SCHEDULE OF WORK

A) CONSTRUCTION OF CAST IN SITU BORED PILES:

1) The Construction and workmanship for piles shall fully conform to and satisfy the requirements of relevant I.S. of Cast-In-Situ bored piles.

2) All R.C.C. works in piles shall be done with M25 grade concrete as per relevant I.S. Codes with cement content not less than 400 kg./cum. of concrete. Approved quality super Plasticizer in appropriate quantity by weight of cement shall have to be used as per relevant I.S. code. The slump of the mix shall be between 150 mm and 180 mm.

3) The reinforcement cage of piles should be strictly in conformity with the detail shown in approved drawing and the cage to be constructed with welding only conforming to specification of IS: 2751-1966 for welding of reinforcement.

4) The pile head shall be cut-off at the required level as indicated in the drawing and the exposed bars shall have to be reset inside the pile cap/capital etc.

5) The load test of piles shall be carried out as per IS: 2911 (Part-IV)-1985 (I.S. code for load test on piles). The test shall be carried out on test piles and representative piles as approved by Engineer-in-Charge. Sufficient time shall be allowed before test to permit adjustment on the soil condition.

6) The period between installation of the test piles or any other piles in the vicinity and test loading of the piles shall be at least 28 days. Besides above pull – out test on the piles shall have to be done as per relevant I.S. The initial load test shall be carried out upto twice the estimated safe load as enumerated in respective schedule of works until the load displacement curve shows a clear break. Routine test shall be carried out to 1.5 times of the estimated safe load as enumerated in the respective schedule of works or 12 mm total displacement whichever is earlier.

7) Lateral Load Test may be carried out as per IS: 2911 (Part-IV)-1985. The loading should be applied in increments of about 20% of the estimated safe load. The next increment should be applied after the rate of displacement is nearer to

0.1 mm per 30 minutes. The displacement shall be read adopting the procedure as laid down in the aforesaid I.S.

B) CONSTRUCTION AND COMISSIONING OF RESERVIOR:

1. Earthwork in excavation of foundation trenches upto required depth (for raft & pile cap), in all sorts of soil (including mixed soil but excluding laterite or sand stone) including removing, spreading or stacking the spoils within a lead of
150m. as directed and including trimming the sides of trenches, levelling, dressing and ramming the bottom, shoring if necessary, bailing or pumping out of water etc. as required complete and filling in foundation trenches or plinth with good earth in layers not exceeding 150 mm. including watering & ramming etc. layer by layer complete .

2. Hire and labour charges for shoring work (including necessary close plank walling, framing, salbullah piling, strutting etc) complete as per direction of the Engineer in-charge for foundation excavation in trenches, rafts pile cap etc.

3. Earth work in filling in foundation trenches or plinth with good earth, in layers not exceeding 150 mm. Including watering and ramming etc. layer by layer complete with earth obtained from excavation for foundation..

4. Supplying & laying black alkathene sheet (400gm. / sqm.) below the foundation, flooring, roofing as and where necessary and as per direction of E.I.C.

5. Normal Mix M-20 Cement concrete with graded stone chips (20 mm size) excluding shuttering and reinforcement, if any, In ground floor and foundation with stone chips of Pakur variety

6. Design Mixed Cement concrete (DMC) Grade M25 and M30 with minimum characteristics strength of 250 kg/cm2 and 300 kg/cm2 respectively with well graded stone chips (20 mm grade) with complete design of concrete mix in a computerised batching plant under controlled condition as per IS: 10262 & IS: 456 and other relevant special publications using approved quality super Plastisizer in appropriate quantity, placing the concrete in position with the help of suitable equipment of suitable capacity or by any other method as approved by the Engineer-in-charge, leveling and compacting the concrete with approved quality vibrator, curing the same as per IS-456 complete in all respect as per direction of the Engineer-in-charge including cost of all materials and labour, cost of super plastisizer and also cost of hire charges of all machineries i/c mixture machine with hopper, mini batching plant with cost of operational charges, vibrators etc. i/c cost of fuel and labour and all other incidental charges in this connection but excluding shuttering & reinforcement.

Consumption of cement shall not be less than 350 kg and 400 kg of cement respectively per cubic meter of controlled concrete, but actual consumption shall be determined on the basis of preliminary test and job-mix formula to be submitted by the agency at no extra cost. Water cement ratio generally shall not exceed 0.45.

(a) DMC grade M-25 will be used in pile, Pile Cap, raft, Pedestal, Bracing, Column, Stairs. (b) DMC grade M-30 will be used in all structures from Heal Beam and above.

7. Hire and labour charges for shuttering with centering and necessary staging upto 4 m. using approved stout props and thick hard wood planks of approved thickness with required bracing for concrete slabs, beams, columns, lintels curved or straight including fitting, fixing and striking out after completion of work.
   a) 25 mm to 30 mm thick wooden shuttering without staging in foundation etc.
   b) Steel shuttering or 9 mm to 12 mm thick approved quality plyboard shuttering in any concrete work.

8. Providing staging and scaffolding made of strong and stout bamboo or salbullah props with necessary cross bracing of bamboo / salbullah including that for unsupported horizontal projections outside lower ring beam with necessary fixtures, making proper platforms/stairs with wooden, planks etc. for the entire construction work and to maintain it till completion of work and removing the same as per direction and instruction of E.I.C.

9. Providing water thinable Non-Toxic Epoxy coating (Techoxy or equivalent brand of approved quality), 2 (two) finished coats over 2(two) coats of primer of same brand, to the ceiling of roof dome including supply of requisite coating materials, cleaning of the substrate properly to make it free from dirt, paint, oil and grease, sludge, blisters, loose plasters, fungas, moss and all other undesirable particles using wire brush, sand paper etc including mending good all damages all complete as per direction of EIC.

10. Plaster (to wall, floor, ceiling etc.) with sand and cement mortar of different thickness & proportion mm thick with necessary admixture of approved quality water proofing compound (Sika/cico/any brand approved by Engineer-in-Charge) @ 0.20% by weight of cement including rounding off or chamfering corners as direction and raking out joints or roughening of concrete surface by chipping etc. including throating, nosing and drip course where necessary and including all lead and lift but excluding the cost water proofing compound.
    a) 20 mm thick (Cement:Sand = 1:3)

    Note : inside the reservoir floor, walls etc. In contact with water & this item of work shall be done only after completion of water tightness test satisfactorily

    b) 10 mm thick (Cement:Sand = 1:4)

    Note : This item of work shall be done on the areas other than in contact with water. This item included fluted, corrugated or ribbed plaster and making V-groove line (about 12mm wide, 12mm deep) in plastered surface where applicable.

    c) 15 mm thick (Cement: Sand = 1:4) for outer surface.

11. Provision for embossing the name and capacity of the Reservoir with 19 mm thick (3:1) raised sand cement plaster with letter size 30 cm x 20 cm on the outside of shell wall of the Reservoir painted complete as per direction of E.I.C.

12. Decorative Exterior Emulsion paint of Weather coat / Weather Shieled or similar approved quality (in this case decision of Engineer-in-Charge will be final) & approved shade (two coat) over a coat of approved primer after preparation of surface of plaster or concrete by scraping and cleaning thoroughly including cost of paint etc. complete in all respects at any height (Manufacturers specification should be strictly followed).

13. Supplying super-plasticizer of approved make and brand (Sika / Cico or any other approved ma Sika/cico/any brand approved by Engineer-in-Charge) in specified proportion in cement concrete, brickwork, sand cement plaster etc.

14. Supplying at site & fitting fixing, erecting & building in position 450 mm wide M.S. Cat Ladder with G.I. Railing consisting of 2 Nos. angles iron (ISA) 60 x 40 x 8 mm thick & 2 Nos. 12 mm dia. M.S. round or square bar as step placed @ 300 mm c/c Including fabrication, welding, drilling etc. as per drawing and finished with two coats of synthetic enamel paintings over a coat of Red lead primer etc all complete as per direction of E.I.C.

15. Providing G.I. Railing in stair, landing, top of roof & walk way of R.C.C. overhead reservoir with 32 mm dia G.I. Pipe (TATA make medium quality) as hand rail integrated with 25 mm dia G.I. pipe (TATA make medium quality) 1200 mm high as post placed @ 400 mm c/c and stiffened centrally with additional 25 mm dia G.I. Pipe, (TATA make medium quality) including cost of G.I. pipe, Tee & cross where necessary, cutting pipes, welding at every junction and intersection of pipes, embedding the post in the concrete floor upto a minimum depth of 80 mm etc. all complete as per drawing and finished with two coats of synthetic enamel painting over a coat of red lead primer to the all exposed surface of G.I. pipes as per direction & satisfaction of E.I.C.

16. Supplying at site fitting, fixing, erecting and building in position where necessary 500 mm wide M.S. ladder as per design consisting of 2 nos. ISMC 100 X 6 mm thick with necessary base plate, 6 mm thick M.S. checkered plate as steps @ 300 mm c/c supported on ISA 40 X 40 X 6 mm angle, ISA 65 X 65 X 6 mm thick angle 600 mm high as posts on both side @ 1000 mm c/c, 32 mm dia G.I. pipe (TATA make medium quality)as hand rail welded with M.S. posts and stiffened centrally with additional 32 mm dia G.I. pipe (TATA make medium quality) welded with M.S. posts including fabrication, welding, drilling etc. as per drawing and direction and finished with two coats of synthetic enamel painting over a coat of primer etc. all complete as per direction of the E.I.C.

17. Making 25 mm thick bituminous expansion joint between shell wall and roof as per drawing and specification.

18. Supplying mosquito proof wire netting of polythene (NETLON) size 75 cm x 75 cm for ventilator including fitting fixing in best sal wood frame 8 cm x 5 cm section with side and cross wooden batten built with R.C.C. wall painted with 2(two) coats of primer as per direction & complete with necessary fixtures as shown in the drawing. (All exposed fixtures to be of rust proof quality).

19. 25 mm thick wooden shutters (Sishu, Hallack, Champ, and Badam) as per design with I.R.C. fabric mesh (25mm X 25mm X 2.7mm X 2.7mm) of approved quality fitted with covering teak wood battens with necessary nails including fitting and fixing shutters in position at the lantern of R.C.C. overhead reservoir on sal wood frame with necessary screws etc. and two coats of painting with approved quality synthetic enamel paint (higloss) over a coat of wood primer etc. complete as per direction of the Engineer-in-charge.

20. Supplying, fitting, & fixing approved type Pressure gange provided with 15 mm dia pipe with stop cock as water level indicator the gauge dial would be calibrated both in meter and feet of water head upto a range of 10 meter (30 feet) with 150mm (6 inch) accuracy etc. all complete as per direction of E.I.C. all complete.

21. Supplying and installation of lightning solid conductor rod of phosphorus bronze size 2 M x 12 mm dia on the top dome of the reservoir structure & runs of the lightning conductor of galvanised iron wire 8 mm dia runs from the roof along shell wall column upto G.L and from G.L to bottom of the earthing main pipe, there should be 10 mm dia galvanised conductor wire fitted and fixed through 12 mm dia. P.V.C. pipe with main earthing G.I. Pipe of 50 mm dia. class-C heavy type to be used as earthing electrode of 3.5 mts. In length driven down to at least 3.5 mtr. below G.L and filling up with charcoal should be installed as per I.E.E Rule.

22. Construction of masonry Surface drain 250 mm x vide x 300 mm deep (for overflow & washout) made of 250 mm thick 1st class cement brick work (4:1) over 125 mm Jhama Concrete (6:3:1) over a brick flat soling & 12 mm thick plaster with sand cement mortar (3:1) or inner vertical face, top portion of walls & upto 150 mm below G.L on outer face of wall & 25 mm thick (1:2:4) wearing course of cement concrete with stone chips on bottom surface and including curring etc. complete to provide outlet of over flow & wash out water to the outside the campus as per drawing, direction & satisfaction of E.I.C. The length of masonry surface drain will be 50mtr. (approx).

23. Construction of masonry valve chamber, washout chamber as per departmental drawing with 1st class brickwork in cement mortar (1:6) including earthwork in excavation with jhama khoa (1:4:8) in foundation, 100 mm thick precasts R.C.C. Slab (1:2:4) shuttering on bottom and sides, reinforcement work and other materials as per departmental drawing complete with supply of 150 mm x 150 mm C.I. Surface box embedded into the precast slab including fitting fixing over the chamber and over hauling the valves (if necessary) all complete including cost of all labour and materials all complete.

One no. – 400 mm dia. / 250 mm dia. / 200 mm dia. (as per drawing) for outlet

One nos. – 300 mm dia. / 200 mm dia. / 150 mm dia. (as per drawing) for inlet

One no. – 300 mm dia. / 250 mm dia. / 150 mm dia. (as per drawing) for over flow

One no. – 250 mm dia. / 150 mm dia. / 100 mm dia.(as per drawing) for wash out

24. Supply and delivery at site, hoisting, erecting, placing and connecting at site CIDF and socket/flunged/Mechanical joint special of different dia (150m to 250mm) as per relevant I.S. Specification with latest amendments providing stays, clamps as required including cost of two coats of painting with synthetic enamel paints, loading, carrying, unloading, stacking properly and Sales Tax & all other charges etc. complete as per drawing and direction of Engineer-in-charge. All down pipes from the reservoir will be laid below G.L. upto 10mtr. length from duck foot bend for interconnection with the the existing Rising Main & distribution line within Headwork site.

Delivery Pipe – 400 mm dia. / 250 mm dia. / 200 mm dia. (as per drawing) for outlet
Rising Main – 300 mm dia. / 200 mm dia. / 150 mm dia. (as per drawing) for inlet

Over Flow Pipe – 300 mm dia. / 250 mm dia. / 150 mm dia. (as per drawing) for over flow

Washout Pipe – 250 mm dia. / 150 mm dia. / 100 mm dia.(as per drawing) for wash out

25. Supplying & Installation of Sluice Valve of different dia (150 mm to 400 mm) including 2 nos DF tail pieces for each value, hoisting, erection, placing, connecting with flanged pipe and specials, securing with built in specials, providing stays, clamps as required including cost of staging platform as required including cost of staging platform for the work etc. complete in all respect as per drawing and specification and instruction of E.I.C.

2 nos. –400 mm dia. / 250 mm dia. / 200 mm dia. (as per drawing) for outlet

One nos. – 300 mm dia. / 200 mm dia. / 150 mm dia. (as per drawing) for inlet

One no. – 300 mm dia. / 250 mm dia. / 150 mm dia. (as per drawing) for over flow

One no. – 250 mm dia. / 150 mm dia. / 100 mm dia.(as per drawing) for wash out

26. Supplying fitting, fixing D.I. Duck-Foot bend including construction of cement concrete (4:2:1) base with stone chips of approved grade & quality including excavation of earth etc. complete in all respects.

a) 400 mm dia (Base size 600 mm X 600 mm X 600 mm deep).
b) 300 mm dia (Base size 600 mm X600 mm X 600 mm deep).
c) 250 mm dia (Base size 600 mm X 600 mm X 600 mm deep).
d) 200 mm dia (Base size 500 mm X500 mm X 550 mm deep).
e) 150 mm dia (Base size 500 mm X 500 mm X 550 mm deep).
f) 100 mm dia (Base size 400 mm X 400 mm X 550 mm deep).

27. Supplying Hoisting fitting and fixing bell mouth with puddle collar in R.C.C. work complete as per drawing and specification in all respect. (diameter 100 mm to 400 mm)

One no. – 400 mm dia. / 250 mm dia. / 200 mm dia. (as per drawing) for outlet

One nos. – 300 mm dia. / 200 mm dia. / 150 mm dia. (as per drawing) for inlet

One no. – 300 mm dia. / 250 mm dia. / 150 mm dia. (as per drawing) for over flow

One no. – 250 mm dia. / 150 mm dia. / 100 mm dia.(as per drawing) for wash out

28. Making arrangement for water tightness test conforming to the provisions laid down in IS-3370 (part-1) 1956, by filling with water upto top water level (TWL) as shown in the drawing and as per direction of E.I.C. for the tank proper including the arrangement of water, its carriage & lifting by necessary pipes, fittings and pumping machinery etc. all required for the purpose.

29. Disinfection & washing the tank and pipe connections by using strong chlorine solution of about 50 ppm free chlorine and till the residual chlorine comes to 10 ppm or more at sumpling points after held in the system for a period not less than 24 hrs. and then flushing & washing the same with potable water till residual chlorine is less than 4 ppm all complete as per direction of E.I.C.

30. Refilling the reservoir (after disinfection and washing the tank etc. as per item 22 above) with fresh water upto top water level (TWL) as shown in the drawing and as per direction of EIC including the arrangement of water, its carriage and lifting by necessary pipes, fittings and pumping machinery etc. required for the purpose.

31. Refilling the reservoir (after disinfection and washing the tank etc. as per item 22 above) with fresh water upto top water level (TWL) as shown in the drawing and as per direction of EIC including the arrangement of water, its carriage and lifting by necessary pipes, fittings and pumping machinery etc. required for the purpose.

32. Supplying to laying of CIDF / DI (k-9) pipes whichever applicable as per site condition in the trenches below the ground carefully in proper alignment, gradient etc. by mobile crane & other devices as necessary, maintaining suitable cover to pass the pipe below the tie beam for at least 5.00 mtr. from the outside of the column faces and upto 600 mm beyond the end of sluice valves including cost of flange joints all complete as per specification to direction of E.I.C.

400 mm dia. / 250 mm dia. / 200 mm dia. (as per drawing) for outlet

300 mm dia. / 200 mm dia. / 150 mm dia. (as per drawing) for inlet

300 mm dia. / 250 mm dia. / 150 mm dia. (as per drawing) for over flow

250 mm dia. / 150 mm dia. / 100 mm dia.(as per drawing) for wash out

33. a) Roof treatment on flat surfaces by 50mm average thick screed concrete (1:1.5:3) after application of 2 coats of cement slurry admixed with diluted chemical compound Sika Raintile-1/Sika Latex powder (1:4:6) or equivalent as per specification and direction of EIC.

b) Roof treatment on curved surfaces by application of 2 coats of cement slurry admixed with diluted chemical compound Sika Raintile-1/Sike Latex powder (1:4:6) or equivalent as per specification and direction of EIC.

34. Artificial stone over floor dome and conical slab with cement concrete 3: 1½: 1 with stone chips, laid in panels as directed with topping made with ordinary cement including smooth finishing and rounding off corners and including application of cement slurry before flooring works, using cement @ 1.75 kg/Sqm. and using water proofing compound all complete including all materials and labour.

35. Reinforcement for reinforced concrete work in all sorts of structures including distribution bars, stirrups, binders etc. including supply of rods, initial straightening and removal of loose rust (if necessary), cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire or weilding if necessary at every inter-section, complete as per drawing and direction.

(i) Tor steel / HYSD.

36. Any other related & ancillary works not covered above from Sl. 1 to sl. 35 to complete the total job as per drawing & specification & instruction of E.I.C.

Superintending Engineer,
Western Circle, PHE Dte

SCOPE OF WORK AND TECHNICAL INFORMATION

SCOPE

A) Pile Foundation

Pile with Cap:

1) Design of pile foundation with cap as per departmental supplied soil test report & to match with the departmental drawing no PC-I/OHR/16/2012, PC-I/OHR/06/2012, PC-I/OHR/10/2012 & PC-I/OHR/09/2012 respectively (according to capacity) schedule, specification with pile cap including
Submission of design & drawing in 5 (Five) sets duly vetted by structural Engineer in any Govt. recognised institution.

2) Construction of R.C.C pile with cap as per approved drawing including cost of all necessary required plant & machinery, boring materials, load test of pile etc. supply of Constructional materials of approved make & brand and Labour required to complete the job including involve any type carriage of all materials, site clearance according to scope of work.

TECHNICAL INFORMATION:

A.1. All levels shown in the drawing are G.T.S. levels in metre.

A.2. Grade of concrete will be of M-20 / M25 as the case may be using Ready Mixed Concrete (RMC) as per specification and its cement content shall not be less than 400 kg/m^3 / 450 kg/m^3 of concrete.

SCOPE: -

B) RESERVOIR

Reservoir Works deal with:

B.1. Construction of R.C.C. Elevated Reservoir as per departmental design supported on columns with bracing supported on R.C.C. bored pile foundation as the case specified.

B.2. Finishing works inside the tank proper by plastering and with neat cement punning where specified and outside the tank by plastering with two coats of Decorative Exterior Emulsion paint.

B.3. Supply and installation of Sluice Valves with DI/CI flanged tailpieces of different diameter for inlet, delivery, overflow and wash out arrangement of the reservoir as shown in the drawing including construction of masonry valve chambers.

B.4. Supply and installation of vertical pipes with specials of different diameter for inlet, delivery, overflow and wash out arrangement of the reservoir as shown in the drawing.

B.5. Supply and installation of M.S. Cat Ladder with hand rail through inside of the tank proper as shown in the drawing.

B.6. Supplying, fitting and fixing of Lightning arrestor and conductor as per I.E.E Rule.

B.7. Supply and installation of water level indicator using pressure gage as per specification.

B.8. Performing water tightness test of the tank proper, disinfection of the same including pipeline and refilling the reservoir with fresh potable water upto its full capacity.

B.9. Testing at various stages of work as per specification.

B.10. Embossing the name and capacity etc. of reservoir as per direction of E-I-C.

TECHNICAL INFORMATION

C.1. All levels indicated in drawing G.T.S. levels in mtr.

C.2. Height of the staging is 20 mtr. From the FGL and the components of the staging are circular columns braced with rectangular bracing.

C.3. D.M.C. of M-30 grade shall be used in the Tank proper i.e. from heel beam to upper edge of shell wall where concrete surface remain in contact with water.

C.4. D.M.C. of M-25 grade shall be used in columns, bracing, pile cap etc in all other components of the reservoir not in contact with water.

C.5. Supper plasticizer to be used in the entire M-25 & M-30 grade concrete @ 0.2% by weight of cement. (i.e.100 ml. per bag of cement) or as specified by the manufacturer or as specified in design mix.

C.6. Supper plasticizer shall be used in the mortar for plastering work as and where specified & directed by E.I.C.

C.7. The inside surfaces of floors and walls shall be finished by artificial stone flooring (20mm) with neat cement punning and 3:1 cement plaster with next cement punning respectively and using water proofing compound. The ceiling of tank proper and the inside surfaces of lantern shall be plastered with 4:1 cement plaster.

C.8. The outside surfaces of the tank and the supporting structure shall be finished with 4:1 cement plaster & painted with 2 coats of Decorative Exterior Emulsion paint over a coat of cement primer as per direction of E.I.C.

C.9. Inside wall surfaces of valve chamber to be finished with 4:1 cement plaster work.

C.10. Inlet, delivery, overflow and wash out pipes shall be of CIDF variety.

C.11. 450 mm wide M.S. Cat ladder with handrail shall be made as per specification & drawing.

Superintending Engineer,
Western Circle, PHE Dte

GENERAL AND TECHNICAL SPECIFICATION

1.0 REQUIREMENTS:

1.1 Application of specification and item of work:

This specification forms part of the contract and shall be read in conjunction with other documents forming the contract, viz. Notice inviting Tender (N.I.T.), conditions and requirements of tendering, Scope of work and technical information, General conditions of contract, General and Technical Specification, drawings and schedule of probable items of works.

The offered rates must cover the cost of all materials, all taxes & duties in vogue, labour, tools, machinery, plant, explosives, scaffolding, staging, shoring, props, bamboos, ropes templates, pegs, and all appliances and operations whatever necessary for efficient execution and completion of the work.

All works are to be executed in accordance with descriptions in the schedule of item of works along with the specifications, terms, conditions provided elsewhere in the tender documents.

Item of works and their details, which are not covered by this specification, shall be carried out as per those of P.W. Department, Govt. of West Bengal, Presidency Circle.

Manner of works not included above, should be carried out as per relevant provisions of Manual on Water Supply and Treatment published by CPHEEO, relevant I.S. specifications and code of practice and as per manufacturer's specification (where ever necessary).

The overall outline of works to be done by the contractor and the detail have been mentioned in the item of works in the schedule and in the specification, drawing and elsewhere in the tender documents. Each scheduled item has to be carried out and completed by the contractor at the accepted rate covering the full extent outlined in the schedule and specification and not withstanding any omission in mentioning of supply and execution of such component of works except in special case specifically mentioned. Items indicated in the schedule are exhaustive. Yet if there by any short fall felt by the tenderer he may include the same while quoting his rate so as to make the item complete in all respect for successful completion of the work.

The contractor's works shall be guided by the total requirement briefly outlined and shall include additional works other than those component of works mentioned in the item to complete the work. The tenderer or the contractor has to completely execute the full requirements ensuring performance guarantee of each component of the works, equipment and machinery so that all the individual components are brought up to the optimum condition for sustained and satisfactory operation individually and collectively.

1.2 **Site Condition:**
The contractor is to visit the site and ascertain local conditions, traffic restrictions, and obstructions in the area before submission of tender paper to satisfy himself.

1.3 **Setting out and leveling :**
The contractor is to set out and level the works, and will be responsible for the accuracy of the same; he is to provide all instruments and proper qualified staff required for checking the contractor's work.

1.4 **Safety Code:**
The contractor shall take adequate precaution to provide complete safety for prevention of accidents on the site.

1.5 **Keeping works free from water:**
The contractor shall provide and maintain at his own cost, electrically or other power driven pumps and other plant and equipment to keep the site and foundation pits and trenches free from water and continue to do so till the site is handed over to the complete satisfaction of E.I.C.

1.6 **Clear Site:**
The site during the execution of works should have sober and tidy appearance with everything necessary for the work neatly and systematically arranged.

The contractor at his own cost, shall clear the site of all trees, roots and obstructions. Where excavation is required, that should be done strictly upto the required level. Any surplus earth should be spread over the low lands or used in earth filling works for development of site.

After the completion of the work, the entire site shall be cleared satisfactorily with (a) all pits, diggings and trenches properly filled up (b) all surfaces adequately dressed (c) all surplus materials, sheds, tents and all other ancillaries removed from the site at his own cost.

1.7 **Bench Marks and Ground Water Gauges:**
The contractor shall establish and protect surveyor's benchmarks and base line marks from damage or movement during work at his cost.

1.8 **Inspection:**
The contractor shall inspect the site of work and ascertain site conditions and the nature of soil to be excavated.

1.9 **Contractor's Staff:**
The contractor must provide at all times efficient staff of trustworthy, skilful and experienced assistants capable of carrying out the work in accordance with the drawings and specifications and to correct levels.

1.10 **Measurement of Work :**
The CONTRACTOR shall be available at site at all reasonable times to take joint measurement of work done for the purpose of payment and shall also provide without any extra charges, the necessary measuring instruments and men.

1.11 **List of I.S. Code of Practices :**
A list of few important Indian Standard (latest edition) is given which does not cover all the relevant sides of practices. Wherever reference towards the Indian standards mentioned below or otherwise appears in the specification, it shall be taken as reference to the latest version of the standard.

SL.NO.	IS NO.	DESCRIPTION
22.	IS-8142 : 1976	Tests for setting time of concrete.
23.	IS-516 : 1959	Tests for strength of concrete.
24.	IS-9013 : 1978	Tests for compressive strength.
25.	IS-4031	Tests for cement.
26.a)	Steel : Iron Work IS-1786 : 1985	High yield strength deformed bar (Grade Fe 415).
b)	IS-1786 : 1985	Tor steel reinforcement.
c)	IS-2751 : 1966	Welding of reinforcement.
27.	IS-2502 : 1963	Bending & fixing of bars for concrete reinforcement.
28.	IS-9077 : 1979	Corrosion protection of steel reinforcement in R.C.C. structure.
29.	IS-2062 : 1992	Structural steel.
30.	IS-2062 (Grade-A)	Low Carbon structural steel.
31.	IS-800 : 1984	Use of structural steel in general building construction.
32.	IS-808 : 1989	Rolled Steel Beams, Channels and angles.
33.	IS-1038 : 1983	Steel doors, windows & Ventilators.
34.	IS-780 : 1984	Sluice valves for water works purposes. (Small dia-50 mm to 300 mm size).
35.	IS-2906 : 1984	- do - (Higher dia-350 mm to 1200 mm size).
36	IS-3950 : 1979	Surface boxes for sluice valves.
37.	IS-13095 : 1991	Butterfly valves for general purposes.
38.	IS-12969 : 1990	Method of test for quality characteristics of valves.
39.	IS-12992 : 1993	Spring loaded safety relief valves.
40.	IS-5312 : 1984	Swing check type reflux valves.
41.	IS-3042 : 1965	Single faced sluice gate (200 mm – 1200 mm).
42.	IS-1661 : 1972	Cement & Cement lime plaster finishes.
43.	IS-782 :1978	Caulking Lead.
44.	IS-11606	Methods for sampling of C.I. Pipes & Fittings.
45.	IS-10221 : 1982	Coating & wrapping of underground mild steel pipe lines.
46.	Is-2911 : 1979 (Part-I Section –2)	Design & construction of bored cast in situ concrete piles.

47.	IS-2911 : 1985 (Part –4)	Load test on piles.
48.	IS-816 : 1991	Use of metal is welding for general construction in mild steel.
49.	IS-1024 : 1979	Welding in bridge and structure subject to dynamic loading.
50.	IS-822 : 1970	Procedure for inspection of welds.
51.	IS-814 : 1991	Electrodes for manual metal arc welding.
52.	IS-3950 : 1979	Surface boxes for sluice valves.
53.	IS-5312 (Part-I) : 1984	Swing check type reflux (non-return) (single door) valves.
54.	IS-5312 (Part-II) : 1986	-do- (Multi door pattern)
55.	IS-5822 : 1994	Laying of Electrically Welded Steel Pipes for water supply.
56.	IS-823	Procedures for manual are welding of mild steel.
57.	IS-4353	Submerged Arc Welding of Mild Steel and Low Alloy Steels.
58.	IS-73-07 (Part – I)	Approved tests for welding procedures (fusion welding of steel)
59.	IS-7310 (Part – I)	Approved tests for welders working to approved welding procedure (Part I: fusion welding of steel).
60.	IS-2595 : 1978	Code of practice for radiographic testing.
61.	IS-4853 : 1968	Recommended practice for radiographic examination of fusion welded circumferential joints Steel Pipes.
62.	IS-1182 : 1967	Recommended practice for radiographic examination of fusion welded butt joints.
63.	SP-34	Hand book of concrete Reinforcement and detailing.
64.	SP-23	Hand book of concrete Mix Design.
65.	IRC-SP-63	Guideline for use of interlocking concrete block pavement.

2.0 APPROVAL OF MATERIALS:

Sample of materials in sufficiently large quantity with descriptive data thereof shall be furnished by the contractor to the Engineer-in-charge well before the collection of such materials and equipments so as to permit inspection, testing and approval. The sample shall be properly marked to show the name of the materials, name of manufacturer, place of origin and item for which it is to be used. After approval, the sample shall be available for inspection at all time.

All materials including C.I.D.F. / D.I.D.F. Pipes, Specials , Rubber Gasket , Nuts & Bolts etc. to be supplied by the contractor shall conform to the requisite I.S. specification properly tested and duly certified. Those are to be approved by the Engineer-in-charge before use. **Third party inspection of such materials has to be arranged by the agency as per direction of E.I.C.**

3.0 MATERIALS:

Stone Chips: These should be obtainable by the contractor from Pakur, well graded conforming to the standard specifications of P.W.D. for M-25, M-30, M-20 etc. as the case may be or approved by the Engineer-in-charge.

Sand : Sand for construction purpose shall have to be collected either from Simlagarh or river bed of Damodar/Mayurakshi/Kangsabati or Ajoy and should be coarse, cleaned, screened and washed & of quality conforming to the standard specification of P.W.D/ this Directorate and also to be approved by the Engineer-in-charge.

Brick : Bricks shall be of first class quality, well burnt in kiln, sound hard , true to shape and of the standard dimensions, and to be got approved by the Engineer-in-charge before use.

Plasticiser: Super-Plasticiser of SIKA / CICO make conforming to IS: 2645-1975 & IS: 9103-1974 must be used.

Cement: The cement shall conform to relevant I.S. grade OPC –53. Cement tests shall have to be carried out at contractor's expenses as and when directed. The contractor shall make arrangement with necessary equipment to carry out crushing strength of 150 cm. Cube concrete block for 7 day's & 28 day's of proper curing. Testing procedure, sample size shall be in accordance with relevant I.S.

Brand of cement for this work may be of Ambuja / Lafarge / Ultratech Brand. For use of any other brand approval of E.I.C. is mandatory.

Steel / Reinforcement:- Reinforcement for reinforced concrete work in all sorts of structures including distribution bars, stirrups, binders etc. initial straightening and removal of loose rust (if necessary), cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire at every inter-section, placing in position etc. must be completed as per drawing and direction. **This should also be read with clause 6.7 of General & technical specification.**
Brand of steel /reinforcement for this work may be of SAIL / TATA / SHYAM / SRMB. **For use of any other brand approval of E.I.C. is mandatory.**

4.0 MAT CONCRETE below foundation
100 mm thick concrete of mix. 1:2:4 with 20 mm down graded stone chips (Chandil / Pakur variety) shall be provided below R.C. foundations and structures over a layer of Polythene Sheet as approved by Engineer-in-charge.

Foundations for brick work below plinth shall have 100 mm ;thick mat concrete 1:2:4 with 20 mm downgraded stone chips (Chandil / Pakur variety) over a layer of Polythene Sheet as approved by Engineer-in-charge.

5.0 BRICK MASONRY:
Brickwork shall be laid in English bond with mortar in proportion 6:1 unless otherwise specified. Brick work shall always be carried up regularly in plumb and true to plan and lines, in level along the entire length. No brick work shall be carried up more than one scaffolding height of 1.5 metre in the stage. Bricks are to be well soaked with water before use and brick work shall be kept clean and joints raked out for subsequent pointing or plastering.

Brick work in foundation and superstructure not in contact with water shall be provided with 19 mm and 12 mm thick plaster to rough and fair faces respectively with cement sand mortar in 1:6 proportions. Brick work in contact with water shall be in cement sand mortar in 1:4 proportion 19 mm thick plaster with water proofing compound as per specification including 1.5 mm thick cement punning in the water contact face. 12 mm thick plastering in 1:6 cement sand mortar in the outer face shall be provided. "Cement Brick" will mean brick work in cement sand mortar in proportion as mentioned above.

6.0 R.C.C. WORKS:

The R.C.C. works for Elevated Reservoir, Pile Caps and Pile foundation shall have to be done by Design Mixed Cement concrete (DMC) as per required Grade with well graded stone chips (20 mm grade) with complete design of concrete mix in a computerised batching plant under controlled condition as per IS: 10262 & IS: 456 and other relevant special publications using approved quality super Plasticizer in appropriate quantity, transporting the mix in agitated transit mixer to work site, placing the concrete in position with the help of concrete pump of suitable capacity or by any other method as approved by the Engineer-in-Charge, levelling and compacting the concrete with approved quality vibrator, curing the same as per IS-456 complete in all respect as per direction of the Engineer-in-Charge. Quantity of cement shall not be less than the quantity stipulated as per relevant I.S. Code per cubic meter of controlled concrete or as specified in the schedule of the work, but actual quantity shall be determined on the basis of preliminary test and job-mix formula to be submitted by the agency at no extra cost. Water cement ratio generally shall not exceed 0.45. For R.C.C. works in other than Elevated Reservoir may be done with nominal mix as specified in the schedule of the work, will be used as per specification of relevant I.S. code.

Design mix of concrete shall be submitted to the E-I- C done by any recognized University subject to condition of approval from the E-I-C .Necessary cube test shall be done at all stages as per guide line of relevant I.S. code with latest addendum at any recognized Test House with prior approval from the authority and necessary all cost bear by the contractor, and shall be submitted to the concerned authority time to time.

6.1 Mixing and Laying: For nominal mix, all concrete work in foundation, superstructure etc. shall be properly mixed in a good quality machine mixer. In no circumstances hand mixing will be allowed. However in special condition, with the permission of the Engineer-in-Charge hand mixing may be allowed. In that case 10% extra cement shall have to be used for which no extra payment shall be made. Concrete shall be laid properly and vibrated thoroughly with the help of mechanical vibrator as per direction of the Engineer-in-Charge.

Mortar and Concrete: Contractors are particularly warned against the use of inferior materials or use of incorrect proportion of different materials in the makeup of concrete or mortar. Detection of any such practice will lead to rejection of all such works and imposition of penalty. Engineer-in-Charge has the right to reject any mortar or concrete, which does not conform to the specification. Cube test for concrete shall have to be done as per IS: 456-1978 and other relevant codes with all cost bear by the contractor.

The water cement ratio is to be determined by proper slump test or as provision of relevant I.S. Codes. In case of slump test the slump cones (300 mm dia. At bottom and 100 mm at top) are to be kept at site at the cost of the Contractor.

Finishing: If the surface of the concrete is found uneven or spongy in appearance, the Contractor shall have to rectify or reconstruct at his own cost.

All R.C.C. work, column, beam, roof, foundation etc. for Elevated service reservoir not forming part of water retaining structure shall be done with M20 grade of concrete as per IS: 456-1978 with cement content not less than 350 kg/cum. of concrete. Approved quality super Plasticizer in appropriate quantity by weight of cement has to be used as per relevant I.S. Code. The water cement ratio should not exceed 0.45.

All R.C.C. work forming part of water retaining structure shall be done with M25 grade of concrete as per IS: 456 with cement content not less than 400 kg. /cu.m. of concrete. Approved quality super Plasticizer in appropriate quantity by weight of cement have to be used as per relevant I.S. Code. The water cement ratio should not exceed 0.45.

The concrete shall be cured as per IS: 456-2000.

6.4 Storage of Materials:
Agency has to arrange for storage of materials at the site at his own cost. Storage should be in such a way that any personnel of the PHE Dte. can access & check the quality of materials (mainly of cement & steel) during the work

6.5 Joints in Concrete Structure:
Type of joints, spacing of joints, use of all jointing materials and other features pertaining to the provision of movement joints in liquid-retaining structures shall be as per relevant I.S. Codes.

6.6 Water Tightness:
All the liquid retaining structures must be made completely water tight as per specification contained in I.S. for water retaining structure. For porous concrete resulting in leakage, this is to be rendered good by cement slurry grouting at the cost of the contractor.

6.7 Reinforcement of R.C.C. Works:
The M.S. work should include cutting to sizes, bending, hooking and fabricating including the supply of B.W.G. wire, and all other works according to specification, drawing or otherwise.

The M.S. reinforcement rods if to be procured by the tenderer shall be HYSD bars (Fe-415) as per relevant IS Code. The contractor shall intimate the department regarding the quantity of steel to be procured by him in the works and the same may be supplied at the agreed rate specified in General terms and conditions.

The reinforcement cage of piles should be strictly in conformity with the detail shown in approved drawing and the cage to be constructed with welding only conforming to specification of IS: 2751-1966 for welding of reinforcement.

6.8 Clear Cover:

The following clear cover to main reinforcement shall be maintained unless otherwise specified in drawing.

a) Water retaining face 30 mm

b) Other than water retaining face 25 mm for beam and 15 mm for roof and floor

c) Column, Pedestal Foundation and Pile 50 mm

6.9 Lap Length :

The Lap length of reinforcement shall be provided as given below; unless otherwise specified in drawing.

Compression members like column, struts @ 40 times the dia of bar.

Tension members like beam, slab, wall etc @ 50 times the dia of bar.

Following Development length/Anchorage length shall be provided.

Concrete Grade	M 15	M 20	M 25
Development Length	68 D	51 D	46 D
Anchorage		As per I.S. – 456-2000	

The reinforcement work will include cutting to sizes, bending, hooking binding with 14 to 18 S.W.G. soft pliable wire etc. as per P.W.D. schedule. The work shall also be inclusive of stirrups, distributors, binders etc.

SHUTTERING AND STAGING:

The form work shall conform to relevant I.S. Code of practice Shuttering in form work shall be either made of steel or plyboard. Surface of shuttering in contact with concrete shall be made smooth & at joints rendered smooth. In every case the joints of the shuttering are to be such as to prevent the loss of liquid from the concrete. All shuttering form work must be adequately stayed and braced to the satisfaction of the Engineer-in-charge for properly supporting the concrete during the period of hardening. All form works shall be removed without shock or vibration. Before the formwork is stripped, concrete surface shall be exposed when necessary in order to ascertain that the concrete has set and hardened sufficiently.

Curing and Finishing:

The joint shall be cleaned off the grey cement slurry with wire/coir brush or trowel to a depth of 2 mm to 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement . The floor shall then be kept wet for 7 days. After curing the surface shall be washed and finished clean. The finished floor and wall shall not sound hollow when tapped with a wooden mallet.

PLASTERING PAINTING & SURFACE TREATMENT:

Cement Plaster

Materials

8.1 Cement:

It should be fresh protland cement (not less than grade 43) as specified in relevant I.S. Different Types of cement shall not be mixed together. In case more than one type of cement is used, a record shall be kept showing the location and the types of cement used. **Brand of cement for the may be of Ambuja / Lafarge / Ultratech Brand. For use of any other brand approval of E.I.C. is mandatory.**

8.2 Sand:

It shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain the amount of clay, silt and fine dust more than 5% by mass. It shall not also contain any harmful impurities such as iron pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shale in such a form or in such quantities as to affect adversely the hardening, strength or durability of the mortar. The grading of sand for use in Plaster shall be conforming to I.S.: 1542-1977.

In case the sand is damp at the time of preparation of mortar, its quantity shall be increased suitably to allow for bulkage in conforming to I.S. 2386 (Part-III) 1963.

8.3 Preparation of Mortar:

The materials shall be at first mixed dry thoroughly in suitable proportion as stated in the schedule till uniform colour reaches and then shall be mixed wet adding water slowly and gradually for at least four times to give a uniform paste. The mix as prepared shall be used within 30 minutes. Wherever plasticiser is required to use, the quantity of water shall be reduced in such a proportion that required consistency is achieved.

8.4 Preparation of Surface:

The surface of wall shall be brushed, cleaned, washed, watered and wetted with water before plastering. All the projections extending more than 13 mm from the general face of the masonry should be knocked off so as to maintain thinner plaster layer. All the joints in masonry should be raked for a depth of about 20 mm. In case of

plastering on concrete surfaces, the face should be roughened by chipping of about 5 mm. Oily, greasy and efflorescence spots should be removed either by brushing, scrapping or both.

8.5 Laying:
In order to maintain uniform thickness of the plaster, the screeds are formed on the prepared wall surface before actual plastering is started. Patches of plaster 15 cm x 15 cm are first of all applied at an interval of about 2 m both horizontally and vertically over the surface. The two dots lying in vertical strips of mortar are formed between dots. Then the plastering shall be started from the top and worked towards the bottom. The whole surface shall be made flush between the screeds with wooden straight edges and rubbed thoroughly with wooden floats. Rounding of corners if desired by the Engineer-in-charge shall be carried out in one operation.

8.6 Curing :
The plastered surface shall be kept wet by sprinkling water after 12 hours for atleast 7 days and shall be protected from rain or sun.

8.7 Thickness:
Unless otherwise specified or desired by E.I.C. the thickness of plaster shall be as follows :-

a)	Plumbed Surface of Brick work	-	15 mm
b)	Rough Surface of brickwork	-	20 mm
c)	Vertical concrete surface	-	10 mm
d)	Ceiling of Roof, Chajja etc.	-	10 mm

Cement Pointing to Exposed Brick Facing

Where shown on the approved drawings or specified in schedule of work, exposed brick faces shall be cement ruled pointed. The mortar shall be raked out of the joints to a depth of 6 mm. The dust shall be brushed out of the joints.

9.0 <u>BOLTS & NUTS:</u>
Make: GKW / TATA or Equivalent
Bolts and nuts conform to the requirements of turned grade bolts of symbol 4D, 5D and 53 specification - IS : 1363 (latest edition) – Technical supply conditions for threaded fastener. The screw thread shall conform to coarse series – medium class referred in IS : 1367 (latest edition)/.

10.0 <u>GASKETS:</u>
Gaskets for flange joints shall be made of natural rubber conforming to IS specifications.

11.0 <u>SALIENT PARTICULARS OF R.C.C. RESERVOIR:</u>
The staging, foundation, circular tank should be of monolithic construction. Depending on poor soil condition, bored pile foundation may be considered as shown in relevant drawing.

11.1 Capacity:
The R.C.C Elevated Reservoir should be of capacity as mentioned in NIT and Staging height will be of 20 m from FGL or as mentioned elsewhere or as shown in relevant drawings.

11.2 Ventilation:
For ventilation windows, rust proof and mosquito proof net as approved by the Engineer-in-Charge of the works are to be fixed on approved quality wooden frame with necessary fixtures at the central top position of the roof of the reservoir as shown in the drawing. The frame has to be painted both sides with 2 coats of approved quality paint over a coat of primer. The cost of such item has been included in relevant items of works. All exposed fixtures should be rustproof.

11.3 M.S. Cat Ladder with Hand railing:
i) The Cat ladder shall be 450mm wide. The frame of ladder shall be made of 2nos 60 X 40 X 8 mm ISA. Two nos. of 12 mm dia M.S round or square bar placed @ 300 mm c/c and integrated with ladder frame by suitable fillet welding shall serve as steps of the ladder. Minimum 5 mm thick fillet welding all round the M.S. bar shall be made conforming to the specification of relevant I.S. Code.

ii) Where the Cat ladder is essential to be provided with handrail, it shall be in one side of the ladder as directed by E.I.C. The handrail shall be made of 32 mm dia G.I. pipe (TATA make medium quality) supported

on 10 X 40 X 6 mm ISA posts placed @ 60 mm c/c. The post shall be secured both with the frame of the ladder and G.I. handrail by continuous fillet welding.

The ladder shall be built with landing slab in position where necessary 500 mm wide M.S. ladder as per design consisting of 2 nos. ISMC 100 X 6 mm thick with necessary base plate, 6 mm thick M.S. checkered plate as steps @ 300 mm c/c supported on ISA 40 X 40 X 6 mm angle, ISA 65 X 65 X 6 mm thick angle 600 mm high as posts on both side @ 1000 mm c/c, 32 mm dia G.I. pipe (TATA make medium quality)as hand rail welded with M.S. posts and stiffened centrally with additional 32 mm dia G.I. pipe (TATA make medium quality) welded with M.S. posts including fabrication, welding,
drilling etc. as per drawing and direction and finished with two coats of synthetic enamel painting over a coat of primer etc. all complete as per direction of the E.I.C.

11.4 Lightning Conductor:

This is to be done as per schedule strictly in accordance with I.E.E. rules and regulations .The Rate includes supply of all necessary labour and materials including cutting and threading of pipes and specials where necessary for which no extra claim will be entertained . The earthing conductor is to be placed below the lowest sub-soil water level during dry weather and away from the underground pipes as far as possible as determined by the Engineer-in-charge of the work. All fitting ,fixing , painting and earthling works for the lightning conductor are included in this work .

11.5 Building in pipes :

The building in of all pipes and fittings is to be done alongwith the original casting. No cutting of the cement concrete in the shell or floor of the tank any where below water lines will be permitted for the purpose of building in the pipe and fitting . No extra payment will be made for providing or making holes in concrete wall floor or shell to fit fix or old pipes and specials.

For building in all vertical pipes, care must be taken up to see that the verticality of pipes are perfectly maintained and in case of failure in doing so , deduction of rate will be made to the extent as would be considered by the Engineer-in-charge .

11.6 Bar Bending Schedule :

The contractor shall prepare his " Bar Bending Schedule " for the entire construction work in phases before starting the work and shall submit it to the EIC for his approval.

Cutting of M.S. rods in an unplanned way will not be allowed and for that if any material is found to be wasted or have to be used in excess due to the fault of the contractor, no payment shall be made on this score and the cost of such excess material shall be realized from the contractor's bill at penal rate as specified elsewhere of this tender document

The item of M.S work should include the cost of cutting to sizes, bending and fabricating including the supply of R.W.G wire, bolts and nuts etc. and all other work according to specifications, drawing or otherwise. Cut pieces of steel materials left surplus on completion of work shall not be taken back if the same be considered as unsuitable for utilization in other works. All surplus materials which will be considered returnable must be carried back to the local departmental store and properly stacked under direction of the EIC by the contractor at his own cost.

11.7 Pipe connections:

Supplying of CIDF and Specials as per relevant IS Specification and laying , erecting, jointing and building in position and providing suitable stays as shown in the drawing , schedule or as per direction of EIC is to be done properly for pipe connection work. All flanged joints should be done with approved quality Synthetic rubber insertions, bolts and nuts etc to be supplied by the contractor and rates for flanged joints are inclusive of all these .All socket joint shall include the supply of all materials (lead & Gasket), labour , tools & plants etc. by the contractor as per relevant item of works. The contractor is also to make necessary connection of inlet, outlet, and washout, overflow pipelines of reservoir, valves etc. with the rising main and delivery lines to be executed by some other agency.

11.8 Foundation Trench :

The rate of excavation are inclusive of excavation up to any depth as shown in drawing through any kind of soil viz. Sand, clay, rock or an admixture or any kind of materials, dewatering, timbering, shoring etc for all cases e.g. seepage water from leakage etc for protection of trench excavated, removing the excavated earth at reasonable distance and doing everything necessary to complete the work in foundation.

The contractor must see that the excavation is carried out only to the required depth, and he shall be reasonable for any excavation even if that be done to facilitate the work and no payment will be made for it. Any such excavation must be filled in with materials approved by the Engineer-in-charge, properly consolidated and the surface thus prepared must be brought to required level.

The bottom and sides of excavation should be level both laterally and longitudinally. All extra excavation necessary for working space must be subsequently refilled and compacted as per direction of EIC.

Earth filling is to be done in layers of 15 cm. thickness, properly rammed and consolidated. Contractor at his own cost must mend good damages show that the structure is sustained and no settlement occurs.

11.9 Water level indicator and gauge :

A pressure gauge indicating the water level as per relevant I.S. specification is to be provided. Calibration should be made to have water level directly so that it must be capable of indicating depth of water in the reservoir correctly. It is to be fitted within pilfer proof steel box with suitable vision arrangement at a height not exceeding 2 meters above G.L.

11.10 Finishing :

If the surface of the concrete is found uneven or spongy in the appearance the contractor will have to rectify/reconstruct the same at his own cost to improve the appearance. If the finishing/ improvement in the opinion of EIC is poor, full payment for the said quantity of the concreting may not be entertained. After completion of work and perfect water tightness testing of the Circular tank to the entire satisfaction of the EIC, the exterior surface of the structure including columns, bracings shell and roof of the tank is to be given decorative cement base paint of Snow Cem Super or similar approved quality and approved shade after preparation of surface of plaster or concrete as per relevant item of work. The inside of floor and wall of the tank is to be cement plastered with addition of water proofing compound as specified in relevant item of works with proper care for good workmanship

All exposed surface of the pipes and specials are to be painted /repainted by the contractor at his cost with 2 coats of approved quality paint as per direction of E.I.C. The verticality of pipes should be perfectly maintained. Failure in doing so will lead to imposition of reduced rate as may decided by EIC for the relevant item.

11.11 Staging & scaffolding:

Whenever necessary staging and scaffolding must be provided .All shuttering and framing must adequately be stayed and braced to the satisfaction of the Engineer-in-charge for properly supporting the concrete during the period of hardening. It shall be so constructed that it may withstand the jerk and shock of vibration of concrete.

Scaffolding must be strong and rigid stiffened with necessary cross bracings and proper deck at every stage where casting work is in progress to prevent any injuries to persons and to facilitate inspection, supervision and taking measurement at any time.

The hire and labour charges for staging, scaffolding, platform etc. as provided in the schedule of works is for the entire construction work including shell wall of reservoir etc till completion of work and removing the same as per direction and instruction of EIC.

11.12 Verticality of structure:

The columns shell wall, sides of bracings, ring beams, heel beam etc. should be perfectly vertical and no deviation in x – axis and /or y- axis is admissible. The Contractor should take adequate precautionary measures to ensure that the structure is constructed true to plumb. Similarly all horizontal members of the structures should be truly horizontal.

12.0 <u>BORED CAST-IN-SITU CONCRETE PILES:</u> (APPLICABLE FOR PILE FOUNDATION)

The bored R.C.C. pile foundation for reservoir should be constructed as per scheduled items, design, specification and provisions made in relevant drawing.

The design and construction of bored cast-in-situ concrete piles shall generally be governed by the recommendations IS 2911 (Part I/Sec-2) 1979.

The pile formed within the ground by excavation or boring a hole within it with the use of a permanent casing and subsequent filling with plain or reinforced concrete is termed as a bored csat-in-situ pile. For purposes of this schedule the piles shall however be always reinforced for the full length with a minimum area of longitudinal reinforcement of 0.4% of the outside sectional area of the permanent casing (liner) or shaft and the lateral reinforcement which may be in the form of links or spirals shall have a minimum diameter of 6mm. with a spacing not less than 150 mm. In the top portion of pile expected to take bending stresses in addition to the compressive one the reinforcements both longitudinal and lateral shall be designed as in a column as per relevant I.R.C. Codes. The minimum clear cover to all main reinforcement in pile shaft shall be not less than

50mm. and the minimum clear distance between two adjacent main reinforcement shall normally be 100 mm. for the full depth of the reinforcement cage. A minimum length of one meter of temporary casing shall be inserted in each pile. For marine situation such piles shall be formed with permanent casing. Boring operation shall generally be done by rotary of percussion type drilling rigs using direct or reverse mud circulation methods to bring the cuttings out. Rope operated grabbing tool or Kelly mounted hydraulically operated grab may also be used. For stabilising sides of boreholes drilling mud shall be used.

12.1 Concrete :

All R.C.C. works in piles shall be done with M20 grade concrete as per relevant I.S.Codes with cement content not less than 400 kg./cu.m. of concrete. Approved quality super Plasticizer in appropriate quantity by weight of cement shall have to be used as per relevant I.S. code. The slump of the mix shall be between 150 mm and 180 mm.

Slump measured at the time of discharge into the pile boring shall be accordance with the standards shown in table below.

Typical conditions of use:-

Pilling	Slump	
	Min.	Max
A	100 mm.	180mm.

A: placed into water-free unlined bore having widely spaced reinforcement leaving ample room for free movement between bars. Where reinforcement is not spaced widely enough, cut off level of pile is within the casing and diameter of pile less than or equal to 600 mm., higher order of slump within this range may he used .

B: Where concrete is to be placed under water of drilling mud tremie or by placer.

12.2 Drilling mud :

The basic properties of drilling mud or Bentonite as it is called shall be as given in Appendix A of IS: 2911(PartI/Sec.2)1979.

12.3 Workmanship :

Piles shall be installed as accurately as possible as per the design and drawing either vertically or to the specified batter. Tolerance for piles shall be in accordance with clause 711.6 of 1.R.C.-78-1983.

12.4 Placing of Concrete in dry boring :

Approved measures shall be taken to avoid segregation and bleeding and to ensure that the concrete at the bottom of the pile is not deficient in grout .

12.5 Placing of concrete under drilling fluid or Water :

Concrete to be place under water or drilling mud shall always be placed by tremie except that when no drilling mud is used, concrete may with special permission be placed by means of specially designed under water placer, to permit deposition of concrete in successive layers, without permitting the concrete within the placer to fall through free water.

Before place concrete, measures shall be taken to ensure that there is no accumulation of silt or other material at the base of the boring. Where bentonite is used a sample of the bentonite suspension shall be taken from the base of the boring using an approved sampler. If the specific gravity of the suspension exceeds 1.2 then place of concrete shall not proceed and the bore hole shall be flushed with fresh drilling fluid. During concreting the slurry should be maintained at 1.5 m. above the ground water level if casing is not used .The hopper and pipe of the tremie shall be clean and watertight throughout. The pipe shall extend to the base of the boring and a sliding plug or barrier shall be placed in the pipe to prevent direct contact between the first charge of concrete in the pipe of the tremie and the water or drilling fluid. The pipe shall at all times penetrate the concrete, which has previously been placed and shall not be withdrawn from the concrete until completion of concreting. At all times a sufficient quantit y of concrete shall be maintained within the pipe to ensure that the pressure from it exceeds that from water or drilling fluid. The internal diameter of the tremie pipe shall not be less than 200 mm. for 22.4 size aggregates. The placing of concrete of shall be continuous in exceptional cases of interruption lasting not exceeding two hours it should be resumed by introducing a little richer concrete with a slump of about 200 mm. for easy displacement of the partly set concrete. During the period of interruption the tremie shall not be taken out of the concrete but shall be raised or lowered time to time to prevent the concrete around the tremie from setting. Temporary casing should be extracted while the concrete within them remains sufficiently workable to ensure that the concrete is not lifted. When the casing is being extracted a sufficient

quantity of concrete shall be maintained within it to ensure that pressure from external water, drilling fluid or soil is exceeded and the pile is neither reduced in section nor contaminated.

12.6 Measurement for payment :

The length of pile shall be measured from the soffit of the concrete girder/capital/cap upto the pile tip. Concrete in piles shall be cast upto a minimum height of 1000 mm above the designed top level of pile, which shall be stripped off at the time of construction of pile cap. The cost of this extra length of pile and labour charges for dismantling of pile head upto the required level is included in the cost of pile and no separate payment will be made for these works. However, cement for such concrete work will be considered in consumption.

13.0 PILE TESTS :

13.1 General

The bearing capacity of a single pile may be determined form test loading a pile . The load test on a concrete pile may not be carried out earlier than 28 days from the time of casting of the pile.

There shall be two carried out on test piles which are not to be incorporated in the work Routine tests shall be carried out as a check on working piles . the number of initial and routine tests on piles shall be as determined by the Engineer-in-Charge depending upon the number of foundations , span length , type of superstructure and uncertainties of founding strata . In any case , the initial load tests shall not be less than 1 in number, while the routine load tests shall not be less than 1 (One) percent of the total number of piles in the structure nor less than 2 in number.

13.2 Pile Caps:

Pile Cap shall be of reinforced concrete. A minimum offset of 150 mm shall be provided beyond the outer faces of the outer most piles in the group If the pile cap is in contact with earth at the bottom, a leveling course of minimum 100 mm. thick of M 15 nominal mix concrete shall be provided.

The attachment of the pile head to cap shall be adequate for the transmission of loads and forces. A portion of pile top may be stripped off from concrete and the reinforcement anchored into the cap. Manual chipping may be permitted after three days of pile casting, while pneumatic tools for chipping shall not be used before seven days after pile casting. The top of pile after stripping shall project at least 150 mm into the pile cap. A layer of surface reinforcement may be provided with a cover of 25 mm to retain the integrity of concrete below the main cap reinforcement, which is to be laid 25mm. above the pile top.

Concreting of the pile cap shall be carried out in dry conditions. The bottom of the pile cap shall be laid preferably as low as possible taken account of the water level prevalent at the time of casting.

The top of concrete in a pile shall be brought above cut-off level to permit removal of all laitance and weak concrete before pile cap is laid. This will ensure good concrete at the cut-off level.

13.3 IMPORTANT CONSIDERATIONS, INSPECTION/ PRECAUTIONS:

While concreting uncased pile, voids in concrete shall be avoided and sufficient head of concrete is to be maintained to prevent inflow of soil or water into the concrete. It is also necessary to take precaution during concreting to minimize the softening of the soil by excess water. Uncased cast-in-situ piles shall not be allowed where mudflow conditions exist.

The drilling mud such as bentonite suspension shall be maintained at a level sufficiently above the surrounding ground water level to ensure the stability of the strata, which is being penetrated throughout the boring process until the pile has been concreted.

Where bentonite suspension is used to maintain the stability of the bore-hole, it is essential that the properties of the material be carefully controlled at stages of mixing, supply to the bore-hole and immediately before concrete is placed. It is usual to limit:

i) The density of bentonite suspension to 1.05 gm/cc.
ii) The marsh cone viscosity between 30 and 40.
iii) The pH value between 9.5 and 12.
iv) The silt content less than 1per cent.
v) The liquid limit of bentonite not less than 400 per cent

These aspects shall act as controlling factors for preventing contamination of bentonite slurry for clay and silt.

The bores shall be washed by bentonite flushing to ensure clean bottom at two stages viz. after completion of boring and prior to concreting after placing of reinforcement cage. Flushing of bentonite shall be done continuously with fresh bentonite slurry till the consistency of inflowing and out-flowing slurry is similar.

Tremie of 150 mm. to 200-mm. diameters shall be used for concreting. The tremie should have uniform and smooth cross-section inside, and shall be withdrawn slowly ensuring adequate height of concrete outside the tremie pipe at all stages of withdrawal. Other recommendations for tremie concreting are;

(i) The sides of the bore-hole have to be stable throughout.

(ii) The tremie shall be water-tight throughout its length and have a hopper attached at its head by a water tight connection.

(iii) The tremie pipe shall be large enough in relation to the size of aggregate. For 20 mm. aggregate the tremie pipe shall be of diameter not less than 150 mm. and for larger size aggregate tremie pipe of larger diameter is required.

(iv) The tremie pipe shall be lowered to the bottom of the bore-hole , allowing water or drilling mud to rise inside it before pouring concrete .

(v) The tremie pipe shall always to keep full of concrete and shall penetrate well into the concrete in the bore-hole with adequate margin of safety against accidental withdrawal if the pipe is surged to discharge the concrete.

(vi) For very long or large diameter piles use of retarding plastisciser in concrete is desirable.
For large diameter pile it may be essential to conduct non-destructive pile integrity tests to evaluate integrity of the pile.

Where possible, it may be desirable to grout the base of pile with cement slurry under suitable pressure after concrete in the pile attains the desired strength. For this purpose, conduit pipes with easily removable plugs at the bottom end should be placed in the bore along with reinforcement cage before concreting.

13.4 Permissible Tolerances for Bore Pile

a) Variation in cross-sectional dimensions . : 50mm – 10mm.

b) Variation from vertical or specified rake : 1 in 50

c) Variation in the final position of the head in plan : 50mm.

d) Variation of level of top of piles. : ± 25 mm.

14.0 <u>TESTING OF CONCRETE</u> :

14.1 Frequency of sampling :

Sampling Procedure – A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units.

Frequency – The minimum frequency of sampling of concrete of each grade shall be in accordance with the following;

Quantity of Concrete in the Work , m^3	Number of Samples
1-5	1
6-15	2
16-30	3
31-50	4
51 and above	4 plus one additional sample for each additional 50 m^3 or part thereof

Test Specimen- Three test specimens shall be made from each sample for testing at 28 days Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the form work or to determine the duration of curing , or to check the testing error. Additional cubes may also be required for testing cubes cured by accelerated methods as described in IS: 9013-1978. The specimen shall be tested as described in IS: 516-1959.

14.2 Test Strength of Sample :

The test strength of the sample shall be the average of the strength of three specimens. The individual variation should not be more than ±15 percent of the average.

Concrete shall be handled from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent the segregation or loss of the ingredients .It shall be deposited as nearly as practicable in the final position to avoid re-handling of flowing. Unless specially permitted by the Engineer-In-Charge, concrete shall not be dropped freely from a height of more than 2 meters.

Before placing the concrete, the moulds shall be cleaned of shavings, pieces of wood or other rubbish. When placing the concrete the finer materials must be carefully worked against the moulds so that the faces of concrete shall be left perfectly smooth and free from honeycombing upon withdrawal of the moulds. Any defect in this respect must be dealt with by the contractor as directed by the Engineer-in-charge without any extra charges therefore.

Depositing concrete under water shall not be allowed without specific permission form the Engineer-in-charge. The method of concreting to be adopted in such cases shall have to be previously approved by him.

During placing and also immediately after deposition, the concrete shall be thoroughly compacted by ramming, spearing etc. until it has been made to penetrate and fill all the spaces between and around the steel rods, around embedded fixtures, and into the corners of formwork in such a manner as to ensure a solid mass entirely free from voids . If so directed by the Engineer-in-charge, in addition to usual ramming, spearing etc. sufficient number and suitable type of vibrators may have to be used on important jobs to enable working with a comparatively low water-cement ratio and ensure the maximum possible degree of compaction and homogeneity . It is imperative that the work should be done quickly as well as efficiently and adequate number of hands must therefore be employed to ensure this.

Concrete shall be placed and compacted in its final position before setting has commenced and shall not subsequently be disturbed.

Concreting shall be carried out continuously up to construction joints the position and arrangement of which shall be predetermined by the Engineer-in-charge or his representative. Any rest, pauses, such as for meal, shall also be subject to his approval. All concreting work should be so programmed as not to necessitate work at night. if for any reasons this becomes imperative , the contractor shall obtain previous permission of the Engineer-in-charge or his representative and made proper lighting arrangements to his satisfaction .

15.0 PROTECTION AND CURING :

The contractor shall adequately protect freshly laid concrete, about1 to 2 hours after its laying from too rapid drying due to sunshine, drying due to sunshine, drying winds etc. and also form rains or surface water and shocks About 24 hours after laying of concrete, the surface shall be cured by flooding with water of minimum 25 mm. depth or by covering with wet absorbent materials viz. layer of sacks, canvas, Hessian or similar materials and shall be kept constant wet for a period of not less then 10 (ten) days from the date of placing the concrete . The curing shall be done for a minimum period of 10 days. Over the foundation concrete the masonry work may be started after 48 hours of its laying, but the curing of cement concrete shall be continued shall be continued along with the masonry work for a minimum period of 10 days.

In case of cement concrete used as sub-grade for flooring, the flooring may be commenced within 48 hours of the laying of sub-grade. In case it is not possible to do so due to exigencies of work, the sub-grade shall be roughened with a steel wire brush without disturbing the concrete, wetted and neat cement slurry at the rate of 1.75 Kg of cement per square meter applied to the base before laying floor and full rate of APS/mosaic flooring will be paid with the specific orders of the Engineer-in-charge . The curing to be continued along with the top layer of flooring for a minimum period of 10 days.

16.0 CONSTRUCTION JOINTS: All joints in slabs and other horizontal members are to be formed by inserting vertical boards against which the concrete deposited can be properly rammed. The Engineer-in-Charge or his representative will indicate the positions where such joints may be made.

In the case of horizontal joints any excess mortar or laitance shall be removed from the surface after the concrete is deposited and before it has set.

When the work has to be commenced on a surface which has hardened, such surface shall be well roughened and all laitance removed ; the surface shall then be swept clean, thoroughly wetted and covered with a thin layer of mortar composed of equal volumes of cement and such works shall be deemed to be covered by the rates for concrete.

For major R.C.C works (Where concrete is specified by strength) the mix should not be leaner than 1:2:4 so as to give ultimate crushing strength not less than 20 N/mm^2 at 28 days cured under field condition. The mix for the concrete is to be so adopted and the slump is to be so allowed as to give specified strength and proper workability at the existing site conditions. Contractor shall remain fully responsible for producing concrete of specified strength in the actual job and therefore cast at his own cost test specimens of 15 cm. cubes as already specified during work and cure the same in similar way as for laid concrete for being tested for strength.

Each set of test specimen shall be taken to cover the quantity of concrete laid on the job during the period from the time of taking the previous set of specimens and the quantity will be estimated by the Engineer-in-charge from records maintained by him.

The interior surface of the mould and base plate shall be lightly oiled before the concrete is placed in the mould When the job concrete is compacted by ordinary methods, the test specimen shall be molded by placing the fresh concrete in the mould in three layers, each approximately one-third of the volume of the mould. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete there slides from it in order to ensure a uniform distribution of concrete within the mould. Each layer shall be rodded, 25 times with a 16 mm. rod, 60 cm in length bullet pointed at the lower end. The strokes shall be distributed in a uniform manner over the cross-section of the mould and shall penetrate into the underlying layer. The bottom layer shall be rodded , throughout its depth . After the top layer has been rodded , the surface of the concrete shall be struck off with at trowel and covered with a glass plate at least 6.5 mm. thick or a machined metal plate . The whole process of moulding shall be carried out in such a manner as to preclude the alteration of the water-cement ratio of the concrete, by loss of water either by leakage from the bottom of overflow from the top of the mould.

When the job concrete is placed by vibration and consistency of the concrete is such that the test-specimens cannot be properly molded by hand rodding as described above, the specimens shall be vibrated to give a compaction corresponding to that of the job concrete. The fresh concrete shall be placed in the mould in two layer each approximately half the volume of the mould. In placing each scoopful of concrete the scoop shall be moved around the top edge of the mould as the concrete there slides from it in order to ensure a symmetrical distribution of concrete within the mould. Either internal or external vibrator may be used. The vibration of each layer shall not be continued longer than is necessary to secure the required density. Internal vibrators shall be of appropriate size and shall penetrate only the layer to be compacted. In compacting the first layer , the vibrators shall not be allowed to rest on the bottom of the mould . In placing the concrete for the to player, the mould shall be filled to the extent that there will be no mortar loss during vibration. After vibrating the second layer, enough concrete shall be added to bring the level above the top of the mould. The surface of the concretes shall then be struck off with a trowel and covered with a glass or steel plate as specified above. The whole process of molding shall be carried out in such a manner as to preclude the alternation of water-cement ratio of the concrete by loss of water either by leakage from the bottom or overflow from the top of the mould.

After curing, the specimen properly wrapped shall be made over to the Engineer-in-charge or his representative who will arrange to have them tested at 28 days from the date of casting. If there by any delay for any reason whatsoever the result of the test shall nevertheless be valid and will be applicable as per rules in case for all test specimens whatsoever. The contractor shall be responsible for proper packing of the specimens at his own cost, for safe and convenient transport of the same from the site to the testing laboratory .The cost of testing the test moulds and other charges including cost of carriage of the test moulds from the work site to the particular laboratory (both ways) and other incidental charges in this connection will have to be borne by the contractor.

In case of concrete showing, on the result of the cube tests, strength less than that as specified above in the "Acceptance Criteria" but has s strength greater than that mentioned in the said "Acceptance Criteria" concrete may, at the discretion of the Engineer-in-charge, be accepted as being structurally adequate without further testing.

If the concrete is deemed not to comply the "Acceptance Criteria", the structural adequacy of the parts affected may by investigated as per provision of Clause 17.4 and/or clause 17.6 of I.S.456-2000 as the case may be before rejection on the application of the Contractor with the undertaking to bear the cost of such tests.

If the strength of the concrete is such that it satisfies provisions made in sub clause 17.4.3 and /or sub-clause 17.6.3. of IS: 456-2000, concrete in that member represented by such tests shall be considered acceptable but the Engineer-in-Charge shall have the full power to fix the rate of deduction @ 100/- per cubic meter.

In case the test results do not satisfy the relevant requirement of the preceding paragraph, the Volume of concrete so deficient shall be deemed to be unacceptable and shall be removed from the structure and replaced by fresh concrete of specified strength and the contractor shall in that case have to carry out the instruction of the Engineer-in-Charge irrespective of the amount of loss, inconvenience and difficulties involved.

The contractor shall remain liable to act / to carry out instruction under the provision of this clause notwithstanding issuing by the Engineer-in-Charge of any certificates or the passing of any bills or accounts.

17.0 <u>ROOF TREATMENT:</u>

Clean the roof surface by wire brush & water jet properly. Apply 1st coat of cement slurry admixed with diluted Sika Raintile-1/Sike Latex Powder (S:W:C=1:4:6) or equivalent upto a height of 150mm on vertical surface of the parapet wall. Apply 2nd coat of the above slurry after drying of 1st coat. While the 2nd coat of cement slurry is still tacky, a screed concrete (1:1.5:3) shall be laid with 6mm down aggregate admixed with Sika Plastocrete super or equivalent (conforming to IS : 264) with a minimum average thickness of 50mm laid with proper slope. The junction with parapet wall will be properly finished with slope using cement sand mortar (1:4) admixed with diluted Sika Raintile-1/Sika Latex Powder (1:6) or equivalent with ratio not 0.5 (Diluted admixture : cement). Proper curing shall be done after completion of the treatment.

Superintending Engineer,
Western Cirle, PHE Dte.

REQUIREMENTS ON SOIL REPORT

1. **The soil test report must include a detailed layer chart (single page) mentioning depth of each stratum, soil type, along with all soil parameter required for design (as shown below):**
   (Also mention EGL – Existing Ground Level and FGL – Finished Ground Level).

Depth (m)		Soil Type (As per IS)	All parameters required for design (Also mention Table no. / Page no. of the report for each parameter)
	Stratum-I		
	Stratum-II		"
	Stratum-III		"
	etc.		"

2. Latest IS codes to be followed in all cases and are to be mentioned. Only conventional symbols of the relevant codes are to be used in such calculations. If any other reference is used, must be supplemented by their respective photocopies (pages).

   Different data/soil parameter those are used for calculations should be clearly referred (such as, Page no. ....., Table no. ..... of Soil Report).

3. A table showing pile capacities from 450 mm diameter to 600 mm diameter PILEs at an interval of 1 m from 15 m to 30 m below FGL is to be provided (Vertical, uplift and lateral capacities). [Considering 2 m C.O.L. from F.G.L.].

4. Sample calculations in detail for vertical, uplift and lateral capacities of PILEs are to be given for 500 mm dia pile only and for each stratum considering piles to be terminated within each stratum (i.e. if there are 5 stratum, there shall be 5 sets of calculations).

5. Soil test report must contain calculation for Shallow foundation even if it is very low.

6. Soil test report must contain clear recommendations about type of foundation to be adopted with justification.

OTHER REQUIREMENT OF SOIL REPORT

1. Soil investigation report(s) shall have to be approved by the respective working Division / Circle before sending the same to the Planning Wing for designing of piles / raft for OHR.

2. **PHED has a standardized set of Drawings for OHR of different capacities, where the sizes of raft foundations are given considering bearing capacities of soil as 7.5 t/m^2 and 10 t/m^2 below 2.0 m (approx.) from G.L. Hence, the respective working divisions are advised to mention the diameter of raft so that the soil investigating agency should calculate the bearing capacity for the same raft size.**

3. Different soil investigating agencies are sometimes using different factor of safety which may be looked into.

4. Finished ground level (FGL) should be intimated to the soil agency.

15/05/18

Superintending Engineer
Planning Circle – II
P.H.E. Dte., Govt. of West Bengal

Government of West Bengal
Office of the Superintending Engineer, Western Circle, P.H.E. Dte.
Narampur PHE Complex, Pin-721101, Paschim Medinipur

GENERAL SPECIFICATION

(Laying Distribution System Including Rising Main)

A) GENERAL CONDITIONS
B) CONSTRUCTION MATERIALS
C) EXECUTION
D) MODES OF MEASUREMENTS
E) SPECIAL TERMS AND CONDITIONS
F) OTHER DETAILS ADDITIONAL TERMS AND CONDITION IF ANY

A) GENERAL CONDITIONS

(A)-I The whole of standard specification as laid down in ISI along with the best practice adopted in the works of P.H.E., Dte. is to be followed. The following papers will also from the part of this contract along with others as given above.

a) Tender Notice
b) W.B.F. 2911 (i) / 2911 (ii) / 2912 (as applicable)
c) Drawing if any
d) Schedule of Rates & Bill of Quantities
e) Additional terms & conditions
f) This Specification

A-2. The tenderer prior to submission of tenders must inspect the site of work to have an estimate knowledge of quantity and nature of various terms of work that may have to be executed. They should consider all future difficulties and loss of labour due to any reason whatsoever as also any hindrances to the progress of works likely to occur due to decay and difficulty in procurement of materials. Nothing extra will be paid for any oversight or ignorance of the site condition. Rates must be quoted by the intending tenderers after due and full consideration of all the factors and contingencies involved.

A-3. The word "Engineer-in-charge" shall refer to the Executive Engineer of the Division concerned of the P.H.Engg. Dte or his authorized representative who may have been delegated with certain powers by the said Executive Engineer in respect of the exercise of the powers so delegated.

A-4. Rates of all items in the schedule are inclusive of labour, materials, transport charges, all taxes (as applicable) and other costs as may have to have to be incurred by the Contractor for getting the respective items of works executed to proper and complete finish.

A-5. The time of completion shall be reckoned from the written order to commence the work. The work must be commenced by the Contractor within 7 (Seven) days from the date to commenced the work.

A-6. The contractor shall be responsible for the true and perfect setting out of the works and for the correctness of the positions, levels dimension of all parts of the works.

A-7. Contractor will draw up a programme of works in consultation with the Asstt. Engineer concerned and will apply for materials which to be supplied departmentally well in advance. Site order Book must be opened and will have to be supplied by the contractor at his own cost to the Assistant Engineer under whose custody it will be kept. Such order book should have machine numbered page in duplicate so that one copy of the order may simultaneously be given to the contractor if so desired by him.

A-8. The work site area is to be cleared if rubbish or other debries and all trees and plants with their roots if any (reasonable quantity), at the cost of contractor. The contractor shall at his own expenses provide and maintain at site adequate supply of clear and fresh water for the purpose of construction.

A-9. For the departmental materials issued to the contractor a stock register shall be maintained by the contractor and the day to day receipt issue and balance of such materials shall be shown therein. This register shall be produced by the contractor to the Engineer-in-charge or his representative, whenever required for verification of stock.

A-10. Departmental materials will be delivered to the contractor in such installments as will be deemed fit by the Engineer-in-charge or his authorized representative. Contractor shall be full responsible for the safe custody of all kinds of departmental materials issued to him, including pipes, specials and valves etc. till consumption there of in the work and return of surplus material, if any to the departmental store. The materials must be stored at site of work and must not be removed without specific permission of the E.I.C. Temporary store will be constructed by the contractor in suitable place near the site of work and will be removed by the contractor at his own cost after the work is completed. All incidental

charges incurred from the time of delivery of the materials from the departmental store to ultimate utilization in the work and return of surplus materials to the deptt. Store shall be borne by the contractor and no extra payment on this account would be made. The contractor shall have to satisfy the E. I.C. about the full and satisfactory utilization of the Deptl materials.

B) CONSTRUCTION MATERIALS

Contents:
1) General
2) Brick
3) Coarse Aggregate of C.C works
4) Sand
5) Cement
6) Steel

B-1 General: All materials to be used in works shall be of approved quality conforming I.S.1.specification work. When material with such certificate marks are not available the same are to be get approved by the E.I.C. before use. All materials will conform to I.R.C. specification if not stated otherwise in a particular tender specify.

B-2. Bricks: All bricks shall be approved quality of standard specification made of good brick earth. uniform deep red, Cherry or copper colour, thoroughly burnt in kiln without being verified, regular in shape and size, sound, hard, homogeneous in texture, true to shape and of standard dimension and shall be free from crack, chips flows, stones or lumps of any kind and shall not show appreciable signs of efflorescence either dry or subsequent to soaking in water. The bricks shall emit a clear ringing sound on being struck and have minimum crushing strength of 135 Kg/Sq.cm. The size of bricks shall be as per convention. All the brick when absorbed water more than 20% of its own dry weight after 24 hours immersion in cold water shall be rejected.

B-3. Coarse aggregate: **(i)** Stone chips or stone ballast for cement concrete, works (plains or reinforced) shall be of hard. Uniform and fine texture free from faults or planes of weakness and free from weathered board. The ballast or chips must be free from loan, clay or any surface containing free from organic matter or other impurities and screened free of dust. Stone of black and hard variety as is generally available from quarries in Pakur / Rampurhat / chandil variety, will be normally used. Stone aggregates from other sources may also be used, provided the same in found suitable in the opinion of E.I.C. The ballast or chips shall be obtained by breaking from large blocks and must be more or less cubical in shape.

(ii) Gravel: For use as coarse aggregates in cement concrete works must be hard absolutely free from surface coating and on being broken the fractured surface must indicate an uniform and fine texture free from laminations of planes of weakness. It shall be thoroughly washed and free of all foreign materials.

B-3. iii) Jhama chips for cement concrete work shall be obtained by breaking good quality jhama bats and must not be spongy or with any coating of foreign materials and homogeneous in texture. The chips shall be more or less cubical.

B-4. Sand:- All sand shall be clean, sharp and free from clay, loam organic or other any foreign matter and shall be obtained from the approved source. The contractor shall get the sample of sand to be used is different kinds of works approved by the E.LC. or his authorized representative before using the same in work. Sand which in the opinion of E.LC. or his representative is dirty must be washed to his satisfaction at the cost and expenses of the contractor. Sand for all cement concrete works must be coarse. Medium sand may be used for cement mortar for masonry etc. Sand filling in plinth or foundation, where specified may be done with fine sand.

B-5. Cement: No cement excepting those supplied by the Deptl, shall be used in the work or brought to the site by the contractor. Cement bags must be stored in a water tight godown as approved by the E.I.C. Any cement damaged by water or otherwise defective must be removed from site immediately.

B-6. **Steel**: Mild/Tor steel round bars will be issued departmentally. The Contractor's rate shall include labour for cutting the bars to correct length, bending coil to correct shape, placing and fixing in position as shown in the drawing with 1.626 mm. wire securely tied at every inter-section. The Contractor shall without extra charge, provided all other supports and fixing required and shall take precautions to see that all such temporary fixings are removed, before the concrete is brought up. The contractor's rate shall also include any initial straighting of the bars whenever necessary and removing loose rust of scale, if any and other incidental works in this connection. The contractor shall be paid on the calculated weight of steel reinforcement only actually placed in structure i.e. The weight of tying wire or cut-piece of rods not to be considered. If bars of exact required lengths be not available, these shall be cut from such lengths or available bars as will involve minimum in cut piece.

C) EXECUTION: Contents :
1) General
2) Exeavation & filling
3) C.C. works
4) Brick work
5) Cement Plaster
6) Laying of pipe line

C-l. General: All work shall be carried out in proper manner as per I.S.I or I.R.C. (specifications if so directed even if required otherwise in tender). Items of works not covered by the schedule of Tendered Estimate shall be carried out as per best practice according to the direction of the E.I.C. and to his entire satisfaction.

C-2. Excavation & filling: i) Foundation Trench when excavated to the level indicated in the drawing will be shown to the E.LC. and if on account of bad ground or for any reason whatsoever be decides to go deeper with the foundation/trenches, the contractor shall excavated further to the depth required by the E.I.C. In no case shall the foundation soling, concrete or pipe line be laid prior to receiving orders to that effect from the E.I.C. or his authorized representative.

ii) The excavated areas around the foundation of structure/pipe line are to be filled up properly to the required level with the earth obtained from excavation or other materials as directed, well rammed with water and consolidated in layers not exceeding 15 ern. at a time. The quantity for this item of work will be measured on the basis of quantity of excavation paid for less the volume occupied by the structure/pipe line in the foundation.

C-3. Cement concrete works (plain or reinforced): i) Shuttering and staging: Whenever necessary shuttering and staging must be provided unless otherwise stated, no payment will be made for such shuttering and the cost thereof will be deemed to have been covered by the rate for relevant finished items of works. Where payment for shuttering has been specified the rate shall be deemed to cover the cost of necessary staging as well. Payment if any, for shuttering will be on the basis of surface area of shuttering is actual contact of concrete. Shuttering may be of approved dressed timber true to line normally not less than 25 mm thick surface to be in contact with concrete are to be planed smooth except where otherwise stated. Interior of all mould and boxes must be thoroughly washed out with a hose pipe or otherwise so as to be perfectly clean and free from extraneous matter previous to the deposition of concrete.

ii) Mixing placing & compacting: The proportion specified is by volume in dry condition of the different constituents. For the purpose of such and every batch of concrete, gauge boxes corresponding to the proper quantities of sand and coarse aggregates must be used. All proportioning must be carried out in such a manner that the proportions of one bag of 50 kg cement being taken as 0.003 cum. and the materials may be easily and greasily checked, the aggregates in each bag of concrete or to be so proportioned as to obtain proper workability so that the mixture may now readily round all the reinforcement and into every part of the moulds. The workability shall be measured by the amount of slump. The total water content in each batch of concrete shall always be kept constant at the amount previous determined by experiments.

Concrete shall be handed from the place of mixing to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of the ingredients. It shall be deposited as near as practicable in the final position to avoid re-handing or following. Concrete shall not be dropped freely from any height. Placing dropping of concrete shall be done as per direction of the E.I.C.

During placing and also immediately after depositing, the concrete shall be thoroughly compacted by ramming spearing etc. until it has been made to penetrate and fill all the spaces between and around the steel rods, around embedded fixtures and into the corners of frame work in such a manner as to ensure a solid mass entirely free from voids. If desired the E.I.C may direct to use vibrators on important job to enable working with a comparatively low water ratio and ensure maximum possible agree of compaction and homogeneity

iii) Protection and Curing: The contractor shall adequately protect freshly concrete about **1** to **2** hours after laying, from two rapid drying due to sunshine, drying winds etc. of laying of concrete, the surface shall be cured by flooding with water of minimum 25 mm. depth or by covering with wet absorbed materials. The curing shall be done for a minimum period of 10 days. Over the foundation concrete, the masonry work may be started after 48 hours. Of its laying but the curing of cement concrete shall be continued along with the masonry work for a minimum period of 10 days.

C-4. Brick work: Brick work shall consist of 1 st. class kiln burnt bricks laid in English bond with mortar as specified in the items. Costs involved for cutting brick as required are covered in the rates for relevant items of brick work. Brick wall shall always be carried up regularly in plumb and true to plan and line and level as far as possible along their entire length. The mortar joints shall be of uniform thickness of 10 mm with such tolerance as may be considered responsible by the E.I.C. All brick work shall be kept thoroughly wet. Bricks are to be well soaked in water before being used and each brick must be thoroughly wet, when it is laid. Brick work will be cured by sprinkling water for 7 days after it is laid. No brick work shall be carried *up* more than one scaffolding height of about 1.2 M. to 1.5 M. above adjoining walls. The surface of the walls shall be kept clean and joints racked out about 12 mm.

C-5. Cement plaster: The proportion for mortar for exterior or interior plaster shall be specified in the item of work. The plaster shall be of thickness as specified and the surface shall be similarly cured as per cement concrete. Interior comers and edges of openings, if so directed by the E.I.C. shall be rounded off or chamfered with the same mortar for which is extra payment will be allowed incase. All cement concrete surface should be chipped off properly before taking up the plastering work. The surface shall be properly cured as required and directed by the Engineer-in-charge.

C-6. Laying of pipe line : - Contents :

1) General
2) Carriage
3) Storage & handling
4) Execution
5) Testing
6) Disinfection
7) Restoration.

C-6. i) General: The E.I.C shall mean the Executive Engineer of the Division concerned. All works will be carried out to the entire satisfaction of the E.I.C Item of works not covered by the following shall be carried out according to the direction of E. I.C.

C-6. ii) Carriage: All pipes, specials valves and joints etc. issued by the department to the contractor or his authorized representative will have to be carried by the contractor from the respective departmental stores to the work site. If it is necessary to carry the materials from one site to another for the work the contractor will have to be done at his own cost. Surplus materials will also have to be returned by the contractor to the departmental stores as may be required.

C-6. iii) Storage & bandling: There should be no damage or breakage of the pipes, specials and valves during storage or handling. The Contractor shall full responsible for any damage / breakage of those materials if occurred during storage /handling.

C-6. iv) Execution: a) Alignment: The pipes are to be laid as far as practicable along road flanks with least hindrance to the vehicle or traffic. The contractor are to obtain at their own cost and responsibility the information regarding the existence and precise position of the underground electric cables, telephone cables and pipe line etc. before fixing up the alignment. Before taking up any excavation of trenches, approval of the alignment must be obtain from the E.I.C.

b) Excavation: Excavation of the trenches is to be done along the alignment to a depth ensuring a minimum cover of 1.00 M. from the top of the pipe up to the surface of the ground. The excavation shall have to be done through any materials as may be specified in the schedule of work including road surface, comer etc. road brick pavement etc. with shuttering and dewatering as may be required to protect the trenches and facilities the works during excavation. The bottoms of the trenches are to be made as even as practicable. Trenching should not carried out too far ahead of pipe laying the extent to which excavation may be done ahead of pipe laying will be decided by the E.I.C. The trenches should be kept as narrow as practicable but must allow adequate room for jointing the pipes and placing and compacting the back filling. A minimum width of 20 cm. on either side of the pipe will have to be maintained.

C) Installation: The pipes, specials, valves and joints should be carefully checked for any manufacturing defects, cracks etc before lowering them in the trench. The cracks in the metal pipes & specials etc are to be detected from the ringing sound obtained by tapping them with a light in mallet. In case of socket and spigot pipes, the socket and spigots are to be examined carefully. Straightening of the pipes is to be done along the corrected alignment. The pipes are to be cut to sizes where necessary. The specials are to be fitted and fixed in the correct position.

For laying of A.C. pipes, bedding is necessary to avoid point contact with rock, hard substance, root of tree or similar materials with either by sand or excavated loose earth (to be decided by the EIC) at least 0'- 6" in depth from the bottom of the pipe. Bonding between asbestos cement pipe and black cotton soil must always be prevented by providing bedding of sand at the bottom as well as on top of the pipe. A.C. pipe shall have to be cured thoroughly in water for at least 24 hours before those are laid in trenches and the rates laying one inclusive of the cost of this curing.

d) Jointing of pipes: For making C.L Socket joints with lead, the spigot end of the pipes of specials as the case may be should be inserted fully into the socket the space between the inside of the socket and out side of the spigot should be cleaned thoroughly. Gasket of approved quality is then to be packed over the spigot and leaving sufficient space to receive required quantity of lead. A mould of sticking clay is to be prepared around the joint under preparation and lead is to be purred into the joint in molten condition. Full quantity of lead required for the joint is to be purred in one operation and allowed to be solidified lead should be caulked properly with caulking tools so that the joint may be perfectly water tight. The lead should 99.8% pure. The cost of fuel required for melting lead is included in the rate for making C.L Socket joints.

For making flange joints, the contractors will supply necessary bolts, nuts washers and rubber insertion etc. The bolts and nuts are to be properly tightened that the joints are made water tight. For jointing A.C. pipes detachable joints set (consists of C.I bracket collor, rubber rings, nuts and bolts etc) are to be used. The detachable joint set to be placed properly by part on each of the A.C. pipe to be jointed and to be tightened properly with nuts and bolts so as to make the joint water tight.

e) Back filling: Back filling of trenches is to be in layers of 0'- 6"each and layer being adequately watered and consolidated. After the trenches have been consolidated the surplus excavated materials and spoils should be removed from the site to the satisfaction of the E.LC. Filling the trenches with loose excavated materials followed by a loose head on top of pipe line will not be allowed. Back filling in any section of the trenches has to be done where jointing in that section has been completed and the joints have been found to be satisfactory during hydraulic testing of the line.

f) Valve Chamber: The sluice valve chambers have to be constructed in accordance with the type drawing which may be seen at the office of the Executive Engineer of the Division concerned. Each of the valve chambers with dimension varying with respect to the pipes sizes shall comprise a square brick walled chamber having W.C.C,(6:3:1) at bottom and R.C.C slab cover with surface box of approved quality.

Unless otherwise mentioned the thickness of the slab should be considered as 125 mm. with 1 % reinforcement both way. In case of difference between drawing and this specification, this specification will superceed the other, the washout value chamber will be constructed as per type designs for sluice valve chamber mentioned above with the supply of labour and materials.

C-6 (v) Testing of pipe line: Hydraulic tests of the pipe line are to be given by the contractors while the works of laying proceed on. The pipe joints (and incidentally pipes also) are to be tested in section of 150 Mtr. to 300 Mtr. and will with stand a water pressure of 6kglSq.cm. for pressure as recommended by E.I.C. for a continuous period of one hour without any leakage. If any defect is detected in the joints or the pipe line during testing, the contractor shall rectify the defects at his own cost to the satisfaction of E.I.C.

For testing of pipe line the Contractors must provide all necessary appliances, tools and plants, pipes and specials and labour. Further the contractor will arrange to procure water to perform the test. If however, water from the existing distribution lines is available and the municipal authorities are agreeable to supply it, the same may be used by the contractors in effecting the hydraulic test after paying the necessary charges to the municipality. If necessary the contractors will have to sunk small dia. tube well (l W'dia.) to procure water for testing for which no extra payment will be paid.

In a non-tube-well area, if it is evident to the E.I.C. that the water for testing cannot be procured for reasons of actual scarcity then the testing of different sections of-the distribution system may be deferred up to a maximum period when water from the new sources is available in the pipe lines. In that cases the contractors must arrange to isolate, free of cost, pipe section (not exceeding 300 mtr.) for the purpose of demonstrating hydraulic test in accordance with clauses under Para above, and must replace the inter connection or make necy. Connection to either close the distribution circuit or to bring about a continuity with the adjacent section. For a differed testing corporate under the sub-clause there will be a deduction of 10% of the value of having and jointing which become payable to the contractor. The sum so deducted will be kept as retention money till the tests of pipe lines are completed satisfactorily.

When departmental water is utilized for effecting hydraulic test the contractor will pay the cost of water as per prevailing departmental approved rate of water taken or the municipal rate in force whichever is less.

C-6. vi) Disinfection : After completion of the pipe laying works all the newly laid lines will have to be thoroughly washed with clear water as per direction of the E.I.C.

The cleaned lines are then to be disinfected with chlorinated water containing 5 P.P.M. of chlorine. The chlorinated water must be kept within the pipe line for 24 hours. The contractors will arrange for clear and chlorinated water at their own cost.

Bleaching powder, if used has to be tested for its available chlorinate contents before use. The contractor will have to bear the cost any probable loss in chlorine content.

The item of disinfection includes the costs of supplying requisite quantities of water. bleaching powder, testing making solution of adequate strength, staining, feeding the solution in the pipe lines, maintaining the water for 24 hours and suitable disposal of the chlorinated water i.e. construction of Surface, drain (temporary) or additional temporary pipe line, which must be necessary to drain out the water from pipes.

C-6. viii) Restoration: During execution of laying pipes under road, the pucca surfaces may have to be disturbed. The road surfaces so disturbed must be restored by the contractor to its original condition. At the time of cutting the road surface, the thickness of soling, metal led roads etc. should be carefully preserved for reuse as required. In these cases in which the owing authorities of the road may be willing to do the restoration the trenches, and consolidate them properly as required for back filling included in the item of laying of pipes. In such cases separate payment will be made for road restoration.

D) Modes of measurements :

i) Modes of measurements will be followed per IS: 1200 (concerned part) for brick work, cement concrete, reinforcement plaster etc.
ii) Measurement for laying of pipes will be taken along the centre line of the pipes, specials and valves as laid.
iii) For measurements for restoration of W.B.M, roads will taken on the top of the surfaces restored so that the area may be found out for the purpose of making payment. Similar measurement would also be taken for the bituminous portion of the road surface.

E) Special Terms and Conditions:

E-l) All works are to be done as per general conditions and gnl, specifications in the P. W.D schedule. This P.W.D schedule

shall mean the South Western Circle schedule of rates for Buildings and road works and carriage of South Western Circle schedule of rates for plumbing sanitary and Drainage works. current of the time of calling of Tenders as the case may be Circle schedule comprises of:-

i) For Building, Road & Carriage works: The printed "South Western Circle" schedule of rates for Buildings, road and carriage works current at the time of calling of Tenders including its General conditions, General specification etc including corrigenda and addenda if any.

ii) For plumbing sanitary & drainage works The printed schedule of South Western Circle for plumbing and sanitary & drainage works current at the time of calling of tender including corrigenda and addenda if any.

E-2) Earnest money is to be deposited into Govt. Treasury or any nationalized Bank in favour of the Executive Engineer of concerned division and the original challan **/** Demand draft **/** Call deposit **/** etc. must be submitted along with tender (at the time of submission) Deposit made in other method as admissible under existing rules of this Directorate will also be acceptable if found in order and fulfilled the condition as specified. The successful tenderer will have to furnish a total security deposit of 10% (ten percent) of the value of work to be actually executed. The earnest money already deposited will be converted into security deposit and the balance security money to make up 2% / 2.50 % of the tendererd amount will have to be deposited within 7 (seven) days from the date of receipt of information (in Regd. Post) of acceptance of tender if and as asked for. The balance 8% /7.50 % Security money shall be deducted from each progressive bill so that the total deduction together with security deposit already taken constitute 10% (ten percent) of the total value of work as actually executed.

In respect of tenderer who has a fixed permanent security of requisite with Govt. has been exempted in writing from payment of E.M. with individual tender. No earnest money need be deposited in his case but security money amounting to a total of 10% (ten Percent) of the value of works to be actually done, will be deducted from the progressive bills @ 10% (ten Percent) of each such bill.

E-3) The earnest money deposited by a unsuccessful tenderer will be refundable on application to the Executive Engineer of concerned Divn. as per rules in such cases or as notified.

E-4) In the event of the tender being submitted by a firm not known to P.R.E., Dte. it must be signed separately by each member of the Finn. In the event of absence of any partner, it must be signed by another partner on behalf of the person authorizing him to do so, such power of attornies will have to be produced at the time of opening of tender. In case of a firm whose function are carried out by one member of a joint family, it must disclose that the firm is duly registered under the Indian Partnership Act.

E-5) The successful tenderer on receipt of intimation of acceptance of his tender must similarly deposit as in Para E(1) above a further sum to make up security money of 2%/2.50% of the tendered amount and execute the tender agreement in triplicate in WBF 2911(i)/2911(ii)/2912 both relevant tender documents within 7(seven) days from the date of receipt of information to that effect through Regd. Post failing which the contract will be liable termination without further reference and the security money at hand stand forfeited to Govt.

E-6 a) All items of works, not included in the specifications are to be carried out in accordance with the general conditions and specification of South Western Circle Schedule in force at the time of acceptance of the tender and that of schedule of rates of P.W. (Roads) Deptt. in force in case of tender of road works.

b) The specifications for works not carried by the specification laid down in the circle schedule! Road's schedule shall be ISI/IRC code of practice and as per sound engineering practice according to the direction of the E.I.C.

c) In addition to above the special terms and conditions and specifications, additional terms and conditions & specification shall also be applicable.

E-7) The supply of materials viz cement, steel, pipes, specials, valves lead etc. which will be issued by the department may not be continuous uniform and regular. No claim whatsoever will be entertained for detention or loss of contractors labour and conveyance etc. arising out of such irregular supply of the materials mentioned above. No claim for idle labour will be entertained under any circumstances.

E-8) a) A tender is to quote their rates in figures as well as in words at percentage above, below or at per the rates shown in the specific priced schedule of probable items with approximate quantities. The said quotation in the exact wording must be written on page-2 only of the printed tender form and no where else. The quotation shall be clearly and legibly written and the whole writings must be by the hand of the person signing the tender and with the same pen and link.

b) The tenderer must also sign at the bottom of each page of the printed tender form and other tender documents. Over writing shall not be allowed. All correction, addition, alternation must be duly signed. When a tenderer signs a tender in any language other than English, the rate quoted by him shall also be written in the same language. In addition he shall furnish a certificate to the effect that all the stipulations of the tender documents have been fully and clearly explained to him and understood by him. The person who has so explained the stipulations shall also furnish a certificate to the effect that the stipulations have been fully and clearly explained by him to the tenderer.

E-9) a) In respect of the successful tenderers, the earnest money on acceptance of tender shall be converted as a part of security deposit. If the security money falls short 2% /2.50% of the tendered amount or be a maximum of Rs: *20,000/-* tenderer shall have to deposit the balance amount within 7(seven) days from the date of information to do so.

b) In all cases the amount of recovery of the final bill will be so adjusted as to make the total amount of security deposit equivalence to 10% (ten percent) of the total value of works so executed.

c) Income tax will be deducted from the progressive bill as per G. O. No. F no. *275/10/72 I.T.J.* dt. 21.03.1972 of the ministry of finance Deptt. of Revenue and Insurance, Govt. of India with its time to time amendments if any.

E-I0) a) The contractor shall provide all pumping and other arrangements that may be necessary to remove from the keep out of foundation or any part of the structure under constructional laying water, whether canal water, sub-soil water and water from any source what-so-ever, such pumping or other necessary arrangements shall not be paid for separately unless otherwise specified and the cost thereof is to be included in the contractor's rate of relevant item of works.

b) Arrangements for water for all works, such as, mixing morter, soaking brick material, brick works, concrete works, consolidation washing of metals and chips etc. construction of platforms and vats etc. Including cost thereof are to be borne by the contractors. The water should be clean, free from loan, silt and organic materials. No hard water shall be used. The rates quoted by the contractors must be inclusive of all such charges and costs.

c) The contractor shall arrange for temporary sheds of latrines, water supply etc. arrangement for the use of his staff. Latrine shall be arranged to be cleaned and disinfected, as well as directed by the E.I.C. of work and shall remove these completely after completion of the work, and the ground restored to its original conditions to the satisfaction of the E.I.C.

d) The contractor shall make their own arrangement for storage space and godown for their tools and plants, material etc. and shall also exact their own cost necessary sheds and godowns for proper storage of Govt. materials such as cement, steel materials etc. which will be issued to them, as necessary from time to time.

e) All sheds godowns vats platforms etc constructed by the contractor for constructional purpose shall have to removed by them and completion of the work at their own cost and the ground restored to its original condition to the satisfaction of the E.I.C. Before using any Govt. land for the above purpose prior approval of the E.I.C. is to be obtained. The land will however be given free or rent for the above purpose, if available.

E-ll) The contractor shall remain responsible for compliance of the provision of contract labour Act (Regulation and abolition) 1970, and W.B. contractor labour (Regulation and Abolition) Rules 1972 in force at the time of submission of tender and subsequent amendment thereof during the pendency of contract.

E-12) Intending tenderers are requested to see the site of work to got themselves thoroughly acquainted with the local conditions near about the site of works. No grumbling on account of bad site conditions or difficult soil conditions or dearth of water supply or approach road will be entertained.

E-13) a) Not-with-standing what has been stipulated in the abridged N.I.T. a bonafide outside contractor while participating in one tenderer under P.H.E. , Directorate shall engaged required number qualified Engineering personal(s) depending upon the value of the work as per prevailing Govt. rules.

b) The Authorized agents or representatives as and when engaged by the enlisted as well as bonafide outside contractors for supervisor of work and for receiving departmental materials on hand receipt shall also be either Degree or Diploma holder in Civil Engineering as the case may be depending on the value of the work as indicated above and should hold appropriate power of attorney.

c) The Engineering personal to be engaged by the contractor shall have to remain present at the time of inspection of works before the E.I.C. for receiving site instructions.

E-14) a) The rates quoted by the tenderer must be inclusive of all incidental charges, sales taxN AT, Royalities Octroy local rates, tools ferry charges etc as necessary.

b) All rates and amounts should be eligibly written in English when the contractor sign in an Indian Language. All rates and the amounts must be written in same language as well as English. In case of illiterate contractors, the rates, Units, amounts tendered must be accepted by the witness of the tenderer known to be accepting authority. The standard unit of rates must not be splitted up failing which the tender will be declared as informal.

E-l5) a) All tools and plants are necessary for by the works, unless provided by this directorate on rental basis, will have to be arranged for by the/contractor at his own cost.

b) Cost of clearing of all verities of Jungles, shrubs and trees (of girth upto 30-45 em.) or any undesirable vegetation from within the boundaries or alignment of works will not be paid for separately. The tenderer must satisfy them selves by

actual visit to the site of work and must quote rates as per schedule inclusive of all those and similar charges both direct and incidental.

E-16) Not with standing what has been laid down in clauses 12 of W.B.F. No. 2911, 2911(i), 2911(ii) the rate of any item of work which does not appear in the schedule of probable item of work quoted by the contractor will be primarily determined form the similar or allied items appearing in the aforesaid schedule of items by adding, subtracting or corportioning as required on applying the same percentage as quoted by the tenderer. Where it is not possible to determine the supplementary rate for tender schedule of items the rates for such items of works will be determined from the circle schedule of rates concerned if available duly applying the same percentage rates for those items when cannot be arrived at by any of the procedure stated above and have been brought to the notice of the E.I.C. before execution of them will be determined from the then current market rates of labour and materials. For analysis of rates and lowest market cost of materials gathered from established business firms will be considered. For labour rates which do not appear ' in the circle schedule, similar or allied rates allowed rates allowed in the circle schedule may be considered. In this case 10% (ten percentage) profit shall be admissible but contractual percentage shall not be appearable.

E-17) Cement, steel materials pipes & specials, lead will supplied by the Department from the departmental store at different Sub-Division under different Division and the cost thereof will be recovered from the bills of contractor. Surplus steel materials are to be returned by the contractor to deptt. Store as per direction of the E.I.C. at his own cost. Cut pieces ofless than 1.0 mtr. length will not be taken back.

E-18) In case of the materials are issued from any other godown, the same are still to be carried in which case necessary adjustment for rate of work or otherwise due to carriage of materials from any other godown will be made with consequent extra payment or less payment as the case may be. The contractor must make his own arrangements for carriage of departmental materials form the departmental store as specified to work site at their own expenses, for which no extra payment will be made unless otherwise, specifically provided in the schedule.

E-19) a) All items of works not Included in the specification are to be as per specifications in vogue of the South Western Circle, P.W:D. Midnapore printed P.W.Roads Deptt. schedule of rates for Road works.

b) In case of ambiguity, the sanctioned drawings would always take precedence over sanctioned estimate.

c) Departmental godown or store would be the godown or store which will be shown or indicated in writings prior to opening of the tender.

E-20) All conditions laid down here will be effective in addition to those of W.B.F. no. 2911, 2911(i), 2911(ii) 12912 provided they do not mitigate against the condition laid sown in the printed from of the specification.

E-21) The earnest money of all tenders other than three lowest tenderers will be refunded after the comperative statement has been prepared and checked. The earnest money of 2nd and 3^{n1} lowest will be refunded after issue of work order to the 1^{51} lowest tenderer.

E-22) a) Regarding materials in respect of items of works for which the contractor's rate are not inclusive of the cost of such materials the contractor shall only act as custodian on behalf of the Govt. & the value of such materials will not be charged to him except under sub-clause (d) (e) hereof.

b) When the contractor provides for use of certain specified materials to be supplied by the Deptt. the contractor shall not obtain such materials from others sources uniess so authorized in writing by the E.I.C.of the works.

c) Materials supplied for a particulars work or part there of shall not be used else where except with the written permission of the said E.I.C.

d) The contractor shall be held responsible for any misuse, less or damage of the materials issued or handed over to him by the E.I.C. in default the costs of such material shall be recovered from the contractor according to the items of the previsions made in sub-clause (e) hereof.

E-22) e) In the following cases the materials issued or handed over to the contractor shall be deemed to have been mis-used by him.

i) Materials lost or damaged due to negligence on the part of the contractor and/or defective storage by him.

ii) Materials used in excess of the requirements as shown in consumption chart in P.W.D. schedule.

iii) Materials used without permission of E.I.C. in temporary works or in the construction of contractor's godown, side office, labour hutments etc.

The value of materials mis-used as above (in which case the decision of the E.I.C. shall be final) shall be recovered at 50%

excess of the highest of the following three rates.

i) Issue rate as specified in the contract.

ii) Depttl. stock rate at the time of recovering of value and

iii) Market rate at the time of recovering of value.

E-23) All materials rejected by the E.I.C. or his authorized representative must be removed from the site within 48 hours of rejection otherwise rent will be charged on the contract for occupying Govt. land at the rate as considered reasonable by the E.I.C. whose decision should be final in this respects.

E-24) Whenever asked for by the E.I.C. during the progress of work and also with the [mal bill, the contractor shall submit to the former a statement showing: (i) the total quantity of materials need by the contractor, from the Depttl. (ii) Consumption there of item by i.e. in the work and (iii) the balance in hand.

E-25) No escalation of rate within the period of execution of the work is admissible.

E-26) In case of any discrepancies or ambiguity in stipulation any where in the tender forms, decision of the Executive Engineer, is final and pending on all concerned.

(F) Additional Terms & Conditions & Specifications:

F-l) Extra works: **(i)** All extra and additional works, if ordered for will have to be carried out under written orders of the E.I.C. of his authorized representative.

(ii) Orders for such extra and additional works will be given either in proper extra works from or in any other form (even in plain paper) duly signed and / or countersigned by the E.I.C.

(iii) The payments for the extra and additional works will be made on the basis of tendered rate of similar nature of works or after analysis in accordance with the clause of B.F. 2911. The decision of the Executive Engineer of this division in this respect will be final and binding upon the contractor.

F-2) Road crossing works (if not included in the schedule) shall be carried out as per direction of E.I.C. The payment will be made or lump sum item rate basis after analysis the various items involved in accordance with labour rates and local market rate including considering the circumstances and situations as to be arose. The decision of Superintending Engineer in this respect is final and binding up to the contractor.

F-3) Departmental materials will be issued to the contractor and cost will be recovered from the contractor's bill at the rate as per followings: If stock permits .

a) Cement ..... per M.T.
b) M.S. Rod .....per M.T.
c) Tor Steel .....per M.T.
d) Lead ..... perM.T.

F -4) If the department fails to issue the materials, contractor has to procure the same from the open market (without extra costs) at his accord with the prior permission of the E.I.C. and materials thus procured will have to be approved before they are put to use. It may be mentioned here that the depttl. may ask the contractor for producing satisfactory certificate about the quality of the materials along with the concerned papers. Nothing extra for payment of tests whatsoever will be paid as extra.

F-5) The supply of departmental materials (Cement / Rod / Lead / pipes/Specials/ Valves/D.T.Joint etc.) will be made over to the contractor in lots from time to time against clear hand receipts from their authorized representatives. The quantity and time of such supplies will decided by the E.I.C.

F-6) a)The contractor will have to maintain a site order book (numbered with triplicate copy) at site before commencement of the work, where in the orders, instructions, comments, sketches etc as may be issued at site by the E.I.C. or demand by the E.I.C. shall be recorded.

F-6) b) The contractors or their authorized representatives at site must sign any such orders, instructions, comments and sketches issued as a token of acceptance in all the three pages of the work site order book.

F-6) c) It may be carefully noted that in absence of site order book any instruction given at site will be treated as instruction given to the contractor and this departmental staff will have the right to classify the subject with results in favour of this department.

F-7) a) The pipes are to be laid as practicable along road flanks with least hindrance to the vehicle or traffic. The

contractors are to obtain at their own cost and responsibility the information regarding the layout, precious position of the underground electri-mains , Telephone or their cables. No responsibility in this regard will be taken by the depttl. supervising staff.

b) Trenches will have to be protected against accidents continuously through out day and night. Demonstrations of danger singles, Red lamps and other signs are to be arranged. Suitable barricade have to be created and maintained by the contractors in the interest of public safety even if the same may not be explicit desired by the E.I.C.

c) The contractors will further shore up and support to the satisfactions of the E.I.C. all buildings, walls electric lines, telephones, or other cables, water drains, culverts, water mains and other pipes which may be or are likely to be affected or damaged or disturbed by the works being in the line thereof or continuous thereto.

d) The contractors will be liable for and take good at their own expenses within a reasonable period of time to be fixed by E.l.C. all damages which may be occasioned to any or any combinations of the items (i.e) buildings, walls water mains, and other pipes mentioned or in consequence of the execution of works or accident whatsoever. In the event of default (i.e. lapse with respect to the time limit) it shall be lawful for the E.l.C. to employ other agency to make good the damages at the risk and cost of the contractor after 24 hours written notice, for time period is lapsed.

F-8) The contractor will indemnify the Govt. from and against every cost, charges, expenses and claims which may become payable to claimable by any person(s)/public private or Govt. concern (i.e.) Railway, Roads, Electric supply, Telephone, Municipality etc for or in respect of any one roachment, damage or any (even if accidental) occasions to the property of life of any such concern or person (as the case may be) by or in respect of any labour of work entitled uP911 any such person/persons by reason of any interference with such property due to the said works.

F-9) The tenderers will consider the connections purported in clauses 7(a) to (e) to mentioned above to Judge the extent of liabilities involved and quote his rates accordingly since no extra claims will be entertained separately on these accounts. Inspections of sited prioror tendering therefore should be done by the trenches.

F-10) i)The expression laying of pipes also include (i) cutting of pipes to sizes where necessary, lowering and staging along the trenches.

ii) Removal of surplus excavated unserviceable materials (except road metal) after the trenches have been rammed to the satisfaction of the EJ.C. If any unserviceable materials such as bricks, stone, ballest, chips, stone setting, asphalt etc. are available from roads and other road flanks along which the pipes have been laid, for restoration the same , contractor will arrange for stacking these materials properly and separately as per direction of E.I.C. for which no extra payment will be entertained.

F-11) For un-satisfactory restoration, the contractor may have to receive 70% payment for the quantities of work done under the item laying of pipe line including jointing. The balance 30% will be kept as retention money pending satisfactory restoration within a reasonable period.

F-12) For carried earth supplied by the contractor the earth is to be first stacked at site for measurement and the earth to be utilized in works after stacks have been measured up. The items of earth work with such carried earth included the cost of such operations. The net quantity for the purpose of payments shall be derived after deducting allowance for sink age and or shrinkage as specified in the circle scheduled. In specials circumstances the E.I.C. may at his sole discretion, take borrow pit measurements at source for such carried earth in which case no allowance for sink age and or shrinking is to be deducted.

F-13) a) For item of carriage no allowance shall be made for wastage of materials in transit and in restacking at different places except, when such loss in due to special circumstances which is the opinion of E.I.C. are beyond the control of the contractor. For road transport, schedule of rate included items for transport, as pacca road. Where any kuccha road is incolved, either in part, or in the full, the length of Kuccha portion will be taken equivalent to pacca portion of length one and half times. the actual length and the total equivalent distance of pacca road calculated accordingly . Payment shall then be made on the basis of rate for transport, corresponding to this equivalent pacca road distance. This method will be applied whether the road is fully Kuccha or partly pacca and partly Kuccha (Irrespective of Kuccha portion on the route).

b) For loading unloading and stacking, payment for carriage by hand load invliving a lead of more than 30 mtr. will be made only when the E.I.C. is satisfied that the trucks cannot approach nearer.

c) When in the opinion of the E.I.C. there are more than one possible route for the transport (payment shall be made or the basis of the cheapest, not necessarily the shortest) of all possible routs irrespective of the route actually followed.

d) The quantities on which carriage items shall be paid, will be the net quantities after due allowance for sink age and/or shrinkage as stipulated, mentioned earlier.

F-14) All rubbish, debris and superfluous materials will have to be removed from the site and contractor's cost as they

accumulate and the whole site left clean and tidy during the progress of work to the entire satisfaction of the E.l.C.

F-15) Not with standing anything contained in the various clauses of the contract, the contractors are bound to abide by the minimum wages Act' 48 (Act No. XI of 1948)

F-16) During execution of work for any alternation in omissions, additions to, or substitutions for the original specification, drawings, designs and instructions (that may appear to be necessary) which do not appear in the attached schedule of items, the contractor shall be bound to carry out the work in accordance with the instruction of E.I.C. without preferring any objection. However supplementary items as per current circle's schedule if so done will be entertained.

F-17) Before submission of tender the contractor should verify from the market about the availability of the materials and in no cases "extension of time" will be generally considered on this Ground.

F-18) Consumption of Deptt. materials will be guided as per provision in the South Western Circle,Schedule.

F-l9) (a) The work must be completed in all respect within the period as mentioned in the notice which will be counted following the date of work order.

(b) In the event of work being not completed within this stipulated period, the contractors will be liable to pay and penalty as per clause -2 of W.B.F.2911las per specified clause of2912 in which from the tender will be accepted.

(c) The contractor will show satisfactory cause for delay in starting the work if the works are not started within 7 days from the date of order to commence the work. Further the contractor will show proportionate progress throughout the tenure of contractor.

(d) For unsatisfactory progress of works, it will be the option of the undersigned to withdraw the work out of the hands of the contractors and to get the balance works done through any agencies at the risk and costs of the contractor.

(e) In case of occurrence of unsatisfactory progress the undersigned shall have power to rescind the contract and to impose such penalties have been specified in the WBF 2911/WBF 2912 contractor may further be barriered from tendering in the Directorate.

Superintending Engineer
Western Circle, PHE Dte.

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ADDITIONAL SPECIFICATION FOR U.P.V.C. PIPE LINE WORK

• **Pipe Quality: -** All pipe to conform **I.S. *4985/2000,*** with latest amendments. The pipes to be of **Class-III category** (6.0 Kg./sqcm. of working pressure) and to bear I.S.I mark as well as **Manufacturer's** brand name, on each of thern. The pipes to have minimum & maximum wall thickness as :-

Size of pipe (O.D. in mm)	Wall thickness (in mm)	
	Minimum	Maximum
63	2.2	2.7
75	2.6	3.1
90	3.1	3.7
110	3.7	4.3
125	4.3	5.0
140	4.8	5.5
160	5.4	6.2
180	6.1	7.1
200	6.8	7.9
225	7:8	8.8
250	8.5	9.8
280	9.5	11.0

Manufacturer's qualification: - The pipes to be procured from the reputed UPVC pipe Manufacturer's preference will be given to Stand based Industries as per guide lines provided in relevant Government order. The Manufacturers shall 'have following minimum infrastructure facilities;-

i) The Manufacturers are to be preferably LS.I.Unit

ii) They must have valid B.I.S. license. I.S.O. accreditation for manufacture of UPVC pipes and specials as pr relevant I.S specification.

iii) They must strictly follow the manufacturing procedures as laid down in ***I.S.4985/2000,I.S.10151/1982,ASTM-D/1785/93.***

iv) They must process well equipped and properly manned laboratory at their factories for carrying out test on quality of materials used; quality of finished products etc.

Storage, Stacking, Handling and Transportations :- The pipes obtained from manufacturers, are to be safely carried including loading, unloading and stacking of pipes as per standard practice, without causing any injury to the pipes, "at local stack yard and then up to actual of the site of work of the contractor, at their own cost. The pipes need be stacked in covered shed in order to avoid direct exposure to sun light, in criss-cross manner layer by layer. The maximum stack height allowed is -up to 2.00mtr. The pipe supplied and required to be used up to laying work, within two months from the date of manufacture of the pipes. The contractor shall be held responsible for safe custody of the materials at their own cost. No surplus materials shall be accepted by the department, So, the contractor shall have to make carefully planning of the pipes to be supplied and used in work.

The Engineer-in-charge 9r his authorized representative shall have free access to the stack yard and store of the contractor for the purpose of checking and inspection as well as at the laboratory testing stage, at any point of line . They may ask for all relevant documents pertaining to the supply and use of pipes, which shall have to be provided forthwith. The contractor shall have to submit all paper relating to supply of pipes from the manufacturer in original, to the Engineer-in- charge.

Testing :- Pipes obtained from manufacturer(s) shall have to be tested stringently as per relevant I.S. specification as laid down in LS.12235/86, by the contractors at their own cost at pre delivery stage and selectively at post delivery stage through CIPET (Haldia / Bhubaneswar (S.G.S./N.T.H.). The choice of such testing agency shall however rest with the Engineer-in- charge. Details test certificate in original to be submitted to the Engineer-in-charge. In Case of any dispute as to the quality of materials, it shall be responsibility of the Agency to replace the disputed materials with good quality ones to the full satisfaction of the E.LC. at their own cost. All materials must bear LS.1. Certification mark on pipes at internal as prescribed by I.S.1. After delivered of the 1.S.1.Certification marked pipes, sample pipes collected through random sampling from different batch supplied shall be sent to anyone of the testing institution (mentioned in above) through the agency or directly by the Department for quality acceptance by the E.I.C. The contractor shall have to pay all the charges

including carriage of samples in properly placed to the testing institution. The cost for such quality acceptance test will be recovered from the progressive bill of the contractor Or alternatively the contractor shall pay such charges directly to the testing instruction from their end. Chemical and other. test (s) report should also be submitted along with the supply of pipe as per direction of E.I.C.or his representative; A.E concerned.

UPVC/ Fabricated UPVC Specials :- All specials (e.g. Tee, Bends, Reducers, Flanged Adopters, Cap etc.) should conform to 1.S.10124/88 with latest amendments. All other terms and conditions as stated *in case* of UPVC pipes to held good.

Solvent cements ;- The valid dated solvent cement to be used in the work. should conform to I.S.14982/94 with latest amendment. The solvent cement supplied shall also be tested by CIPET (Haldia/ Bhubaneswar/S.G.S/N.T.H) at the cost of contractor at pre-delivery and selectively at post delivery stages .. The materials are to be stored in cool, dry covered and enclosed space.

All other terms and conditions as stated in case UPVC pipes, to held good.

Consumption rate of solvent cement as follows ;-

Size of pipe (O.D. in mm)	No. of joints per ltr. (Tee,Bend,Adopter)	No. of joints per ltr. (Bell ended)
63	125	250
75	103	206
90	79	158
110	54	108
125	45	90
140	36	72
160	27	54
180	20	40
200	15	30
225	12	24
250	9	18
280	6	12

Laying & joints ;- For proper laying excavation of any kind of soil and strata including shoring work (where needed and so directed by the Engineer-in-charge), dewatering of trenches by pumps, preparation of bed (having no sharp and hard materials which can cause injury to the pipes and specials), has to be done by contractor including removing of excavated earth at the safe distance, as directed by the Engineer-in-charge . The depth of excavation shall be in such a manner that a minimum clear cover of 1.OO mtr. is available from top of pipe for filling. Lowering ·cleaning, laying and jointing of pipes and specials shall have to be done as per methods already described. However for application of solvent cement and subsequent jointing, shall have to *carry* out as follow~.

The endl of pipes and specials need to shaped (is required) cleaned thoroughly and solvent cement be applied uniformly on the entire face where joints shall be made, the ends to pushed up to required depth and turned up to 90^0 and to left for drying. The joints to ensure complete water tightness.

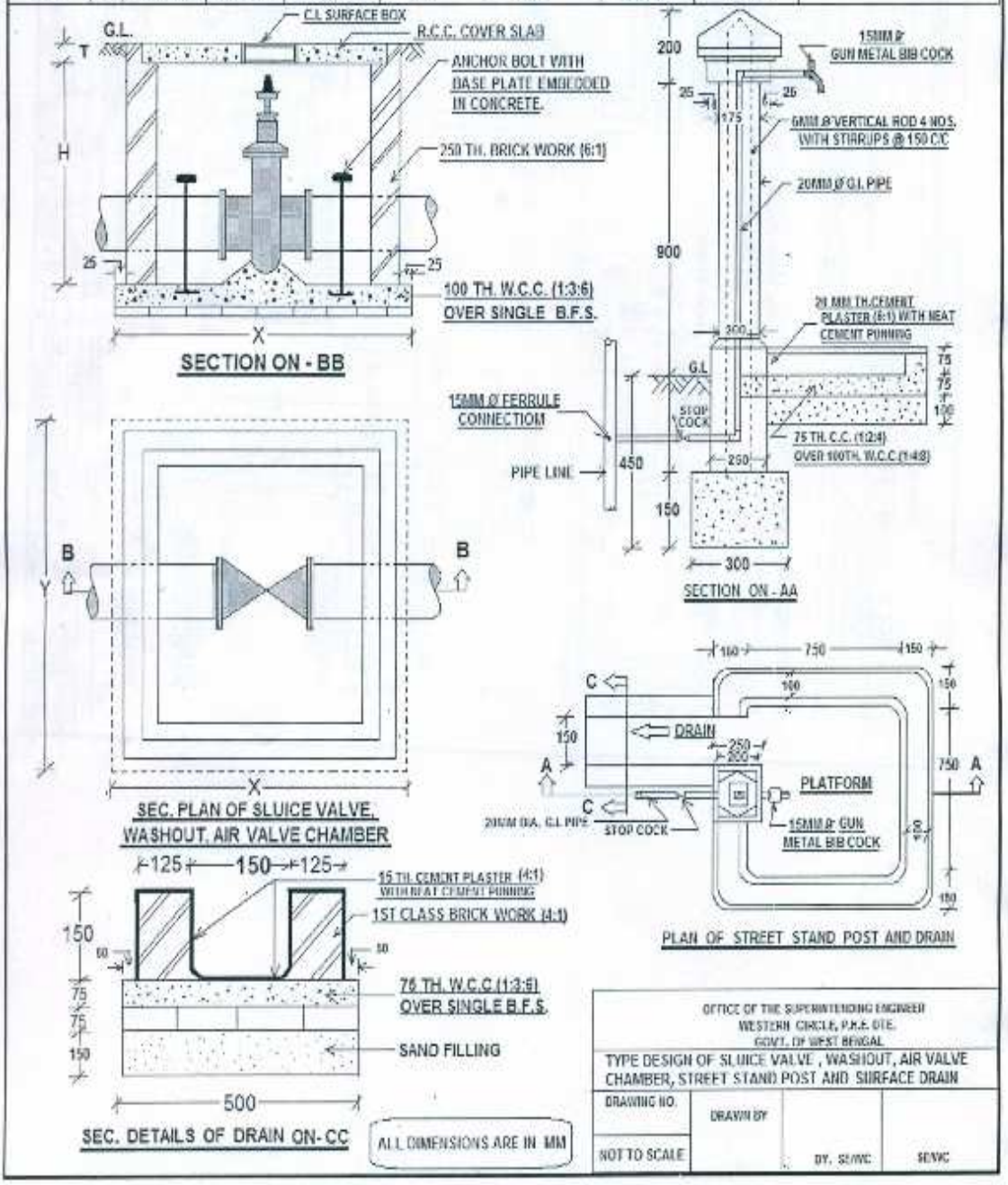
Specification regarding flange joints and all other aspect have been detailed in other parts of specification, which are to be followed strictly. Relevant standard specification for laying and jointing of UPVC pipes and specials to be strictly followed.

No excess stock of' UPVC pipes, UPVC specials and solvent cement etc. shall be entertained by the Department, such excess materials shall have to be turn back by. the contractor at their own cost.

Cleaning disinfections and hydraulic testing:- All cleaning, washing , disinfections and hydraulic testing of laid lines to be done as specified in case of CI/AC/DI pipes.

Superintending Engineer
Western Circle, PHE Dte.

CONSUMPTION OF CEMENT & STEEL	SL NO.	DIA. OF VALVE	SINGLE B.F.S X x Y	HT. OF BRICK WORK(H)	REINFORCEMENT FOR R.C.C COVER SLAB		CEMENT CONSUMPTION		CONSUMPTION OF CEMENT & STEEL FOR R.C.C STREET STAND POST
					125TH SLAB (T)	200TH. SLAB (T)	125TH SLAB (T)	200TH. SLAB (T)	
	1	80MM	1320 x 1170	1000	9 KG	14 KG	3 BAGS	3.5 BAGS	REINFORCEMENT - 2 Kg
	2	100 TO 150MM	1370 X 1370	1030	12KG	18KG	3.5 BAGS	4 BAGS	CEMENT - 2.50 BAGS
	3	200 TO 300MM	1560 X 1470	1100	15KG	23KG	4.5 BAGS	5 BAGS	



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TECHNICAL SPECIFICTION FOR LAYING D.I. PIPE LINE

- For underground pipe line, the DI S/S pipes shall be laid with its crown at least one mtr. below the ground level.
- The width of trench at bottom between faces of sheeting shall be as per relevant IS-12288.
- Additional width shall be provided as per direction of Engineer-in-charge if position of sockets and flanges for jointing to be made properly. Depths of pits at such places shall be sufficient to permit finishing of joints.
- In rocky formations, rocks, boulders and large stones shall be removed to provide adequate clearance at bottom of barrel and on each side of pipes, valves and fittings as per relevant IS and filled to required depth with filling materials as specified in the relevant IS.
- The trench shall be so braced and drained that the workmen may work therein safely and efficiently.
- Dewatering of trenches if required shall be done by the contractor without any extra claim.
- The laying, jointing, testing and commissioning of the DI pipes shall be strictly be followed as per provisions of IS-12288.
- Excavation and preparation of trench shall be as per latest IS specification.
- Usage of anchor and thrust blocks shall be as per relevant IS-Specification.
- Rubber gasket used with push on joints or mechanical joints shall conform to IS-5382.
- Hydrostatic tests shall conform to relevant IS specification.
- Back filling shall be as per relevant IS-specification
- Flushing and Disinfection of mains before commissioning shall be as per relevant IS specification. Rubber gasket for use with flanged joints shall conform to IS-638.
- No extra payment shall be made to the contractor on account of breakage of specials etc. during transportation, loading and unloading. The contractor shall replace those materials at his own cost. Similarly, any damage of DI pipes due to mishandling by the contractor during transportation, loading and unloading shall have to be taken care of /replaced by the contractor.
- The thrust block and pillars shall be done as per drawing approved by EIC.
- Blasting for excavation shall be permitted only after the approval of competent authority is obtained by the contractor.
- Thrust blocks shall be provided in the pipe line at required places by the contractor as per requirement in consultation with Engineer–in-charge.
- No section shall be accepted unless it withstands the test pressure. The contractor shall made all arrangement including labour, pumps, pressure gauge and equipments etc for testing of the pipe line as per relevant IS specification.

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Technical Specifications

HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 GENERAL

1.1 SECTION DESCRIPTION

1.1.1 This specification includes but is not limited to high-density polyethylene (PE 3408) (ductile iron pipe size O.D) pressure pipe primarily intended for the transportation of water and sewage either buried or above grade.

1.2 REFERENCES

1.2.1 AWWA C901 Polyethylene (PE) pressure Pipe & Tubing, ½ inch through 3 inch for water
1.2.2 AWWA C906 Polyethylene (PE) pressure Pipe & Fittings, 4 inch through 63 inch for water
1.2.3 ASTM D3035 Standard Spec for PE Pipe (DR-PR) Based on Controlled Outside Diameter
1.2.4 ASTM D3261 Butt Heat Fusion PE Fittings for PE Pipe & Tubing
1.2.5 ASTM D3350 Standard Specification for PE Pipe & Fittings Materials
1.2.6 ASTM D1238 Melt Flow Index
1.2.7 ASTM D1505 Density of Plastics
1.2.8 ASTM D2837 Hydrostatic Design Basis
1.2.9 NSF Std.#14 Plastic Piping Components & Related Materials
1.2.10 TR-33/2005 Generic Butt Fusion Joining Procedure for Field Joining of PE Pipe

1.3 GENERAL

1.3.1 USE

1.3.1.1 High Density Polyethylene (HDPE) pipes/fittings shall be allowed for use as water, wastewater and reclaimed water pressure pipe where compatible with the specific conditions of the project. The use of material other than HDPE pipe may be required by DEPTTL. AUTHORITY if it is determined that HDPE pipe is unsuitable for the particular application. All material used in the production of water main piping shall be approved by the National Sanitation Foundation (NSF).

1.4 DOCUMENTATION

1.4.1 Documentation from the resin's manufacturer showing results of the following tests for resin identification:

1.4.1.1 Melt Flow Index ASTM D1238
1.4.1.2 Density ASTM D1505

1.5 MANUFACTURER

1.5.1 All HDPE pipe and fittings shall be from a single manufacturer, who is fully experienced, reputable and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications. Qualified manufacturers shall be: PLEXCO Division of Chevron Chemical Company, DRISCOPIPE as manufactured by Phillips Products Co., Inc., SCLAIRPIPE as manufactured by DuPont of Canada or equal as approved by the Utilities Engineer.

1.6 FINISHED PRODUCT EVALUATION

1.6.1 Production staff shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.

1.6.1.1 Pipe in process shall be checked visually, inside and out for cosmetic defects (grooves, pits, hollows, etc.)

1.6.1.2 Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.

1.6.1.3 Pipe wall thickness shall be measured at 12 equally spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F714 or ASTM D3035, whichever is applicable.

1.6.1.4 Pipe length shall be measured.

1.6.1.5 Pipe marking shall be examined and checked for accuracy.

1.6.1.6 Pipe ends shall be checked to ensure they are cut square and clean.

1.6.1.7 Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).

1.7 STRESS REGRESSION TESTING

1.7.1 The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of
1,600 psi as determined in accordance with ASTM D2837.

1.8 COMPATIBILITY

1.8.1 Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

1.9 WARRANTY

1.9.1 The pipe MANUFACTURER shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the OWNER. The MANUFACTURER shall replace at no expense to the OWNER any defective pipe/fitting material including labor within the warranty period.

PART 2 PRODUCTS

2.1 MATERIALS FOR PIPE SIZES 4-INCH DIAMETER AND LARGER

2.1.1 Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345434C per ASTM D3350; and meeting Type lll, Class C, Category 5, Grade P34 per ASTM D1238.

2.1.2 High Density Polyethylene (HDPE) pipe shall comply with AWWA Specifications C906.

2.1.3 If rework compounds are required, only those generated in the Manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

2.1.4 Dimensions and workmanship shall be as specified by ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

2.1.5 HDPE pipe and accessories 4-inch diameter and larger, shall be 160 psi at 73.4°F meeting the requirements of Standard Dimension Ration (SDR) 17 as MINIMUM STRENGTH.

2.1.6 The pipe Manufacturer must certify compliance with the above requirements.

2.2 MATERIALS FOR PIPE SIZES 2-INCH DIAMETER AND LESS

2.2.1 Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high density polyethylene resin compound meeting cell classification 345434C per ASTM D3350; and meeting Type lll, Class C, Category 5, Grade P34 per ASTM D1238.

2.2.2 High Density Polyethylene (HDPE) pipes shall comply with AWWA Specifications C901.

2.2.3 If rework compounds are required, only those generated in the Manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

2.2.4 Dimensions and workmanship shall be as specified by ASTM D3035. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

2.2.5 HDPE pipe and accessories 2" and less in diameter, shall be 160 psi at 73.4°F meeting the requirements of Standard Dimension Ration (SDR) 9 as MINIMUM STRENGTH.

2.2.6 The pipe Manufacturer must certify compliance with the above requirements.

2.3 FITTINGS

2.3.1 All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor fabricated fittings shall be used unless approved by the Engineer.

2.3.2 The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.

2.3.3 All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters and must be approved by the Engineer. **NO** size on size wet taps shall be permitted.

2.3.4 All transition from HDPE pipe to ductile iron or PVC shall be made per the approval of Depttl. Engineer and per the HDPE pipe manufacturer's recommendations and specifications. A molded flange connector adapter within a carbon steel back-up ring assembly shall be used for pipe type transitions. Ductile iron back-up rings shall mate with cast iron flanges per ANSI B16.1. A 316 stainless steel back-up ring shall mate with a 316 stainless steel flange per ANSI B16.1.

2.3.4.1 Transition from HDPE to ductile iron fittings and valves shall be approved by Depttl. Engineer before installation.

2.3.4.2 No solid sleeves shall be allowed between such material transitions.

2.3.4.3 Fittings and transitions shall be as manufactured by Phillips DRISCOPIPE, Inc., 1000 Series Pressure Pipe, Chevron Chemical Company Plexco/Spiralite pipe, or equal.

2.3.4.4 The pipe supplier must certify compliance with the above requirements.

2.4 PIPE IDENTIFICATION

2.4.1 The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-feet:

2.4.1.1 Name and/or trademark of the pipe manufacturer.

2.4.1.2 Nominal pipe size.

2.4.1.3 Dimension ratio.

2.4.1.4 The letters PE followed by the polyethylene grade in accordance with ASTM

2.4.1.5 D1248 followed by the hydrostatic design basis in 160's of psi, e.g., PE 3408.

2.4.1.6 Manufacturing standard reference, e.g., ASTM F714 or D-3035, as required.

2.4.1.7 A production code from which the date and place of manufacture can be determined.

2.4.1.8 Colour Identification, either stripped by co-extruding longitudinal identifiable colour markings or shall be solid in colour and as follows:

i. BLUE – Potable Water

i. GREEN – Sanitary Sewer

2.4.2 Tracing Wire

2.4.2.1 Open trench installation of HDPE shall be identifiable per Depttl. Specification Sec. 02600, Part 2, 2.01 (A).

2.4.2.2 Directional Drilled HDPE shall have wire conforming to Copperhead Industries Reinforced #1245 Extra-High Strength Tracer Wire and affixed to the drilling head/reamer per Detail M-17.

2.4.3 Marking Tape: Marking tape shall be installed per Depttl. Engineer approval.

PART 3 EXECUTION

3.1 JOINING METHOD

3.1.1 The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D2657 and conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical Report TR-33/2005, published by the Plastic Pipe Institute (PPI). All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of the Depttl. Authority .

3.1.2 Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying lengths not to exceed 50 feet and no shorter than 20 feet.

3.1.3 On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of a Depttl. Authority. The following shall apply:

3.1.3.1 Heating plate surfaces shall be inspected for cuts and scrapes and shall be free of dirt and residue. Heater surfaces should be between 400^{o}F (minimum) to 450^{o}F (maximum). Measure the temperature @ 12:00, 3:00, 6:00 and 9:00 o'clock positions using a pyrometer of infrared thermometer at locations where the heating plate will contact the pipe/fitting ends. The maximum temperature difference between any two points on a single heating surface must not exceed 24^{o}F. If this

temperature is exceeded, the heating plate shall be cleaned per the manufacturer's recommendations.

3.1.3.2 The fusion or test section shall be cut out after cooling completely for inspection.

3.1.3.3 The test section shall be 12" or 30 times (minimum) the wall thickness in length and 1" or 1.5 times the wall thickness in width (minimum).

3.1.3.4 The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e. – joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16" to a maximum 3/16".

3.1.4 The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation, apply a bitumastic coating to bolts and nuts.

PART 4 INSTALLATION

4.1 High Density Polyethylene (HDPE) Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.

4.2 HDPE shall be installed either by Open Trench Construction or Directional Bore Method.

4.3 Care shall be taken in loading, transporting and unloading to prevent damage to the pipe. Pipe or fitting shall not be dropped. All pipe or fitting shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the contractor, at his own expense.

4.4 Under no circumstances shall the pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back".

4.5 Care shall be taken during transportation of the pipe such that it will not be cut, kinked or otherwise damaged.

4.6 Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.

4.7 Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated

temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

4.8 Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.

4.9 Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings.

4.10 When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.

4.11 Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.

4.12 The pipe shall be joined by the method of thermal butt fusion. All joints shall be made in strict compliance with the manufacturer's recommendations.

4.13 Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consists of the following:

4.13.1 A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
4.13.2 A 316 stainless steel back up ring shall mate with a 316 stainless steel flange.
4.13.3 A 316 stainless steel bolts and nuts shall be used.

4.14 Flange connections shall be provided with a full-face neoprene gasket.

4.15 All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

4.16 If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. kinked or otherwise damaged.

4.17 Open Trench Installation:

4.17.1 Depttl. Standards and Specification, Section 02200 – Utility Excavation, Trenching, and Backfilling shall apply in its entirety. For proper laying excavation of any kind of soil and strata including shoring work (where needed and so directed by the Engineer-in-charge), dewatering of trenches by pumps, preparation of bed (having no sharp and hard materials which can cause injury to the pipes and specials), has to be done by contractor including removing of excavated earth at the safe distance, as directed by the Engineer-in-charge. The depth of excavation shall be in such a manner that a minimum clear cover of 1.OO mtr. is available from top of pipe for filling. Lowering ·cleaning, laying and jointing of pipes and specials shall have to be done as per methods

already described. However, other precaution and measure shall have to carry out as follows;

4.17.2 The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

4.17.3 Good alignment shall be preserved during installation. Deflection of the pipe shall occur only at those places on design drawings and as approved by the Engineer Fittings, in addition to those shown on the Drawings, shall be used only if necessary or required by the Engineer.

4.17.4 Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".

4.17.5 Precautions shall be taken to prevent flotation of the pipe in the trench.

4.17.6 When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

4.17.7 Restrained joints shall be installed where shown on the Drawings or as directed by the Engineer.

4.18 Directional Bore Installation:

4.18.1 Refer to Depttl. Specification 02320 - Horizontal Directional Drilling in its entirety

PART 5 CLEANING

5.1 At the conclusion of the work, thoroughly clean all of the new pipe lines to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period by forcing a cleaning swab through all mains 4" or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with Depttl. Engineer and Water Resources Department. Debris cleaned from the lines shall be removed from the job site.

PART 6 TESTING

6.1 Pressure testing shall be conducted per Manufacturer's recommendations and as approved by the Depttl. Authority.

6.2 All HDPE water mains shall be disinfected prior to pressure testing as per Depttl. specification.

6.3 All HDPE mains shall be field-tested. Contractor shall supply all labor, equipment, material, gages, pumps, meters and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.

6.4 All mains shall be tested at 150 percent of the operating design pressure of the pipe unless otherwise approved by the Engineer.

6.5 Pressure testing procedure shall be per Manufacturer's recommendations or as follows:

6.5.1 Fill line slowly with water. Maintain flow velocity less than 2 feet per second.

6.5.2 Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at points of highest elevation.

6.5.3 Apply initial test pressure and allow to stand without makeup pressure for two to three hours, to allow for diametric expansion or pipe stretching to stabilize.

6.5.4 After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for one to three hours.

6.5.5 Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the resident project representative and Depttl. Authority representative at the point where the pressure is being monitored and shall show on the recorded pressure read-out submitted to the Engineer of Record.

6.6 Allowable amount of makeup water for expansion during the pressure test shall conform to Chart 6, Allowance for Expansion Under Test Pressure, Technical Report TR 31/9-79, published by the Plastic Pipe Institute (PPI). If there are no visual leaks or significant pressure drops during the final test period, the installed pipe passes the test.

6.7 If any test of pipe laid disclosed leakage significant pressure drop greater than the manufacturer's recommended loss, the Contractor shall, at his/her own expense, locate and repair the cause of leakage and retest the line. The amount of leakage, which will be permitted, shall be in accordance with AWWA C600 Standards.

6.8 All visible leaks are to be repaired regardless of the amount of leakage.

6.9 The Contractor must submit his plan for testing to the Engineer for review at least 10 days before starting the test and shall notify Depttl. Authority inspector a minimum of 48 hours prior to test.

Superintending Engineer
Western Circle,PHE Dte.

SCOPE OF WORK
FOR
FUNCTIONAL HOUSEHOLD TAP CONNECTIONS (FHTC)

Before providing House Service Connections, Service Provider (Contractor) shall collect a list of authorized beneficiary/consumer from the department/EIC on monthly basis (written/verbal). After getting such list from the department/EIC, Service Provider shall have to identity each consumer at site and a notice shall have to be served by the Service Provider at least 3 days in advance stating that new service connection shall be provided at their respective premises. Making holding list, in case of any difficulty to locate any consumers at site by the Service Provider, representative from department/EIC shall have to accompany the service provider to locate the Consumers at site.

Service Provider shall be responsible to upload details of consumer data alongwith photos of Adhaar Card, FHTC etc. to the Departmental Apps available in Android mobile before, during and after providing House Connections as per directions of Competent Authority of PHE Dept.

Service Provider shall be responsible to connect a new service connection up to inside the Boundary of Consumer Premises and the beneficiary is responsible to further connect it to their existing network (inside the premises) as per requirement. All the damages made on the compound wall for providing service connection shall have to restored by the Service Provider.

All the excavation and trenches made for providing the Service Connection shall have to back filling by the Service Provider as per standard engineering practices.

Superintending Engineer,
Western Circle, PHE Dte.

GENERAL SPECIFICATIONS OF MATERIALS TO BE USED FOR HOUSE CONNECTIONS

Ferrule
Gun Metal Confirming to IS 2692/1994(reaffirmed 2005) ISI Marked.

Non Return Valve (NRV) for connection of meter.
Gun Metal Horizontal Non Return Valve Confirming to IS 779 ISI Marked

PVC Pipe & Fittings for house connection:-
15 mm dia nominal bore PVC pipes for underground work of approved make of Schedule 80 (medium duty) conforming to ASTMD -1785 and threaded to match with GI Pipes as per IS : 1239 (Part - I).

HDPE Pipe for House Service Connection:
Pipes shall be made out of HDPE raw materials, the pipes shall be conforming to IS:4984-2016, 20mm dia OD, PE-100, PN 16. (Average 15 mtrs.)

COMPRESSION FITTINGS FOR HDPE PIPES

90 DEG COMPRESSION ELBOW WITH METAL INSERT (Male/Female)
90 DEG COMP ELBOW with COMPRESSION JOINT BOTH ENDS
FEMALE / MALE THREADED ADAPTER with METAL OFFTAKE
The compression fittings shall be tested as per below

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

30/06/2020
SE, WC &
Convenor, Schedule
Committee

30/06/2020
CHIEF ENGINEER
Planning & Water Quality Management
PHE Dte.
Govt. Of West Bengal