written demand and without cavil or argument, any sum or sums within the limits of……(amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demands for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any

liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

The Bank Guarantee is encashable at……branch of……..

Bank in……Town in Tamil Nadu Only.

This guarantee shall be valid until 28days from the date of expiry of the defects liability period.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank……..

Address……