

## **TECHNICAL SPECIFICATIONS OF THE CONTRACT (PLUMBING AND CIVIL WORKS)**

### **SANITARY AND PLUMBING WORKS.**

General: All sanitary and plumbing works shall be carried out in proper workman like manner. Item of works not covered by the following specifications shall be carried out as per best practice according to direction of the Engineer-in-Charge and to his satisfaction. Unless otherwise specified here or in the description of items the cost of all stages of works mentioned here under shall be deemed to have been included in the rates of items provided in the schedule.

All sanitary and plumbing works should conform to plumbing services as laid down in the “National Building Code of India, 1970”.

All cutting holes, chases, trenches etc., at any place necessary in connection with sanitary and plumbing works and subsequent mending damages as per specification and as directed shall be carried out without any extra payment unless otherwise expressly specified.

Unless otherwise specified in the items themselves, all materials including fittings shall conform to standard laid down by the B.S.I. and bear I.S.I. certification mark where such standardisation has been made.

#### Jointing of S.W. Pipes and Fittings

The half of the depth of the annular space between socket and spigot shall be packed with tarred gasket and the remaining half shall be filled up with cement mortar (3:1) and shall be finished bevelled at 45 degrees.

#### Laying of C.I. pipes and specials

Before lowering the pipes and specials (by means of Chain-pully block or derrick, ropes or by some other means/tools) in the trench each unit shall be inspected for defect and be rung with a light hammer preferably while suspended, to detect creaks.

### **Technical Specification Terms and Conditions. (Water Main)**

#### Laying of Main

#### Excavation and preparation of trench

The trench shall be so dug that the pipe may be laid to the required alignment and at the required depth. When the pipe line is under a road way, a minimum cover of 1.0m. is recommended for adoption, but it may be modified to suit local conditions with the written permission of the Engineer-in Charge. The trench should not be excavated in advance of pipe laying unless directed by the Engineer-in-Charge. Trenches shall be of such width, when required as will permit the convenient placing of timber support, strutting and planking and handling of specials. Additional width shall be provided at positions of specials, sockets and flange for jointing to be made properly. The trench shall be excavated to the exact gradient specified so that no levelling of the sub-grade by backfilling is required and the pipe rests on solid and undisturbed ground when laid. When the bottom of the trench at the specified gradient is found to be unstable or to include ashes and cinders all types of refuse, vegetable or other organic materials, or large pieces or fragments of inorganic materials, they shall be removed to the satisfaction of the Engineer-in-Charge. In all cases there shall be a uniform and continuous bearing and support for the pipe at every point between the sockets or flanges. The finished sub grade shall be prepared accurately by means of hand tools.

While unloading, pipes shall not be thrown down from the tracks or hard roads. Unloading them on timber skids without a standing rope and thus allowing the pipes to bump hard against one another should not be allowed. In order to avoid damage to the pipes and specially to the spigot end, pipe should

not be dragged along concrete and similar pavement with hard surfaces. The pipe and fitting shall be inspected for defects and be rung with a light hammer preferably while suspended to detect cracks. Smearing the outer side with chalk, dust helps the locations of cracks. If doubt persists further confirmation may be obtained by pouring a little kerosene on the inside of the pipe at the suspected spot. If a crack is present, the kerosene seeps through and shows on the outer surface. If a pipe handled either accidentally or due to carelessness during unloading or lowering operation, it should be thoroughly inspected before laying and shall be rejected if found in suitable by the Engineer-inCharge.

Proper implements tools and facilities satisfactory to the E.I.C. shall have to be provided and used for the safe and convenient prosecution of the work. All pipes fittings valves and hydrants shall have to be carefully lowered into the trench, piece, by means of a derrick, ropes or other suitable tools and equipment, in such a manner as to prevent damage to pipe material and protective coating and limitation. Under no circumstances pipes specials etc. should be dropped or dumped into the trench. All lumps blisters and excess coating materials shall have to be removed from the socket and spigot end of each pipe and the outside of the spigot end the inside of the socket should be wire brushed and wiped clean and dry and free from oil and grease before the pipe is laid. Every precaution must be taken to prevent foreign material from entering the pipe while it is been placed in the line. A heavy, tightly woven canvas bag of suitable size shall have to be placed over each and left there until jointing is to be done with the adjacent pipe. After placing a length of pipes in the trench, the spigot shall be centered in the socket and the pipe forced home and aligned to gradient.

The pipe shall secured in the place with approved black filled materials tamped on either side except at the socket. Pipes bad fittings which do not allow a sufficient and uniform space joints have to be removed and replaced with pipe and fitting of proper dimensions to ensure such uniform space. Precautions are to be taken to prevent temperature so that when stirred it will show a rapid change of colour. Before pouring, all scum shall have to be removed. Each joint should be made with one continuous pour filling of the entire joint space with solidified mouton lead. Spongy or imperfectly filled joints shall have to be burnt / chiselled out and repoured.

The form of joint is to be made by first caulking in spun yarn then the remainder of the joint space by running in molten long, talking care that noose entire the joints and then thoroughly caulking the lead.

The lead need dirt form entering the joint space. When pipe laying is not in progress, the open ends of pipe must be closed by a water tight plug or other means approved by the Engineer-in-Charge. The cutting of pipe for inserting valves, fittings closure pieces shall have to be done in a neat and workman like manner without damage to the pipe or cement lining so as to leave smoothed at right angles to the axis of the pipe. For this purpose use of pipe cutting machine is recommended. When the pipe cutting machine is not available and the site conditions do not permit pipe cutting by machines, the pipe can be cut using chisels on level ground. The socket ends should face the upstream. When the line runs uphill the socket ends should face the upgrade. Where necessary to deflect pipe from a straight line, other in the vertical or horizontal place, to avoid obstructions oe where long radius are permitted deflection at joint shall not exceed the following :-

LEAD JOINTS : 240

For tyton joints of nominal bore 80 to 300 mm dia. C.I. Tyton pipes : 5<sup>0</sup>

No pipe shall be laid when in the opinion of the Engineer-in-Charge, trench conditions are unsuitable. When the pipes run beneath the heavy vehicular roads, suitable size of casing pipe / culverts may have to be provided as directed by the Engineer-in-Charge to protect the carrier pipe. When crossing existing pipe lines or other structure, alignment and grade shall have to be adjusted as necessary, with the approval of the Engineer-in-Charge to provide clearance as required by state or local regulations or as deemed necessary by authority to prevent future damage to the existing installation.

JOINTING OF PIPES (I) (LEAD JOINTS) :-

Jointing is to be done with molten lead.

Yarning or packing material :-

Yarning or packing material shall consist sterilized spun yarn.

The materials mentioned above shall have to be handled with care in order to prevent contamination and shall have to be dry when put in place in joints. The material used should be free of oil, tar or greasy substances.

The yarning materials shall have to be placed around the spigot end should be of proper dimensions to centre the spigot in the socket. When the spigot is above home, the yarning material shall have to be driven tightly against the inside base or hub of the socket with suitable yarning tools. When a single string of yarning materials is used, it shall have an overlap at the top of not more than 50 mm. when more than a single string is required for a joint, each strand shall have to be out to sufficient length so that the ends can meet without causing overlap. The ends of the strands should meet on opposite sides of the pipe and not on the top or at the bottom. Successive strands of yarning materials should be driven home separately.

Lead for caulking purposes should conform to IS : 782-1978.

The quantities of lead and spun yarn for different sizes of pipes are given below

NOMINAL SIZE OF PIPE (MM)	LEAD JOINT (KG)	SPUN YARN JOINT (KG)
80	1.80	0.10
100	2.20	0.18
150	3.40	0.20
200	5.00	0.30
250	6.10	0.35
300	7.20	0.48
400	9.50	0.75

TABLE 1 : - Quantity of lead for different sizes of pipes.

Lead shall have to be heated in a molting pit kept in easy reach of the joint to be poured so that the molten does not get chilled in being carried from the molten pot to the joint and shall have to be brought to a proper.

The spun yarn is used to centre the spigot in the socket, to prevent the flow of molten lead in the bore of the pipe, to reduce the amount of lead required to complete the joint and to make the joint water tight. Spun yarn should be effectively disinfected as directed by the Engineer-in-Charge before use. Caulking may be done with pneumatic tools or with hand hammer not less than 2 kg. as decided by the Engineer. When working with lead tools, caulking tools of appropriate thickness will have to be used to fill the joint space, and to thoroughly consolidate the material from the back to the front of the socket. Lead joints shall have to be finished in line with the socket face.

Flanged joints : Cast iron pipes may also be jointed by means of flanges.

The gaskets used between flanges of pipes shall have to be compressed fibre board or natural / synthetic rubber Sec IS : 638 – 1979 of thickness between 1.5 to 3 mm. the fibre board should be impregnated with chemically natural mineral oil and should have a smooth and hard surface. Its weight per square metre should not less than 112 kg/mm. thickness. Each bolt should be tightened a little at a time taking care to tighten diametrically opposite bolts alternatively. The practice of fully tightening the bolts one after another must be avoided.

Tyton joints :-

The joints are of the 'PUSH IN' type employing only one component, as specially designed high grade material rubber gasket as approved by the Engineer-in-Charge. The socket of the C.I. Tyton pipes has an annular ridge matching with that of the gasket. For jointing, the following procedures should be followed.

a) Cleaning of socket

The surface inside of socket with which rubber gasket will come to contact should be cleaned properly applying waste cloth or brush so that the surface is free from dirt, sand and hard chips. Everything stacked fast to the surface should be removed with driver otherwise it will not only resist insertion of spigot but also may cause leakage of water.

b) Moulding rubber gasket

The rubber gasket should be cleaned properly and should be set on the inside surface of the cleaned up socket with the gasket bulb facing bottom of socket. The gasket should be selected properly by confirming its proper mounting.

c) Cleaning of Spigot

The outside surface of the spigot and that of the pipe should be cleaned properly to make it free from any foreign materials on the surface.

d) Application of lubricant

Lubricant grease, soap, solution etc. should be applied on the outside surface of spigot end and inside surface of rubber gasket. Care should be taken not to allow lubricant to flow in inside surface of socket. Lubricant plays a very important role in inserting pipe.

e) Setting of spigot end

The spigot end should be put on the socket and provisionally keeping it in line with the socket. Taper provided in the spigot end, socket end and inside of rubber gasket make it easier to insert spigot end into the socket. If there is any burrow sharp edge existing on the spigot end that they injure rubber gasket and cause water leaking from the joint. The sharp edge should therefore be removed with file.

f) Inspection of spigot

The pipe is required to be hanged up a little above trench bottom and held in floating condition for insertion. The spigot end of the pipe should be pushed home by using special tacks (suitably designed levers) suitable to weight of the pipe. One is reqd. to conduct insertion watching spigot end being in the line with the socket and the pulling / pushing force being applied properly.

g) Confirmation of insertion

After insertion it is reqd. to make that spigot is inserted properly in the socket. This can be easily done if two white line marks are provided on the spigot end of the pipe in such a way that one line should be hidden in the socket after proper pointing and the other line may be seen just outside the socket. The white lines may be checked after insertion of the pipe.

Hydrostatic Tests

After a new pipe has been laid, jointed and partially back filled keeping the joints open it or any valve action there of shall have to be subjected to the following :-

Pressure test at a pressure of 6 kg. / Cm<sup>2</sup>

If pressure not made at lowest point of the section, and allowance should made for static head between the lowest point and the point of measurement ensure, that the maximum is not exceed at the lowest point. There should be any drop of pressure within an hour of applying the required pressure. If a drop in pressure occurs beyond one hour, the quantity of water added in order to re-establish the test pressure should be carefully measured. This should not exceed 0.1 ltr./mm of pipe dia. per km. of pipe line / day for each 30 mtr. Head of pressure applied.

Each valve section of pipe shall to be filled with water slowly & specified test pressure, based on the elevation of lowest point of the liner section under test and corrected to the elevation of the rest gauge shall have to be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer-in-Charge.

All exposed pipes, fittings valve hydrants and joints should be carefully examined during the open trench test. All joints showing visible leaks shall have to be redone until tight. Any cracks or defective pipe, fittings valves or hydrant discovered in consequence of this pressure test shall have to be removed and replaced by should material and the test shall have to be repeated until satisfactory to the Engineer-in-Charge.

No extra payment whatsoever will be made to the Contractor on account of redoing the joints or replacing the defective pipe, specials, valves etc. as well as for re-testing the pipe line till the satisfaction of the Engineer-in-Charge. The Contractor should keep this in mind quoting the rates for the work.

Disinfections of pipe line

- i) After the laying and testing of pipe lines have been complete the pipe lines shall have to be washed thoroughly with clean water as per direction and specification.
- ii) The washed pipe lines are to be then disinfected by flushing with water containing bleaching powder i.e. chlorinated line should be contain at least 25% available chlorine at the rate of 500 gm (0.50) per cubic metre (1000 litre) of water and cleaning the same with water. The operation is to be repeated until the residual chlorine as mentioned below is obtained. Before the last cleaning with water the residual chlorine should be tested after 24 hours standing of water in pipe lines. Residual chlorine should not be less than 10 p.p.m. (mg/l after 24 hours standing). For such purpose, samples of water are to be collected from disinfected mains and tested from all approved laboratory as per specification and direction of the Engineer-in-Charge at the cost of the Contractor. The no samples of water to be collected for testing shall be decided by EIC. And his decision shall be final and binding upon the Contractor.
- iii) All materials tools and plants and labour required for dis-infection of pipe lines shall have to be supplied by the Contractor and their cost including necessary charges for laboratory testing of water samples shall be included in the rates of the Contractor for relevant item of this infection and no extra claim will be entertained on this account.

Before testing the trench can be partially backfilled, if required by site condition, except at the material that shall be free from cinders, ashes, slag, refuse, rubbish, vegetable or organic material, lumpy or frozen material, boulders, rocks or stone or other material which in the opinion of the EIC is unsuitable or deleterious. Such filling shall however have to be done after obtaining the permission from the Engineer-in-Charge.

After the trench back-filled, the main shall be filled with water in the manner specified and shall not be subject to hydrostatic pressure inspected and tested for leakage till at least 36 hours have elapsed thereafter. The pipe shall remain full of water until all tests have been made.

In case where there are no valves, or valve sections are too long the testing may be permitted to be carried out in suitable segments with the permission of the Engineer-in-Charge.

Unless otherwise specified in the price schedule the rate of laying of water mains includes all the activation with the terms, condition and specifications detailed above. The rate is also inclusive of shoring dewatering that may be necessary for excavation and or lay the pipe. The tenderers should keep this in mind while quoting this rate for the work.

The Technical Assistant and the Assistant Engineer is to furnish the following certificate :-

“Each section of water main and proposed to be paid for in this bill has been tested as per the condition specified and satisfactory result has been obtained”.

#### Specification & Conditions of laying sewer line

All S.W. pipes and fittings shall be sound and free from visible defects which impair the strength, durability and serviceability. The glass of the pipes and fittings shall be free from erasing. The pipes and fittings shall give a sharp clear note when struck with a light hammer. The interior and exterior surface of the pipes and fittings which remain exposed after jointing shall be glazed. The portions which remain covered after jointing may or may not be glazed.

The dimensions of barrels and sockets shall be in accordance with I.S. 651-1971 or as specified in the item. The permissible variation in the internal diameter and mean thickness of the barrel and the socket of the pipe shall be in accordance with I.S. 651-1971.

The length and straightness of barrel of pipes shall be in accordance with I.S. 651-1971.

The interior of the sockets and the exterior of the spigots shall be grooved circumferentially and such grooving on the spigot shall be for a length equal to 1½ times the depth of the sockets and the depth of such grooving shall be between 1mm and 2 mm.

The level (information regarding) of invert, direction of flow and the condition of the existing sewer (trunk) to which the proposed sewer (lateral) is to be connected must be collected by the Contractor before taking up the work. The levels of total layout of proposed sewer should be checked with respect to invert level of existing sewer to ensure proper slope and connection level. Connection should not be made below half depth of existing sewer. It should also be examined whether the level of the proposed sewer can serve the lowest area of the slum. If the existing sewer (trunk) is observed to be either defunct or surcharged, the works of laying sewer (lateral) must not be taken up. A written instruction of the Engineer-in-Charge will be necessary in such circumstances so as to proceed with the work.

#### Excavation and picking up hard crust

Unless otherwise specified or instructed by the Engineer-in-Charge all excavation shall be open cut and the side of trenches shall be kept vertical. Before taking up excavation, the width of excavation shall clearly be marked on the ground surface and damage to the existing pavements beyond those limits should be avoided. A minimum of 100 cm, berm shall be provided on either sides of the trench which should be kept free from spoils and materials. Where the excavation will be through an existing pavement of water bound macadam, bituminous or stone set road, the materials like road metals, bricks, stone set, flat stones concrete block etc. should be salvaged screened and preserved separately in stack at road side spaces any admixture with sub-soil.

There shall be no extra payment for sand blowing or silt clearance during excavation. Spoil excavated from trenches except the material needed for filling shall not be stacked at the work site. As the excavation of a section of trenches proceeds, the quantity of excavated earth collected

for filling shall, unless otherwise specified elsewhere in this tender documents, be dumped within 75 M in a convenient place as indicated by the Engineer-in-Charge. This quantity of earth will be brought back for filling the trenches after the sewers, drains, pipes etc. are laid and tested. The cost of carrying away and bringing back such quantity of earth as required for filling shall be included in the overall cost of excavation. Nevertheless, as soon as the work in one section is completed and the excavation work in adjoining section is undertaken.

Concreting for S.W. pipes will be as per the standard drawing available from the office of the concerned Executive Engineer & direction of the Engineer-in-Charge concrete mixer machine in a must for mixing of concrete.

After the pipe units are aligned and laid in the trench jointing is to be done after thorough cleaning for the joint surface of S.W. pipe is to be done in accordance with I.S. 4127-1967.

In each joints, spun yarn soaked in neat cement slurry or tarred gasket shall be passed round the joint and inserted in it by means of caulking tool. More pieces of yarn or gasket shall be added if necessary. And shall be well caulked.

The gasket after thoroughly caulked shall not occupy more than one fourth the depth of socket and the ropes should fully encircle the spigot with a slight over lap. The remainder of the annular space is to be hand packed with cement mortar (1:3) and then thoroughly caulked with a caulking tool. The joint shall then be finished off neatly and leveled smoothly at an angle of 45° with the outside of the pipe. The cement mortar joint shall be cured at least seven days before testing. Each length of pipe sewer shall be completed from pit / manhole unless otherwise ordered, perfectly straight and true in level and gradient and the trench shall not be filled in until the length has been inspected tested & passes by the Engineer-in-Charge or his representative. Should it be found before the expiration of the prior maintenance that any length of sewer between certain manholes / pits has become out of alignment or grade, leaky or damaged, the Contractor shall at their own expense re do the work as per instruction of the Engineer-in-Charge.

Unless otherwise mentioned in the price schedule of the tender, no separate payment will be made for shoring and or dewatering the trench that be needed for excavation of trench or for laying sewer.

Hydraulic testing of pipe sewers

Water test < of all dia.

Each section of sewer shall be tested for water tightness preferably between manhole / pits. To prevent change in alignment and disturbances after the pipes have been laid, it is desirable to back fill the pipes upto the top, keeping at least 90 cm. length of the pipe open at the joints. However, this may not be feasible in the case of pipes of shorter length. With concrete in casement or concrete cradle, partial covering of the pipe is not necessary.

In case of concrete and stoneware pipes with cement mortar joints pipes shall be tested three days after the cement mortar joints have been made. It is necessary that the pipelines are filled with water for about a week before commencing the application of pressure to allow for the absorption by pipe wall.

The sewers are tested by plugging the upper end with a provision for an air outlet pipe with stopcock. The water is filled through funnel concrete at the lower and provided with a plug. After the air has been expelled through the air outlet, the stop cock is closed and water level in the funnel is raised to 2 m. above the invert at the upper end. Water level in the funnel is noted after 2 hours and the quantity of water required to restore the original water level in the funnel is determined. The pipeline under pressure is then inspected while the funnel is still in position. There shall not

be any locks in the pipe or the joints. Any sewer there of that does not meet the test shall be emptied and repaired or re-laid is reqd. and tested again at the cost of the Contractor.

No separate payment for water testing or sewer laid in the manner specified above will be made unless otherwise specified in the price schedule of the tender. The tenderers should keep this in mind while quoting their rates.

The following certificates is to be furnished by T.A. and A.E.

The length of sewer proposed to be paid for in this bill has been tested as per tender condition and satisfactory result has been obtained.

Earth from the adjoining section may be used for filling of the completed portion as per the direction of the E.I.C. the Contractor shall remove all sort of stump of trees, logs, debris or / and other buried lose materials encountered during the corse of excavation for which no extra payment will be made.

The E.I.C. shall have the power to direct the Contractor to take up any section of the work in preference to another and to limit the extent of any excavation to be made at one time and the Contractor shall comply the same and expedite the completion of any such particular section/ components of work as per direction of E.I.C.

Laying of S.W. Pipes :-

The trench shall be so dug that the pipe can be laid to the reqd. alignment and at reqd. depth. The width of the trenches shall be in accordance with the following :-

Diameter of the pipe in MM	Width of the trenches in MM
150	631
225	719
300	800

When unloading pipes shall not be thrown down from the truck on hard ground. Unloading them on timber skids without a steadying rope and thus allowing the pipes to bum phard against one another should not be allowed. In order to avoid the damage to the pipes and especially to the spigot end. Pipes should not be dragged along concrete and similar pavement with hard surface. In shallow trenches manual handling is enough in drop trenches they should be lowered in to the trenches by means of ropes. Under the circumstances shall the pipes be dropped or dumped in to the trench.

All lumps, blisters and excess coating materials shall be removed gently from the socket and spigot ends of each pipe and the outside of the spigot and the inside of the socket shall be wiped clean and dry before the pipe is laid. Every precaution shall be taken to prevent foreign materials from entering the pipes when it is being placed in the line. Normally the socket end should face the upstream. After placing a length of pipe in the trench on a concrete bedding, the spigot shall be entered in the socket and the pipe forced home and aligned to gradient. Pipe and fittings which do not allow sufficient and uniform space for joints shall be removed & replaced with pipe and fittings of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space. At times, when pipe laying is not in progress, the open ends of pipes shall be closed by temporary wooden plug or canvas. Each pipe unit of fittings shall be so laid as to form a close joints with the adjoining pipe and pring inverts continuously to the reqd. Grade with the help of side rails and bounding rod.



The cutting of pipe or inserting, fitting or closure pieces shall be done in neat & workman like manner without damage to the pipe so as to leave a smooth surface at right angles to the axis of the pipe.

The pipe when laid should not be subjected to superimpose load beyond their safe crushing strength.

The connection to an existing sewer shall be done through manhole / pits etc.

Surface Drain : Construction of surface drain should preferably start from the outfall / discharge point. The invert levels and cross-sections of the surface drain will be shown in the drawings to be supplied by the department. Contractor should strictly follow the lines and levels and if any deviations are found to be necessary due to site conditions, he should take prior permission of the Engineer-in-Charge. After completion of the work, Contractor should arrange at his own expenses testing of the surface drain towards smooth and constructed flow in the proper direction. During testing if it is found that the slop and invert levels are not conforming to the specification, the defective sections of the surface of drain should be dismantling and reconstructed by the Contractor at his own cost / expense.

Plastering and neat cement finishing : Plastering and neat cement finish should be extended in the outer surfaces of walls of the surface drain upto a depth of 150 mm from the top or as directed by the E.I.C.

Excavation : Before excavation, Contractor should take levels of the ground surface with respect to the reference level to be given by the department and should preserve the levels by suitable markings. This should be done by the Contractor with the help of his own engineering level. All costs to wards levelling should be borne by the Contractor.

Cement concrete work (Plain or Reinforced) : All concrete work, plain or reinforced, shall be carried out strictly in accordance with the specification and any working drawing or instruction given from time to time by E.I.C. The relevant Clauses of IS :456/1978 shall also to be followed.

The contractor's rate shall allow for Wastage in all materials as well as testing of construction materials and finished concrete.

No concrete shall be cast in absence of the Engineer-in-Charge or his authorised representative. Before in tempting the department, the contractor's Engineer shall Personally check that both the form work and reinforcement have been correctly : aced and fixed and shall satisfy himself that all work preparatory to the casting is completely ready. At least 24 (twenty four) hours' notice shall be given by the contractor to the department for their final inspection and approval.

Water to be used for both mixing and curing shall be potable and free from injurious Amounts of deleterious materials.

Aggregates and cement shall be mixed in the proportion laid down in the schedule. No Concrete leaner than 1:2:4 nominal mix shall be used for reinforced concrete work.

(a) The minimum compressive strength for different grades of concrete with nominal mix

shall be as follows while tested on 15 cm. cubes at 28 days after mixing, test being conducted in accordance with IS : 516/1989

1 : 1½ : 3 Mix concrete	200 Kg./cm <sup>2</sup>
1 : 2 : 4 Mix concrete	150 Kg./cm <sup>2</sup>
1 : 3 : 6 Mix concrete	100 Kg./cm <sup>2</sup>

The above minimum strengths of different grades of concrete should be obtained on works test as defined in IS : 456/1978.

- (b) For the purpose of ensuring the above strengths during actual construction the contractor shall carry out, if so desired by the E.I.C., preliminary tests as defined in IS : 456 on 15 cm cubes at 28 days after mixing, test being conducted in accordance with IS : 516/1991 in which case the minimum compressive strength shall be as ;

1 : 1½ : 3 Mix concrete	250 Kg./cm <sup>2</sup>
1 : 2 : 4 Mix concrete	200 Kg./cm <sup>2</sup>
1 : 3 : 6 Mix concrete	155 Kg./cm <sup>2</sup>

The cost of carrying out such works tests and preliminary tests shall be entirely borne by the contractor and no extra claim whatsoever shall be entertained on this account.

- (c) Fine Aggregate : In case of fine aggregate, allowance will have to be made for bulking, which may vary from day to day and at different parts of the day on account of varying moisture content. Frequent tests for bulking shall be carried out with the sand to be used and the amount of bulking should be allowed for in the field mix, so as to keep the actual proportions constant throughout. Costs of such tests shall be borne by the contractor.

Mixing of concrete : Concrete shall be mixed in a Mechanical Mixer. Mixing shall be continued until there is a uniform distribution of materials and the mass is uniform in colour and consistency, for this purpose IS : 1971/1968 should be followed. Hand Mixing shall not be permitted except in unavoidable circumstances, but the same shall be purely at the discretion of the E.I.C. The contractor shall use 10% extra cement over the design requirement for hand mixing for which no extra payment shall be made to the contractor.

- a) The mixed concrete shall have slump as decided by the E.I.C. for a particular job or a part of a job. All arrangements for frequent test of slump of concrete are to be made by the contractor at his own cost.
- b) Ready Mix Concrete should be follows IS: 10262, IS: 456, IS: 4926:2003(2<sup>nd</sup> Revision) and have equivalent strength of M<sub>25</sub> grade of concrete.

Placing and compaction of concrete : Before placing the concrete, the form works shall be cleaned of all loose materials. Depositing concrete under water shall not allowed without specific permission of the E.I.C. and in that case the concrete shall contain at least 10% more cement than what is required for the same mix placed in the dry, for which no extra payment will be made.

All concrete shall be places in position as rapidly as possible before initial set commences.

Concrete shall not be dropped into position from a height of more that 1 (one) metre.

During placing and also immediately after deposition the concrete shall be thoroughly, compacted by the use of approved mechanical vibrators.

Protection and curing : The contractor shall adequately protect freshly laid from rapid drying at the top due to strong sunshine, drying winds etc. and also from running of surface water and shocks.

All concrete shall be cured with fresh water for a minimum period of 14 (fourteen) days after concreting or as advised by the E.I.C.

The rates quoted by the contractor for concrete shall include all cost of protection and earning of concrete.

Test of concrete: Tests shall be conducted in accordance with I.S. code of practice The contractor shall provide all labour, materials and appliances required for making test specimens. All costs in connection with carrying out works tests and preliminary and any other related tests in the Central Laboratory, K.M.D.A. or National Test House or any other Laboratory approved by the Engineer-in-Charge shall be entirely borne by the Contractor and no extra claim whatsoever will be entertained on this account.

Acceptance Criteria for acceptance of concrete of a specified grade shall be in accordance with 18:456/1978.

Frequency of Sampling:

Sampling Procedure – A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance to being tested, that is, 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 shall be in accordance with the following :

Quantity of Concrete in the Work, Cu.m	Numbers 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 <sup>3</sup> or part thereof

Test Specification : The specification shall be made each sample for testing at 28 days. Additional cubes may be required for various purpose such as to determine the strength of concrete at 7 days or at the time of sinking the form ware 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

## **STRENGTHENING OF EXISTING R C C FRAME STRUCTURE FIVE STORIED BUILDING WITH PATCH REPAIR OF CONCRETE DUE TO REBAR CORROSION**

Note: - Cracking and spalling of concrete suffer due to durability distress, which frequently involves corrosion of reinforcement. Penetration of water and /or aggressive chemicals during the service life of structures is the primary reason for the problem. Detailed inspection to be carried out by Structural Engineer/Consultant to assess the condition of the structure and based on report and specification of structural engineer recommendations restoration work / strengthening works should be carried out.

### **Surface Preparation:**

- All defective loose/unsound areas will be delineated and marked out on site.
- Providing and fixing steel props for sufficient support before starting the repair at distress locations of columns, beams and slabs.
- Chipping off all loose mortar, concrete, existing delaminated portion of shear walls, column, beams, roof slab ceiling, etc. to be taken by using suitable tools and equipment such as pneumatic breaker, electric hammer, high pressure water jetting and hammer and bolster to expose the rebar completely and at least 20 mm beyond the reinforcement.
- All defective concrete will be removed by using appropriate tools and equipment, such as pneumatic breaker, electric hammer, high pressure water jetting and hammer and bolster.
- Ensure all the rust particles are cleaned by mechanical means like metal wire brushing or abrasive blasting.
- Where reinforcing bars need to be replaced, they will be anchor fixed or tack welded.
- If welded, the slag will be removed prior to continuing.
- Where large areas of steel reinforcing are exposed, these will be made fully secure using clean tie-wires and, if necessary, anchored to the concrete substrate in an approved manner.
- All dust and loose particles will be removed from the treated area using clean, oil-free compressed air. Where chlorides are known to have been present, the concrete and the exposed reinforcing bars will be thoroughly washed down with clean water to ensure the removal of residual contamination.

### **Supports:**

- The RCC members should be properly supported before chipping the spalled / loose concrete. The props provided shall be adequate to provide sufficient structural support to the load carrying members. Fixing steel bars with anchoring adhesive
- Check existing rebar diameter and if it is reduced by more than 20 % then replace the same with low voltage tack welding method and anchored with polyester resin grouts of Anchor fix for a minimum 50 mm depth inside the concrete. Insert 'L' hooks tie rod at 500 mm c/c and fix with polyester resin grouts of Anchor fix.
- Structural engineer needs to be consulted where additional reinforcement needs to be provided. The additional reinforcement needs to be embedded right from foundation to each roof slab as per the

requirement and structural engineer has to decide the size of increased section of repaired section of RCC members and required additional main reinforcement, tie bars and its spacing.

### **Application of Rust Remover:**

- Apply Rust Remover on affected surface by using cotton waste swab or by brush application.
- The rusty surface will change its colour to original blackish steel; remove the same with cotton cloth.
- Then remove the loose rust particles by scrubbing or simple dusting with the brush. Wash the steel surface with water jetty to remove all the acidic residue left on the bar, and clean with cotton cloth.
- The reinforcing steel will be cleaned to a bright condition such as BS 4232.

### **Steel Priming:**

- Priming of the exposed steel reinforcing bars will take place immediately the blasting operation is complete. In the case of wet blasting process, priming will take place immediately the steel is dry. Apply a coat of anti-rust coating. Stirred thoroughly until a uniform consistency.
- A single continuous coating will be applied to all exposed reinforcing bars using a suitable paint brush. Care will be taken to ensure an unbroken coating is achieved, particularly to the back of each bar. The minimum wet film thickness will be approximately 75 microns, 4 Sq. per litre for a single coat of application. The primer will be allowed to dry. Concrete Priming (optional)
- Ensure the SSD the surface before applying bond coat by 5 Plus 1 in the ratio of 1:1 (5 Plus 1: Cement) as a bond coat and ensure the apply RPM when the bond coat is touch dry condition. Mixing of Repair

### **Polymer Mortar (RPM):**

- RPM must be mixed mechanically with heavy-duty slow speed drill with spiral mixing paddle.
- @16% W/Pratio. Start the mixer and add the RPM powder rapidly and continuously. Mix for 3 to 5 minutes until mortar is homogeneous and lump free along with it. • Add water, if necessary, to get the desired consistency. Mix for a further 1 to 2 minutes.
- Under no circumstances should excess water be added. Little extra water may be required in hot climatic conditions.
- If ambient temperature is more than 35°C, use chilled water for mixing and store unused product in shed.

Application of RPM:

- After mixing, RPM can be trowel applied.
- When applying by hand prepacked single component polymer modified cementitious dry spray mortar, conforming to the requirements RPM must be forced tightly into the substrate to ensure complete contact with the pre-wetted substrate. In situations where reinforcement steel is countered, the mixed material should be placed behind the bars tightly and then subsequent thickness should be built.

- Levelling and initial finishing should be carried using a wooden or plastic float. Final finishing should be carried out using a steel float.
- Apply RPM to the desired layer thickness of 12 to max 50 mm (wet on dry method) and level using a screeding bar, trowel or wooden board. Can be applied in thicker layers in smaller patches or where additional reinforcement is present. Smoothing with a trowel or finishing by float or sponge can be done as soon as the mortar has begun to stiffen.

**Curing:**

- Provide adequate water curing as per standard requirement. Good curing is essential. Particular care is required in hot and / or windy conditions.

Precautions & Limitations:

- Strictly follow water-powder ratio as specified.
- Ensure full circumference exposure of reinforced steel.
- Consult structural engineer if the diameter of rebar is reduced by more than 20% of the original diameter.
- Replacement or provision of additional steel shall be done in consultation with structural consultant.
- The product during application should not be exposed to running water or prior to final setting.
  - Do not add extra water or more than recommended dosage.

**Scope:**

- Providing waterproofing treatment at water reservoir and roof.

**Specification:**

Surface Preparation:

- Clean the surface thoroughly with mechanical means and water jet to make the surface free from dirt, dust, oil laitance if any, fungus, moss etc. till the sound substrate is exposed
- Find out all the visible cracks and open the same in “V” groove manner and fill proper crack filling as per the structural repair guidelines.
- All loose area shall be removed and repaired with polymer modified mortar as per the thickness of repairs.
- Grouting of construction joints / honeycomb areas, using suitable grouting pump at pressure not exceeding 2 Kg/SqM.
- The spacing of grouting holes shall be 1-meter c/c. The final judgment of pressure will be decided at site depending upon the porosity of the concrete. The depth of hole shall not be more than 2/3rd of the thickness of the concrete. The hole drilled shall be of 12 mm dia for fixing 10 mm dia PVC nozzles.
- Remove the grout nipples and level the surface with mortar.

- Prepare the surface to Saturated Surface Dry (SSD) condition before application of

**Application:**

- Use soft bristle brushes to apply to have uniform and required thickness in 2 coats one perpendicular to the other. Second coat can be applied after a minimum gap of 8 hours under normal climatic conditions.
- Sand Sprinkling has to be done immediately after the 2nd coat, when it is in tacky condition, to create a bond key for protective screed, OR Bonding agent has to be applied before screed application.
- Average thickness of each coat should be in the range of 0.6-0.7mm DFT and number of coats may be increased to achieve higher thickness as per the demanding application areas.
- A water proofing coating has to be protected with a screed concrete.
- Use soft bristle brushes to apply water proofing compound to have uniform and required thickness in 2 coats one perpendicular to the other. Second coat can be applied after a minimum gap of 8 hours during normal climatic conditions.
- Sand Sprinkling has to be done immediately after the 2nd coat, when it is in tacky condition, to create a bond key for protective screed, OR Bonding agent has to be applied before screed application.
- Average thickness of each coat should be in the range of 0.6-0.7mm DFT and number of coats may be increased to achieve higher thickness as per the demanding application areas.



## **TECHNICAL SPECIFICATIONS OF THE CONTRACT (ELECTRICAL WORKS)**

### 1.0 Scope of Works

1.1. This specification is intended to cover entire electrical wiring installation works consisting of supply, delivery, storage, fitting and fixing of brand new electrical wiring materials, accessories properly packed at site, as necessary for receiving power from electric service provider, drawing main line, sub main line through PVC conduit concealed, distribution point wiring for light, fan, call bell, exhaust fan, distribution point wiring for 6/16 Amp socket outlets for utilities including earthing works and attachments as specified here in after and all other ancillary item of works required for building up a completely efficient and trouble free electrical wiring installation for individual rooms and common area utilities.

1.2 This specification is also intended to test and commission the entire electrical installation and test operate all the equipments and accessories of the building in question as applicable and necessary at site of works, as per this technical specification including other terms, conditions and intents as specified in different sections of this document.

1.3 This specification is also covered for any item of works which may not have been mentioned here but is usual or necessary to complete this instant electrical wiring installation work shall be deemed to be included with this specification

1.4 Successfully carrying out commissioning and test operation on each distribution point wiring by putting the point on load. Arrangement of load (lamps) shall be the responsibility of the contractor.

1.5 The scope of work under this contract work shall also include but not limited to the following; -

- (a) Opening of equipments and accessories packing boxes where necessary, inspection and joint checking of stores with packing list for their completeness and condition along with the representative of the department.
- (b) Supply of all goods, mentioned else where, to undertake and to carry out the commissioning of the entire electrical installations.
- (c) Supply of all required tools and plants to undertake and to carry out the contract job.
- (d) Providing all hand holding support and promptest attendance against the call of the department and or end user during the guarantee period.

1.6 Preparation and submission of drawings as required and as specified elsewhere in this document. It is responsibility of the agency for arrangement of construction power during execution of work

1.7. Any other work which has not been mentioned here but otherwise incidental and necessary for completeness of the contract work shall be carried out by the contractor within the scope of work under this specification.

1.8 The intending bidder shall have Valid Electrical Contractor's License with SCC Part No. - 1, 2, 4, 7A 11) or they may engage electrical supervisor with valid supervisory certificate (SCC Part No. - 1, 2, 4, 7A, 11 and along with consent letter of the supervisor.

Declaration of such engagement shall be uploaded

1.9. Agency is to bring materials at the site as per requirement and as per direction of EIC.

## 2.0 TECHNICAL SPECIFICATIONS

The entire electrical installation shall be carried out in accordance with latest Indian Electricity Code and relevant IS Standards up to date.

### 3.0 LT P.D.B. panel Board :

Since the supply source shall be derived from the single phase source and distribution wiring has been envisaged on two wires wire systems for individual rooms, all main switches with fuse shall be placed on the live conductor of the circuit and shall be placed at the point of entry of service line/ supply.

The panel board shall be fabricated using CRCA M.S. sheet of 2.03 mm thick and painted with powder coated anti corrosive paint and provided with re-wire able TPN main switch as incoming and DP outgoing switching-cum-busbar, for distribution power to the various loads as per the requirement of the system, designed for vertical wall mounting, cubicle/industrial type. The main switches, wherever used, shall be sheet steel enclosed and double pole, triple pole & neutral rated for various common utilities. No fuse or switches shall be placed on earthed neutral.

## 4.0 DISTRIBUTION BOARDS.

All distribution boards shall be of single phase (240 volts) type with incoming isolator or MCB as in Schedule of quantities. Distribution boards shall contain plug in or DIN type miniature circuit breaker mounted on bus bars. Miniature circuit breakers shall be quick make and quick break type with trip free mechanism. MCB shall have thermal and magnetic short circuit protection. MCB shall conform with IS 8828-1978. Neutral bus bars shall be provided with the same number of terminals as there are single ways on the board, in addition to the terminals for incoming mains. An earth bar of similar size as the neutral bar shall also be provided. Ample clearance shall be provided between all live metal and the earth case and adequate space for all incoming and outgoing cables. All distribution board enclosures shall have an etched zinc base stove painted followed by synthetic stoved enamel, colour light gray.

A circuit identification card in clear plastic cover shall be provided for each distribution board.

Miniature Circuit Breakers for lighting circuits shall be of "C" series where as MCB's shall be invariably used for motor loads, halogen. All miniature circuit breakers shall be of 9 KA rated rupturing capacity

The distribution boards shall generally be as per panel specifications above. All DB's shall be MCB type suitable for concealed installation. DB's shall be horizontal type with hinged secured front covers, with double door arrangement top and bottom knockouts, earthing studs & circuit marking provisions. Top & bottom plates shall be removable as far as possible

## 5.0 SWITCH BOARDS:

The switchboards shall be modular type metal boxes of approved makes as per attached list with all sides' knockouts except top. Top plate fixing arrangement shall be provided at all corners with tapped holes. At least 1 No. earth stud shall be provided. Switchboard shall be at-least 50mm deep. M.S. Switch

board shall be painted with 2 coats of Red Oxide primer from inside and outside if not plated or galvanized. In case of surface mounted boards switchboards shall be powder coated with necessary treatment. The switch plate shall be 2mm thick while phenol-bonded sheet unless specified and shall be fixed with chrome-plated screws with cap washers. For modular switch range switch boxes shall be of same make. Metal boxes shall be used for concealed wiring

#### 6.0 Distribution wiring for light / fan / call bell / exhaust fan points

##### 6.1 Conduit laying in roof slabs :

Rigid PVC shall be laid straight as far as practicable and properly placed including binding with the steel reinforcement rods with 22 SWG G.I. binding wire so that proper positions of conduits are maintained.

While laying the conduits for concealed wiring in the ceiling / beams / columns / walls before casting, the contractor shall ensure that both ends of the conduit are plugged by means of dead-end sockets or otherwise to prevent the entry of any foreign material against conduit choking.

There shall be no intermediate joints in one straight run of conduit.

All ceiling outlets shall be terminated in a round M.S./ G.I. circular box (80 mm depth minimum)/ deep box to suit standard size ceiling rose or/ and rectangular M.S. junction box or Fan Hook Box as the case may be.

It will be mandatory for the contractor to get the layouts approved by the Engineer-in-charge.

##### 6.2 Conduit laying in wall:

The concealed conduit work shall be carried out along with construction of walls prior to plaster. The work covers chasing walls with wall cutters only if necessary fixing the conduits, boxes, and accessories, redoing the damaged surface using chicken mesh. All horizontal conduit runs shall be straight at wall point light level to necessary junction/pull boxes and then straight vertical drop to switch box if necessary.

6.3 Fish wire: 1 x 18 SWG G.I. wire inside the conduit and accessories to be provided with an extension of 250 mm at both the conduit ends.

#### 7.0 LIGHTING AND POWER WIRING:

7.1 All final branch circuits for lighting and appliances shall be single core copper conductor run inside conduits. The conduit shall be properly threaded and screwed into sockets, bends, junction boxes.

7.2 Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.

- 7.3 Final branch circuits shall preferably be kept in separate conduit up to the distribution Board No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits.
- 7.4 All points shall include necessary circuit mains from distribution boards up to switch boards as specified, point wiring up to points locations from switchboard, switch, switch sockets & boxes with switch plates as specified, Connector, ceiling rose or brass light holder as required at point location.
- 7.5. No lopping wiring shall be used in junction box. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made.
- 7.6. Control switches modular type shall be connected in the phase conductors only and shall be “ON” when knob is down. Switches shall be fixed in 3mm thick galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.
- 7.7 Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 19mm and wires not less than 1.5 sq.mm copper shall be used.
- 7.8 Distribution Wiring to 5 pin 16 Amp power plug point shall consist of wiring from a separate way of MCB BDB to the point of utilization, 15A 5 pin 5 in one combined unit fixed at the wall at a height as per direction of EIC.
- 7.9 All outlets, such as switches, wall sockets, etc. may be either flush mounting type and all metal box shall be effectively earthed

8.0 Sub main wiring

From individual Re-wireable main switch to distribution board suitable copper wire shall be drawn through PVC conduit concealed in wall as per direction of EIC.

9.0 Wire cross section for different point wiring

The minimum required size of the conductor for internal distribution point wiring shall be as follows:

Sl. No	Type of point wiring	Minimum size of wire
1.	Light / fan /exhaust / call bell point	2 x1.5 mm <sup>2</sup> copper & 1x1.5 mm <sup>2</sup> copper as Earth wire
2.	Receptacle-16A	2 x2.5 mm <sup>2</sup> copper & 1x1.5 mm <sup>2</sup> copper as Earth wire
3.	As above but Looped	2 x 4.0 + 1 x 2.5 sq. mm up to 1st Point.      2 x 2.5 + 1 x 1.5 sq. mm for Looped Point

## 10.0 Cables & Wires

### 10.1 1100 volt grade wires

All wires for wiring work shall be single core stranded Flame Retardant PVC insulated and unsheathed wire for working voltages up to and including 1100 Volt with copper conductor and shall conform to latest revision of IS: 694 (P-I).

### 10.2 Cables & Wire termination

For 1.1 KV grade LT power wires (PVC / XLPE) having copper conductor, either soldering or crimping type joints are to be used. Extreme care and cleanliness shall be maintained to achieve satisfactory results in joints. All other necessary components and hardware (compression glands, lugs and jointing materials) for making a cable joints complete in all respect shall be within the contractor's scope.

## 11.0 LIGHTING FIXTURE AND FANS

### 11.1 Indoor luminaries:

The luminaries shall be suitable for 1x18W LED tube lamp as per schedule of supplies attached herewith and shall comprises all accessories like high luminous efficiency LED lamp(s), lamp holders, batten duly wired up to the connector block. The channel shall be provided with knockouts suitable for 19 /20 mm conduit. Provision of an earthing facility shall be made. The luminary shall be complete in all respect and ready for use at site.

### 11.2 Outdoor luminaries:

The luminaries shall be suitable for 50W LED out door type IP-65 protection luminaries as per schedule of supplies attached herewith and shall comprises all accessories and duly wired up. The fitting shall be fixed /projected from the wall of the building incl. making holes/providing clamping arrangement & necy. GI reducer as required. S&F 40 mm GI pipe (ISI-Medium) quality 1.5 mts. average length having suitable bend S&F necy. length of 1.5 sqmm PVC insulated single core stranded annealed copper wire and making connections as required and mending good damages to wall incl. painting etc. earthing facility shall be made. The luminary shall be complete in all respect and ready for use at site

### 11.3 CEILING FANS

All ceiling fans shall be provided with suspension arrangement in the concrete/slab/roof members. Contractor to ensure that provision are kept at appropriate stage at locations shown on the drawing. Fan box with MS hook shall be as per specification. Ceiling fan shall be double ball bearing type, copper wound motor complete with canopy, down rod, blades etc. and shall conform to relevant energy efficient standards ceiling fan shall be suitable color as per direction of EIC. Ceiling fan shall be provided with standard regulator. Regulator shall be suitable for 240 volts A.C supply 50 Hz and shall be of continuous duty type

### 11.4 EXHAUST FANS

Exhaust fans shall be heavy duty type with double ball bearing and conforming to IS 2312-1967. Exhaust fan shall be complete with copper wound motor, capacitor, Cowl/Louver/shutter, frame and mounting bracket. Exhaust fan shall be suitable fan operation on 240 volts single phase A.C supply.

#### 12.0 Sign Boards

Illuminated sign board box shall be made of 22 swg thick aluminium sheet and coloured powder coated. The front fascia of the box shall consist of lettering pasted on quality flex. The board shall be ready in all respect i.e. factory wired with reputed make LED tube light fittings and tube lamps. The size of the lettering and the 'matter' of the board shall be determined by the department later. Computerized display of the entire display arrangement shall be available prior to the finalization of the board and shall be got approved by the department prior to manufacturing.

#### 13.0 Pump motor set:

The drinking water pump motor sets shall be of self-priming centrifugal submersible type in horizontal execution. The pump motor sets shall be capable to discharge at least 115 lps from the UGR wet sump at a head of 15 meter. The pump shall be mono block type. The pump set shall be coupled with single phase submersible motor having degree of protection IP-68 and shall be complete with all foundation / fixing arrangement. Preferably the motor control panel shall have overload protection, dry run protection with float switch. The discharge piping shall be either suitably sized GI/PVC pipe with all specials, valves (GM) and other accessories as required for successful performance of the pump set. The starting device of the pump motor sets (DOL Starter) shall be located nearer to the pump motor sets. No extra payment shall be made for cabling connection.

#### 14.0 Earthing

The installation shall generally be carried out in accordance with the Indian Electricity Rules 1956, as amended from time to time and in conformity with the requirement included in the Indian Standard Code of Practice for Earthing IS: 3043 -1987.

All terminal connections for earthing shall be carried out by soldering earth strips / wires with suitable lugs. Pipe electrodes for earthing shall be made of galvanized steel of class 'B' Medium quality and shall not be smaller than either 50 mm 3.64 mm thick. The length of the pipe electrode shall not be less than 3.04 Mtr (10'). A hole shall be provided at 100 mm (4") from the top end to receive a 13 mm (½") dia galvanized bolts, nuts etc and the bottom end shall be chiseled out for penetration in the soil. Proper sizes of galvanized flat shall be connected securely on the properly cleaned surface of top end of pipe electrode by means of a 100 (4") long x 13 mm (½") dia GI bolts, nuts and double washers. The earth lid flat / conductor shall be protected mechanically by means of a continuous length GI protection pipe of suitable dia up to a height of 0.6 Mtr (2') above ground level and the same shall be completely filled with bitumen compound and topped up to over flowing. All galvanization shall be hot deep quality and the galvanization thickness shall be as per latest IS specification.

The distance between the pipe electrodes where multiple earthing is employed shall be at least not less than the length of electrodes and no two pipe electrodes shall be connected together in parallel.

## 15.0 Erection

15.1 Prior to erection of any equipment, the contractor, upon opening of the packing cases in presence of the departmental representative not below the rank of Junior Engineer shall ensure the quantity of the respective packing list items and their conditions for proper erection. If any defect / damage in any item are observed, the same shall be brought into the notice of manufacturers for remedial measure.

15.2 All wiring installations shall be made at site in a most Engineer like manner as per the direction of the Engineer-in-Charge observing all recommendations and guide lines of the individual equipment manufacturers.

15.3. All the appropriate tools and tackles as would be required for the proper installation works of any equipment and or requisitioned by the department for such purpose shall be arranged at site by the contractor before the work is started.

15.4. All false works, staging, scaffolding etc and as would be required for good workmanship shall be arranged by the contractor and same shall be removed by the contractor after completion of the erection works, mending all damages good in the civil structure.

15.5. All electrical installations shall comply with the requirements of Indian Electricity Acts and rules made there under and with any other regulations that may be applicable. The electrical installations shall only be carried out by authorized persons competent to undertake such work under the rules and regulations.

15.6. All connections for the internal wiring shall be terminated by crimping type lugs.

15.7. Maximum number of wires in PVC conduit pipe shall not exceed the limits specified in IS.

## 16.0 Tests

Before the wiring installation is put into service, following acceptance tests shall be carried out by the contractors in presence and to the entire satisfaction of EIC or his representative. The instruments used for testing shall be up to date calibrated.

### 16.1 Polarity of Switches

It shall be ensured by physical tests at site that all single pole switches have been fitted on the live side of the circuits they control.

### 16.2 Insulation Resistance Tests

By applying a 1000-volt Megger between earth and the whole system of conductors or any section thereof with all fuses in place and all switches closed, all lamps in position or both poles of installation otherwise electrically connected together. The results shall not be less than 50 divided by the number of points on the circuit and less than 1megohm.

Between all conductors connected to one phase and all other conductors connected to the neutral or to the other phase conductors of the supply, after removing all metallic connections between the two poles of the installation and switching on all switches. The value of the insulation resistance shall be acceptable by EIC.

### 16.3 Earth continuity Test

The earth continuity conductor including metal conduits and metal sheaths of cables in all cases shall be tested for electrical continuity.

16.4 Earth resistance Tests

In order to ensure the effectiveness of the earth installation, the value of earth resistance shall be within acceptable limit.

16.5 Submission of Test Form

The contractor shall have to submit the test form duly filled in the test results and signed by the Electrical Supervisor for obtaining the power from the supply company.



# PROCESS FOR STRUCTURE REHABILITATION AND RETROFITTING WORK FOR RENOVATION OF INDIAN BANK STAFF QUARTERS, SELIMPORE

This write up is given to guide the Management, if they go for maintenance by own Contractors & in house Engineers.

## **A. PREPARATORY & ENABLING ITEMS**

- A1. Providing barricade along the marked periphery of site using bamboo posts (2M Height) temporarily with all warning sign till the completion of the job.
- A2. Providing and erecting steel props (of appropriate heights) braced at centre and supporting a continuous 2" x 3" wooden runner resting on wedge and block, having minimum capacity -3 ton to support the structure professionally during repair and jacketing etc. and maintaining them in position till necessary
- A3. Providing and erecting the safely net of opening 75 mm. X 75 mm. X 12mm. Size in addition to sturdy GI corrugated arrester tray at 1<sup>st</sup> floor level to prevent the debris falling on ground during progress of work and keeping the same during the entire period of work.
- A4. Providing and erecting at site self supported two legged B class tubular steel scaffolding to reach any place of work on external facade of building, including approaches extension working platform, ladders lifting track for men and materials etc. all complete dismantling and taking away all materials and debris after completion of proposed work etc.

## **B. STRUCTURAL REPAIRING FOR CORROSION DAMAGES & PREVENTION**

- B1. Removing & cleaning of existing concrete carefully by low impact high frequency hammer without damaging the existing concrete including clearing the surface by air jet etc.
- B2. Carry out application of Bi-polar migratory corrosion inhibitor EPCO-KP-100 on concrete surface. This inhibitor has migratory kind of property which permits the material to migrate to a virtual extent of 100mm through pores of concrete, inhibiting the corrosion & passivating the Electro-chemical reaction . It has property to attack anode as well as cathode, which is purely alkaline in nature (pH 9.5), so it has no carcinogen activity with concrete.
- B3. Clean existing reinforcement with wire /rotary wire brush making the surfaces free from loose material dirt etc by applying two coats of alkaline rust converting primer confirming to ASTM-B 117, on the rebars including clearing the reinforcement wire brushing to remove loose rust spalls with time interval of 1 hour between the coats.
- B4. Anticorrosive treatment to reinforcement by IPNET RB. Application of two coats of IPNET RB on exposed reinforcement in two coats with time interval of minimum 4 hours between each coat. The application shall be by brush .
- B5. Providing and applying structural grade epoxy-latex bond coat prior to application of any type of mortar confirming to ASTM-C-882-91 (ARIZONA slant shear Test) to ensure bond between old concrete & new concrete by brush application.

## PROCESS OF RESTORATION ( Contd. )

- B6. Repairing of excessively damaged member with micro-concrete including application of form work filling de-shuttering etc.
- B7. Building up the profile of structure member by using latex modified air cured mortar system in damaged areas ( 1 cement -3 part graded cleaned pre packed river-5 to 10% latex mortar by weight of cement 0.35% w/c ratio) in 20 mm. Thickness including leveling profiling etc.

### PREVENTION AGAINST CORROSION

- C  
C1. Drilling and fixing teflon nozzles in RC members including -  
**Drilling Holes** : Drilling 14 mm dia 50 to 100 mm deep holes in structural members at the intervals of 600 mm in staggered manner or as directed by the consultant in RC structural element.  
**Cleaning of holes** : Clean the holes by air blower prior to fixing nozzles.  
**Fixing of Nozzles** : Insert 12mm dia . Teflon nozzles in cleaned holes .External end of nozzels to be machined to receive outlet of grouting gun. Fix it inside the holes by applying EPCO 1010 putty to ensure complete sealing. Cure the system for minimum 12 hrs.

### GROUTING OF MCI

- C2. Grouting of concrete penetration corrosion inhibitor in required quantity as per specification & detailed furnished methodology  
**Mixing of materials** : Mixing of material components in required quantities as per manufacture's instruction by weight batching .  
**Grouting** : Fill the grouting gun with MCI. Maintain desired pressure in the gun by air compressor, maintain the pressure gauge at exit (2 to 3Kg/cm<sup>2</sup>) by monitoring pr. Gauge at exit. Grout the fix material quantity through prefixed nozzles in the structural elements. Seal the nozzle with EPCO 1010 putty after the refusal. Monitor leakages through other nozzles while grouting and seal them as per the requirement. Repeat the process for all the nozzles. Complete the operation with in pot life of the material.  
**Cleaning of gun and accessories** : Clean the gun and accessories with T-60 thinner after the operation to have smooth functioning thereafter.

### ITEMS FOR STRUCTURAL STRENGTHENING AND RETROFITTING

- D  
D1. **Grouting** :  
Injecting low viscosity Polymer grout by pressure and using epoxy ejector with accessories till nozzles refuses to accept the grout including .  
**Mixing of materials** : Mixing of material components (part a&b) in required quantities as per manufacture's instruction by weight batching .  
**Grouting** : Fill the grouting gun with RESIN. Maintain desired pressure in the gun by air compressor maintain the pressure at exit (3 to 4 Kg/cm<sup>2</sup>) by monitoring pressure gauge at exit. Grout the material through prefixed nozzles in the structural element still it's refusal .Seal the nozzle with EPCO 1010 putty after the refusal. Monitor leakages through other nozzles while grouting and seal them as per the requirement. Repeat the process for all the nozzles. Complete the operation within pot life of the material .  
**Cleaning of gun and accessories** : Cleaning the gun and accessories (valves, pipes, other fixtures) with T-60 thinner after the operation to avoid jamming of the gun .
- D2. Removing plaster / loose concrete on existing structural element and cleaning of concrete surface prior to application of jacketing or wrapping .



## TEST AND PROCEDURES ( Contd. )

- D3. Removing existing flooring to reach the existing concrete surface including removing of bedding mortar cleaning etc.
- D4. Re doing the flooring where ever needed.
- D5. Cutting the groves below the existing wall up 35 mm deep inside the existing wall on top of floor beams.
- D6. Removing of Brick work adjacent to RCC column and beams prior to application of jacketing or wrapping.
- D7. Providing and applying structural grade high pot life (Pot life min. 3hrs) epoxy bond coat prior to application of jacketing confirming to ASTM-C-882-91 to ensure bond between old concrete & new concrete by brush application .
- D8. Providing and applying jacketing around column with M20 grade concrete. Including all lifts shuttering drilling holes and fixing shear anchor as per specification. Reinforcement to be done separately for all sections.
- 1) UP TO 100 MM THK
  - 2) UPTO 150 MM THK
- D9. Providing and applying jacketing around BEAMS with M20 grade concrete .Including all lifts shuttering drilling holes and fixing shear anchor as per specification. Reinforcement to be done separately for all sections.
- 1) UP TO 100 MM THK
  - 2) UPTO 150 MM THK
- D10. Providing and fixing additional main steel rebar of designed diameter in various structural elements like column beams and foundation including drilling bending and fixing the bars with epoxy putty etc. Steel to be provided on the basic of 1 % of volume of concrete .
- D11. Casting and jacketing of structural element like plinth beam column foundation with M25 polymer modified concrete by adding 5% polymer by the weight of cement and corrosion inhibiting additive as per designed mix including fixing and removing off from work curing etc.
- D12. Strengthening structural element with non metallic composite fiber wrapping system comprise of unidirectional glass fiber sheet (600GSM-BD) and compatible saturant, by wet layup system including
- Surface preparation** : Grinding / moulding concrete substrata cleaning it with wire brush removing oil laitance if present, rounding sharp edges to min 25 mm radius etc.
- Profiling** : Applying compatible primer on prepared substrate filling the holes and uneven surface with thixotropic putty etc.
- Wrapping** : Wrapping the fiber sheet to structural element at desired orientation using tamping roller to avoid any air voids etc. Repeat the same procedure for multiple layer with the interval of 8 hrs.

**Sand pasting :** Applying second coat of saturant after minimum.12 hrs, rectify air voids if any paste the river sand on it to make surface rough to take any further finishes.  
(1.4 mm th & 50MM wide)

D13. Applying pre-cured carbon fiber laminates (2.5 mm thick & 50MM wide) with compatible structural adhesive including

**Surface preparation :** Grinding concrete substrate cleaning it with wire brush removing oil laitance if present etc

**Profiling :** Applying compatible primer on prepared substrate filling the holes and uneven surface with thixotropic putty etc.

**Application of plate :** Marking the application area on structural element cutting the plate to required size applying compatible structural adhesive on plate in parabolic manner by adhesive laminating machine, paste the laminate on desire area by using tamping roller to avoid any air void etc.

**Sand pasting :** Applying second coat of saturant after min. 12 hrs rectify air voids if any paste the river sand on it to make surface rough to take any further finishes .

### MISC AREA

D14 Providing 9 inch thk. Brick work wherever required

D15 Providing epoxy bond coat on wrapped surface prior to wrapping

D16 Providing ordinary cement plaster on wrapped surface

We are to add that the exposed M.S sections (as per site conditions) can be welded & re introduced before casting to keep the better life.

Our Structural Engineers, kept in mind that Welding Technology at your site may not be advisory at all times due to your INFLAMABLE substances in the residential premise.

The painting is the last finish after all repairs. The cost of painting will be low if done on re structured area only. To keep symmetry, if the entire section is painted, it will be huge (say Rs 25-30/- sq.ft)

### PROCESS IN BRIEF:

Whatever to write now, the ultimate technology will be to do the following:

- To prepare site condition safe, secured & well supported.
- To open damaged area and take the individual care & design, to the merit of the requirement.
- Cleaning the area to dust & rust free situation & application for protection.
- To provide strength to the structure by welding missing segment or putting SS rod/plate/net, or Fibre or RCC blocks etc as may be applicable.
- Necessary caging for the damaged area for injecting RCC compatible ingredient & allow for curing.
- After the rectification is done, and after a span of Time (say 45-90 days) NDT can be done to gain confidence.
- After the re construction process, finishing work can be done by plastering/painting etc.

The process to be followed from case to case & merit To merit.

