TENDER DOCUMENT

TENDER No: DLI/CON/755/612 dated 17.01.2018

FOR

Tender for Phase-II works of Repair, renovation & Face Lifting of STPI Building at Borjhar, Guwahati

VOLUME-II

ADDITIONAL CONDITIONS OF CONTRACT, TECHNICAL SPECIFICATIONS & DRAWINGS
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract (GCC) of EPI and other conditions of the tender documents. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of GCC and other conditions of the tender documents, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 Engineering Projects (India) Limited (EPI) has been selected by Software Technology Parks of India (STPI) as PMC for planning, design and construction of various works required for “Phase-II works of Repair, renovation & Face Lifting of STPI Building at Borjhar, Guwahati” for creation of state of the art STPI facilities. The instant contract shall include (but not limited to) providing labour, tools and plants, machineries, detailed engineering, transport and all other components including all materials (except those which are specifically excluded from scope/present tender as spelt out elsewhere in the tender documents) required for completion of construction work in the buildings as mentioned in the NIT. The work site is located at Borjhar, Guwahati. The Location of site is about 1.0 KM from Guwahati LGBI Airport and well connected with main road.

3.0 Clause no 3.0 of GCC shall stand amended as below:
The items of work given in the tender documents are for general guidance of the contractors and the works shall be carried out by the contractor on item rate basis in conformity with the detailed drawing, scope of work, technical specifications, additional conditions of contract (including any addition/modification/alteration/deletion made from time to time therein found essential for completion of works). The contractor shall be deemed to have satisfied himself before tendering as to the sufficiency and correctness of his tender for the works and of the rates and prices quoted in the brief specifications, drawings, scope of work and payment (billing) schedule, which rates and prices shall, except as otherwise provided, cover all obligations under the contract and all matters and things found necessary for proper completion and maintenance of the works. It shall be responsibility of the contractor to incorporate the changes that may be in the scope of work envisaged at the time of tendering and as actually required to be executed. The contractor has quoted his rates after clearly studying the scope of work given in Tender Documents availed by him by downloading from the website at the tendering stage itself and getting fully satisfied with the various items and technical intricacies involved in the work under his scope of work as envisaged in the tender. EPI shall not entertain any claim of the contractor on account of error or omission by him in this respect except what is admitted by the client.

4.0 No mobilisation advance shall be paid and hence clause no. 8 of GCC shall stand deleted.

5.0 Safety Code:
General
Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with safety rules as stated forth herein for information and guidance:

First Aid and Industrial Injuries
(1) Contractor shall maintain first aid facilities for his employees and labours.
(2) Contractor shall make outside agreements for ambulance service and for the treatment of industrial injuries. Names of those providing these services shall be furnished to the EIC prior to start of construction and their telephone numbers shall be prominently posted in Contractor's field office.
(3) All critical industrial injuries shall be reported promptly to the EIC, and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to the EIC.

General Rules
Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators of the no smoking rules shall be discharged immediately.

Contractors Barricades
(1) Contractor shall erect and maintain barricades required in connection with his operations to guard or protect.
   (a) Excavations.
   (b) Hoisting areas.
   (c) Areas adjudged hazardous Contractor's or Owner's inspectors.
   (d) Owner's existing property subject to damage by Contractor's operations.
   (e) Railroad unloading spots.
(2) Contractors' employees and those of his sub-contractors shall become acquainted with owner's barricading practices and shall respect the provisions thereof.
(3) Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights.

Scaffolding:
(i) Suitable scaffolding should be provided for workmen for all works that safety can be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be gaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder shall be given an inclination not steeper more than 1 in 4 (1 horizontal and 4 vertical)
(ii) Scaffolding or staging than 4 meters above the ground or floor, swingsuspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise rewarded at least 3 ft.
High above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as maybe necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

(iii) Every opening the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 metre.

(iv) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform of the gangway or the stairway is more than 4 metres above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in above.

(v) Safe means of access shall be provided to all working platforms and other working places, every ladder should be securely fixed. No portable single ladder shall be over 9 metres in length while the width between side rails in rung ladders shall in no case be less than 30 cms for ladder up to and including 3 metres in length. For longer ladder this width should be increased at least 5 mm for each additional foot of length. Uniform steps spacing shall not exceed 30 cms. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the site of work shall be so stacked or placed to cause danger or inconvenience to any person or public. The Contractor shall also provide all necessary fencing and light to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings of law that may be brought by any person for injuries sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the Contractor be paid to compromise any claim by any such person.

Excavation and Trenching
All trenches 1.2 metres or more in depth, shall at all times be supplied with at least one ladder for each 50 metres length or fraction thereof.

Ladder shall be extended from bottom of the trench to at least 1 metre above the surface of the ground. The sides of the trenches which are 1.5 metres in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 metres of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.

Demolition:
(i) Before any demolition work is commenced and also during the progress of the work.
(a) All road and open areas adjacent to the work site shall either be closed or suitably protected.

(b) No electric cable or apparatus which is liable to be a source of danger shall remain electrically charged.

(c) All practical cares shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

(ii) All necessary personal safety equipment as considered adequate by the Engineer-in-charge (i.e. EIC) should be kept available for the use of the persons employed on the site and maintained in condition suitable for immediate use, and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

(a) Workers employed on mixing asphaltic materials, cement and lime mortar shall be provided with protective footwear and protective gloves.

(b) Those engaged in white washing and mixing or stacking of cement bags or any materials which are injurious to the eyes shall be provided with protective goggles.

(c) Those engaged in welding and cutting works shall be provided with protective face and eye shields, hand gloves etc.

(d) Stone breakers shall be provided with protective goggles and protective clothing, and seated at sufficiently safe intervals.

(e) When workers are employed in sewers and manholes, which are in use, the Contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to gate in to the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or board to prevent accident to the public.

(f) The Contractor shall not employ men below the age of 18 years and women on the work of painting with products containing lead in any form. Wherever men above the age of 18 years are employed on the work of lead painting, the following precautions should be taken,

1. No paint containing lead or lead product shall be used except in the form of paste or ready-made paint.

2. Suitable face masks should be supplied for use by the workers when paints are applied in the form of spray or a surface having lead paint dry rubbed and scrapped.

3. Overalls shall be supplied by the Contractor to the workmen and adequate...
facilities shall be provided to enable the working painters to wash them during andon cessation of.

(iii) When the work is done near any place where there is a risk of drowning, all necessary safety equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

(iv) Use of hoisting machines and tackles including their attachments, anchorage and supports shall conform to the following standards or conditions:

(a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect and shall be kept in good working order.
(b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.
(c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 12 years should be in charge of any hoisting machine including any scaffolding, which or give signals to the operator.
(d) In case of every hoisting machine and of every chain ring hook, shackle, swivel, and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gears referred to above shall be plainly marked with the safe working load of the conditions under which it is applicable which shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
(e) In case of departmental machine, the safe working load shall be notified by the Engineer-in-charge. As regards Contractor's machines, the Contractor shall notify the safe working load of the machine to the Engineer-in-charge whenever he brings any machinery to site of work and get it verified by the Engineers concerned.

(v) Motors, gearing transmission, electric wiring and other dangerous part of hoisting appliances should be provided with such means as to reduce to the minimum the accidental descent of the load, adequate precautions should be taken to reduce to the minimum the risk of any part or any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves, and boots as may be necessary should be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

(vi) All Scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe conditions and no scaffold, ladder or
equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

(vii) These safety provisions should be brought to the notice of all concerned by the displaying on a notice board at a prominent place at the work-spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

(viii) To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by the Welfare Officer, Engineer-in-Charge or safety Engineer of the administration or their representatives.

(ix) Notwithstanding the above clauses there is nothing in these to exempt the Contractor from the operations of any other Act or rules in force in the Republic of India. The works throughout including any temporary works shall be carried out in such a manner as not to interfere in any way whatsoever with the traffic on any roads or footpaths at the site or in the vicinity thereto or any exiting works whether the property of the Administration or of a third party. In addition to the above, the Contractor shall abide by the safety code provision as per C.P.W.D. Safety Code and Indian standard Safety Code framed from time to time.

(x) The contractor shall keep one earmarked vehicle such as EECO or MAGIC or equivalent with driver, fuel & lubricant for meeting any emergent condition at site till the works under the instant contract are completed and taken over by the Owner.

(xi) The contractor shall also construct a suitable office accommodation at site at his cost to ensure safe and proper custody of all drawings, documents, appliances including easy access to them and relief to the staff and other personnel in case of any exigency. The office should be fully equipped with basic facilities such as telephone, internet, regular electric and water supply, computer/typing with printing facilities, storage of documents and datas like almirahs or file cabinets etc.

6.0 The clause no. 10.0 of GCC shall stand amended as below:
An amount @5% (Five percent) of the gross value of the running bill shall be deducted from each running bill by way of retention money. In case the EMD has been deposited by the contractor in the form of demand draft, the said amount of EMD shall be adjusted first towards the retention money and further recovery of retention money shall commence when the up to date amount of retention money exceeds the amount of EMD deposited in the form of demand draft. The retention money shall become refundable to the contractor at the end of the defects liability period free of any interest provided always that the contractor has rectified all the defects arising during the defect liability period pertaining to his scope of work, EPI did not have to incur any expenditure in setting right the defects, if any, pertaining to the contractor’s scope of work, the contractor has demolished and removed all structures including foundations and withdrawn fully from the worksite and EPI has received the clearance certificate from the concerned Labour Enforcement
Officer/RLC pertaining to the labour etc. deployed by him at the worksite or there is nothing on record against him in the local market affecting functions of EPI. In case EPI has been required to make any expenditure on any of these accounts EPI will keep the retention money till the time all these matters are settled in full including recovery of the expenses, if any, made by EPI from the retention money. Further the contractor has to furnish a ‘No Claim’ certificate to EPI in confirmation of his having no claim on getting refunded the retention money to EPI at the time of claiming refund of retention money. Further retention money deducted in such manner shall be released against furnishing of Bank Guarantee of equivalent amount as per EPI’s prescribed format valid for 08 (Eight) years from completion of the work.

7.0 Setting out works
The Engineer-in-Charge shall furnish the Contractor with only the four corners of the work site and a level bench mark and the Contractor shall set out the works and shall provide and efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

The Contractor shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the Contractor. The work shall be set out to the satisfaction of the Owner. The approval thereof or joining with the Contractor by the Owner in setting out the work, shall not relieve the Contractor or any of his responsibilities. Before beginning the works, the Contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboo, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Owner. The Centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable a theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge in writing but such approval shall not relieve the Contractor of any of his responsibilities. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction. Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the Contractor. On completion of works, the Contractor must submit the geodetic documents according to which the work was carried out.

8.0 Responsibility for level and alignment

The Contractor shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the Contractor, at his own cost, when instructions are issued to that effect by the Engineer-in-Charge. It is highly possible that there shall be more than one agency working at the same time at the site. The contractor shall at all times
remain bound to co-ordinate with the agencies, deployed by EPI for the above works, including providing free access and making required provisions for them in execution of works pertaining to their portion of works. He shall also remain bound to ensure uninterrupted progress of work by these agencies in a peaceful and smooth manner. He shall also remain bound to make the required changes/additions/alterations in the works done by him to accommodate the items under the scope of work of such other agencies deployed by EPI or the client. The contractor is deemed to have made the estimated allowances in this respect while quoting his rates at the tendering stage.

Even though EPI has taken all care to attach all the drawings as vetted by the client it shall be the responsibility of the contractor to interpret the drawings for completion of the works under this contract.

The list of minimum tools, plant and machinery to be provided by the contractor within the period mentioned against the respective item is given at Annexure-A.

9.0  The following shall also be read with clause number 13 of the GCC:

a) The bidder/contractor must be registered with GST and should have valid GSTIN.

b) The bidder/contractor must submit as compliance under GST Act, the invoices in GST complaint format failing which the GST amount shall be recovered/adjusted without any prior notice from the next invoices or available dues with EPI.

c) The bidder/contractor are required to update/upload the GST/Taxes data periodically so as to avail ITC credit by EPI failing which it shall be recovered/adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

d) Rates to be quoted in this tender all inclusive with all taxes and duties etc. excluding GST. GST will be reimbursed after submission of requisite paper.

e) Bidder while quoting the rates in the tender must also consider the ITC credit applicable for the works, if any.

The rates quoted by the contractor shall be deemed to be include all taxes and duties, cess (including BOCW cess) but except GST which shall be reimbursed to him subject to raising of tax invoice and filing of return and payment of tax as per GST law, failing which EPI shall not be able to honour his claims for any payment. The contractor has quoted his rates knowing fully well that submission of return and display of the same on GSTN portal is mandatory.

However, any variation in taxes and duties after submission of due date of submission of tender shall be to the owner's account i.e. in case of any decrease in the taxes and duties shall be passed on to the owner and any increase in taxes and duties shall be borne by the Owner. Similarly, the imposition of any fresh taxes and duties shall also be borne by the Owner.

All the above reimbursements shall be admitted to the extent these are admitted by the Owner.
The contractor’s rates are also deemed to be inclusive of PF contribution on part of employer as applicable under the relevant laws/acts. The contractor is required to furnish PF deposit proofs progressively along with his RA bills failing which 4.70% of his gross bill value shall be hold from his RA bills/Payments. If it is incumbent upon EPI to deposit the withheld amount with EPFO, the same shall be deposited by EPI and the amount shall not be refunded to the contractor even after production of PF deposit proofs by the contractor at a later date.

10.0 The following shall stand added to the clause no 20 of GCC:

The contractor shall keep EPI indemnified against all claims, damages, compensation and expenses payable, if any, in consequence of any accident, or injury sustained by any workman or any other person employed by the contractor.

12.0 The following shall stand added to the clause no 27.0 including its sub clauses of GCC of EPI:

The contractor, within 10 days of issuance of LOI (Letter of Intent) to him shall depute at least one graduate civil engineer with 5 years of post-qualification experience and one person having diploma in civil engineering with 10 years of post-qualification experience. The contractor shall also depute at least one graduate electrical engineer with 5 years of post-qualification experience or one person having diploma in electrical engineering with 10 years of post-qualification experience as and when instructed by the Engineer-in-charge. Should the contractor fail to provide them within such period or as directed by the Engineer-in-charge, EPI shall be at liberty to recover an amount @30,000.00 per month person from any amount including the retention money due to the contractor.

13.0 The clause no 28.3 of the GCC shall stand deleted.

14.0 No secured advance shall be paid to the contractor and hence clause no. 35.0 of GCC shall stand deleted.

15.0 The clause no. 43.2 shall stand amended as below:

The contractor shall execute the works so as to complete the works within the stipulated completion time. He shall remain bound to submit a programme of completion of items and got the same approved from EIC. Any shortfall in progress shall be proactively made good by contractor.

16.0 The following shall stand added to clause no 45.0 of the GCC:

The contractor shall at all-time remain bound to provide the samples in quantity and manner as instructed by EPI to be analysed or tested in an outside laboratory or in the field laboratory at site. The cost of testing charges is included in the prices of the contractor. EPI shall, however, be at liberty to get the materials tested independent of the contractor and the contractor shall remain bound to render all assistance to EPI in conductance of such tests including making available the materials in sufficient quantity and in time and payment of the testing charges. EPI/client shall at all times have full access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery.
contractor shall afford every facility and assistance and cost in obtaining the right and visit to such access.

EPI shall have full powers to require the removal from the premises of all materials which in their opinion are not in accordance with the specifications and in case of default, EPI shall be at liberty to employ at the expense of the contractor, other persons to remove such materials without being answerable or accountable for any loss or damage that may happen or arise to such materials. EPI shall also have full powers to require other proper materials to be substituted thereof and in case of default by the contractor, may cause the same to be supplied and all costs which may require such removal and substitution shall be to the contractor’s account.

17.0 The following shall be added to clause no 52.6 of GCC:
The field testing laboratory to be established by the contractor at his cost shall be equipped with the minimum number of testing equipment as per Annexure-B. In case the contractor fails to provide them EPI shall get them installed and debit the cost to the contractor.

18.0 The following provisions shall supersede that of clause no 69 of GCC wherever applicable:
No claim on account of extra / substituted / variation of items etc. pertaining to the contractor’s portion of work save and except what is admitted and paid by Owner, shall be entertained or admitted by EPI. Any claim by the contractor, if not paid by the Owner, whatsoever be the reason shall not be admitted by EPI. But under no circumstances contractor shall suspend the work on the non-settlement of rates under this clause.

19.0 In case the project execution is delayed beyond the contractual scheduled completion period due to reasons attributable to the contractor, the staff and site expenses of EPI for extended period shall be paid by him to EPI at the rate of Rs. 10,000/- per month. This shall be in addition to the other recoveries, if applicable as per clause no 72 (including its sub clauses) of GCC and Penalties etc. if any, levied by Owner for the works pertaining to the contractor’s scope of work. The decision of EPI in this regard shall be final & binding on the contractor.

20.0 The work executed by the contractor shall be subject to audit and quality control checks from Quality Control Division & Technical Audit of EPI, Client, and Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/ substandard works as brought out in the report or noticed otherwise at any time during execution, maintenance period etc., the same shall be made good by the contractor without any cost to EPI. In case the contractor fails to rectify the defect/sub-standard work within the time period stipulated by EPI, EPI shall get it rectified at the risk and cost of the contractor and shall recover the amount from the dues of the contractor. Further all works Executed by the contractor shall be subject to third party testing to be deployed by EPI for which the expenses shall be borne by the contractor within his quoted rates.

21. Execution of Work. Once the contract is awarded a work order will be issued to the contractor and site handed over and in no case this will be issued on back date.
Time for completion will commence from the date of issue of work order. Engineer in charge will be nominated by name and communicated to all concerned and during his absence relief will be given by name. Following procedures to be ensured:

(a) A Testing Laboratory will be established by the Agency or suitable tie up done with approved testing laboratory or consultancy for quality check.

(b) Following registers/documents will be maintained and produced when asked for:

- i. Hindrance recording register.
- ii. Stage passing register.
- iii. Site order book.
- iv. Inspection register.
- v. Materials testing register.
- vi. Contractor ledger.
- vii. Labour license.
- viii. CAR/EAR/MCI Policy with STPI, Earthquake & TPL

(c) Monthly progress will be monitored and forwarded to all concerned.

(d) Time extension if required must be processed well in advance before existing completion date supported by documents like newspaper cutting, letter from user etc.

(e) If any willful delay from contractor is noticed suitable action taken as per contract condition and work to be completed by due date by resorting to alternate means specified in contract conditions.

(f) Quality checks to be carried out at each level to be laid down percentage wise during the process of execution.

(g) If any unforeseen delay occurs the same must be resolved by coordinating with all stakeholders.

22. Preparation of Running Account Register. Work carried out by the contractor should be jointly measured and recorded.

(a) Joint Measurement.
(b) Photographs of the work carried out duly signed by Agency and EPI Site-in-charge.
(c) Quality test reports.
(d) Recommended Liquidity Damages for delayed works if any.
(e) RAR Movement slip.

23. Completion and Handing over of Assets to User. Once the work is completed the contractor will notify EPI in writing to handover the completed works to STPI. Contractor shall be bound to rectify/make good any construction defect during
handing over and after handing over for the period of defect liability mentioned elsewhere in the contract. The date of handing over of the completed work shall be counted from the date of Taking over of the works by STPI.

It is mandatory to adhere to the guidelines for executing the works pertaining to STPI. Any deviation or failure will be treated as violation of contract and due penalty will be imposed on the Agency as deemed fit by EPI.

24.0 There shall be no Arbitration Clause for this Contract except between Central Public Sector Undertakings inter se / Government of India Departments / Ministries as mentioned and Clause Nos. 76.1 & 76.2 of General Conditions of Contract (GCC) shall stand amended as below:

24.1 Clause no 76.1 of GCC shall stand deleted.

24.2 Clause no 76.2 shall stand amended as below:

i) In the event of any dispute or difference relating to the interpretation and application of the provisions of the contract, such dispute or difference shall be referred by either party to the arbitration as per the instructions (Office Memorandum / Circulars) issued by Govt. of India from time to time with regard to arbitration between one Government Department and another one Government Department and a Public Sector Enterprise and Public Sector Enterprise inter se.

ii) Subject to any amendment that may be carried out by the Government of India from time to time, the procedure to be followed in the arbitration shall be as is contained in D.O. No. F.No.4(1)/2013-DPE (PMA)/FTS-1835 dated 11.04.2017 of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Govt. of India or any modification issued in this regard.

25.0 EPI has awarded this contract on behalf of STPI (Software Technology Park of India), Owner. In case EPI ceases to or exits from the project the right and responsibility etc of EPI in the contract shall get transferred to STPI (Software Technology Park of India), or his nominated agency (ies).

26.0 Completion and taking over:
As soon as the works are completed the contractor shall inform EPI and EPI in turn shall inform STPI who will nominate a board of officers for checking/verification of completed work as per the contract for final taking over of the project.

A final certificate of rectification of all defects pointed out during handing/taking over by the nominated board of STPI and /or during defect liability period shall be obtain from EPI along with following to release of security deposit.

a) Completion certificate issued by the Engineer-in-charge specifying the handing over of the work including list of inventories (fitting & fixtures).
b) No claim certificate by the Contractor.
c) No claim certificate from the sub-agencies/vendors engaged by the Contractor.
d) Detail required for preparing as built drawings.
e) Periodical services and measurement books.
f) Drawings for layout of underground cables and details showing location of sluice valves, electric cable joints etc.
## LIST OF MINIMUM TOOLS, PLANT AND MACHINERY

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Portable Grinder (Electric)</td>
<td>Two nos.</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>2</td>
<td>Portable Welding Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>3</td>
<td>DG Set 25 KVA (Minimum)</td>
<td>One no</td>
<td>15 days</td>
</tr>
<tr>
<td>4</td>
<td>Portable Gas Cutting Sets with hoses and regulator</td>
<td>Two nos.</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>5</td>
<td>Pipe Threading Machine</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>6</td>
<td>Pipe Bending Machine (Hydraulic)</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>7</td>
<td>Portable Drilling Machine suitable for drilling of different sizes</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>8</td>
<td>Power Hacksaw</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>9</td>
<td>Hydraulic Crimping Machine</td>
<td>One no</td>
<td>-do-</td>
</tr>
<tr>
<td>10</td>
<td>Hand Crimping Tools</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>11</td>
<td>Portable Electric Blowers</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>12</td>
<td>Portable Vacuum Cleaners</td>
<td>Two nos.</td>
<td>-do-</td>
</tr>
<tr>
<td>13</td>
<td>Plate/sheet cutting machine, Bending Machine</td>
<td>Two sets.</td>
<td>-do-</td>
</tr>
<tr>
<td>14</td>
<td>Hoisting lift for materials with winch</td>
<td>One set</td>
<td>25 days</td>
</tr>
<tr>
<td>15</td>
<td>D-spanners, Ring spanners, box spanners etc of assorted size</td>
<td>As required</td>
<td>-do-</td>
</tr>
<tr>
<td>16</td>
<td>Cutting, twisting and combination pliers</td>
<td>Three nos.</td>
<td>10 days</td>
</tr>
<tr>
<td>17</td>
<td>Screw drivers-both star headed and plain headed of different sizes</td>
<td>Two sets</td>
<td>As and when instructed</td>
</tr>
<tr>
<td>18</td>
<td>Slide wrench, pipe wrench etc</td>
<td>-do-</td>
<td>-do-</td>
</tr>
<tr>
<td>19</td>
<td>Auto level &amp; staff</td>
<td>One</td>
<td>-do-</td>
</tr>
<tr>
<td>20</td>
<td>Hand tools for plumbing/plaster/concrete cutting/Tile cutting etc.</td>
<td>Lot</td>
<td>-do-</td>
</tr>
<tr>
<td>21</td>
<td>Concrete Mixer (10/7)</td>
<td>1</td>
<td>15 days</td>
</tr>
<tr>
<td>22</td>
<td>Reinforcement steel cutting machine</td>
<td>1</td>
<td>-Do-</td>
</tr>
<tr>
<td>23</td>
<td>Excavator</td>
<td>1</td>
<td>As and when required</td>
</tr>
<tr>
<td>24</td>
<td>Welding Machine</td>
<td>1</td>
<td>15 Days</td>
</tr>
<tr>
<td>25</td>
<td>40 mm Needle Vibrator</td>
<td>2</td>
<td>-Do-</td>
</tr>
<tr>
<td>26</td>
<td>2 HP Pump</td>
<td>2</td>
<td>-Do-</td>
</tr>
</tbody>
</table>

Notes:

1) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this contract.

2) The quantities and list of equipment indicated are tentative and can be increased/amended as per the requirement of work OR as per the direction of Engineer-in-Charge. The above
equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as contract documents.

3) The contractor will not be allowed to take out equipment from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
## LIST OF MINIMUM TESTING EQUIPMENT

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insulation tester 0-500-1000 V hand driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>2</td>
<td>Insulation tester 2500/5000 V motor driven</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>3</td>
<td>Phase sequence indicator</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>4</td>
<td>Earth megger</td>
<td>One set</td>
<td>10 days</td>
</tr>
<tr>
<td>5</td>
<td>Single phase variac</td>
<td>One set</td>
<td>15 days</td>
</tr>
<tr>
<td>6</td>
<td>3 Phase Variac</td>
<td>One no</td>
<td>20 days</td>
</tr>
<tr>
<td>7</td>
<td>AVO-meter/multimeter</td>
<td>One no</td>
<td>10 days</td>
</tr>
<tr>
<td>8</td>
<td>Portable ammeter, wattmeter, voltmeter</td>
<td>One set</td>
<td>7 days</td>
</tr>
<tr>
<td>9</td>
<td>Hydraulic pressure testing apparatus</td>
<td>One set</td>
<td>30 days</td>
</tr>
<tr>
<td>10</td>
<td>Clip on meters of different ranges</td>
<td>18 nos.</td>
<td>10 days</td>
</tr>
<tr>
<td>11</td>
<td>Tachometer</td>
<td>One set</td>
<td>15 days</td>
</tr>
<tr>
<td>12</td>
<td>Sieve Set for CA &amp; FA</td>
<td>One Set each</td>
<td>10 Days</td>
</tr>
<tr>
<td>13</td>
<td>CC Compressive Testing Machine</td>
<td>One Set</td>
<td>10 Days</td>
</tr>
<tr>
<td>14</td>
<td>Digital Weigh Machine (0-10 Kg)</td>
<td>One</td>
<td>10 Days</td>
</tr>
<tr>
<td>15</td>
<td>Cube Moulds 150x150x150</td>
<td>2 Sets</td>
<td>10 Days</td>
</tr>
<tr>
<td>16</td>
<td>Spatula, Tray, Measuring Cylinder, Slump Cone etc</td>
<td>2 Sets</td>
<td>10 Days</td>
</tr>
<tr>
<td>17</td>
<td>Measuring Tape (Steel) &amp; vernier caliper</td>
<td>1 Each</td>
<td>10 Days</td>
</tr>
</tbody>
</table>

Notes:
1) The period mentioned above shall be reckoned from the date of start of commencement of work as mentioned under this tender.

2) The quantities of equipment indicated are tentative and can be increased as per the requirement of work OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy all the required equipment to complete all the works within stipulated specifications & time period as per contract documents.

3) The contractor will not be allowed to take out equipment from the site without the written permission of Engineer-in-Charge.

(Signature and seal of the Tenderer)
SPECIFICATION FOR CIVIL WORKS

1.0 GENERAL

1.01 Unless otherwise specified in the nomenclature of individual item or in the specifications, for all works mentioned in this tender, the specifications and mode of measurements shall be in accordance with C.P.W.D. specifications (latest publication with up to date correction slips) up to the date of tender. For the item not covered under CPWD specifications mentioned above, the work shall be executed as per latest relevant standards / codes published by B.I.S (formerly ISI) inclusive of all amendments issued thereto or revision thereof, if any, up to the date of submission of tender.

All mandatory tests specified in latest CPWD specifications with up to date correction slips shall be carried out from the approved laboratories as desired by Architect / Engineer in charge of EPI. Testing charges including cartage, conveyance etc. what so ever shall be borne by the successful bidder. If after any such test and in the opinion of the Architect / Engineer in charge of EPI any work is found defective or unsound, the same shall have to be dismantled and to be redone by the successful bidder at their own cost.

In case of BIS (formerly ISI) codes / specifications are not available for any item of work the decision of the Engineer based on acceptable sound engineering practice and local usage shall be final and binding on the successful bidder.

1.02 The rates for different items of work shall be for all heights, lifts, leads and depths except where otherwise specified in the item of work or in additional conditions appended with the tender.

1.03 The work shall be carried out in accordance with the approved drawings. The drawings shall have to be properly co-related before executing the work. In case of any difference noticed between the drawings, final decision, in writing of the Engineer-in-Charge shall be obtained by the contractor. For items, where so required, samples shall be prepared before starting the particular items of work for prior approval of the Engineer and nothing extra shall be payable on this account.

1.04 Unless otherwise specified in the bill of quantities or drawings, the rates for all the items of work shall be considered as inclusive of pumping out water if required for which no extra payment will be made. This will include water encountered from any source such as rains, floods, sub-soil water table being high or due to any other cause whatsoever.

1.05 Any cement slurry added over base surface (or) for continuation of concreting for bond the cost for the same is deemed to have in built in the item unless otherwise / explicitly stated and nothing extra shall be payable or extra cement considered for consumption on this account.

1.06 The rates for all items in which the use of cement is involved in inclusive of charges for curing.

1.07 The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work dressed the site to the satisfaction of the Engineer before the work is considered as complete.
1.08 The rate quoted for all brick / concrete work shall be deemed to include making openings and making good these with the same specifications as shown in drawings and / or as directed. No extra payment shall be made to the contractor on this account.

1.09 The quoted rate shall be for finished items and shall be complete in all respects including the cost of all material, labour tools & plants, machinery etc. all taxes, duties, levies, octroi, royalty charges, statutory levies, cess etc. applicable from time to time and any other item required but not mentioned here involved in the operations described above. EPI shall not be supplying any materials, labour, plant etc. unless explicitly mentioned so.

1.10 Random Rubble Masonry retaining wall shall be constructed as per approve drawings based on different heights at different locations and payment for the same shall be made as per the rates of respective items available in the Bill of Quantities.

1.11 Rate for plastering work (excluding washed stone grit plaster on external wall surface) shall include for making grooves, bands etc. wherever required and nothing extra shall be paid for the same.

1.12 Rates for all concrete / plaster work shall include for making drip course molding, grooves etc. wherever required and nothing extra shall be paid for the same.

2.0 SCOPE OF WORK

- RCC framed structure incorporating recommendations from latest CPWD Specifications / National Building Codes.

- RCC Raft foundation / isolated footing as per latest CPWD Specifications / National Building Codes.

- Infill to frame with First Class Brickwork as per CPWD Specification / relevant BIS Code.

- Random Rubble Masonry / Stone Masonry Work as per latest CPWD Specifications / National Building Codes.

3.0 CIVIL FINISHES

Civil finishes shall be as mentioned in the relevant drawings, specifications and schedule of finishes.

3.1 The bidder shall be responsible for structural soundness of the building / project in all respect and a certificate thereon shall be furnished by the bidder to EPI on the completion of the work.

4.0 MATERIAL

All materials shall be of standard quality and from approved manufacturer, conforming to Indian Standards or equivalent and shall have IS Mark as far as possible unless otherwise approved by Engineer-in-Charge. The contractor shall get all materials approved by Engineer-in-Charge prior to procurement and use. The contractor shall furnish
manufacturers certificates, for the material supplied by him when asked for. Further to that he shall get all the materials tested from an approved test house, if asked for by the Engineer-in-Charge. The cost for all tests and test certificates shall be borne by the contractor. No separate payment shall be made for the testing. The Engineer-in-Charge shall have the right to determine whether all or any material are suitable. If any material procured or brought to site found not conforming to specifications and satisfaction of Engineer-in-Charge, the contractor shall have to remove the same immediately from the site at his own expense and without any claim for compensation due to such rejection.

The contractor shall submit documentary evidence e.g. challans, bills etc. against the construction materials brought to site as a check to ensure that the required quantities as required for execution of works as per specification have been brought to site for incorporation in the work.

The contractor shall ensure that the bought out materials are brought to site in original sealed containers or packing bearing name of manufacturer and brand.

4.1 CEMENT

General: The cement shall be ordinary Portland cement of 43/53 grade conforming to IS: 8112 / IS: 12269 or Portland Pozzolana Cement of approved manufacturer, as applicable for design and drawing.

4.1.1 TESTS AFTER DELIVERY

Each consignment of cement may, after delivery at site and at the discretion of the Engineer-in-Charge, be subjected to any or all of the tests and analysis required by the relevant Indian Standard Specifications. The contractor shall bear the cost of all such tests. Engineer-in-Charge may reject any cement as a result of any tests thereof, notwithstanding the manufacturer's certificate.

4.2 REINFORCEMENT STEEL

General: Thermo Mechanically Treated bars conforming to IS : 1786 from approved manufacturers (BIS approved) shall be used.

4.3 BRICKS

The bricks shall be of approved quality having a minimum compressive strength of 75 Kg / cm², best quality locally available, well burnt, sound and of uniform quality and colour. These shall be free from salt and of standard size and shall conform to IS: 1077. The water absorption shall not be more 20% of its dry weight when soaked in cold water for 24 hours, as per IS : 3102. The tolerance limit shall be 3% for absorption.

The brick sample taken at random from the lot shall be deposited with, and be approved by the Engineer-in-Charge before being used. All subsequent deliveries shall be upto the standards of the approved sample.

4.4 COARSE AGGREGATE

General: Aggregate of sizes between 4.75 mms to 150 mms will be termed as coarse aggregate. Coarse aggregate from approved quarries and conforming to IS: 383 will only be allowed to be used for the works. Coarse aggregate for reinforced concrete work shall
consists of approved broken stone aggregate free from flat laminated or elongated pieces and shall be free from any organic material and shall be within the limits of the relative grading in IS – 383 table – II. Unless otherwise shown on the drawings all coarse aggregate in reinforced concrete shall be graded crushed stone aggregate of 20mm nominal size.

For plain cement concrete 40 mm down / 20 mm down coarse aggregate as per IS : 383 shall be used as per instructions of Engineer-in-Charge.

For damp proof coarse / screed concrete above roof slab 12 mm down coarse aggregate as per IS : 383 shall be used.

4.5 FINE AGGREGATE

Aggregate smaller than 4.75mm and within the grading limits and other requirements set in IS: 383 is termed as Fine aggregate or sand. Fine aggregate from approved sources and conforming to the above IS specification shall only be allowed to be used for the works.

For reinforced concrete, plain cement concrete, Brick work, damp proof coarse, screed concrete etc. sand of zone I & II shall only be used. Sand shall be clean river or pit sand of approved quality and shall be free from salts, earth dust or others impurities. It shall be washed with clean water and not more than 5% fine materials shall be allowed by settlement in water and passing through 10,000 mesh sieve.

For plasters sand of zone – II / zone – III shall be used as per instructions of Engineer-in-Charge.

4.6 Water: Water shall be clean and reasonably free from injurious deleterious materials, generally potable water shall be used.

5.0 OTHER MATERIALS

All materials not fully specified herein and which may be used in the work shall be approved by the Engineer-in-Charge and he shall have right to determine whether all or any of the materials offered or delivered for use in the work are suitable for the purpose. Contractor shall give the samples of materials to Engineer-in-Charge and shall get it approved before procurement and use.

6.0 PLAIN AND REINFORCED CONCRETE

This section of the specification deals with cement concrete plain or reinforced for general use and covers the requirements for concrete mix design, strength and quality, pouring at all levels, form work, protection, covering, finishing, admixtures, inserts, and other miscellaneous works. The provision of the latest version of IS : 456 shall be compiled with unless permitted otherwise and any other Indian Standard Code (Latest Revision) shall form part of the specification to the extent it has referred to or applicable within this specification.

6.1 GRADE OF CONCRETE
All reinforced concrete shall be design mix concrete and of grade M – 25 unless otherwise specified in drawing.

Nominal mix concrete proportioned for a given specified grade including cases where the Engineer-in-Charge directs use of additional cement over the quantity specified for the particular grade, shall not, however, be placed in a higher grade on the ground that the test strengths are higher than the minimum specified for the desired grade.

6.2 **MIX PROPORTIONS**

The mix proportions for grades of concrete specified in drawings shall be designed to obtain strength corresponding to the values specified in IS : 456 for respective grades of concrete. The minimum quantities of cement shall be as specified in Table-I.

Preliminary tests, as specified in the IS code or as required by the Engineer-in-Charge, shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative sample of aggregate and cement expected to be used on the job to ascertain the ratios by weight of cement to total aggregate, of fine to coarse aggregate and water cement ratio required to produce a concrete having specified strength and sufficient workability to enable it to be well consolidated and to be worked into corners of shuttering and around the reinforcement.

**TABLE – I**

**MINIMUM CEMENT CONTENT SPECIFIED FOR DIFFERENT GRADES OF CONCRETE**

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Minimum cement content per Cum of finished concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>M – 10</td>
<td>236 Kg.</td>
</tr>
<tr>
<td>M – 15</td>
<td>310 Kg.</td>
</tr>
<tr>
<td>M – 20</td>
<td>360 Kg.</td>
</tr>
<tr>
<td>M – 25</td>
<td>410 Kg.</td>
</tr>
<tr>
<td>M – 30</td>
<td>500 Kg.</td>
</tr>
</tbody>
</table>

**LIMITS OF CONSISTENCY**

<table>
<thead>
<tr>
<th>Degree of Workability</th>
<th>Slump in mm, with standard code as per IS : 1199 Min.</th>
<th>Max.</th>
<th>Use for which concrete is suitable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>0</td>
<td>25</td>
<td>Vibrated concrete in roads or Large sections.</td>
</tr>
<tr>
<td>Low</td>
<td>25</td>
<td>50</td>
<td>Simple reinforced sections with vibrations.</td>
</tr>
</tbody>
</table>
Note: Not with standing the above, the slump to be obtained for work in progress shall be as per the instructions of the Engineer-in-Charge.

6.3 WORKMANKSHIP

All workmanship shall be according to the latest and best possible standard.

Before starting any pour the contractor shall obtain the approval of the Engineer-in-Charge. He shall obtain complete instruction about the materials and proportion to be used, slump, workability, quantity of water per unit weight of cement, number of test cubes to be taken, type of finishing to be done, any admixture to be added, any limitation on size of pour and stopping of in case of premature stopping of pours.

Before pouring any concrete the reinforcement steel, shuttering, staging, inserts etc. are to be got checked by the Engineer-In-Charge of EPI, to be recorded in the stage passing register and to be got signed by Engineer-In-Charge of EPI. Quality of stone chips, sand etc. and availability of the same in adequate quantity shall also to be got checked by Engineer-In-Charge of EPI.

6.4 MIXING OF CONCRETE

All concrete shall be mixed in a mechanically operated mixer of minimum capacity of 14 / 10 and including mechanically operated hopper capable of ensuring of uniform distribution of the materials throughout the mass. The proportion of fine and coarse aggregate, cement and water shall be as determined by the mix design or according to the fixed proportions in case of nominal mix concrete and shall be approved by the Engineer-in-Charge. The quantities of cement, fine aggregate and coarse aggregates shall be determined by weight. The water shall be measured accordingly after giving proper allowance for surface water present in the aggregate for which regular check shall be made by the contractors.

Water shall not be added to the mix until all the cement and aggregates constituting the batch are already in the drum and dry mixed for at least one minute. Mixing of each batch shall be continued until there is a uniform distribution of the materials but in no case shall mixing be done for less than two (2) minutes and at least forty (40) revolutions after all materials and water are in the drum. When absorbent aggregates are used or when the mix is very dry, the mixing time shall be extended as be directed by the Engineer-in-Charge. Mixer shall not be loaded above their rated capacity as it prevents thorough mixing. If there is segregation after unloading from the mixer the concrete should be remixed.

The entire contents of the drum shall be discharged before the ingredients for the next batch are fed into the drum. No partly set or remixed or excessively wet concrete shall be used and it shall be immediately removed from the site. Each time the work stops, the mixer shall be thoroughly cleaned and when the next mixing commences, the first batch shall have 10% additional cement at no extra cost to the owner to allow for loss in the drum.
6.5 PLACEMENT OF CONCRETE

Form work and reinforcement shall be approved in writing by the Engineer-in-Charge before concrete is placed. The forms shall be well wetted and all shavings, dirt and water that may have collected at the bottom shall be removed before concrete is placed. Concrete shall be deposited in its final position without segregation, re-handling or flowing. The interval between adding the water to the dry materials in the mixer and the completion of the final placing including compaction of the concrete shall be well within the initial setting time for the type of cement in use or as directed by the Engineer-in-Charge.

As far as possible, concrete shall be placed in formwork by means approved by the Engineer-in-Charge and shall not be dropped from a height or handled in a manner which may cause segregation. Any drop over 180 cm shall be approved by the Engineer-in-Charge. Once the concrete is deposited in its final position, it shall not be disturbed. Care should be taken to avoid displacement of reinforcement or movement of form work.

The placing of concrete shall be a continuous operation with no interruption in excess of 30 minutes between the placing of continuous portions of concrete.

After the concrete has been placed it shall be spreaded and thoroughly compacted by approved mechanical vibration to a maximum subsidence without segregation and thoroughly worked around reinforcement or other embedded fixtures to correct form and shape. Vibrators shall not be used for pushing and shoveling concrete into adjoining areas. Vibrators must be operated by experienced men and over-vibration shall not be permitted. Hand tamping in some cases may be allowed subject to the approval to ensure that the inserts, fixtures, reinforcement and form work are not displaced or disturbed during placing of concrete. No concrete shall be placed in open while washing of cement and sand, the concrete shall be entirely removed immediately. Suitable precautions shall be taken in advance to guard against rains before leaving the fresh concrete unattended. No accumulation of water shall be permitted on or around freshly laid concrete. Slabs, Beams and similar members shall be poured in one operation normally. In special circumstances with the permission of Engineer-in-Charge these can be poured in horizontal layers not exceeding fifty (50) cm in depth. When poured in layers, it must be ensured that the under layer, is not already hardened. Bleeding of under layer if any, shall be effectively removed. Moulding, throating, drip courses, etc., shall be poured as shown in the drawing or as desired by the Engineer-in-Charge. Holes shall be left in concrete as shown on the approved drawings or as directed by the Engineer-in-Charge.

Whenever vibration has to be applied externally the design of formwork and the disposition of vibrators shall receive special consideration to ensure efficient compaction and to avoid surface blemishes.

6.6 CONSTRUCTION JOINTS

Whenever work is to be interrupted, the concrete shall be rebated at the joint to such shape and size as may be required by the Engineer-in-Charge or shown on the drawings. All vertical construction joints shall be made with stop boards, which are rigidly fixed and slotted to allow for the passage or reinforcement steel. If desired by the Engineer-in-Charge, keys and or dowel bars shall be provided if so specified on the drawings or
desired by the Engineer-in-Charge. Constructions joints shall be provided in positions as shown or described, the joints shall be in accordance with following:

i) In a column, the joint shall be formed about 75 mm below the lowest soffit of the beams framing into it.

ii) Concrete in a beam shall be placed throughout without a joint, but if the provision of a joint is unavoidable, the joint shall be vertical and at the middle of the span.

iii) A joint in a suspended floor slab shall be vertical, at one of the quarter points of the span and at right angle to the principal reinforcement.

iv) In forming a joint, concrete shall not be allowed to slope away to thin edge. The locations of construction joints shall be planned by the contractor well in advance of pouring and shall be got approved from the Engineer-in-Charge.

v) Construction joints in foundation of any equipment shall not be provided without specific concurrence of the Engineer-in-Charge.

vi) Before fresh concrete is placed, the cement skin of the partially hardened concrete shall be thoroughly removed and surface made rough by hacking, sand blasting, water jetting, air jetting or any other methods as directed by Engineer-in-Charge. The rough surface shall be thoroughly wetted for about two hours and shall be dried and coated with 1:1 freshly mixed cement sand slurry immediately before placing the new concrete. The new concrete shall be worked against the prepared surface before the slurry etc. Special care shall be taken to see that the first layer of concrete placed after a construction joint is thoroughly rammed against the existing layer. Old joints during pour shall be treated with 1:1 freshly made cement sand slurry only after removing all loose materials.

6.7 REPAIR AND FINISHES TO CONCRETE

All concrete surface either cast-on-situ or pre-cast shall have even, clean finish, free from honey combs, air bubbles, fine or other blemishes. The formwork, joint marks for concrete work exposed to view shall be rubbed out with carborundum stone and defects patched up with a paste of 1 part sand and 1 part cement and cured. The finish shall be made to the satisfaction of the Engineer-in-Charge.

Concrete surface to be subsequently plastered or where brickwork shall be build against it shall be adequately hacked as soon as the form is stripped off so that proper bond can develop.

6.8 CURING AND PROTECTION OF CONCRETE

Newly placed concrete shall be protected by approved means from rain, sun & wind. Concrete placed below ground level shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free
from contact with such ground or with water draining from such ground during placing of concrete for a period of at least three days or as otherwise instructed by the Engineer-in-Charge. The ground water around newly poured concrete shall be kept to an approved level by pumping or other approved means of drainage. Adequate steps shall be taken to protect immature concrete from drainage by debris, excessive loading, vibration etc., which may impair the strength and durability of the concrete.

All fresh concrete shall be covered with a layer of Hessian or similar absorbent materials, and kept constantly wet for a period of fourteen days or more from the date of placing of concrete as per directions of the Engineer-in-Charge. Curing can also be done by ponding. Concrete slabs and floors shall be cured by flooding with water of minimum 25 mm depth for the period mentioned above. Steps shall also be taken to protect immature concrete from damage by debris, excessive loading, vibrations, abrasion, deleterious ground water, mixing with earth or foreign materials, floatation etc. that may impair the strength and durability of the concrete. Approved curing compounds may be used in view of moist curing with the permission of the Engineer-in-Charge. Such compounds shall be applied to all the exposed surfaces of the concrete as soon as possible after the concrete has set.

6.9 TESTING AND ACCEPTANCE CRITERIA

The contractor shall carry out all sampling and testing in accordance with the relevant Indian Standards at his own cost, in a laboratory approved by the Engineer-in-Charge.

6.9.1 TESTING OF CONCRETE

a) Normally, only compression tests shall be performed but the Engineer-in-Charge may require other tests to be performed in accordance with IS: 516 (Latest Edition).

b) The minimum frequency of sampling for each grade of concrete shall be as follows:

<table>
<thead>
<tr>
<th>Quantity of concrete in the work cu.m</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 5</td>
<td>1</td>
</tr>
<tr>
<td>6 – 15</td>
<td>2</td>
</tr>
<tr>
<td>16 – 30</td>
<td>3</td>
</tr>
<tr>
<td>31 – 50</td>
<td>4</td>
</tr>
<tr>
<td>51 &amp; above</td>
<td>4 plus one additional sample for each additional 50 cu.m or part thereof.</td>
</tr>
</tbody>
</table>

However at least one sample shall be taken from each shift.

At least 6 (six) specimens per sample shall be taken and 3 (three) of these shall be tested at 7 (seven) days and the remaining at 28 days. Minimum compressive strength on 15 cm cubes of different grades of concrete at 7 days shall be as per table 5 of IS: 456-1978.
a) To control the consistency of concrete from every mixing plant, slump test and or compaction factor test in accordance with IS: 1199 shall be carried out by the contractor every two hours or as directed for the test specimens and shall be recorded for reference. The Engineer-in-Charge may, at his discretion, may waive the above tests for small and unimportant concreting.

6.9.2 ACCEPTANCE CRITERIA FOR CONCRETE

a) The acceptance criteria for concrete shall be in accordance with IS: 456 (Latest Edition). However, in exceptional circumstances, the Engineer-in-Charge may, at his discretion, accept a concrete of lower strength than specified and which is otherwise unacceptable according to IS: 456 (Latest Edition).

b) Payment for concrete which is normally unacceptable as per the criteria laid down in IS: 456, but has been accepted by the Engineer-in-Charge shall be made at a reduced rate prorate to the strength obtained.

c) Concrete work found unsuitable for acceptance shall have to be dismantled and replacement is to be done as per specification by the contractor. No payment shall be made for the dismantled concrete, the relevant formwork and reinforcement, embedded fixtures, etc. wasted in the dismantled portion. If any damage is done to the embedded portion or adjacent structures, the same shall be made good, free of charge by the contractor, to the satisfaction of the Engineer-in-Charge.

6.9.3 LOAD TEST OF CONCRETE

Load test on concrete, if desired by the Engineer-in-Charge, shall be carried out as soon as possible after expiry of 28 days from the time of placing of concrete as per IS : 456. Entire cost of load testing shall be borne by the contractor and if, any portion of the structure is found unacceptable under the relevant clause of IS: 456, the same shall be dismantled and replaced by a new structure as per specification at no extra cost. If the adjacent structure gets damaged, the same shall be made good, free of charge by the contractor to the satisfaction of the Engineer-in-Charge.

7.0 FORMWORK

If it is so desired by the Engineer-in-Charge, the contractor shall prepare before commencement of the actual work, design and drawings for formwork and centering and get them approved by the Engineer-in-Charge. The formwork shall conform to the shape, line and dimensions as shown on the drawings.

Formwork shall be of laminated shuttering plywood of minimum 12 mm thickness as per BIS for columns and beams etc. and of laminated shuttering plywood of minimum 12 mm thickness as per BIS and or welded steel plates of uniform pattern for slabs. Struts shall generally be of mild steel tubes and strong sal ballis 150 mm or above in diameter. Bamboos, small diameter ballis, etc., shall not be used unless approved by the Engineer-in-Charge in specific cases.

Supports or props should not be put on any un-propped lower suspended floor or beam unless calculations are submitted to the Engineer-in-Charge to confirm the strength of the
lower floor beam and no propping shall be taken out until the Engineer-in-Charge’s approval has been obtained.

The centering shall be true and rigid and thoroughly braced both horizontally and diagonally. The forms shall be sufficiently strong to carry without undue deformation, the dead weight load. Where the concrete is vibrated the form work shall be strong enough to withstand the effects of vibration without appreciable deflection, bulging, distortion or loosening of its components. The joints in the form work shall be sufficiently tight to prevent any leakage of mortar. The form work shall be such as to ensure a smooth uniform surface free from honeycombs, air bubbles, bulges, fins and other blemishes. Any blemish or defect found on the notice of the Engineer-in-Charge immediately and rectified free of charge as directed by him. To achieve the desired rigidity tie bolts, spacer blocks, the wires clamps as approved by the Engineer-in-Charge shall be used but they must in no way impair the strength of concrete or leaves stains or marks on the finished surface. Where there are chances of these fixtures being embedded, only mild steel or concrete of adequate strength shall be used. Bolts passing completely through liquid retaining walls/slabs for the purpose of security and aligning the form work should not be used.

For exposed interior and exterior concrete surface of beams, columns and walls, plywood or other approved forms thoroughly cleaned and tied together with approved corrosion-resistant device shall be used. All floor and beam centering shall be crowned not less than 8 mm in all direction for every 5.0 meters span. Unless described on the drawing or to the contrary beveled strips 25 mm by 25 mm shall be provided, without any extra charge, to form angles and in corners of column and beam boxes for chamfering of corners. Temporary openings for cleaning, inspection and for pouring concrete shall be provided where they are necessary and as may be directed by the Engineer-in-Charge. The temporary opening shall be so formed that they can be conveniently closed when required and must not leave any mark on the concrete.

7.1 CLEANING AND TREATMENT OF FORMS

All forms shall be thoroughly cleaned of old concrete, wood shaving, saw dust, dirt and dust sticking to them before they are fixed in position. All rubbish loose concrete, chippings, shavings, saw dust etc., shall be scrupulously removed from the interior of the forms before the concrete is poured as directed by the Engineer-in-Charge.

Before shuttering is placed in position, the form surface in contact with concrete shall be treated with approved non-staining oil or composition. Care shall be taken that the oil or composition does not come in contact with reinforcing steel or existing concrete surfaces. It shall not be allowed to accumulate at the bottom of the shuttering.

The form work shall be so designed and so erected that the forms for slabs and the sides of beams, columns and walls may be removed first, leaving the shuttering to the soffits of beams and their supports in position. Supporting of beams shall not be done except with the approval of the Engineer-in-Charge and props can be reinstated in anticipation of abnormal conditions. If form work for column is erected for the full height of the columns, one side shall be left open and built up in section as placing of concrete proceeds. Wedges, spacer bolts, clamps or other suitable means shall be provided to allow accurate adjustments of the form work and to allow it to be removed gradually without disturbing the concrete.
7.2 **REMOVAL OF FORMS**

The contractor shall begin the removal of form work only after approval of Engineer-in-Charge. He shall place on record the date on which the concrete is placed in different parts of the work and the date of the removal of form work there from. This record shall be checked and countersigned by the Engineer-in-Charge. The contractor shall be responsible for the safe removal of form work but the Engineer-in-Charge may delay the time of removal if he considers it necessary. Any work showing signs of damage through premature removal of form work or loading shall be entirely removed of form work or loading shall be entirely reconstructed without any extra cost to owner.

Forms for various types of structural components shall not be removed before the minimum periods specified in IS: 456 (latest edition) which shall also be subject to the approval of the Engineer-in-Charge.

However, in any case, form work shall not be struck until the concrete has reached a strength at least twice the stress to which the concrete may be subjected at the time of removal of forms.

The number of props left under, their sizes and disposition shall be such as to be able to safely carry the full dead load of the slab, beam or arch as the case may be together with any live load likely to accrue during or further construction.

Where the shape of the element is such that the form work has re-entrant angles, the form work shall be removed as soon as possible after the concrete has set to avoid shrinkage cracks occurring due to the restraint imposed.

The form work shall be so made as to produce a finished concrete, true to shape, lines, levels, plumb and dimensions as shown in drawings.

7.3 **RE – USE OF FORMS**

Before re–use all forms shall be thoroughly scrapped, cleaned, joints etc., examined and when necessary repaired and inside surface treated as specified herein before. Formwork shall not be used/ re-used if declared unfit or unserviceable by the Engineer-in-Charge.

8.0 **FABRICATION AND PLACEMENT OF REINFORCEMENT STEEL**

The contractor shall prepare and furnish to EPIL bar-bending schedule with working drawings for all R.C.C. works for review and approval by the Engineer-in-Charge. No work shall be commenced without the approval of the bar-bending schedule by the Engineer-in-Charge.

The contractor shall supply, fabricate and place the reinforcement steel to shapes and dimensions as per drawings and specifications.

Any adjustment of reinforcement to suit field conditions, construction joints other than those shown on drawings shall be subject to approval of the Engineer-in-Charge.
8.1 CLEANING

Before placing the concrete all steel for reinforcement shall be made free from loose scale, rust, oil, grease, paint or any other harmful matter which may effect its bond with concrete.

8.2 BENDING

Unless otherwise specified, reinforcing steel shall be bent in accordance with procedure specified in IS: 2520 and or as approved by the Engineer-in-Charge. Bends and shapes shall comply strictly with the dimensions given in the approved Bar Bending schedule. Bending schedule shall be rechecked by the contractor before bending and he shall be entirely responsible for its correctness.

No reinforcement steel shall be bent when in position in the work without approval of Engineer-in-Charge, whether or not it is partially embedded in concrete. Bars shall not be straightened in manner that will injure the material. Re-bending can only be done if approved by the Engineer-in-Charge. Reinforcement bars shall be bent by machine or other approved means producing a gradual and even motion.

8.3 PLACING IN POSITION

All reinforcement shall be accurately fixed and maintained in position as shown on the drawings by such approved means as steel chairs and or concrete spacer blocks. Bars intended to be in contact at crossing points shall be securely bound together at all such points by two number No. 20G annealed soft iron wire.

Binders shall tightly embrace the bars with which they are intended to be in contact and shall be securely held. The vertical distance between successive layers of bars shall be maintained by provision of steel spacer bars. They should be so spaced that the main bars do not sag perceptively between adjacent spacers.

The placing of reinforcement steel shall be completed well in advance of concrete pouring. Immediately before pouring, the reinforcement steel shall be checked by the Engineer-in-Charge for accuracy of placement and cleanliness and necessary corrections as directed by him shall be carried out. The concrete cover over the reinforcement shall be as shown on the approved drawings unless otherwise directed by the Engineer-in-Charge. Care should be taken to ensure that projecting ends of ties and other embedded metal do not encroach into the concrete cover. Where concrete blocks are used for ensuring the cover and positioning reinforcement, they shall be made of mortar 1:2 (one part cement: two parts sand) by volume and cured for at least 7 days. The sizes and locations of the concrete blocks shall be approved by the Engineer-in-Charge. Laps and anchorage lengths of reinforcing bars shall be in accordance with IS:456, unless otherwise specified. If the bars in a lap are not of the same diameter, the smaller will guide the lap length. The laps shall be staggered as far as practicable and as directed by the Engineer-in-Charge, and not more than 50% of bars shall be lapped at particular section.

9.0 BRICK WORK
9.1 SCOPE

This specification covers furnishing, installation, repairing, finishing, curing, protection, maintenance and handing over of masonry works for use in structures and at locations covered under the scope of the contract.

9.2 GENERAL

All masonry work shall be true to lines and levels as shown on drawings. All masonry shall be tightly built against structural members and mounded with dowels, inserts etc., as shown on drawings.

9.3 MORTAR

Mortar for brick work except for half brick or lower thickness walls shall generally be in 1 part cement and 5 parts sand by volume unless otherwise stated. Mortar for half brick and lower thickness brick walls shall be 1 part cement and 4 parts sand by volume unless stated otherwise.

The unit of measurement for cement shall be a bag of cement weighing 50 Kg. and this shall be taken as 0.035 cu.m. Other ingredients in specified proportions shall be measured in boxes of suitable size. Sand shall be measured on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulkage.

Cement and sand shall be mixed dry thoroughly on clean approved platform and water shall then be added to obtain a mortar of the consistency of a stiff paste, care being taken to add just sufficient water for the purpose. Mortar shall be used as early as possible after mixing and before it has begun to set and in any case within 30 minutes after water is added to dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from site of work.

9.4 LAYING

Brick shall be soaked by submergence in clean water for at least 6 hours in approved vats before use. The contractor shall provide tanks of sufficient capacity to allow the specified immersion. Bricks shall be laid in water by hand and not thrown. The bricks shall not be too wet at the time of use, as they are likely to slip on the mortar bed and there will be difficulty in ensuring plumbness of the wall. Bricks shall be laid in English bond unless specified otherwise. Broken bricks shall not be used. Cut bricks shall be used if necessary to complete bond or as closers. Bricks shall be laid with frogs upwards over full mortar beds. Bricks shall be pressed into mortar and tapped into final positions so as to be embed fully in mortar. Inside faces shall be buttered with mortar before the next brick is placed and pressed against it. Thus all joints between bricks shall be fully filled with mortar. Mortar joints shall be kept uniformly 10 mm thick. All joints on face shall be raked to minimum 10 mm depth using raking tool while the mortar is still green to provide bond for plaster or pointing. Where plaster or pointing is not provided, the joints shall be struck flush and finished immediately. Brickwork of two bricks thick or more shall have both faces in true plane. All brickwork shall be built tightly against columns, floor slabs or structural parts, around window and door frames with proper distance to permit caulked joint.

In half brick work 02 Nos. 6 mm dia MS bar to be provided in every 4th course.
9.5 CURING OF MASONRY WORK

Masonry shall be cured by keeping it wet for seven days from the date of laying. In dry weather at the end of days work top surface of masonry shall be kept wet by ponding.

10.0 STONE WORK

10.1 STONE

The stone shall be of granite, trap, limestone, sandstone, quartzite etc. and shall be obtained from quarries approved by Engineer-in-Charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and others similar defects that may adversely affect the strength and appearance. As far as possible stone shall be of uniform colour and texture. Generally stones shall not contain crypst crystalline silica or chart, mica and other deleterious materials like iron oxides, organic impurities etc.

10.2 SIZE OF STONE

Normally stone used should be small enough to be lifted and placed by hand. Unless otherwise indicated the length of stone shall not exceed 3 times the height and the breadth or base shall not be greater than three-fourth of the thickness of the wall or not less than 15 cm. The height of stone may be upto 30 cm.

10.3 LAYING

All stone shall be wetted before use. Each stone shall be placed closed to the stone already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face stone shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided.

10.4 BOND STONE

At least one bond stone or a set of bond stones shall be provided for every 0.5 sqm of area of wall surface. All the bond stones should be marked suitably with paint as directed by Engineer-in-Charge.

11.0 PLASTER WORK

11.1 SCOPE

This specification covers furnishing, installation, repairing, finishing, curing, testing, protection, maintenance till handing over, of plastering to masonry and concrete. Before commencing work on the finishing items the contractor shall obtain the approval of the Engineer-in-Charge regarding the scheduling of work to minimize damage by other contractors. He shall also undertake normal precautions to prevent damage or disfiguration to work of other contractors and other installations.
11.2 **PREPARATION OF SURFACE**

All joints in masonry walls be raked out to a depth of at least 10 mm with a hooked tool made for the purpose while the mortar is still green. Walls shall be brushed down with stiff wire brush, to remove all loose dust from the joints and thoroughly washed with water.

For all types of work the base cement concrete slab or masonry surface shall be roughened by chipping and cleaned of all dirt, grease or loose particles by hard brush and water. The surface shall be thoroughly moist to prevent absorption of water from the base course. Any excess of water shall be mopped up.

Prior to commencement of actual work, the approval of the Engineer-in-Charge shall be taken as to the acceptability of the base.

11.3 **MORTAR**

Mortar for plastering shall be as specified in the drawings and in the schedule of finishes. For sand cement plaster, sand and cement in the specified proportion shall be mixed dry on a water tight platform and minimum water added to achieve working consistency.

No mortar which has stood for more than half an hour shall be used, mortar that shows tendency to become dry before this time shall have water added to it.

11.4 **INTERNAL WALL PLASTER**

This plaster shall be laid in a single coat of 12 mm thickness with cement mortar 1:6 (1 cement : 6 fine sand). The mortar shall be dashed on the prepared surface with a trowel and finished smooth by trowel on the surface. Internal wall plaster shall be carried out on jambs, lintel and sill faces, top and undersides etc., as shown in the drawing or as directed by the Engineer-in-Charge.

11.5 **INTERNAL CEILING PLASTER**

Ceiling plaster shall be laid in a single coat of 6 mm thickness with cement mortar 1:3 (1 cement : 3 fine sand) applied before wall plaster.

11.6 **EXTERNAL PLASTER**

Exterior plaster shall be carried out in 2 layers, the first layer being 12 mm thick and the second layer being 6 mm thick. The first layer shall be dashed against the prepared surface with trowel to obtain an even surface. The second layer shall then be applied and finished leaving an even and uniform surface, trowel finished unless otherwise directed by the Engineer-in-Charge.

11.7 **APPLICATION OF PLASTER**

Plaster when more than 12 mm thick, shall be applied in two coats, i.e., a base coat followed by the finishing coat. Thickness of the base coat, however, shall not exceed 12 mm in thickness. The lower coat shall be thicker than the upper coat. The overall thickness of the coat shall not be less than the minimum thickness shown on the drawings. The under coat shall be allowed to dry and shrink before applying the second
coat of plaster. The under coat shall be scratched or roughened before it has fully hardened to form a mechanical key. The method of application shall be ‘thrown on’ rather than ‘applied to trowel’.

To ensure even thickness and true surface, patches of plaster about 100 mm to 150 mm square or wooden screed 75 mm wide and of the thickness of the plaster shall be fixed vertically about 2000 mm to 3000 mm apart to act as gauges. The finished wall surface shall be true to plumb, and the contractor shall, without any extra cost to the owner, make up irregularity in the brick work with plaster. All verticals edges of brick pillars, door jambs etc., shall be chamfered or rounded off as directed by the Engineer-in-Charge. All drips, grooves, moldings and cornices as shown on the drawing or instructed by the Engineer-in-Charge shall be done with special care to maintain true lines, levels and profiles. After the plastering work is complete, all debris shall be removed and the area left clean. Any plastering that is damaged shall be repaired and left in good condition at the completion of the job.

12.0 FINISH

Wherever any special treatment to the plastered surface is indicated, the work shall be done exactly as shown on the drawings, to the entire satisfaction of the Engineer-in-Charge regarding the texture, colour and finish.

12.1 STANDARD FINISH

Wherever punning is indicated, the interior plaster shall be finished rough. Otherwise the interior plaster shall generally be finished to a smooth surface. The exterior surface shall generally be finished with a wooden float.

12.2 NEAT CEMENT FINISH

Immediately after achieving a true plastered surface with the help of a wooden straight edge, the entire area shall be uniformly treated with a paste of neat cement at the rate of one Kg per sq.m. and rubbed smooth with a trowel.

12.3 CURING

Curing of plaster shall be started as soon as the applied plaster has hardened enough so as not to get damaged. The Engineer-in-Charge will give the decision as to when the plaster has hardened in. Curing shall be done by continuously applying water in a fine spray and shall be carried out at least 7 days. Each individual coat of plaster shall be kept damp continuously for a minimum two days.

12.4 WATER PROOFING ADMIXTURES

The contractor shall use approved water proofing admixtures made of approved manufacturer in the mortar for external plaster work. The quantity to be used etc., shall be in accordance with the manufacturer’s instructions, however, subject to approval of the Engineer-in-Charge. These admixtures shall not contain calcium chloride unless specifically allowed by the Engineer-in-Charge and shall conform to IS : 2645.
12.5 **ACCEPTANCE CRITERIA**

Finish to masonry and concrete shall fully comply with the drawings, specifications, approved samples and instructions of the Engineer-in-Charge with respect to lines, levels, thickness, colour, texture, pattern and any other special criteria as mentioned in the specification or as shown on the drawing.

13.0 **FLOORING**

13.1 40 mm thick marble chips flooring rubbed and polished to granolithic finish, under layer 25 mm thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size) and top layer 15 mm thick with white, black, chocolate, grey, yellow or green marble chips of sizes from 1 mm to 4 mm nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble powder) by weight in proportion of 4:7 (4 cement marble power mix : 7 marble chips) by volume including cement slurry etc complete with medium shade pigment with ordinary cement.

13.2 **KOTA STONE FLOORING / SKIRTING**

a) **Material:** All the kota stone slab shall be of selected quality, hard, sound, dense and homogenous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to be requisite thickness. They shall be of the colour indicate in the drawing or as instructed by the Engineer-in-Charge.

The slab shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slab shall be conform to the size required. Before starting the work the successful bidder shall get the sample of slabs approved by Engineer-in-Charge.

b) **Laying:**

Mortar of specified mix shall be spread under the area of each slab, roughly to the average thickness specified in the items. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped with wooden mallet and brought to the level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar then shall be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4Kg of cement per sqm. The edges of the slab already paved shall be buttered with grey cement, with admixture of pigment to match the shade of the slab including polishing and finishing complete.

13.3 **NON-SKID CERAMIC TILES**

Tiles shall be of 1st quality conforming to IS: 15622, of minimum size 300 mm x 300mm minimum 7 mm thick unless otherwise indicated in the schedule of finishes and drawing. The tile shall be laid over 20 mm thick cement mortar 1:4 over neat cement slurry @ 3kg per sqm over RCC slab including filling joints with neat white cement slurry mixed with pigment to match the color of tiles. The color and shade of the tiles shall be as directed by Engineer-in-Charge. The tile shall be of approved make.
13.4 **GLAZED TILES IN SKIRTING / DADO**

The tiles shall be 1st quality conforming to IS: 15622 of minimum thickness of 5 mm and of size as mentioned in the drawing / finishing schedule. The colour shall be got approved by Engineer-in-Charge of EPI. The tile shall be sound, true to shape, flat and free from flaws and other manufacturing defects affecting their utility. The tiles shall be laid over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and joining with grey cement slurry @ 3.3 kg / sqm including pointing in white cement mixed with pigment of matching shade.

14.0 **PROPERTIES, STORAGE AND HANDLING OF COMMON BUILDING MATERIALS**

14.1 **SCOPE**

The scope of this section is to specify the properties, storage and handling of common building materials unless otherwise mentioned in the drawings or schedule of items.
14.2 GENERAL

The whole of the materials to be mobilized in connection with the permanent work of the contact must be new and of good quality and description of their respective kinds and shall be approved by the Engineer-in-Charge.

Except where otherwise specified or permitted by the EPIL, all materials shall conform to the latest edition of the Bureau of Indian Standards. The initials ‘I.S./’BIS’ followed by a number in any of the contract document shall refer to the relevant Indian Standards and current at the date of tendering including all amendments published before that date.

Before ordering materials of any description, the bidders shall submit to the Engineer-in-Charge the names or suppliers proposed and shall obtain approval in writing from the Engineer-in-Charge of the supplier from whom he proposes to obtain such materials. Should the Engineer-in-Charge at any time be not satisfied with the methods of operations carried on at any supplier’s works or place of business, he shall have the power to cancel his previously given consent to obtaining any material from such suppliers.

15.0 WATER PROOFING TREATMENT ON ROOF SLAB

1. The water proofing treatment of roof slabs shall be as given below:

a) For flat roof prior to water proof treatment grading of slope 1:80 is to be provided with screed concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 12 mm nominal size) with minimum thickness of 25 mm near rain water drainage pipe.

b) Inaccessible Roof: Providing and laying APP (Atactic Polypropylene Polymer) modified pre fabricated five layer, 3 mm thick water proofing membrane black finished reinforced with polyester / glass fibre matt. The membrane to be laid over a coat of bitumen primer by using butane torch and finally painted with two coat of aluminum paint of approved make. The laying of the membrane to be done as per the specifications provided by the manufacturer.

Approved Manufacturers: Bitumat Co. Ltd., Pidilite, General Membrane, Tamko, STP Ltd., Tixsa India Ltd.

c) Accessible Roof: Providing and laying APP (Atactic Polypropylene Polymer) five layer, 3 mm thick water proofing membrane black finished reinforced with polyester / glass fibre matt. The membrane to be laid over a coat of bitumen primer by using butane torch and finally overlaid with 40 mm thick concrete screed 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 12 mm nominal size). The laying of the membrane to be done as per the specifications provided by the manufacturer.

Approved Manufacturers: Bitumat Co. Ltd., Pidilite, General Membrane, Tamko, STP Ltd., Tixsa India Ltd.

c) Water proofing treatment for roof slab shall be carried out by an approved specialized firm. Ten years guarantee shall be given by the specialized firm and the contractor on non-judicial stamp paper of Rs. 50.00 (Rupees fifty only) for the effectiveness of water proofing treatment.
16.0 WATER PROOFING TREATMENT ON SUNKEN PORTION

Providing and laying water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C., kitchen and the like consisting of:

i) 1st course of applying cement slurry @ 4.4 Kg/sqm mixed with water proofing compound ‘Imperno’ of Snowcem or equivalent conforming to IS : 2645 in recommended portions.

ii) 2nd course of 20 mm cement plaster 1:3 (1 cement : 3 coarse sand) mixed with water proofing compound in recommended proportion.

iii) 3rd course of applying blown or residual bitumen applied hot at 1.7 Kg. per sqm of area.

iv) 4th course of 400 micron thick PVC sheet. (Overlaps at joint of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 Kg/sqm.).

Water proofing treatment for sunken portion shall be carried out by a approved specialized firm. Ten years guarantee shall be given by the specialized firm and the contractor on non-judicial stamp paper of Rs. 50.00 (Rupees fifty only)

17.0 EXPANSION / ISOLATION / SEPARATION JOINTS

17.1 GENERAL

Expansion / Isolation / separation joints in concrete and masonry structure shall be provided at specified places, as per detail indicated in the drawings. The material and types of joints shall be as specified herein after. In case of liquid retaining structures, additional precautions shall be taken to prevent leakage of liquids as may be specified in the drawings or as directed by the Engineer-in-Charge. All materials are to be procured from reliable manufacturers and must have the approval of the Engineer-in-Charge. The Engineer-in-Charge may demand test certificates for the materials and or instruct the contractor to get them tested in an approved laboratory at no extra cost to the owner. Joints shall be formed true to line, level, shape, dimension and quality as per drawings and specifications. Prior approval of the method of forming the joints shall be obtained from the Engineer-in-Charge before starting the work.

17.2 BITUMEN BOARD / EXPANDED POLYSTRENE

17.2.1 BITUMEN BOARD

Bitumen impregnated fibre board of approved manufacturer as per IS : 1838 may be used as filler for expansion joints. It must be durable and waterproof. It shall be compressible and possess a high degree of rebound. The dimensions of the board shall be equal to that of the joints being formed. It shall, preferably be manufactured in one piece, matching the dimensions of the joints and not prepared by cutting to size smaller pieces from larger boards at site.

If required, commercial quality of expanded polystyrene products commonly used for commercial insulations may also be used as filler materials in expansion joints. The
thickness may vary from 12 mm to 50 mm. The material shall have to be procured from reliable manufacturers as approved by the Engineer-in-Charge. The method of installation shall be similar to that recommended by the manufacturers. A coat of Bitumen paint may have to be applied on the board against which concrete will be placed.

17.2.2 JOINT SEALING STRIPS

Joint sealing strips may be provided at the construction, expansion and isolation joints as a continuous diaphragm to contain the filler material and or to exclude passage of water or any other material into or out of structure. The sealing strips shall be either metallic like G.I. aluminum or copper, or non-metallic like rubber or PVC.

Sealing strips shall not have any longitudinal joint and shall be procured and installed in largest practicable lengths having a minimum number of transverse joints.

The material is to be procured from reputed manufacturers having proven record of satisfactory supply of joints strips of similar make and shape for other jobs. The jointing procedure shall be as per the manufacturer’s recommendations, revised if necessary by the Engineer-in-Charge. The contractor is to supply all labour and material for testing, protection etc.

17.2.3 METAL SEALING STRIPS

Metal sealing strips shall be either G.I., Aluminum or Copper and formed straight, U shaped, Z shaped or any other shape and of thickness as indicated in the drawings and schedule of finishes and or as instructed by the Engineer-in-Charge.

The transverse joints shall be welded using brass rods and approved fix and shall be tested by method approved by the Engineer-in-Charge to establish that it is leak proof. In case it is found that the joints can not be made leak proof, longer lap lengths and different method of brazing which will render it leak proof, shall be adopted by the contractor without any additional cost to the owner. The edges shall be neatly crimped and bent to ensure proper bond with the concrete.

17.2.4 G.I. STRIPS

G.I. Strips shall be minimum 18 gauge thick and 200 mm in width unless specified otherwise. The standards of galvanizing shall be as per relevant Indian Standard for heavy duty work.

The strips shall be strong, durable, without any rust or grease. At the joints the over –lapping shall be for a minimum length of 50 mm.

17.2.5 ALUMINUM STRIPS

Aluminum strips shall be minimum 18 swg thick 300 mm width unless specified otherwise and shall conform to IS : 737 of 19000 grade or 31000 grade (Designation as per IS : 6051). A minimum lap of 50 mm length, if required shall be provided at the joints.
17.2.6 COPPER STRIPS

The copper strips shall be minimum 18 swg in thickness and 300 wide unless specified otherwise and shall conform to relevant Indian Standards.

It shall be cleaned thoroughly before use to expose fresh surface, without any reduction in gauge. A minimum lap of 50 mm in length, if required, shall be provided at the joints.

18.0 DAMP PROOF COURSE (DPC)

It shall consists of a layer of cement concrete of proportions 1:2:4 (1 cement : 2 coarse sand : 4 grades stone aggregate of 12 mm nominal size) and of thickness 40 mm.

Cement concrete shall be, admixed with integral water proofing compound in specified proportion as per manufactures instructions. The proportions of water proofing compound shall not exceed 3% by weight of cement. Cement concrete laying shall be thoroughly compacted to dense impervious mass, be cured at least 7 days.

19.0 PLINTH PROTECTION AND DRAIN

It shall be provided around the building as per drawing.

20.0 SYNTHETIC ENAMEL PAINT

Shall be made from synthetic designs and drying oil with rutile titanium dioxide and other selected pigments to give a smooth, hard, durable and glossy finish to all exterior and interior surfaces. The paint shall conform to IS : 2932 and IS : 2933.

21.0 WATER PROOF CEMENT PAINT

Shall be made from good quality white cement and lime resistant colours with accelerators, waterproofing agents and fungicides. The paint shall conform to IS : 5410.

22.0 ACRYLIC EMULSION PAINT

Shall be water based acrylic copolymer emulsion with rutile titanium dioxide and other selected pigments and fungicide. It shall exhibit excellent adhesion to plaster and cement surface and shall resist deterioration by alkali salts. The paint film shall allow the moisture in wall to escape without peeling or blistering. The paint, after it is dried, should be able to withstand washing with mild soap and water without any deterioration in colour or without showing flaking, blistering or peeling.

23.0 OIL BOUND DISTEMPER

Oil bound distemper (IS : 428 -1969) of approved brand and manufacturer shall be used. The primer where used be cement primer or distemper primer. These shall be of same manufacturers as that of distemper. The distemper shall be diluted with prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day’s work shall be prepared.
24.0 **WHITE WASHING**

Shall be done from pure shell lime or fat lime, or a mixture of both as instructed by the Engineer-in-Charge, and shall conform to IS : 712 latest edition. Samples of lime shall be submitted to the Engineer-in-Charge for approval and lime as per approved sample shall be brought to site in unslaked condition. After slaking it shall be allowed to remain in a tank of water for two days and then stirred up with a pole until it attains the consistency of thin cream. 100 grams of gum to 6 litres of white wash water and little quantity of indigo of synthetic ultramarine blue shall be added to the lime.

25.0 **DOOR, WINDOW AND VENTILATOR**

25.1 **STEEL DOOR, WINDOW & VENTILATOR**

Steel door frames shall be manufactured form commercial mild steel sheet of 1.25 mm thickness conforming to IS: 266 and IS: 435. Hot rolled steel section for fabrication of steel window and ventilator shall conforms to IS: 7452. Shapes, weight and designation of hot rolled sections shall be as per IS: 7452. The workshop for fabrication shall be got approved by Engineer-in-Charge.

Fabrication drawings shall be submitted by the contractor which shall also include the weights of materials used and got approved from the Engineer-in-Charge.

25.2 **GLAZED ALUMINUM DOOR, WINDOWS, FRAMES**

Work to be executed as per IS – 1948. All sections shall be approved by Engineer-in-Charge before fabrication is taken up. Doors, Windows, Frames, Mullions, Transoms etc. shall be anodized in bath of sulfuric acid to provide a clear coating of minimum 15 micron (IS: 1968). The anodized materials shall then be sealed by immersing in boiling water for 15 minutes. A protective transparent coating shall be applied to the sections before dispatch from the factory.

Fabrication drawings shall be submitted by the contractor which shall be include the weights of materials used and got approved from the Engineer-in-Charge.

26.0 **GLASS AND GLAZING**

**SCOPE**

The work in general shall consists of supplying and fixing all glass and glazing including all chips, putty, mastic cement etc. wherever required as shown on drawings.

**INSTALLATION**

The contractor shall supply and install all glass and glazing as required for various doors, windows, sashes, ventilators and fixed louvers, miscellaneous glazing having uniform refractive index and free from flaws, specks and bubbles. The glass be brought to site in the original packing from the manufacturer and cut to size at site. The cut edges shall be straight free from chips, spalls or any other damages. Clear glass shall be flat drawn sheet glass and shall be at least 4 mm thick. Sheet glass for doors shall be minimum 6.3 mm thick.
Wired glass shall be thick rolled glass with centrally embedded 24 g. wire mesh of Georgian type. This may be of clear or coloured glass, as shown in drawings.

Quick setting putty shall be used for windows and sashes except when glare reducing glass is used where it shall be of non-setting type of approved make conforming to IS: 419.

Neoprene gaskets with snap-fit glazing shall be fixed as per manufacture’s instructions and shall fit firmly against the glass to give a leak-proof installation.

27.0 CARPENTRY AND JOINERY

27.1 SCOPE

This shall include supply and fixing of door and window shutters, paneled and flush doors, partitions, wall paneling, shelves, furniture, cabinets, pelmets etc., as shown in drawings including a prime coat of approved paint, varnish/synthetic enamel paint or fixing of plastic laminate where called for in the schedule. This shall also include supply and fixing of all hardware and fittings shown in the drawings.

27.2 TIMBER

Unless otherwise specified all timber shall be best quality well seasoned second class hard wood free from larger loose knots, cracks, and other defects. Where specified timber shall be treated with approved wood preservative. Before starting the carpentry work, the contractor shall have the wood approved by the Engineer-in-Charge.

27.3 PLYWOOD

Plywood shall be commercial quality or with decorative surface veneer. Unless otherwise stated, the adhesive used in plywood shall be phenol formaldehyde resin of B.W.R. grade conforming to IS: 848.

27.4 FLUSH DOORS

Flush doors shall be block or solid core doors with commercial or decorative faces and hardwood edges. The core for solid core doors shall be of block board or wood particle board. The thickness shall be as specified in the ‘Schedule finishes’.

Flush doors and board shall be of the required size and thickness. Flush doors shall be ordered to a size little more in which to that after trimming, it fits the opening between rebates perfectly. Where shown in the drawings and the schedule, flush doors shall be surfaced with decorative laminates of required type and design. The laminate shall be glued to the panel with liquid synthetic phenol formaldehyde resin glue and kept in suitably pressed for at least 12 hours as per best trade practice.

27.5 PANELED AND GLAZED DOORS AND WINDOW SHUTTERS

The wood shall be accurately cut, planed and smoothened to hold full dimensions as shown in the drawings after finishing. The thickness of stiles and rails shall be as required for the shutters.
Stiles and rails shall be properly and accurately mortised and tounge. While assembling a leaf, stiles shall be left projecting as a horn. The stiles and rails shall have 12 mm groove or as specified in the drawings for the panel or glass to fit in.

27.6 **FLY PROOF SHUTTER**

The wood shall be accurately cut, planed and smoothened to hold full dimensions as shown in the drawings after finishing. The thickness of stiles and rails shall be as required for the shutters. Patching or plugging of any kind shall not be permitted except as provided. The stiles and rails shall be given a rebate to receive the wire gauge which shall from the panels.

24 gauge MS, wire Gauze conforming to IS: 1568 shall be used for fly proof shutter.

27.7 **CABINET WORK**

All cabinet work shall be a prime cost item. Cabinets shall be prepared at site as per best practices and techniques, machines, tools and craftsmen available in the furniture making industry. Sample of the work shall be approved by the Engineer-in-Charge.

Details shall be incorporated as shown in the drawings. Bottom shall be framed in to the drawer front, sides and back. Accurately aligned guides and proper clearance smoothly without bending. All joints and all work shall be glued together with phenol formaldehyde synthetic glue resin, the parts being clamped and pressed at least for 12 hours.

28.0 **FITTINGS AND FIXTURES**

Fixtures and fittings for doors, windows etc., shall be as shown on drawing and finishing schedule. These shall be heavy type, good quality and from approved manufacturer.

28.1 **WORKMANSHIP**

28.1.1 **GENERAL**

The work shall be done by skilled carpenters as per details shown on drawing or instructed by the Engineer-in-Charge.

Farming timber and other work shall be close fitting with proper wood joinery, accurately set to required lines or levels and rigidly secured in place.

The surface of frames etc., which will come in contact with masonry after fixing, shall be given two coats of approved paint before fixing. Mastic caulking shall be done after fixing external door and window frames. Special care shall be taken to match the grain of timber or plywood which will be subsequently polished. Screwing or nailing will not be permitted to the edge of plywood or chip board sheets. All exposed plywood edges shall be finished with teakwood lipping unless otherwise shown on drawings.

28.1.2 **FINISH**

All carpentry work after finishing shall be sand papered smooth. A prime coat of paint shall be given after inspection by the Engineer-in-Charge to all surfaces other than those which shall be subsequently polished or covered with laminated plastic sheet.
29.0 The successful bidder shall establish a field testing laboratory at site, equipped with the minimum following equipments.

1. One no. compression testing machine of 100 tonne capacity suitable for testing concrete cube of 150 mm x 150 mm x 150 mm size.

2. One no. electronic weighing machine with maximum weight of 10 kg.

3. 24 nos. MS cube moulds of size 150 mm x 150 mm x 150 mm.

4. One no. slump cone.

5. One set of sieves for fine aggregate. (includes sieves of designation 4.75 mm, 2.36 mm, 1.18 mm, 600 microns, 300 microns, 150 microns).

6. One set of sieves for coarse aggregate. (includes sieves of designation 37.5 mm, 19 mm, 9.5 mm, 4.75 mm).

7. One no. silt testing jar.

8. One no. electric oven.

9. One no. vernier calliper.

10. One no. screw gauge.
### LIST OF APPROVED VENDORS/MAKES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>DESCRIPTION OF ITEMS</th>
<th>APPROVED MAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>FLOAT GLASS</td>
<td>MODI GUARD, ST. GOBAIN (FRANCE) ASHAHI , GUARDIAN (U.S.A),ATUL.</td>
</tr>
<tr>
<td>2.</td>
<td>ALUMINIUM EXTRUSIONS</td>
<td>HINDALCO, INDALCO, JINDAL</td>
</tr>
<tr>
<td>3.</td>
<td>STAINLESS STEEL</td>
<td>SALEM STEEL, INDALCO, JINDAL</td>
</tr>
<tr>
<td>4.</td>
<td>EPDM</td>
<td>AMEE OR AS APPROVED BY EIC</td>
</tr>
<tr>
<td>5.</td>
<td>EXPANSION ANCHORS/FastNERS</td>
<td>HILTI, FISHERS SS 316 (WITH STAINLESS STEEL BOLTS NUTS AND WASHERS)</td>
</tr>
<tr>
<td>6.</td>
<td>NUTS &amp; BOLTS</td>
<td>HILTI, FISHER, , GKW, AVON, ARMOURE</td>
</tr>
<tr>
<td>7.</td>
<td>VITRIFIED TILES</td>
<td>KAJARIA, NITCO,JOHNSON,SOMANY</td>
</tr>
<tr>
<td>8.</td>
<td>PAINTS</td>
<td>BERGER/ASIAN PAINTS/ICI/JENSON &amp; NICHOLSON.</td>
</tr>
<tr>
<td>9.</td>
<td>CEMENT ( ORDINARY PORTLAND/ PORTLAND POZZOLANA )</td>
<td>ACC/ ULTRATECH / LAFARGE/ STAR/ DALMIA/VALLEY STRONG</td>
</tr>
<tr>
<td>10.</td>
<td>WATER PROOFING COMPOUND</td>
<td>CHOCKSEY CHEMICAL, IMPERNO, CICO, ACCO PROOF, FOSROC, ROFFE, SCOT,IMPERMO,PIDILITE</td>
</tr>
<tr>
<td>11.</td>
<td>APP (atactic Polypropylene Polymer) Membrane</td>
<td>PIDILITE INDUSTRIES LTD. TEXSA INDIA LTD., STP LTD., BITUMAT CO. LTD., GENERAL MEMBRANE.</td>
</tr>
<tr>
<td>12.</td>
<td>REINF./STRUCTURAL STEEL</td>
<td>SAIL/TATA/RINL/JINDAL/KAMDHENU/SYAM STEEL/ ELEGANT/BALAJI</td>
</tr>
<tr>
<td>13.</td>
<td>EPOXY PAINT</td>
<td>CHOCKSEY CHEMICAL (PVT.) LTD., DR. BECK, ASIAN PAINTS, GARWARE PAINTS</td>
</tr>
<tr>
<td>14.</td>
<td>POLYSULPHIDE/POLYURETHENE SEALANT</td>
<td>MBT, CHOKSEY</td>
</tr>
<tr>
<td>15.</td>
<td>CONCRETE ADDITIVE</td>
<td>FOSROC, STP, CICO-TL, SIKA, PIDILITE</td>
</tr>
<tr>
<td>16.</td>
<td>CHEQUERED TILES</td>
<td>NITCO, BASANT BETONS, BEZELAL</td>
</tr>
<tr>
<td>17.</td>
<td>INSULATION</td>
<td>TWIGA, ROCKWOOL</td>
</tr>
<tr>
<td>18.</td>
<td>CHEMICAL WATER PROOFING</td>
<td>CHOCKSEY CHEMICAL, FOSROC</td>
</tr>
<tr>
<td>19.</td>
<td>ZINC CHROMATIC PRIMER</td>
<td>SHALIMAR, ASIAM PAINTS, GARWARE</td>
</tr>
<tr>
<td>20.</td>
<td>CHEMICAL/ MECHANICAL ANCHOR FASTNERS</td>
<td>HILTI, FISCHER,DASH</td>
</tr>
<tr>
<td>21.</td>
<td>SUNKEN PORTION TREATMENT</td>
<td>CHOSKEY, ROFEE, CICO, SIKA, PIDLITE</td>
</tr>
<tr>
<td>22.</td>
<td>DOOR CLOSER / FLOOR SPRING</td>
<td>DORMA/EVERITE/ HARDWYN</td>
</tr>
<tr>
<td>23.</td>
<td>UPVC PIPES &amp; FITTINGS</td>
<td>PRINC/E/SUPREME/CALCUTTA PIPES/ ISI MARKED</td>
</tr>
</tbody>
</table>
REMARKS:

1) The materials of first quality of the above approved makes are to be used.

2) The material samples shall be got tested by Engineer-in-Charge as per provisions of tender documents for which all costs shall be borne by the contractor.

31.0 I.S. CODE

Some of the important relevant applicable IS codes are mentioned below:

IS: 1200 (Pertaining to respective work): Method of measurement of building and Civil Engineering works.


IS: 1199 Method of sampling and analysis of concrete.

IS: 1838 Preformed fillers for expansion joints in concrete non extruding and resilient type (Bitumen impregnate filler)

IS: 2386 (Part I to IV) Methods of tests for aggregates for concrete.

IS: 2505 General requirements for concrete vibrators, immersion type.

IS: 2506 Screed board concrete vibrators.

IS: 2514 Concrete vibrating tables.

IS: 3025 Code of practice for concrete structure for the storage of liquids.

IS: 3350 Methods of tests for routine control for water used in industry.

IS: 4565 From vibrators for concrete.

IS: 9130 Admixture for concrete.

IS: 516 Method of tests for strength of concrete.

IS: 1786 High strength deformed bars for concrete reinforcement.

IS: 1081 Code of practice for fixing and glazing of metal doors, windows and ventilators.

IS: 2502 Code of practice of bending and fixing bars for concrete reinforcement.

IS: 2571 Code of practice for welding and mild steel bars used for reinforced concrete construction.

IS: 2202 Specification for wooden flush door shutter.

IS: 1661 Code of practice for cement and cement lime plaster finish on walls and ceilings.
IS: 4101  Code of practice for external facing and veneers.
IS: 6248  Metal rolling shutter and rolling grills.
IS: 1081  Code of practice for fixing and glazing metal doors, windows and ventilators.
IS: 1038  Specifications for steel doors, windows and ventilators.
TECHNICAL SPECIFICATION: ELECTRICAL WORKS

The intent of this chapter of the specification is to define the general technical requirements of electrical works.

1.0 STANDARDS
The work shall be carried out in conformity with this specification, the relevant specifications / code of practice of the Bureau of Indian Standards approved, drawings and instructions of the Engineer-in-Charge or his authorized representative issued from time to time. In addition to the above, all works shall conform to the requirements of the following:

a) Indian Electricity Act and Rules.
b) Regulations laid down by Chief Electrical Inspector of the state, power supply authority.
c) Relevant Indian Standards and National Electrical Code.
d) Any other regulation laid down by the local authorities.

Specification of items / works including definition of terms, measurement, classification etc. not covered in this specification shall be governed by the latest General Specification for Electrical works of CPWD.

2.0 EQUIPMENT SPECIFICATIONS
All materials, fittings, applications, accessories to be supplied by the Contractor shall be of best quality and shall conform to the specification given hereunder. The equipment shall be manufactured in accordance with the current Indian Standards Specification. Samples of all materials before being used shall be procured by the Contractor to the Engineer-in-Charge or his authorized representatives. The material shall be used / installed only after approval by the Engineer-in-Charge.

2.1 Switches
All switches for wiring shall be manufactured in accordance with IS:3854 and shall be piano type unless otherwise specified.

2.2 Receptacles
Only three pin-type receptacles manufactured in accordance with IS:1293 shall be used with third terminal connected to the earth. All receptacles shall be provided with a switch mounted on the same enclosure. Receptacles shall be of flush mounting type except for the rating above 15/16 amps unless otherwise specified.

2.3 Outlet / Switchboard boxes
Outlet boxes for socket, switches fixtures and regulators etc. shall be of minimum 18 gauge (for size up to 20 cm x 30 cm) and 16 gauge (for size above 20 cm x 30 cm) or specified in the schedule of items. Junction / outlet boxes shall be used in roof slab where concealed wiring has been adopted. The junction / outlet / switch boxes shall be painted with anticorrosive paint before installation. Cover plates shall be of Formica or approved equivalent with colour to suit the wall. Cover plates shall be fixed by cadmium plated brass screw and suitable c.p. brass cup washers. An earth terminal with stud and washers shall be provided in each MS box for termination of protective earth conductors.

2.4 Conduit and Fittings
Conduits shall be of metallic or non-metallic type as specified:

a) All rigid metallic conduit pipes shall be of steel and be ISI marked. The minimum wall thickness shall be 1.6 mm (16 SWG) upto 32 mm dia and 2 mm (14 SWG) above 32 mm dia. The conduit
shall be solid drawn or reamed by welding and finished with galvanised or stove enameled surface.
b) All non-metallic conduit pipes and accessories shall be of suitable material complying with IS:2509-1973 and IS:3419-1976 for rigid conduits and IS:6946-1973 for flexible conduits. The interior of the conduits shall be smooth and free from obstructions. The rigid pipes shall be ISI marked. The minimum wall thickness of the rigid non-metallic conduits shall be 1.6 mm upto 25 mm dia conduit.
c) No conduit less than 20 mm in diameter shall be used.
d) All metallic conduit accessories shall be only threaded type, pin grip or clamptype accessories are not acceptable.
e) Accessories for non-metallic rigid type of conduits shall be normally of grip type.

2.5 Casing and Capping
a) Casing and capping shall be of good quality PVC, free from defects like deformations, unevenness, blisters, cavities, etc.
b) The casing shall be of square or rectangular body with top of the side walls suitable for tightly fitting slide-in type capping with double grooving. All surfaces shall have smooth finish inside and outside.

2.6 Wires and Cables
a) Wiring cables
   - Wires shall be PVC insulated 1100 V grade as per IS:1554.
   - Conductors shall be of stranded copper.
   - The smallest size of conductor for lighting circuits shall have a nominal cross-sectional area of not less than 1.5 sq.mm, while minimum size of power wiring shall be 2.5 sq.mm.
   - All wires shall be ISI marked.

b) Flexible cable
   - Flexible cables shall be PVC insulated having a minimum size of 14/0.0193 mm.
   - All flexible wires shall be mechanically protected by tough rubber or PVC sheath.

c) Underground cables
   Power cables: Power cables for use in 415 V system shall be of 1100 V grade, aluminium stranded conductor, PVC insulated, PVC sheathed single wire armoured and overall PVC sheathed. All power cables for 11 kV and 33 kV shall be aluminium conductor, XLPE insulated, screened, PVC bedded galvanized steel flat armoured (non-magnetic material in case of single core cable) and PVC sheathed cable. All 415 V cables shall conform to IS:1554 and HT cables shall conform to IS:7098. Unarmoured cables will be used only where specified.
   Control cables: Control of cables shall be 1100 V grade, 2.5 sq.mm copper conductor, PVC insulated, PVC sheathed, single wire armoured with overall PVC sheathed as per IS:1554.

d) Communication cables
   Communication cable shall comprise 1 pair unarmoured, 2-pair, 5-pair and multi-pair armoured cable of size as specified in the schedule. Minimum conductor size shall be 0.5 mm dia for telephone system and 0.71 for other communication system.

2.7 Switchgear and Control Gear
a) General
   - All items of switchgears and distribution boards shall be metal clad type except those forming part of cubicle type switch boards.
   - The types, ratings and make of the switchgear and protective gear shall be as specified in this specification and the schedule of works.
   - RCCBs (ELCBs) shall conform to the ratings specified in the schedule of works.
- Each distribution boards shall have one independent and separate terminal block each for the neutral and the earth conductors.
- Each distribution boards shall be provided with earthing terminals for body earthing – one for single phase and two for three-phase.
- All DBs (single phase or three phases) shall be of 4, 6, 8 or 12 ways as specified. Number of ways as stated above, in case of three phase DB shall mean ways per phase.
- Bus-bars used shall be of electrolyte copper of appropriate size.

b) MCB Type Distribution Board (MCBDB)
- MCB type distribution boards shall be either single phase or 3-phase type horizontal or vertical, depending upon whether outgoing circuits are single phase or 3 phased/1 phase.
- All MCBDBs shall have provision for accommodating MCB type isolators and RCCB (ELCB) at incoming in single pole or multiple configurations.
- All MCBDBs unless specifically mentioned and/or having different circuit configuration than the standard manufacturing range shall be factory fabricated and completely pre-wired and ready for installation at site.
- MCBDBs shall be fabricated out of 1.6 mm thick sheet steel with stove enameled paint finish and shall be wall mounted type if not specified otherwise.
- The boards shall have adequate provision for entry of incoming and outgoing cables/ wires through knockout holes with or without detachable plates.

c) Medium Voltage Switchboard
Medium voltage switchboards or MV switchgear panels shall be as per the schedule of items and as per the following specific requirements in addition to the general requirements as per the latest editions of applicable Indian Standards.

The switchboard shall be free-standing, metal enclosed, compartmentalized, modular type, dust and vermin proof suitable for indoor installation. Switchgear enclosure shall provide degree of protection not less than IP-31 as per IS:2147. The switchgear shall be assembled out of vertical panels of uniform height not exceeding 2450 mm. The maximum height of the operating handle/switches shall not exceed 1800 mm and minimum height not below 300 mm.

The switchgear shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance with the energized bus-bar system and without taking any special precautions. The switchgear shall permit maximum interchangeability and shall be extensible on either side.

The switchboard shall be sheet steel clad with the frame fabricated out of 14 SWG cold rolled sheet steel and doors/ covers out of 15 SWG cold rolled sheet steel; having integral base frame for each vertical panel. All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made of galvanized, zinc passivated or cadmium plated high quality steel bolts, nuts and washers, secured against loosening. The switchgear shall be suitable for bottom cable entry. Provision for incoming connection through busduct shall be made as per requirement of the specification and schedule of rates. Individual circuit breakers, switch fuse units, MCCBs, bus-bars, cable termination compartment shall be housed in separate enclosed compartments separated from each other by metallic barriers. Circuit breaker panel shall be in single front execution only. Not more than two breaker cubicles shall be housed in single vertical panel except for the incomer and bus-coupler, which shall each be housed in independent vertical panels. Motor starters, switch fuse units, MCCBs shall be in suitable arrangement in single or double front as specified in the schedule of items. All auxiliary devices for control, indications, measurement and protection such as push-button, control and selector switches, indicating lamp, metering instruments protective relays except bimetallic relays shall be mounted on the front side of the respective compartment. Components requiring frequent inspection during operation shall be easily accessible. Main bus-bars shall be of high conductivity aluminium or electrolytic copper as
specified having uniform current rating throughout their length. Horizontal and vertical bus-bars shall be sized depending upon the maximum expected current and to limit the maximum operating temperature at specified design ambient temperature to 85°C for normal operating condition and to 200°C for short-circuit condition considering installation in a poorly ventilated area.

Adequately sized auxiliary copper / aluminium bus-bars running horizontally in a separate enclosure shall be provided for space heaters, control supply and metering requirements. Necessary tee-off connections shall be used for distributing auxiliary supply to each vertical panel. All bus-bars shall be colour coded and designed to withstand specified short circuit currents for one second.

Aluminium earth bus with 300 sq.mm minimum size or equivalent copper bus shall be provided throughout the length of the switchboard with provision for interconnecting to earth grid. All non-current carrying metallic parts of the mounted equipment shall be earthed. Door and movable parts shall be earthed using flexible copper connections.

Inside the switchboards the wiring for power, control, signaling protection and instrument circuits shall be done with PVC insulated copper, conductors having 660 / 1100 V grade insulation. Minimum size of the control wire shall be 1.5 sq.mm copper for circuits having fuse rating 10 Amps or less. For control circuit with higher fuse rating min 2.5 sq.mm copper conductor shall be used. —Elmex‖ type terminals shall be acceptable for wiring upto 10 sq.mm size and for conductors larger than 10 mm², bolt type terminals with crimping lugs shall be provided. Each wire shall be terminated at a separate terminal. A minimum of 10% spare terminal shall be provided for all CT terminals.

For modules rated above 100 amps., preferably copper strip connection shall be used. The air circuit breakers shall be fully draw-out type, Circuit breaker panel shall have three distinct positions : viz – ‘service’, ‘test’, ‘full out’ position complete with necessary safety interlocks, scraping, earth connection, shutters, safety barriers and suitable guides for easy movement of the trolley. Access to the cables shall be from the rear side after opening the door of the separate cabling compartment.

Circuit breakers shall be trip free type having anti-pumping features and electrically operated mechanism suitable for control supply specified in the schedule of items /specification. Circuit breaker trip coils shall be rated for satisfactory operation with 50% to 110% of rated voltage and the closing coil shall be rated for 85% to 110% of the rated voltage.

All switch fuse units shall be load break, heavy duty, air break type (double break) with the operating handle mounted on compartment door, complete with necessary interlocking mechanism. All fuses shall be non-deteriorating HRC cartridge, pressure fitting link type. All relays shall be back connected, draw-out type suitable for flush mounting and fitting with dust tight covers along with hand reset type built in flag indication.

Current transformers for metering shall have an accuracy class 1.0 and instruments safety factor less than 5. Protective current transformers shall have an accuracy class 5 P and accuracy limit factor greater than 10.

All indicating instruments shall be flush mounting type and of 96 x 96 mm square pattern, except the digital instruments. Digital instruments if required shall be as per schedule of items / specific technical specifications.

All control / selector switches shall be rotary back connected type having a cam operated contact mechanism.

2.8 Miniature Circuit Breaker

a) Miniature circuit breakers shall be of approved make and rating as specified.
b) LI series MCBs shall be used only for normal lighting circuits.
c) GI series MCBs shall be used for all motor loads, air conditioners, halogen and other discharge lamps and all power circuits.

2.9 Moulded Case Circuit Breaker
a) Moulded case circuit breakers shall be of approved make. Adjustable type MCCBs shall be used unless otherwise specified in the schedule of items / specific technical specification.
b) Current rating and the short circuit rating of the MCCBs shall be as per schedule of items.

2.10 Medium Voltage Bus-duct

a) Enclosure
The enclosure of the medium voltage bus-duct shall be of 14 SWG sheet steel with removable cover in one side and shall be totally enclosed, dust and vermin proof. The cover shall be fitted with dust preventing gaskets, secured with sufficient number of cadmium plated iron screws to ensure that the cover is dust tight. Suitable openings shall be provided for cable / conduit entries as required.

The enclosure shall be painted with one coat of primer paint after cleaning the surface and after dressing and degreasing. Two coats of finish paint shall thereafter be applied by spray painting process. This shall be done in the works before bringing the materials to site.

b) Bus-bars and Supports
Bus-bars shall be made of electric grade copper conforming to relevant Indian Standards and shall be supported on robust non-hygroscopic insulators at regular intervals to withstand the specified short circuit current. Bus-bars shall be suitably insulated with PVC sleeves / tapes. An aluminium / copper earth bus of suitable size to be specified shall be run along the bus-duct having necessary provision for connection to the earthing network.

3.0 Building Wiring System

Wiring system to be adopted shall be as specified under specified technical requirements and shall conform to the general requirements as specified hereunder.

3.1 Conduit Wiring System
A. General
a) Surface or concealed conduit wiring system with ERW or GI or polyethene conduit as specified shall be adopted.
b) Conduit work whether surface or concealed shall be completed before the cables are drawn in.
c) Conduit pipes shall be jointed by means of screwed couplers and screwed accessories (in case of metallic conduits) only. In case of non-metallic conduits joints shall be properly sealed.
d) All bends in the wiring system shall be done either by bending the pipes neatly without any crack or by inserting suitable accessories like bends, elbows or similar fittings. Radius of bends in conduit pipes shall not be less than 7.5 cm.
e) All metallic parts of conduits and accessories in recessed wiring system shall be painted with anticorrosive paint before their installation.
f) In all conduit wiring system, a protective earth conductor as specified shall be drawn inside the conduit to provide for earthing of non-current carrying metallic parts of the installation. Earth wires shall be terminated in the switch boxes and / or the earth terminal blocks at the DBs. In case, the earth wire specified is of large size which may not be possible to be carried inside the conduits may also be laid external to the conduit subject to approval of the Engineer-in-Charge. In case of the metallic conduits entire conduit system shall be electrically and mechanically continuous.
g) Maximum number of PVC insulated 650 / 1100 V grade cables that can be drawn in one conduit is given size wise in Table-1, which shall not be exceeded. Conduit sizes shall be selected accordingly.
h) When crossing through expansion joints in buildings, the conduit sections across the joint may be through flexible conduits of the same size as the rigid conduit.
B. Additional Requirements for Surface Conduit Wiring System

a) Conduit pipes shall be fixed by heavy gauge non-metallic saddles in case of non-metallic conduits and 24 gauge (up to 25 mm dia) / 20 gauge (for larger dia) steel saddles in case of metallic conduit system.

b) Saddles shall be fixed at an interval not more than 60 cm in case of non-metallic conduits and not more than 1 m in case of metallic conduit. However, on either side of the couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm (for metallic conduit) / 15 cm (for non-metallic conduit) from the surface of such fittings.

c) Where conduits are required to be laid along the trusses / joist etc., the same shall be secured by means of saddles / girder clips etc. as per instruction/approval of the Engineer-in-Charge.

d) In all the cases when conduits are laid in masonry / concrete work, saddles shall be properly secured by inserting polyethylene plugs approved by the Engineer-in-Charge.

C. Additional Requirements for Recessed Conduit Wiring System

a) Fixing of Conduits in RCC works.

i) The conduit pipes shall be laid in position and firmly secured to the steel reinforcement bars by steel binding wires before concreting is done.

ii) Instead of using standard bends or elbows the conduit itself should be bent in long radius to facilitate easy drawing of conductors.

iii) Inspection and junction boxes should be suitably located to avoid long conduit runs and such boxes shall be properly identified to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv) Special care shall be taken in laying the conduits and during the concreting work to avoid damage to the conduits.

b) Laying of conduit in wall

i) Conduits shall be laid in the wall before plastering work in neatly made chase.

ii) The conduits shall be secured by means of staples / saddles / J-hooks at intervals not more than 60 cm.

iii) The joints between the conduits and the switch boards / distribution boards shall be properly sealed.

TABLE – 1
MAXIMUM PERMISSIBLE NUMBER OF 650 / 1100 V GRADE CABLES THAT CAN BE DRAWN INTO RIGID CONDUITS

<table>
<thead>
<tr>
<th>Size of cable Nominal Cross-sectional Area mm²</th>
<th>Size of conduit, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20</td>
</tr>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>1.5</td>
<td>4</td>
</tr>
<tr>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>—</td>
</tr>
<tr>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>16</td>
<td>—</td>
</tr>
</tbody>
</table>
3.2 Casing Wiring System

Casing wiring system may be adopted as specified by using metallic or PVC casing and capping. All specifications for casing wiring system shall be as per the "General Specifications" for Electrical Works (Part-I internal), 2005 of CPWD.

3.3 Earthing

a) Materials
   i) Earth electrodes shall be any of the following type as specified.
      a) Pipe / rod earth electrode
      b) Plate earth electrode
      c) Strip electrode

Pipe electrode shall be of G.I. heavy class with minimum 38 mm dia and 2.5 m long as per details shown in the drawing. Rod electrodes may be of steel or copper of 2.5 m minimum length. Minimum dia shall be 16 mm in case of steel and 12.5 mm in case of copper. The electrodes shall have no joints.

Plate electrodes may be of galvanised iron / steel or copper. In case of galvanised iron or steel thickness shall not be less than 6.30 mm, which in case of copper plate electrodes, thickness shall not be less than 3.15 mm. Minimum size of plate electrodes for both GI and copper shall be 60 cm x 60 cm. Strip electrodes shall not be smaller than 25 mm x 1.6 mm if of copper and 25 mm x 4 mm if of galvanised iron. If round conductors are used as earth electrodes, their cross sectional area shall not be smaller than 3.0 sq. mm. if of copper and 6 sq.mm. if of G.I.

ii) The main earthing conductor (from earth electrode to the main switch board or earth bus) shall be of G.I. or copper as specified. The sizes shall also be as per specification. However, in no case the size of the main earthing conductor be less than
       a) 5 mm dia (6 SWG) for G.I. or 4 mm dia (8 SWG) for copper wire.
       b) 25 mm x 4 mm in case of G.I. strip.
       c) 20 mm x 3 mm in case of copper strips.

iii) The earth continuity or loop earthing conductor shall be of copper, aluminium or G.I. as specified. The minimum size of the earth continuity conductor shall be as follows : 
       a) 2 mm dia (14 SWG) in case of bare copper (1.5 mm² in case of insulated)
       b) 2.24 mm dia (13 SWG) in case of bare aluminium 2.5 mm² in case of insulated)
       c) 2.5 mm dia (12 SWG) in case of G.I.

iv) Installation

   a) Electrodes shall be as far as practicable, be embedded below permanent moisture level to a depth of at least 1.25 m. If rock is encountered, the depth of burial may be less than the specified value, subject to approval of the Engineer-in-Charge. In such case, the electrodes may be buried inclined to the vertical with inclination not more than 30° from the vertical.

   b) In case where more than one electrode has been specified, the distance between two electrodes shall preferably be not less than twice
c) Plate electrodes shall be buried such that its top edge is at a depth not less than 1.5 m from the surface of the ground.

d) Earth electrode normally shall not be located closer than 1.5 m from any building and should not be installed in proximity to a metal fence to avoid the possibility of the fence becoming live due to voltage gradient of the electrodes. If the metal fence is unavoidable, it should be earthed.

e) The strip electrodes shall be buried in trenches or ditches not less than 0.5 m deep and the length of the buried conductor shall be sufficient to give the required earth resistance. It shall, however, be not less than 15 m.

3.4 Installation of Fixtures / Fan

i) Fixtures shall be firmly supported from the structures, support clamps, etc., may be bolted or welded to the existing steelwork or metal inserts. In case of concrete structures, where metal inserts are not available, fixtures will be fixed to or supported from concrete surfaces with the help of anchor fastener. In such cases, special care shall be taken to see that anchoring is firm.

In case of concrete structures where metal inserts are not available, fixtures having smaller weights shall be supported by nylon sleeve / steel sleeve anchors inserting in neatly drilled holes or appropriate size as shown in the typical drawing. Nylon or steel sleeve / rawl plugs should be inserted by making 1.5” deep, 0.25 dia, cylindrical hole using electric hand drill. In no case wooden plugs shall be allowed. This procedure shall be followed for fitting all types of electrical fittings, switchboard, conduits etc. on surface in wall / ceilings.

ii) Fan clamps shall be of suitable design according to the nature of construction of the ceiling on which these clamps are to be filled. In all cases the fan clamps shall be fabricated from new metal of suitable sizes and they shall be as close fitting as possible. Fan clamps for reinforced concrete roof shall be buried with the casting and due care shall be taken that they shall serve the purpose. Fan clamps for woodbeams shall be of suitable flat iron fixed on two sides of the beam and according to the size and section of the beam one or two mild steel bolts passing through the beam shall hold both flat iron together. Fan clamps for steel joints shall be fabricated from flat iron to fit rigidly to the bottom flange of the beam. Care shall be taken during fabrication that the metal does not crack while hammering to shape. In cases where false ceiling exists, the fans shall be firmly connected to the structure / ceiling and not to the false ceiling.

3.5 Lightning Protection

i) Lightning protection shall be done in accordance with the tender specification, IS:2309-1989 and National Electrical Code.

ii) The materials for the air-termination, down conductors etc. for the lightning protective system shall be copper or G.I., as per specification. Recommended shape and minimum sizes of the conductors for use above ground and below are given below:

<table>
<thead>
<tr>
<th>Shape and minimum size of conductors for use above ground:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials and shape</td>
</tr>
<tr>
<td>Round copper wire</td>
</tr>
<tr>
<td>Stranded copper wire</td>
</tr>
<tr>
<td>Copper strip</td>
</tr>
<tr>
<td>Round galvanised iron</td>
</tr>
<tr>
<td>Galvanised iron strip</td>
</tr>
</tbody>
</table>
Shape and minimum size of conductors for use below ground:

- Round copper wire : 8 mm dia
- Copper strip : 32 x 6 mm
- Round galvanised iron wire : 10 mm dia
- Galvanised iron strip : 32 x 6 mm

iii) Air Termination

1. Air termination network may consist of vertical, horizontal or a combination of both vertical and horizontal conductors.
2. Vertical conductors shall project at least 30 cm above the object and shall have one point.
3. Horizontal air termination shall be so interconnected that no part of the roof is more than 9 m away from the nearest horizontal conductors.
4. Horizontal air terminations should be laid down the contours such as ridges, parapets and edges of flat roofs and where necessary over flat surfaces in such a way as to join each air termination to the rest and should themselves from closed network.
5. All metallic finials, chimneys, ducts, vent pipes, railings, gutters and the like, on or above the main surface of the roof of the structure shall be bonded to and form part of, the air termination network. If portions of a structure vary considerably in height any necessary air termination of air termination network of the lower portions, in addition to their own conductors be bonded to the downconductors of the taller portions.
6. All air terminals shall be effectively secured against overturning either by attachment to the object to be protected or by means of substantial braces and fixings which shall be permanently and rigidly attached to the building.

iv) Down Conductors

1. The number and spacing of the down conductors shall be as per the tenderspecification as directed by the Engineer-in-Charge. However, there shall be minimum 2 down conductors for structures up to 400 sq.m area and one extradown conductor for every additional 300 sq.m or part thereof.
2. Down conductors should be distributed round the outside walls of the structure. They shall preferably be run along the corners and other projections. Lift shafts shall not be used for fixing down conductors.
3. Down conductors shall be laid in such a way that they follow the most direct path possible between the air termination and the earth termination, avoiding sharp bends, upturns and kinks. Joints shall as far as possible be avoided in down conductors. Adequate protection may be provided to the conductors against mechanical damage. Metal pipes should not be used as protection for conductors.
4. Metal pipes leading rain water from the roof to the ground may be connected to the
down conductors. Such connections should have disconnecting joints for testing purpose.

5. Any extended metal running vertically through the structure should be bonded to the lightning conductor at the top and the bottom unless the clearances are in accordance with IS:2309-1989.

6. Where the provision of suitable external routes for down conductors is impracticable or inadvisable, as in buildings of cantilever construction, from the first floor upwards, down conductors may be used in an air space provided by a non-metallic, non-combustible internal duct. Any covered recess not smaller than 75 x 15 mm or any vertical service duct running the full height of the building may be used for this purpose, provided it does not contain an unarmoured or non-metal sheathed cable.

v) Joints and bonds

a) Joints
   The lightning protective system shall have as few joints in it as necessary. In the down conductors below ground level these shall be mechanically and electrically effective and shall be so made as to exclude moisture completely. The joints maybe clamped, screwed, bolted, crimped, riveted or welded. With overlapping jointsthe length of the overlap should not be less than 20 mm for all types of conductors. Contact surfaces should first be cleaned and then inhibited from oxidation with a suitable non-corrosive compound. Joints of dissimilar metal should be suitably protected against bimetallic action and corrosion. In general, joints for strips shall be tinned, soldered, welded or brazed and at least double-riveted. Clamped or bolted joints shall only be used on test points or on bonds to existing metal, but joints shall only be of the clamped or screwed type.

b) Bonds
   External metal on or forming part of a structure may have to discharge the full lightning current. Therefore, the bond to the lightning protective system shall have a cross-sectional area not less than that employed for the main conductors. On the other hand, internal metal is not so vulnerable and its associated bonds are almost only likely to carry a portion of the total lightning current, apart from their function of equalising potential. These latter bonds may, therefore, be smaller in cross-sectional area than those used for the main conductors. All the bonds should be suitably protected against corrosion. Bonds shall be as short as possible.

c) Testing Points
   Each down conductor shall be provided with a testing point in a position convenient for testing but inaccessible for interference. No connection, other than one direct to an earth electrode, shall be made below a testing point. Testing points shall be phosphorbronze, gunmetal, copper or any other suitable material.

d) Earth Terminations

   1. Each down conductor shall have an independent earth termination. It should be capable of isolation for testing purposes. Suitable location for the earth termination
shall be selected after testing and assessing the specific resistivity of the soil and with due regard to reliability of the sub-soil water to ensure minimum soil moistness.

2. Water pipe system should not be bonded to the earth termination system. However, if adequate clearance between the two cannot be obtained, they may be effectively bonded and the bonds should be capable of isolation and testing. The gas pipes, however, should in no case be bonded to the earth termination system.

3. It is recommended that all earth terminations should be interconnected. Common earthing besides equalising the voltage at various earth terminations also minimises any risk to it of mechanical damage.

e) Earth Electrodes
Earth electrodes shall be constructed and installed in accordance with section 3.3.

f) Fasteners
Conductors shall be securely attached to the building or other object to be protected by fasteners which shall be substantial in construction, not subject to breakage and shall be made of galvanised steel or other suitable material. If fasteners are made of steel, they should be galvanised to protect them against corrosion. If they are made of any other material suitable precautions should be taken to avoid corrosion. Some samples of fasteners are shown in IS:2309-1969.

g) Earth Resistance
Each earth termination should have a resistance in ohms to earth not exceeding numerically the product of 10 and the number of earth terminations to be provided. The whole of the lightning protective system should have a combined resistance to earth not exceeding 10 ohms before any bonding has been effected to metal in or on the structure or to surface below ground.

3.6 Testing of Wiring Installation
After completion of wiring a general inspection is carried out by the Engineer-in-Charge or his representative to verify that the provisions of the specification and Indian Electricity Rules, 1956 have been complied with. After inspection, the following tests shall be carried out before an installation or an addition to the existing installation is put into service:

a) The insulation resistance shall be measured by applying between earth and the whole system of conductor or any section thereof with all fuses in place and all switches closed and except in earthed concentric wiring, all lamps in position or both poles of installation otherwise electrically connected together, a DC voltage of not less than twice the working voltage, provided that it does not exceed 500 volts for medium voltage circuits. Where the supply is derived from thee-wire (AC or DC) or a polyphase system the neutral pole of which is connected to earth either direct or through added resistance, the working voltage shall be deemed to be that which is maintained between the outer or phase conductor and the neutral.

b) The insulation resistance in mega-ohms of an installation measured as in (a) shall be not less
than 50 divided by the number of points on the circuit, provided that the whole installation need not be required to have an insulation resistance greater than 1 M ohm.

c) Control rheostats, heating and power appliances and electric signs, may, if desired, be disconnected from the circuit during the test, but in that event the insulation resistance between the case or framework, and all live parts of each rheostat, appliance and sign shall be not less than that specified in the relevant Indian Standard specification or where there is no such specification shall be not less than 0.5 M ohm.

d) The insulation resistance shall also be measured between all conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire to the neutral on to the other pole of phase conductor of the supply. Such a test shall be made after removing all metallic connections between the two poles of the installation and in these circumstances the insulation resistance between conductors of the installation shall be not less than that specified in (b).

e) On completion of an electrical installation (or an extension to an installation) a certificate shall be furnished by the Contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority. In addition to this a completion certificate, as enclosed under Appendix – I.

Earthing

For checking the efficiency of earthing the following tests are recommended.

a) The earth resistance of each electrode is measured.

b) The earth resistance of earthing grid is measured.

c) All electrodes are connected to the grid and the earth resistance of the entire earthing system is measured.

These tests shall preferably be done during the summer months.

4.0 Cable Laying

4.1 Route

i) Before the cable laying work is undertaken, the route layout of the cable shall be submitted to the Engineer-in-Charge and the work shall be undertaken only after approval of the route layout.

ii) a) Whenever cables of different voltages are laid following points shall be noted while laying along well demarcated or established roads, the LV / MV cables shall be laid further from the kerb line than HV cables.

b) Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted such that this requirement cannot be met, LV / MV cables shall be laid above HV cables.

c) Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

iii) Proximity to communication cables

Power and communication cables shall as far as possible cross each other at
rightangled. The horizontal and vertical clearance between them shall not be less than 60cm.

4.2 Methods of Laying
The cables shall be laid direct in ground, pipe, closed or open ducts, cable trays or on surface of wall etc. The method(s) of laying required shall be specified in the tender / schedule of work.

4.3 Laying direct in ground
i) This method shall be adopted where specified in the schedule of works. Normally this method shall be adopted when the cable route is through open ground, along roads, lanes, etc. and where no frequent excavations are likely to be encountered and where re-excavation is easily possible without affecting other services.

ii) Trenching
a) Width and depth of the trench shall be as shown in the drawing. When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of the trench shall be increased by 30 cm for each additional tier to be formed.

b) The trenches shall be excavated in reasonably straight lines. Wherever there is a change in the direction, a suitable curvature shall be adopted complying with the minimum bending radius specified in Table – 11. Where gradients and changes in depth are unavoidable, these shall be gradual. The bottom of the trench shall be level and free from stones, brick bats etc.

<table>
<thead>
<tr>
<th>System voltage</th>
<th>Minimum bending radius</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single core</td>
</tr>
<tr>
<td></td>
<td>Unarmoured</td>
</tr>
<tr>
<td>11 KV</td>
<td>20 D</td>
</tr>
<tr>
<td>22 KV</td>
<td>25 D</td>
</tr>
<tr>
<td>33 KV</td>
<td>30 D</td>
</tr>
</tbody>
</table>

D is the overall diameter of the cable.

The excavation should be done by suitable means – manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.

c) Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation. Wherever bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.

Existing property, if any, exposed during trenching shall be temporarily supported adequately as directed by the Engineer-in-Charge. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein, if required.
If there is any danger of a trench collapsing or endangering adjacent structures, the sides should be well shored up with sheeting as the excavation proceeds. Where necessary, these may even be left in place when backfilling the trench.

Excavation through lawns shall be done in consultation with the department concerned.

iii) Laying of Cable in Trench

a) Sand cushioning
The excavated trench shall be provided with a layer of clean, dry sand cushion of not less than 8 cm in depth, before laying the cables therein.

However, sand cushioning may not be provided for MV cables, where there is no possibility of any mechanical damage to the cables due to heavy or shock loading on the soil above if so specified in the tender document and as per approval of the Engineer-in-Charge. Sand cushioning shall however be invariably provided in the case of HV cables.

b) The cable drum shall be properly mounted on jacks, or on a cable wheel at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating.

c) The cable shall be pulled over in rollers in the trench steadily and uniformly without jerks and strain. The entire cable length shall be far as possible laid off in one stretch. PVC / XLPE cables less than 120 sq.mm size may be removed by —Flaking‖ i.e. by making one long loop in the reverse direction.

Note:
For short runs and sizes up to 50 sq.mm of MV cables, any other suitable method of direct handling and laying can be adopted without strain or excess bending of the cables.

d) After the cable has been so uncoiled, it shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 m apart and drawn straight. The cable shall then be lifted off the rollers and laid in a reasonably straight line.

e) Testing before covering
The cables shall be tested in presence of the Engineer-in-Charge for continuity of cores and insulation resistance and the cable length shall be measured, before closing the trench.

f) Sand covering
Cables laid in trenches in a single tier formation shall have a covering of dry sand of not less than 17 cm above the base cushion of sand before the protective cover is laid.

In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30 cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30 cm as stated above. Cables in the topmost tiers shall have a final sand covering not
less than 17 cm before the protective cover is laid.
Sand covering as stated above need not be provided for MV cables where a
decision is taken by the Engineer-in-Charge as per sub-clause (iii-a) above, but
the inter tier spacing should be maintained with soft soil instead of sand between
tiers and for covering.
Sand cushioning shall however be invariably provided in the case of HV cables.

g) Extra loop cable
At the time of original installation, approximately 3 m of surplus cable shall be left
on each terminal end of the cable and on each side of the underground joints.
These surplus cable shall be left in the form of a loop. Where there are long runs of
cable such loose cable may be left at suitable intervals as specified by the Engineer-in-
Charge. Where it may not be practically possible to provide separation between cables when
forming loops of a number of cables as in the case of cable emanating from a
substation, measurement shall be made only to the extent of actual volume of
excavation, sand filling etc and paid for accordingly.

h) Mechanical protection over the covering
Mechanical protection to cables shall be laid over the covering to provide warning
to future excavators of the present of the cable and also to protect the cable
against accidental mechanical damage by pick-axe blows etc. as follows:
i) Unless otherwise specified, the cables shall be protected by second class brick of nominal size
22 cm x 11.4 cm x 7 cm or locally available size, placed on top of the sand (or, soil as the case may
be). The bricks shall be placed breadth-wise for the full length of the cable. Where more than one
cable is to be laid in the same trench, this protective covering shall cover all the cables and projects
at least 5 cm over the sides of the end cables.
ii) Where bricks are not easily available, or are comparatively costly, there is no objection to use
locally available material such as tiles or slates or stone / cement concrete slabs. Where such an
alternative is acceptable, the same shall be clearly specified in the tender specifications.

iv) Backfilling

a) The trenches shall be then backfilled with excavated earth, free from stones or other shall edged
debris and shall be rammed and watered, if necessary insuccessive layers not exceeding 30 cm
depth.
b) Unless otherwise specified, a crown of earth not less than 50 mm and not exceeding 100 mm in
the centre and tapering towards the sides of the trench shall be left to allow for subsidence. The
crown of the earth, however, should not exceed 10 cms so as not to be a hazard to vehicular
traffic.
c) The temporary restatements of roadways should be inspected at regular intervals, particularly
during wet weather and settlements should be made good by further filling as may be required.
d) After the subsidence has ceased, trenches cut through roadways or other paved areas shall be
restored to the same density and materials as the surrounding area and repaved in accordance
with the relevant building specifications to the satisfaction of the Engineer-in-Charge.
e) Where road berms of lawns have been cut out of necessity, or kerb stones displaced, the same shall be repaired and made good, except for turfting/asphalting, to the satisfaction of the Engineer-in-Charge and all the surplus earth or rock shall be removed to places as specified.

v)Laying of single core cables

a) Three single core cables forming one three phase circuit shall normally be held in close trefoil formation and shall be bound together at intervals of approximately 1 m.
b) The relative position of the three cables shall be changed at each joint at the time of original installation, complete transposition being effected in every three consecutive cable lengths.

vi) Route markers

a) Location
Route markers shall be provided along with the runs of cable at locations approved by the Engineer-in-Charge and generally at intervals not exceeding 100m. Markers shall also be provided to identify change in the direction of the cable route and locations of underground joints.
b) Plate type marker
Route markers shall be made out of 100 mm x 5 mm G.I. / aluminium plate welded /bolted on 35 mm x 35 mm x 6 mm angel iron, 60 cm long. Such plate markers shall be mounted parallel to and at about 0.5 m away from the edge of the trench.
c) CC marker
Alternatively, cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm in size) as shown in figure 2 shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer-in-Charge, shall project over the surrounding surface so as to make the cable route easily identifiable.
d) Inscription
The words IITG-MV / HV CABLE as the case may be shall be inscribed on the marker.

4.4 Laying in Pipes / Closed Ducts

i) In locations such as road crossing, entry in to buildings, paved areas etc., cables shall be laid in pipes or closed ducts. Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used for cables as specified in the schedule of works.

ii) Following guide of the pipe fill shall be used for sizing the pipe size:

<table>
<thead>
<tr>
<th>Type of Cable</th>
<th>Pipe Fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 cable in pipe</td>
<td>53% full</td>
</tr>
<tr>
<td>2 cables in pipe</td>
<td>31% full</td>
</tr>
<tr>
<td>3 or more cables</td>
<td>43% full</td>
</tr>
<tr>
<td>Multiple cables</td>
<td>40% full</td>
</tr>
</tbody>
</table>

iii) Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Engineer-in-Charge before cutting is done.

iv) At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
v) At road crossings, the top surface of pipes shall be at a minimum depth of 1 m from the
pavement level. When pipes are laid cutting existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layers with watering as required to ensure proper compaction. A crown of earth not exceeding 10 cm should be left at the top. After the subsidence has ceased, the top of the filled up trenches in road ways or other paved areas shall be restored to the same density and material as the surrounding area in accordance with the direction of the Engineer-in-Charge(Civil) up to his satisfaction.

vi) All G.I. pipes shall be laid as per layout drawings and site requirements. Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the Contractor), all the burrs from the pipes shall be removed. G.I. pipes with bends shall be buried in soil / concrete in such a way that the bends shall be totally concealed. For G.I. pipes buried in soil, bitumen coating shall be applied on the buried lengths. Installation of G.I. pipes shall be undertaken well before paving is completed and necessary coordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. plugs after they are laid in final position. G.I. plugs shall be supplied by the Contractor at no extra cost.

4.5 Laying in Open Ducts

a) Open ducts with suitable removable covers (RCC slabs or chequered plates) are generally provided in substations, switch rooms, plant rooms, workshops etc. for taking the cables. The cable ducts should be of suitable dimensions for the number of cables involved.
b) Laying of cables with different voltage ratings in the same duct shall be avoided. Where it is inescapable to take HV & MV cables same trench, they shall be laid with a barrier between them or alternatively, one of the two (HV / MV) cables may be taken through pipe(s). Splices or joints of any type shall not be permitted inside the ducts.
c) The cables shall be laid directly in the duct such that unnecessary crossing of cables is avoided.
d) Where specified, cables may be fixed with clamps on the walls of the duct or taken in hooks / brackets / cable trays through in ducts.
e) Where specified, ducts may be filled with dry sand after the cables are laid and covered as above, or finished with cement plaster, specially in high voltage applications.

4.6 Laying on Surface

The method may be adopted in places like switch rooms, workshops, tunnels, rising (distribution) mains in buildings etc. This may be necessitated in the works of additions and / or alternations to the existing installation, where other methods of laying may not be feasible. Cables may be laid in surface by any of the following methods as specified:
a) Directly clamped by saddles or clamps
b) Supported on cradles
c) Laid on troughs / trays, duly clamped.

4.7 Laying on Cable Tray

This method may be adopted in places like indoor substations, air-conditioning plant rooms, generator rooms etc. or where long horizontal runs of cables are
required within the building and where it is not convenient to carry the cable in open ducts. This method is preferred where heavy sized cables or a number of cables are required to be laid. The cable trays may be either of perforated sheet type or ladder type as specified.

4.8 Jointing

i) Location
a) Before laying a cable, proper locations for the proposed cable joints, if any, shall be decided, so that when the cable is actually laid, the joints are made in the most suitable places. As far as possible, water logged locations, carriageways, pavements, proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks etc. shall be avoided for locating the cable joints.
b) Joints shall be staggered by 2 m to 3 m when joints are to be done for two or more cables laid together in the same trench.

ii) Joint pits
a) Joint pits shall be of sufficient dimensions as to allow easy and comfortable working. The sides of the pit shall be well protected from loose earth falling into it. It shall also be covered by a tarpaulin to prevent dust and other foreign matter being blown on the exposed joints and jointing materials.
b) Sufficient ventilation shall be provided during jointing operation in order to disperse fumes given out by fluxing.

iii) Safety precaution
a) A caution board indicating —CAUTION – CABLE JOINTING WORK IN PROGRESS— shall be displayed to warn the public and traffic where necessary.
b) Before jointing is commenced, all safety precautions like isolation, discharging, earthing, display of caution board on the controlling switchgear etc. shall be taken to ensure that the cable wound not be inadvertently charged from live supply. Metallic armour and external metallic bond be connected to earth. Where —Permit to Work— system is in vogue, safety procedures prescribed shall be complied with.

iv) Jointer
Jointing work shall be carried out by a licensed / experienced (where there is no licensing system for jointers) cable jointer.

4.9 Testing

i) Testing before laying
All cables, before laying, shall be tested with a 500 V megger for cables of 1.1 KV grade, or with a 2500 / 5000 V megger for cables of higher voltage. The cable cores shall be tested for continuity, absence of cross phasing, insulation resistance from conductors to earth / armour and between conductors.

ii) Testing before backfilling
All cables shall be subjected to the above mentioned tests, before covering the cables by protective covers and backfilling and also before taking up any jointing operation.
iii) Testing after laying
After laying and jointing, the cable shall be subjected to a 15 minutes pressure test. The test pressure shall be as given in Table – III. DC pressure testing may normally be preferred compared to AC pressure testing.

TABLE – 3
TEST PRESSURE IN KV

<table>
<thead>
<tr>
<th>Working Volts in KV</th>
<th>AC 15 minutes test</th>
<th>DC 15 minutes test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Between conductors</td>
<td>Conductor to earth</td>
</tr>
<tr>
<td></td>
<td>Between conductors</td>
<td>Conductor to earth</td>
</tr>
<tr>
<td>Up to 1.1</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>3.3</td>
<td>6.0</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>9.0</td>
<td>5.0</td>
</tr>
<tr>
<td>6.6</td>
<td>12.0</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>18.0</td>
<td>10.5</td>
</tr>
<tr>
<td>11</td>
<td>20.0</td>
<td>11.5</td>
</tr>
<tr>
<td></td>
<td>30.0</td>
<td>17.5</td>
</tr>
<tr>
<td>22</td>
<td>40.0</td>
<td>23.0</td>
</tr>
<tr>
<td></td>
<td>60.0</td>
<td>35.0</td>
</tr>
<tr>
<td>33</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

In the absence of facilities for pressure testing as above, it is sufficient to test for one minute with 1,000 V megger for cables of 1.1 KV grade and with 2500 /5000 V megger for cables of higher voltages.

4.10 Measurement
All measurement will be made as per guidelines laid under the latest edition of the General Specifications for Electrical works (Part – I and II) of CPWD. All the works in progress will be jointly measured by the representatives of the Engineer-in-Charge of the Owner and EPI and the Sub-contractor shall remain bound to render all assistance during such recording of the measurements. The measurements such recorded shall be binding on the Sub-contractor. He shall have no claim other than what has been jointly recorded or certified by the Owner.

4.10 Specific Technical Requirements:
  a) All wiring for light and power circuits shall be in PVC conduits recessed or exposed in wall /ceiling as instructed by the Engineer-in-charge.
  b) All wires for point wiring and the single core wires specified for sub main and circuit wirings shall be 1.1 KV grade PVC insulated FR copper multi-strand wires of approved brand. The underground cables indicated in the drawings shall however, be PVC insulated and sheathed armoured aluminium underground cables of approved brands.
  c) All 6A receptacles shall be flush type and shall have 5 pins with 1 pin for earth connection and 2 pins each for phase and neutral connections. 16A receptacles shall have 6 pins (suitable for connecting both 6A and 16A plug tops) with 2 pins each for phase, neutral and earth connections.
  d) Samples of all the materials to be used in the work shall be submitted to the Superintending Engineer (Elect.), IITG for approval. No material other than those approved by the IITG shall be used in any of the works.
In case of any materials other than those approved by the SE (Elect.) is detected, the same shall be replaced by the Tenderer with the approved quality, free of cost, failing which, the owner shall have right to withhold all pending bills due to the Contractor, until the
rectification / replacement work is completed.

e) All materials, equipments and accessories shall be of makes listed as enclosed. Makes of 
any item(s) not specified under the list, but required in the work shall be approved by the 
Engineer-in-Charge prior to use in the works.

f) After partitions & placing work stations the position of the switch boards have to be 
changed as well as new wirings will be needed for the work stations.

g) Separate switch boards will be fixed for each incubation/partitions hence additional switch 
boards are required.

h) The lighting arrangements will have to be changed according to the new setup and more 
luminaries will be required.

i) The existing LAN cablings does not match the new proposed furniture plan, so entire LAN 
work proposed to be done in fresh, routing above the ceiling and through specially 
designed Tray to be fixed all along the partitions and brick walls.

j) In addition to existing CCTV cameras of common space of building, new CCTV cameras 
will be installed for STPI's own administration covering STPI’s space only.

LIST OF APPROVED MAKES OF MATERIALS:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Materials</th>
<th>Manufactures / Brand names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conduits pipes &amp; accessories – MS PVC</td>
<td>BEC / AKG (ISI marked)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BERLIA / AKG</td>
</tr>
<tr>
<td>2.</td>
<td>Bushes</td>
<td>Rubber / PVC of superior quality.</td>
</tr>
<tr>
<td>3.</td>
<td>Wire (Copper conductor)</td>
<td>FR copper wire (FINOLEX / HAVELLS / RR KABEL /ANCHOR)/BERLIA/NICCO/V-GUARD/Gloster</td>
</tr>
<tr>
<td>4.</td>
<td>Cable (underground)</td>
<td>GLOSTER / CCI / INCAB / INDUSTRIAL CABLES /RPG / UNIVERSAL / NICCO / HAVELLS / POLYCB/ CRYSTAL / FINOLEX/KEI</td>
</tr>
<tr>
<td>5.</td>
<td>Cover plate</td>
<td>Hylum sheet 3 mm thick of colour &amp; design as approved</td>
</tr>
<tr>
<td>6.</td>
<td>Cover plate fan box</td>
<td>Formica of approved shade 2 mm thick</td>
</tr>
<tr>
<td>7.</td>
<td>Switch &amp; Socket -</td>
<td>ANCHOR / KOLORS / GOLDMEDAL/HPL/HAVELLS (ISI) or equiv.</td>
</tr>
<tr>
<td></td>
<td>Flash Piano type -</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modular type -</td>
<td>MK / CRABTREE / LEGRAND / SCHNEIDER/PHILIPS</td>
</tr>
<tr>
<td>8.</td>
<td>Switch fuse unit (HRC Type) (re-wirable type)</td>
<td>ENGLISH ELECTRIC/L&amp;T/ SIEMENS/CONTROL&amp;SWITCHGEAR</td>
</tr>
<tr>
<td>9.</td>
<td>a) Fuse bases for HRC fuse forfeeder pillar</td>
<td>SIEMENS / L&amp;T / STANDARD</td>
</tr>
<tr>
<td></td>
<td>b) HRC fuses</td>
<td>E.E. / L&amp;T / SIEMENS</td>
</tr>
<tr>
<td>10.</td>
<td>MCB</td>
<td>LEGRAND/SIEMENS/ SCHNEIDER / L&amp;T / ABB /HAVELLS / HAGER</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>11.</td>
<td>Distribution Board MCB type</td>
<td>LEGRAND/SIEMENS/ SCHNEIDER / L&amp;T / ABB / HAVELLS / HAGER</td>
</tr>
<tr>
<td>12.</td>
<td>Telephone cables</td>
<td>DELTON / FINOLEX / POLYCAB</td>
</tr>
<tr>
<td>15.</td>
<td>Screws</td>
<td>Good quality brass screws</td>
</tr>
<tr>
<td>16.</td>
<td>Ceiling Rose</td>
<td>ANCHOR / MK / GOLDMEDAL / KOLORS</td>
</tr>
<tr>
<td>17.</td>
<td>ELCB / RCCB</td>
<td>LEGRAND / SIEMENS / L&amp;T / ABB / HAVELLS / SCHNEIDER / HAGER</td>
</tr>
<tr>
<td>18.</td>
<td>MCCB</td>
<td>GE/L&amp;T/SCHNEIDER/CONTROL&amp;SWITCHGEAR// CROMPTONGREAVES/ABB/C&amp;S/HAVELLS/LEGRAND / HAGER</td>
</tr>
<tr>
<td>19.</td>
<td>Air Circuit Breaker</td>
<td>L&amp;T/SIEMENS/SCHNEIDER/ CROMPTONGREAVES/ABB/CONTROL&amp; SWITCHGEAR,</td>
</tr>
<tr>
<td>20.</td>
<td>Industrial type Metal clad sockets &amp;plugs</td>
<td>LEGRAND/SIEMENS/ SCHNEIDER / L&amp;T / HAVELLS / ABB.</td>
</tr>
<tr>
<td>21.</td>
<td>Meter, Metering, Equipment &amp;C.T.s</td>
<td>A) AUTOMATIC ELECTRIC B) CONZERV C) RISHAV D) MECO E) HPL</td>
</tr>
<tr>
<td>22.</td>
<td>Electronic Energy Meter</td>
<td>HPL / CONZERV / L&amp;T / RISHAV</td>
</tr>
<tr>
<td>23.</td>
<td>Exhaust Fan</td>
<td>ALSTOM / ORIENT / CROMPTON / HAVELLS</td>
</tr>
<tr>
<td>24.</td>
<td>Ceiling Fan</td>
<td>ORIENT/CROMPTON/BAJAJ/HAVELLS / BERLIA</td>
</tr>
<tr>
<td>25.</td>
<td>Electronic Step Fan Regulator</td>
<td>ANCHOR / KOLORS / MK or equiv.</td>
</tr>
<tr>
<td>26.</td>
<td>Lugs</td>
<td>DOWELLSII crimping type</td>
</tr>
<tr>
<td>27.</td>
<td>MDBs / BDBs / SDBs</td>
<td>CPRI approved vendors, having facilities for powdercoated finish and antirust treatment by seven/eighttank process (vendor detail shall be submitted for approval)</td>
</tr>
<tr>
<td>28.</td>
<td>APFC Panel</td>
<td>SCHNEIDER/L&amp;T or equivalent subject to approval.</td>
</tr>
<tr>
<td>29.</td>
<td>Bus-bar trunking system</td>
<td>Control &amp; Switchgear or equiv. Subject to approval</td>
</tr>
<tr>
<td>30.</td>
<td>Light fittings</td>
<td>Makes &amp; catalogue reference shown in the BOQ orequivalent from the brands—Philips/Crompton/Bajaj/Wipro/Havells – subject to approval.</td>
</tr>
</tbody>
</table>
TECHNICAL SPECIFICATION INTERNAL WORKS

All the works shall be done as per the specifications as under. In case the specification of any particular item is not given, the same may be done as per the latest CPWD Specifications and Indian Standards. The Decision of the Engineer In Charge will be final in such case.

DISMANTLING AND DEMOLISHING

1. IS 1200 (Pt – XVIII) Method of Measurements of Building and Civil Engineering Works
(Part –XVIII) Demolition and Dismantling

2. IS 4130 Demolition of Buildings–Code of Safety

TERMINOLOGY

(i) DISMANTLING: The term ‘Dismantling’ implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the building as specified or shown on the drawings.

(ii) DEMOLITION: The term ‘Demolition’ implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the drawings.

SCOPE OF WORK:

The work envisaged under this sub-head is for dismantling and demolition of brick masonry in cement/lime mortar, reinforced concrete works, and removing wooden doors, wooden or steel windows.

GENERAL:

The term dismantling implies carefully taking up or down and removing without damage. This shall consist of dismantling one or more parts of the building as specified or shown on drawings.

The term Demolition implies taking up or down or breaking up. This shall consist of demolition whole or part of working including relevant items as specified or shown on drawings.

PRECAUTIONS:

Necessary propping, shoring and/or underpinning shall be provided for safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such way that no damage is caused to the adjoining work or property. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust- nuisance down as and when necessary. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from...
height or demolishing roofs, masonry etc., shall be carefully dismantled first. The dismantled articles shall be passed by hand where necessary and lower to the ground and not thrown. The materials then be stocked properly as directed by the Engineer – in – charge. All materials obtained from dismantling or demolition shall be the property of the government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer – in – charge. Any serviceable material, obtained during dismantling or demolition shall be separated out and stacked properly as indicated by Engineer – in – charge within a lead of 150m. Or as specified in the item. All under serviceable materials, rubbish etc. shall be disposed of as directed by the engineer in charge.

TREATMENT:

All the dismantled area shall be rendered clean of all debries, dust etc. The sides of jambs, sills, soffits, etc of the openings if any , after taking out doors and windows chowkhats, unless and otherwise to be treated, shall be plastered in CM 1:3 with finishes to render true sides, corners, edges etc.

RATES: The rate shall include cost of all such operations mentioned above including necessary labour, material, transport, scaffolding, staking the serviceable materials, disposing the unserviceable materials within the lead specified, all as directed by the Engineer in charge.

CARPET

Approved make 100% Optimum SD / Wear On Nylon Tufted, Textured Loop Pile carpet tiles of 20 oz/ sq.yd of size 609x609mm permanent static control solution dyed, pile height to a maximum of 0.101 inches with synthetic non-woven Glasbac backing of Vinyl cushion with glass reinforcement / PVC free underscore cushion including colourfastness> or = 4 after 100 hours, moth proof, stain resistant etc. complete, over existing flooring as per Manufacturer's specification. The rate shall be inclusive of the PVC free underscore cushion backing for entire area to be covered by carpet. (Note: Volatile organic compound free adhesive of approved make shall be used for laying the carpet.)

INSTALLATION

FLOOR

A good floor is literally and figuratively the basis for a well-laid carpet. The floor must be completely level (i.e. free of holes, irregularities and remains of old carpets), clean, dry, secure and stable. Seams and cracks between the floor and the floorboards must be sealed with an appropriate sealant to prevent any air flows from leaving dust deposits.

CARPET UNDERLAY

A good underlay is an important aspect of laying a carpet. It ensures increased comfort, luxurious radiance and a longer-lasting, more beautiful appearance of the carpet. Underlay acts as sound
proofing and keeps in warmth, gives a soft feel underfoot and overcomes any slight bumps in floor surfaces. Rubber underlay (including the foam and sponge types) is especially good where you suspect that damp may be a problem, where floorboards are uneven, or where under floor heating is fitted.

LAYING

The carpet underlay is laid on the floor at right-angles to the direction in which the carpet is laid, and fixed in position with a suitable adhesive. When properly applied, a non-slip adhesive provides sufficient adhesive strength and does not leave any residue when the carpet underlay is removed. The floor must therefore be completely level; otherwise irregularities in the floor will show in the carpet.

To install carpet properly, you need to start with a piece that overlaps the edge of the floor by about 4 inches. The overlay can be trimmed later so the carpet fits properly. To cut your first section, measure the room at its longest point and add 4 inches to that measurement. The carpet is glued to the underlay with a suitable adhesive. Due to the drying time of the adhesive, gluing is done in sections until the entire carpet has been stuck down. After the carpet has been glued in position, wait for a while before putting any furniture in place to avoid permanent indents. The carpet must be rolled with a laying roller. The time required for this is indicated by the manufacturer of the adhesive and must be observed. Please observe the manufacturer’s guidelines on the quantity of adhesive to be applied and ventilation times. Foam backed carpet does not need to be stretched. Foam-backed carpets should never be laid directly onto polished, varnished or vinyl floors or they will stick permanently.

JOINING OF CARPETS

If your room is wide enough that you need put another piece of carpet, follow the same process with the second piece - measure, mark and trim. Be sure the carpet pile is running the same way in all pieces, and that the carpet you cut is large enough to overlap the wall by about 4 inches, as well as overlapping the first piece of carpet by 4 inches. Try to layout your carpet pieces so the seams won't be in noticeable position or in high traffic areas. Where the carpet pieces will join, overlap the two pieces, and then cut through both pieces of carpet using an electric carpet cutter, glued the gap and fix ensuring the edges will match exactly.

CARPET CARE AND MAINTENANCE

Clean Carpet before it gets dirty and vacuum on a regular basis to making Carpet last years longer. Install Carpet properly. Choose the correct padding, with the wrong pad carpet could develop waves and wrinkles, the backing could fall apart or it could begin to wear out and mat down quickly in all the
main walkways. Remove stains using water and a wet/dry vacuum. Have carpet professionally cleaned every 12 to 18 months depending on the traffic level and how often you vacuum it.

ENGINEERED WOOD FLOORING

Providing and supplying Engineered Wood Flooring, with four side micro beveled. Planks would be 120 mm wide and in random length comprising of 5 ply including top veneer with a total thickness of 10.5 mm available in species of Teak/ Hickory/ Sapele/ Oak/Distressed Hickory Brandywine/Distress Antique Natural and respectively. The top 2mm veneer / laminate Finish.

INSTALLATION:

It is important to ensure the sub floor on which the planks are being laid is smooth, flat & hard & free from moisture, grease, etc. In case of uneven sub floor the same should be leveled by self leveling compound. The moisture level present in the subfloor should be less than 8% before installation of the floor.

The Engineered hardwood should be a completely floating floor (using recommended a water barrier of minimum of 250 microns and 2mm polyethylene foam). The tongue and groove joints shall be glued together using recommended adhesive.

The installation shall be undertaken as per the manufacturer’s installation instructions.

STORAGE & HANDLING:

The material has to be handled and unloaded with care. It has to be store in a dry place being sure to provide at least a four-inch air space under cartons which are stored upon “on-grade” concrete floors. Flooring should not be delivered until the building has been enclosed with windows, doors are in place and cement work and plastering and all other “wet” work is completed and dry.

PREPARATION:

All concrete, masonry, framing members, drywall, paint and other “wet” work should be thoroughly dry. The wall coverings should be in place and the painting completed except for the final coat on the base molding. When possible, delay installation of base molding until flooring installation is complete. Basements and crawl spaces must be dry and well ventilated.

SUB FLOOR CONDITIONS:

• CLEAN—Subfloor must be free of wax, paint, oil, sealers, adhesives and other debris.
• LEVEL/FLAT—Within 3/16” in 10’ (5 mm in 3 m) and/or 1/8” in 6’ (3 mm in 2 m). If the floor is not leveled an underlayment using self leveling compound shall be done.
• Underlayment Additive: Follow the instructions of the leveling compound manufacturer but make certain the leveling compounds are completely DRY before beginning installation. Leveling materials must provide a structurally sound subfloor that does not affect the holding power of the fastener.

• DRY—Check and document moisture content of the subfloor using the appropriate moisture test. Concrete subfloors must be a minimum of 30 days old before testing begins.

• STRUCTURALLY SOUND—Nail or screw any areas that are loose or squeak. Wood panels should exhibit an adequate fastening pattern, glued/screwed or nailed as system requires, using an acceptable nailing pattern. Flatten edge swell as necessary. Replace any waterdamaged, swollen or delaminated subflooring or underlayment.

DOORWAY AND WALL PREPARATION

• Undercut door casings and jambs. Remove any existing base, shoe mold or doorway thresholds. These items can be replaced after installation. All door casings and jambs should be undercut to avoid difficult scribe cuts.

ESTABLISHING A STARTING POINT

• Installation parallel to the longest wall is recommended for best visual effects, however, the floor should be installed perpendicular to the flooring joists unless the subfloor has been reinforced to reduce subfloor sagging.

INSTALLING THE UNDERLAYMENT:

• The underlayment should be installed in the same direction that the hardwood flooring.
• The underlayment should be extended a few inches up the wall.
• Excess underlayment should be cut prior to installing trim or moldings.

INSTALLATION:

• Floor should be installed from several cartons at the same time to ensure good color and shade mixture.

• When possible, preselect and set aside boards that blend best with all horizontally mounted moldings (reducer/stair nose, etc.) This will ensure a uniform final appearance. Install these boards adjoining the moldings.

• When installing as a linear pattern be attentive to staggering the ends of the boards at least 4”–6” (10–15 cm) when possible, in adjacent rows. This will help ensure a more favorable overall appearance of the floor.

• Avoid staggering the rows uniformly to prevent stair-stepping. Boards cut from the opposite end of the row may be used for the next starter boards.
• Always allow a minimum ¼” (6 mm) expansion around all vertical obstructions. Allow ½” (13 mm) for floating floors.

• Select the first board. All installations should begin with the groove side against the wall using the longest boards available. Apply a continuous 1/8"(3 mm) glue bead to the inside bottom of the groove on the end of the board. Do not apply glue to the groove side at this time. Products with the end tongue on the left should be installed right to left, opposite tongues should be left to right. If a sacrificial board was used DO NOT glue the first row to it.

• Complete the first row. Cut the last board allowing for 1/2"(13 mm) clearance between the wall and the floor. (Use the remaining end of the cut board as a starter board for any row following row three). Install a wedge on the end of the board between the hardwood flooring and the wall allowing 1/2"(13 mm) expansion space. Avoid installation of any boards shorter than 16"(40.6 cm) in the first four rows.

• Use a pull bar to pull the last board into place from the opposite end. Install wedges into the gap and tighten

• If any glue gets on the surface of the flooring, wipe off immediately with a clean damp cloth.

• Cut or use a shorter board for the first board of the second row. Start the second row by applying a 1/8"(3 mm) bead along the inside, bottom of the end and side groove of the new board. Install the first board of row two. Apply a bead of glue to the inside bottom of the end and side groove of the next board and install. When installing boards together, use a tapping block against the tongue, not the groove. Tap the boards into place by tapping with a hammer on the tapping block. DO NOT tap on the edge directly with the hammer. Complete the second through fourth rows using this technique. Insert wedges on the ends, as necessary, to restrain the movement of the floor.

• In the remaining rows, stagger joints 4”–6”(10–15 cm) apart. Install the rest of the floor. Be sure all joints are tight. Use spacers on the long and butt walls. Use a pull bar to tighten the joints from the ends.

COMPLETING THE INSTALLATION:

• All tape should be removed and the floor should be cleaned with the recommended hardwood flooring cleaner.

• Any transition pieces that may be needed should be installed or uninstalled such as Reducer Strips, T-moldings, or Thresholds. The products are available pre-finished to blend with your flooring.

• All underlayment (floating only) should be cleaned and any transition pieces, reducer strips, T-moldings if necessary, should be installed or uninstalled. Thresholds, bases and/or quarter round moldings that may be needed.

MODE OF MEASUREMENT:

The mode of measurement is per Sqmt of plan area.
FALSE FLOORING ACCESS FLOOR SYSTEMS

SYSTEM: Access floor system to be installed shall provide a maximum finished floor height of 600mm from the existing floor level. The system shall provide for suitable pedestal and understructure designed to withstand various static loads and rolling loads subjected to it in an server / DCS / panel / rack area. The entire Access floor system shall provide for adequate fire resistance, acoustic barrier and air leakage resistance.

Panels: Panels shall be made from steel. The bottom of the panel shall be embossed in 49 hemispherical shape of 60mm dia and 12 reverse conical of 25mm dia to give strength and flexural rigidity. The top sheet shall be plain and resistant welded at various locations after the top and bottom sheets have been degreased and phosphated. The above hollow panel shall have an infill of light weight cementations material. The entire panel shall be coated with epoxy coating on the exposed surface. Panels shall remain flat through and stable unaffected by humidity or fluctuation in temperature throughout its normal working life.

Panels shall provide for impact resistance top surfaces minimal deflection, corrosion resistance properties and shall not be combustible or aid surface spread of flame. Panels shall be insulated against heat and noise transfer. Panels shall be 600 x 600mm fully interchangeable with each other within the range of a specified layout. Panels shall rest on the grid formed by the stringers which are bolted on to the pedestals. Panels shall be finished with anti-static Laminate of colour and PVC beading / trimming along the edges.

PEDESTALS: Pedestal installed to support the panel shall be suitable to achieve a finished floor height of 75 to 600mm. Pedestal design shall confirm speedy assembly and removal for relocation and maintenance. Pedestal base to be permanently secured to position on the sub floor. Pedestal assembly shall provide for easy adjustment of levelling and accurately align panels to ensure lateral restrain. Pedestals shall support an axial load of 2000 Kgs, without permanent deflection and an ultimate load of 3500 Kgs. Pedestal head shall be designed to avoid any rattle or squeaks.

PEDESTAL ASSEMBLY: Consisting of 100 x 100 x 2mm thick galvanized epoxy polyester coated MS Base plate die-pressed orbit ally riveted to a 21mm. O.D. 2.5mm thick epoxy coated MS pipe to engage the pedestal head assembly. The pedestal head assembly consists of an embossed steel plate having 4 holes with ¼ th tapping for fastening and locating of tile; orbit ally riveted to a corresponding threaded stud 16mmdia. (O.D), length 100mm which is designed to engage the pedestal base assembly. The assembly shall provide a range of height adjustment up to 25mm, with the help of check nuts.

UNDER STRUCTURE: Under structure system consists of stringers of size 575 x 30x 20 x 1.5mm to form a grid of 600 x 600mm. These stringers are locked into the pedestal head and run both ways. The US system shall provide adequate solid, rigid and quiet support for access floor panels. The US system shall provide a minimum clear, uninterrupted height of 550 mm between the bottom of the floor and bottom of the access floor for electrical conduiting and wiring.
STRINGERS: Stringer system is all steel construction, rectangular channels 30 x 20 x 1.6mm thick with pre-punched counter sunk holes at both ends for securing the stringers onto the pedestal head ensuring maximum lateral stability in all directions. The grid formed by the pedestal and stringer assembly shall receive the floor panel.

LIFTING HOOK - 2 Nos shall be given to HPCL free of cost and necessary cutting for supply/return Air Grills and for Grommet of required size, of for electrical supply wires wastages, lead & lift, grouting the system with anchor fastener, removing all debris from the premises etc. complete, as directed shall be in the scope of the work.

VITRIFIED TILES FLOORING AND DADOING

MATERIALS

Tiles shall be matching with existing tiles or any equivalent, fully vitrified with high gloss polished surface. The surface hardness of the tiles shall be min 7 on moh's Scale. The thickness of tile shall be min 9 mm for 400mm sq tile & shall be min 12mm for large tiles of 900mm sq. Tiles shall be true to shape & shall have sq edge. The surface shall be perfectly in level. Bent tiles or tiles with variation in dia shall not be used. Morter shall be cement mortar 1:4. Slurry shall be neat cement paste of money like consistency.

WORKMANSHIP

The tile pattern shall be first established and approved by the Engineer-in-charge/Architect. Internal cut pieces shall not be permitted. If the area where the tiles are to be laid is not perfect Rectangle or Square, the different shall be adjusted at edges away from the visible or open areas in consultation with the Architect/Engineer in charge. Diagonal Pattern in such areas may be permitted. In case of irregular shaped areas & where diagonal Pattern is provided, extra care shall be taken to fix angular tile pieces.

Tiles with chipped off Surface Finish shall not be used. Entire tile work shall be protected by laying over it a thick layer of Gypsum plaster or loose full size plywood boards.

MODE OF MEASUREMENTS AND PAYMENT

The rate shall be for a unit of m² and clear visible area shall be measured. The rate shall include for all materials, labour and edge polishing, sundry involved in operation of the above specified item.

FIBRE CEMENT BOARD DRY WALL PARTITION

Providing and fixing of ready for primer and paintable surfaced 72mm drywall partition using non asbestos, non combustible, fibre cement boards made of recycled fibres and cement as raw materials manufactured by wet recessed autoclaved technology with density of 1300Kg/m³ as per (ASTMC
The G.I. frame of thickness 0.60 consists of steel metal stud frame of size 50mm having one flange of 41mm and other of 44mm placed at every 600 mm c/c in vertical direction upto soffit and horizontally at board joints. These studs are to be placed at floor and ceiling channels of 52mm width and 0.60 mm thick and having equal flanges of 32 mm. The floor and ceiling channels are fixed to floor and soffit using fasteners at every 600mm c/c. A horizontal frame section is placed at every 1200mm c/c. Next one layer of 10mm thick fibre cement board are fixed in staggered joints on either side of the studs to avoid leakage through joints. These boards are joined using Specified “type S” Self tapping SS W 25 / 3.5 x 25mm corrosion resistant drywall steel screws spaced at 200mm centers on all joints and 300mm centers in the field of boards. Screw fixing is done mechanically. Finally, boards and screw heads are to be jointed and finished with epoxy putty so as to have a flush look which includes filling tapered edge and square edges of board with cement based joining compound and fibretape.

Toughened GLAZING:

Glass used for Toughened glazing shall be float glass of best approved quality free from flaw, specks, bubbles and shall be of thickness specified in the Schedule of Quantities.

All glass to be of approved manufacturer complying with I.S. 3548-1966 as per approved quality and sample to be of the selective qualities specified and free from bubbles, smoke, air holes and other defects. Polished plate glass shall be "glazing glass" (G.G.) conforming to IS 3438-1965 or as per approved sample and quality.

The compound for glazing to metal is to be a special non-hardening compound manufactured for the purpose and of a brand and quality approved by the EPIL / Architects.

While cutting glass, proper allowance be made for expansion. Each square of glazing to be in one whole sheet. On completion of work clean all glass inside and out, replace all cracked scratched and broken panes and leave in good condition.

FLUSH DOORS:

All flush doors shall be solid core unless otherwise specified. It shall conform to the relevant specifications of I.S.2202 and shall be obtained from approved manufacturers. The finished thickness of the shutter shall be as mentioned in the item. Face veneers shall be of the pattern and colour approved by the EPIL / Architects and an approved sample shall be deposited with the EPIL/Architects for reference.

The solid core shall be of Wood Laminate prepared from battens of well-seasoned and treated good quality wood having straight grains. The battens shall be of uniform size of about 2.5 cm width. These shall be properly glued and machine pressed together with grains of each piece reversed from that of adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm in length. Alternatively, the core shall be of solid teak particle board. Edges of the
The core shall be lipped with first class teakwood battens of 4 cm. (1 ½") minimum depth, glued and machine pressed along the core.

The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross Bond) shall be laid with its grains at right angles to those of the core and the second the third veneer with their grains parallel to these of the core. The under veneers shall be of good quality, durable and well-seasoned wood. The face veneer shall be of minimum one mm thickness and of well-matched and seasoned first class teak, laid along with grains of the core battens. The combined thickness of all the veneers on each face shall not be less than 4 mm. Thermo setting synthetic resin conforming to IS 303 for moisture proof plywood grade M.P.F.I. shall be used in manufacture. In addition all doors shall have external lipping all round 8 mm thick.

STEEL FRAME WITH FIRE DOOR SHUTTERS

GENERAL

INDIAN STANDARDS

Work shall be carried out to Indian Standards and Code of practices. In absence International standards shall be followed. These shall be latest issue. List given hereunder is not to be considered as conclusive and is for reference and guidance only. Any discrepancies / conflict noticed shall be directed to the PM for his direction / approval. However as a general rule more stringent specification shall take precedence.

QUALITY ASSURANCE

1 Material used shall conform to IS. It shall withstand stresses and strains to which it is subjected.
2 Fabrication, assembly, erection, fastening, etc. shall be in accordance to details approved by PM.
3 Manufacturer shall have minimum five years experience in these products. Works shall be carried out under qualified supervisions. SUBMITTALS.

PRODUCTS

a) The contractor shall submit detailed catalogues, literature for products proposed to be used by him. He shall submit detail comparison for properties, test etc specified in BOQ and those of products he intends to use.

b) Certificate of manufacturer of products that it conforms or exceeds specification given in contracts and its suitability for use.

c) Manufacturer and the contractor shall give guarantee for performance and durability.

SHOP DRAWING

The contractor shall submit including required designing shop drawing for doorframes, shutters complete with

• a) Plan, elevation with relative position of adjacent works
• b) Details of tracks, guides, rollers, hood, locking arrangement
c) Full size details with specification of materials, sizes spacing of welds, screws bolts, rivets, anchors etc.

d) Construction, fabrication and erection details

e) Glazing details with type size and fixing

f) Fitting and fixtures with type size, brand and fixing details.

g) Finishing details

SAMPLES:
Samples of following shall be submitted along with submittals

Frame corner 300 x 300 mm with corner construction and finish

Shutter frame corner with inner construction details, stiffening, its welding, riveting, bolting, insulation etc.

Glazing with method of fixing, PVC / neoprene beadings, GI anchors, Fittings and fixtures

MATERIALS

GALVANIZED STEEL

Welding electrodes used shall confirm to respective IS Bolts, Bolts conforming to IS 1367 shall be used. Bolts may be turned and fitted or black bolts. Bolts, nuts shall be free from excessive rust, scaling/pitting, crack or any other defects. They shall be with sharp, defined threads and heads. They shall be well protected and securely stored at site.

ELECTRODES

Covered welding electrodes conforming to IS 814 shall be used in metal arc welding. Electrodes shall be fresh and packed in watertight packing as received from manufacturers with date of manufacture. They shall be stored in damp proof store.

FITTINGS AND FIXTURES

Fittings and fixtures shall be with IS mark and as required for respective locations. Thickness, size shall be as specified and the contractor shall ensure that material withstands the type of loading they are subjected to finishing of fittings and fixtures shall be in conformity to specification. Also it shall be noted that fitting and fixtures material are compatible and no harmful electrolytic / anodic actions are likely to take place.

Screws, bolts, nuts etc shall be compatible with fitting and fixtures provided.

DELIVERY, STORAGE AND HANDLINGS.

Fabricated products shall be handed over and transported to site with precautions not to damage, bend, dent, sag etc.
Fabricated finished product shall be received with self-adhesive protective coating prior to being transported to site. Store all material in a dry, lockable ventilated place. Material shall be placed on runners/packing and they are off the ground minimum 150mm. Inspect material received for dimension, quality and finish. Replace all damaged materials immediately. All acceptable material shall be repacked and stored. Special care shall be taken to store glass.

SCOPE OF WORK
Providing, designing, drawing, fabricating, shifting and installation of steel door frames and shutters and shutters with accessories such as anchorage, fittings, fixtures, finishing etc complete as per specification, conforming to IS and as accepted and approved by the PM to his entire satisfaction. Item proposed under this shall be Pressed sheet metal door frame Pressed metal sheet shutters

WORKMANSHIP
GENERAL
Fabrication shall be carried out only after approval to shop drawings by PM. Work shall be carried out at factory and shall be with proper tools and tackles and complying to Engineering practices. Factory shall be accessible to Architect's and PM's representative at all times. Points to be noted are

CUTTING
Cut shall be by sawing, shearing or blanking. Flame cutting shall be avoided. However if permitted, cut edges shall be ground back to clean, smooth edges. Cut shall be accurate, clean, sharp, square and free of burrs, without deforming adjacent surfaces of metals.

HOLES
Holes shall be drilled or cleanly punched to achieve accurate, clean, neat and sharp without deforming adjacent surfaces of metals. Gas cutting of hole not permitted.

JUNCTIONS / ASSEMBLY
Connections and junctions shall be located as approved in drawings. Connections shall be tight joints capable of developing full strength within members. Joints and connections shall be flush unless specified differently. In exposed condition where required water draining arrangement shall be provided. Provision for thermal movement jointing shall be provided at locations approved by the Architect.

WELDING
Welding shall be in accordance with recommendations of the Indian Standard code of practice. Welder shall be trained and certified as per IS 817. Work shall be done with electrodes and/or
methods recommended by the manufacturers of the metals being welded. Welds shall be continuous, except where spot welding is specifically permitted. Exposed welds shall be finished free of imperfections such as pits, runs, splatter, cracks, wrapping, dimpling, depressions or other forms of distortion, discoloration. Exposed welds shall be ground flush and dressed smooth to match adjoining surfaces.

BOLTS AND SCREWS
Threaded connections shall be with tight threads entirely concealed. At exposed locations lock nuts, bolts and screw heads, shall be flat and countersunk. Cut off projecting ends of exposed bolts and screws flush with nuts or adjacent metal.

SITE FIXING
Work shall include providing and fixing nonferrous anchor bolts / insert plates, plates or other anchoring devices for fixing into or to concrete, masonry or other trades of work. All these shall be with approval of the Architect and the Engineer.

FINISHING
Work shall be clean, free from dirt, stains, grease, scratches, distortion, waves, dents, buckles, tool marks, burrs, etc. and defects which mar appearance of finish work.

MOCKUP SAMPLES
The contractor shall prepare mockup samples as per approved shop drawing. Mockup samples shall be to full size and shall be true representation of actual works to be carried out at site.

JOINERIES

PLYWOOD
Marine plywood shall generally conform to I.S.710-1980 or latest, bonded with phenol formaldehyde, treated with wood preservative.

TEAK WOOD
Timber shall be well seasoned and of the best quality, Indian Teak of specified (viz). Bandeli, Ballarshah, Malabar, etc.

Timber shall be considered as well seasoned, if its moisture content does not exceed the following limits.

(i) Timber for frames ... 14%
The moisture content of timber shall be determined according to method described in Paragraph 4 of IS: 287 for 'Maximum Permissible Moisture content of Timber used for different purposes in different climatic zones'. First Class Indian Teakwood means locally available best quality and well seasoned. It shall have uniform color, reasonably straight grains and shall be free from large loose dead knots, or defects of any kind. No individual hard and sound knot shall be more than 2.5 cm. in diameter and aggregate area of all knots shall not exceed 1% of the area of the piece. There shall not be less than growth rings per 2.5 cm. width.

All the wood shall be properly seasoned, natural growth and shall be free from worm holes, loose or dead knots cracks, shakes, twists, bends, sapwood or other defects, saw die square and shall not suffer warping, ting or other defects. All internal frame work shall be treated with approved wood preservative. All wood brought to site should be clean shall not have any preservative. All rejected decayed, bad quality wood shall be immediately removed from site. All wood brought to site must be stacked-stored properly as per instructions.

WOOD WORK:

Timber used shall confirm to specifications described under materials, shall be in accordance with the drawing in every detail and all joiner’s work shall be accurately set out, framed and finished in a proper workman like manner. Frames of partitions and opening, etc., shall be of accurately planned smooth and rebates, rounding and mouldings shall be made as shown on the drawings. Patching or Plugging of any kind shall not be allowed. Joints shall be simple, neat and strong. Framed joints shall be coated with suitable adhesive like glue or synthetic resin before the frames put together. All mortise and tenon joints shall fit in fully and accurately without wedging or filling. The joints shall be pinned with hardwood or rust resisting star shaped metal pints of 8 mm dia., after the frames are put together and pressed in position by means of a press. The frames shall be protected during the progress of work by providing suitable boxing. All portions of timber abutting against or embedded in masonry or concrete shall be treated against termites by giving a coat of any approved wood preservative. All T.W.work should be painted with a coat of approved wood primer.

Frames and Shutters shall not be painted or erected before being approved by the EPIL / Architects.

JOINERY:

Joinery is to be prepared immediately after the placing of the Contract framed up, bonded and waged up. Any portions that are warped or found with other defects are to be replaced before wedging up. The whole of the work is to be framed and finished in a workmen-like manner in accordance with the detailed drawings wrought and whenever required, fitted with all necessary metal ties. Straps, belts, screws, glue etc. Running beaded joints are to be cross-tongued with teak tongues wherever 1(1/2) thk. Double cross tongued. Joiners work generally to be finished with fine sand/glass paper.
Joints:
All joints shall be standard mortise and tenon, dowel, dovetail, and cross halved. Nailed or glued but joints will not be permitted, screws, nails etc. will be standard iron or wire of oxidized Nettle fold tenons should fit the mortises exactly.

Nailed or glued butt joints will not be permitted, exceptional cases with approval of Architects/EPIL.

Where screws shown on a finished surface, those will be sunk and the whole plugged with a wood plug of the same wood and grain of the finished surfaces will be neatly punched and the hole filled with wood filler to match the colour.

Should joints in joiner's work open, or other defects arise within the period stated for defect liability in the contract and the clause thereof be deemed by the Architects to be due to such defective joinery shall be taken down, and refilled, redecorated and/or replaced if necessary and any work disturbed shall be made good at the Contractor's expense.

Nails, spikes and bolts shall be of lengths and weights approved by the HPCL/Architects. Nails shall comply with IS 1959-1960. Brass headed nails are to comply with B.S.1210. Wire staples shall comply with B.S.1494 or equivalent.

The contact surface of dowels, wedges etc., shall be glued with an approved adhesive.

Where glued, joinery and carpentry work is likely to come into contact with moisture; the glue shall be waterproof grade.

- IS 226 Structural steel (Standard quality) superseded by IS 2062:1992
- IS 277 Specification for galvanized steel sheets
- IS 1038 Specification for steel doors, windows and ventilators
- IS 1081 Code of practice for fixing and glazing of metal (steel & aluminium) door, windows and ventilators
- IS 1361 Specification for steel windows for industrial buildings
- IS 1367 (Part 1-19) Technical supply conditions for threaded steel fasteners
- IS 1977 Structural steel (ordinary quality)
- IS 2062 Steel for general structural purposes
- IS 4351 Specification for steel door frames
- IS 4736 Hot - dip zinc coating on mild steel tubes
FLUSH DOORS:

All flush doors shall be solid core unless otherwise specified. It shall conform to the relevant specifications of I.S.2202 and shall be obtained from approved manufacturers. The finished thickness of the shutter shall be as mentioned in the item. Face veneers shall be of the pattern and colour approved by the EPIL / Architects and an approved sample shall be deposited with the EPIL / Architects for reference.

The solid core shall be of Wood Laminate prepared from battens of well-seasoned and treated good quality wood having straight grains. The battens shall be of uniform size of about 2.5 cm width. These shall be properly glued and machine pressed together with grains of each piece reversed from that of adjoining one. The longitudinal joints of the battens shall be staggered and no piece shall be less than 50 cm in length. Alternatively, the core shall be of solid teak particle board. Edges of the core shall be lipped with first class teakwood battens of 4 cm. ( 1 ½”) minimum depth, glued and machine pressed along the core.

The core surface shall then have two or three veneers firmly glued on each face. The first veneer (called cross Bond) shall be laid with its grains at right angles to those of the core and the second the third veneer with their grains parallel to these of the core. The under veneers shall be of good quality, durable and well-seasoned wood. The face veneer shall be of minimum one mm thickness and of well-matched and seasoned first class teak, laid along with grains of the core battens. The combined thickness of all the veneers on each face shall not be less than 4 mm. Thermo setting synthetic resin conforming to IS 303 for moisture proof plywood grade M.P.F.I. shall be used in manufacture. In addition all doors shall have external lipping all round 8 mm thick.

WALL PAINTING WITH PLASTIC EMULSION PAINT

The plastic emulsion Paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These Paints are to be used on internal surfaces except wooden and steel.

Plastic Emulsion Paint as per IS 5411 of approved brand and manufacture and of the required shade shall be used.

PAINTING ON NEW SURFACE

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material conforming to IS 345 with same shade as Paint shall be used where specified. The surface treated for knotting shall be dry before Paint is applied. After obtaining approval of Engineer-in-Charge for wood work, the priming coat shall be applied before the wood work is fixed in position. After the
priming coat is applied, the holes and indentation on the surface shall be stopped with glazier’s putty or wood putty. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

APPLICATION: The number of coats shall be as stipulated in the item. The Paint will be applied in the usual manner with brush, spray or roller. The Paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on nonabsorbent surfaces. The thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the under coat which is applied on the absorbent surface. The quantity of water to be added shall be as per manufacturer’s instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

PRECAUTIONS

(a) Old brushes if they are to be used with emulsion Paints, should be completely dried of turpentine or oil Paints by washing in warm soap water.

Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the Paint from hardening on the brush.

(b) In the preparation of wall for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

(c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

(d) Washing of surfaces treated with emulsion Paints shall not be done within 3 to 4 weeks of application.

PAINTING ON OLD SURFACE

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material conforming to IS 345 with same shade as Paint shall be used where specified. The surface treated for knotting shall be dry before Paint is applied. After obtaining approval of Engineer-in-Charge for wood work, the priming coat shall be applied before the wood work is fixed in position. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glazier’s putty.
or wood putty. Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

The surface before application of Paint shall be flattened well to get the proper flat velvety finish after painting.

APPLICATION: The number of coats shall be as stipulated in the item. The Paint will be applied in the usual manner with brush, spray or roller. The Paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 the thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the under coat which is applied on the absorbent surface. The quantity of water to be added shall be as per manufacturer's instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance and thinning with water shall not normally be required.

PAINTS:
All material required for the works like Lime for lime wash, dry distemper, oil bound distemper, cement, primer, oil paint, enamel paint, flat oil paint, plastic emulsion paint, anti-corrosive primer, red lead, water proof cement paint shall be of specified and approved manufacturer, delivered to the site in the manufacturer's containers with the seals etc., unbroken and clearly marked with the manufacturer's name or trade mark with a description of the contents and colour shall conform to the latest Indian Standards for various paints. All materials are to be stored on the site of the work.

Spray painting with approved machines will be permitted only if written approval has been obtained from the EPIL/Architects prior to painting. No spraying will be limited in the case of priming neither coats nor where the soiling of adjacent surfaces is likely to occur. The buzzle and pressure to be so operated as to give an even coating throughout to the satisfaction of the EPIL/Architects. The paint used for spraying is to comply generally with the specification concerned and is to be specially prepared by the manufacturer for spraying. Thinning of paint made for brushing will not be allowed.

Wood preservative shall be Bison or other equal and approved impregnating wood preservative and all concealed wood work shall be treated with wood preservative.
All brushes, tools, pots, kettles etc. used in carrying out the work shall be clean and free from foreign matter and are to be thoroughly cleaned out before being used with a different type of class of materials.

All iron or steel surfaces shall be thoroughly scraped and rubbed with wire brushes and shall be entirely free from rust, mill scale etc. before applying the priming coat.
Surfaces of new wood work which to be painted are to be rubbed down, cleaned, down to the approval of the Architects.

Surfaces of previously painted woodwork which are to be cleaned down with soap and water, detergent solution or approved solvent to remove dirt, grease etc. While wet the surfaces shall be flatted down with a suitable abrasive and then rinsed down and allowed to dry. Minor areas of defective paint shall be removed by scraping back to a firm edge and the exposed surface touched in with primer as described and stopped with putty. Where wood work has been previously painted or polished and is to be newly polished, scraping, burning off or rubbing down.

Surfaces of previously painted metal which shall be painted are to be cleaned down and flattened down as described in surfaces of any rust and loose scale shall be removed completely by chipping, scrapping and wire brushing back to the bare metal and touched in with primer as described.

SANITARY FIXTURES AND CHROMIUM PLATED (C.P) FITTINGS:

General: All sanitary fixtures and Chromium plated C.P. fittings shall be fixed in a neat workman like manner true to line and as recommended by the manufacturer or shown in the drawings. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor tiling or terrace shall be made good at contractors cost. Care shall be taken to fix all fixtures brackets and accessories by proper wooden cleats rawal plug bolts and nuts.

Care shall be taken in fixing all approved C.P. fittings and sanitary fixtures so as not to leave and tool marks or damages on the finish. All such fittings shall be tightened with fixed spanners. Use of pipe wrenches with toothed jaws shall not be allowed.

All C.P. fittings and sanitary fixtures shall be fixed in accordance with a set pattern matching the tiles or interior finish as the architectural / interior designer’s requirements. Wherever necessary, the fittings shall be centered to dimensions and pattern desired. All sanitary fixtures and C.P. fittings shall be thoroughly tested after connecting up the drainage and water supply system. These shall be thoroughly finished and if any leakage, it shall be corrected to the entire satisfaction of the Engineer.

When directed, contractor shall install sanitary fixtures and C.P. fittings in a mock-up room for the approval of the engineer. Mock-up room fixtures and C.P. fittings may be reused on the works if undamaged, but no additional payment for fixing and dismantling shall be admissible.

Upon completion of the work, all labels, stickers, plasters, etc. shall be removed from the sanitary fixtures and all C.P. fittings shall be cleaned so as to present a neat and clean toilet.
WASH BASINS:

They shall be of white vitreous China best quality manufactured by an approved firm and size as specified. They shall be supported on a pair of C.I. brackets of approved design or on Granite slab as per Architect’s instructions.

Each wash basin shall be provided with 15mm C.P. brass angle stopcock, 450mm long 8mm dia C.P. inlet pipe, 32mm C.P. waste coupling, 32mm dia bottle trap with C.P. extension pipe brass chain and rubber plug unless otherwise specified and 32 mm dia G.I. pipe from Bottle trap to Floor Multi-trap.

The wash basin is normally supported on a cantilever brackets. However, there is a tendency to simply rest the wash basin on the cantilever bracket. The basin is not fixed properly; it can be taken away easily. The basin should have plaster on the rear side touching the wall resting over the top edge of the basin apart from closing one of the gaps through which the water leaks it also makes the basin fixed to the wall and cannot be taken out easily. Other tendency is to discharge basin waste through a flexible pipe on floor which many times allows the water overflow. The correct way of installing the wash basin is therefore through bottle trap.

BIB-COCKS:

The Bib-cock shall be of 15mm dia brass C.P. with C.P. wall flanges.

TOILET ACCESSORIES:

TOWEL ROD:

Towel rail shall be of anodised aluminum C.P. with reinforced bends and circular flanges. The size of the rail shall be as specified. The bracket shall be fixed by means of C.P. brass screws to wooden cleats firmly embedded in the wall.

TOILET PAPER HOLDER:

Toilet paper holder shall be of CP type as specified in schedule of quantities.

SOAP TRAY:

Soap tray shall be of CP type as specified on schedule of quantities.

TOWEL RING:

Towel ring shall be of C.P. / anodisedaluminium /powder coated as specified in schedule of quantities. It shall be fixed by means of C.P. brass screws to wooden cleats / plastic expansion plugs firmly embedded in the wall.
Mode of Measurement:

All the items mentioned above shall be measured in numbers and the quoted rate shall be per number only which shall include unless otherwise specified and shall include:

a) The cost of respective materials.
b) Necessary fixtures and accessories.
c) Fixing in position and testing where necessary / specified.
d) And necessary fittings, hardware, etc. to complete the above.

PVC PIES AND FITTINGS:

MATERIAL:

PVC pipes and fittings for rainwater pipes shall conform to IS - 4985-88, (SWR Type) fitting to IS 7834 - 1987 and rubber rings to IS 5382.

LYING:

Exposed as the case may be as shown on the drawings, the minimum thickness of the fittings shall be of 3.2 mm, the fitting shall be injection moulded type with rubber ring socket. The exposed pipes and fittings shall be capable of withstanding sun-rays (Ultra-violet radiation) without having decolorization and brittleness.

JOINTING:

The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions / recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:

Clean the outside of the pipes spigot end and the inside of the ceiling groove of the fitting. Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Mark the position of the socket edge with pencil or felt open on the pipe, then withdraw the pipe from the socket by approximately 10 mm. to make the pipe fully fitted to the fitting. The horizontal pipes on the wall shall be fixed with M.S. fabricated clamps with necessary provisions to take care the expansion and contraction in PVC pipes. The spacing of the clamps shall be at the intervals of 1.5 mtr. To 2 mtr. Depending on the requirement of the supporting arrangements.
PIPE HANGERS, BRACKETS, ETC.:-

Sturdy hangers, brackets and saddles of approved design shall be installed to support all pipe lengths which are not embedded over their entire run. The hangers and brackets shall be fabricated from suitable MS rolled section. The hangers and brackets shall be of adjustable heights and prime coated with red oxide primer. Clamps, collars and saddles to hold pipe shall be designed to carry the weight of pipes safely. All pipes and fittings shall be secured near every joint and half way through every pipe length unless otherwise specified.

TESTING. :-

PVC pipes and fittings shall be tested for three meters of water head the openings of the pipes shall be sealed for the section to be tested. The water pressure shall be maintained for maximum of one hour. The Engineer shall examine carefully all the joints for leakage.

MODE OF MEASUREMENT. - PIPES:-

These pipes shall be measured along the center line of the pipe including all specials in Rmt. The quoted rate for respective items shall include the following :-

Cost of respective pipes and specials and jointing materials. Laying, fixing and jointing with necessary clamps, brackets, screws etc. and curing. Making good all damages to the parts of the building to suit the surroundings. Testing and making good the defects, if any.

B. MODULAR FURNITURE:

TECHNICAL SPECIFICATIONS OF FRAMES:

Partition thickness is 50mm for more stability and with inside gap between two tile carrying wire. The inside frame is made out of 1.6mm thick CRCA sheets and the thickness of 56mm.

All the Frames are duly powder coated in JET black colour to a thickness of 50-60 microns.

The horizontals and verticals of the frames are welded together at different heights so as to facilitate the wire management system running within the frame. The frame has various slots at different heights for fixing of tabletop brackets, tiles, storages & shelves.

All the frames are joined together by means of screws and nuts. They can be attached to form a 2way, 3-way or a 4-way configuration. Possibility to join the frames at 120 degree can also be provided within the system.

All frames are fixed with aluminum trims. These trims are finished in an epoxy powder coating finish.
The connectors at the top of the frames are made out of Die-cast Aluminum. These caps also are finished in an epoxy powder coating finish in the same color.

All the frames are fitted with M10 leveling bolts.

TECHNICAL SPECIFICATIONS OF RACEWAYS:
The raceways are made out of 0.8mm thick CRCA & powder coated.
The raceway can be provided below worktop or above worktop.
The skirting raceway is hallow and throughout.

TECHNICAL SPECIFICATIONS OF TILES:
FABRIC TILE: Constructed out of 8mm thick Medium Density Fiber Board (MDF) and covered with Fabric of choice.

LAMINATE TILE: Made out of 8mm thick Pre-laminated Medium Density Fiber Board (MDF)

GLASS TILE: 4mm Toughened glass fixed within an aluminum powder coated frame. Two such tiles on either side of the frame complete the assembly.

STEEL TILE: Constructed out of 0.8mm CRCA sheet and finished in epoxy powder coating. Can be given with perforations.

MAGNETIC TILE: Constructed out of 0.8mm Galvanized sheet and covered with fabric of choice.

WHITEBOARD MARKER TILES: Made out of 6mm MDF with 1mm glossy highly wear resistant face laminate with a balancing laminate on the back. Total thickness is 8mm.

TECHNICAL SPECIFICATIONS OF TABLE TOPS AND GABLE ENDS:
All table tops and Gable ends can be either out of 25mm Pre-laminated particleboard with PVC edge banding or 25mm Plain particleboard with post forming of 0.8mm laminate on top and balancing laminate at bottom.

Specially designed powder coated M.S. brackets fixed to the partition frame support the tabletops and gable ends.

PEDESTAL DRAWER UNIT:
The Pedestal Unit of Dimensions 450W x 450D x 680H is made of 18mm thick pre laminated particle Board, All the exposed edges are sealed with 0.8mm thick PVC good quality edge banding on sides and bottom. The top and drawer facia are sealed with 2mm thick PVC edge. The drawer unit consists of 2 box drawer and 1 file drawer. The sides of Inside drawer box are of metal and powder coated. The drawer box is fitted with roller Slide with self-closing action and for free movement. The drawer unit is provided with central locking system, where in the three drawer are locked with one key. Brush Steel finish handles are provided for easy opening and closing of drawer. The drawer unit is fitted on castors (optional) for easy mobility. All the
hardware is from Mepla/Hafele/Hettich of Germany or Ebco or reputed manufacturer in India. PVC edge banding is from Rehau&Dolken or equivalent.

The complete furniture unit is assembled with knock down fitting.

CPU TROLLEY:
CPU trolley is made from 1mm Thick CRCA steel sheet. The width of the trolley can be varied for accommodating various widths of CPUs; the trolley is mounted on lockable castors from reputed manufacturers in India.

KEYBOARD DRAWER:
Keyboard tray is made of ABS Plastic mounted on metal slides for easy movement. The slides are from reputed companies from India.

STORAGE UNIT:
Storage body is made of 18mm thick pre laminated particle Board conforming to IS : 12823, The back of the unit is made from 9mm pre-laminated board. All the exposed edges are sealed with 0.8mm thick PVC edge banding on sides and bottom. The top and hinged shutters are sealed with 2mm thick PVC edge banding.

The units are assembled by knock down fittings such as Minifix&Dowels. All the hardware and Hinges are from Mepla/Hafele/Hettich of Germany or Ebco or reputed manufacturer in India. PVC edge banding is from Rehau&Dolken or equivalent.

WIRE MANAGEMENT

The partition has two integrated raceway provided one at skirting level and another at the work surface level thus ensuring separation of power and networking cables. The free space available within raceway accommodates power, data and communication cables.

The cable can be taken into the Frame either from the ceiling through power pole or from the bottom. Once the cables enter the Frames, it can be taken from one end to the other end continuously as per Power / LAN layout plan. Approximately 60-75 (5mm Dia) cables can be accommodated in the raceway channels.

The raceways are provided with CRCA Snap cover on both side of raceways where required or on one side depending upon where worktop is being used. The second raceway at work top level can be given either below tabletop or above tabletop. The cable running at skirting level can be terminated at tabletop level through disciplined wiring channels inside the frames.

The raceway covers will be provided with appropriate electrical switch cutouts, as per the samples of switches provided, the number of cutouts in each workstation would depend upon the size of the switches.
BRIEF SCOPE OF WORK FOR DATA AND VOICE WORKS

New installation and integration with existing LAN setup includes but not limited to the following tentative work:

1. Indoor UTP Cable Laying through PVC Pipe, Casing including all materials
2. Installation of IO/Crimping/Patch Panel/ Rack/ Switch and System Integration
3. Laying and Termination of CAT6 / CAT5E UTP Cable. All cabling must be “structured”
4. Network Documentation (on Paper and CD)
5. All the floppy-disc., CD’s, operational manuals, stationery and similar Accessories made available by Equipment vendor would be handed over by the Contractor to EPIL after installation work is over.
6. Labeling of Cables, I/Os, Jack Panel, Switches for new connections
7. Repair/Refurnishing work owing to damage caused due to cabling or any other work related to this Project. There should not be any hanging or uncovered wire.
8. Patch cord should be branded and factory crimped.
9. Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment's and/or needed for erection, completion and safe operation of the equipment's as required by applicable codes though they may not have been specifically detailed in the tender document, unless included in the list of exclusions. All similar standard components/parts of similar standard equipment's provided, shall be interchangeable with one another.
10. The Bidder shall be responsible for providing all materials, equipment's, and services, specified or otherwise, which are required to fulfill the intent of ensuring operability, maintainability, and reliability of the complete equipment covered under this specification within his quoted price. This work shall be in compliance with all applicable standards, statutory regulations and safety requirements in force of the date of award of this contract.
11. The bidder shall also be responsible for deputing qualified personnel for installation, testing, commissioning and other services under his scope of work as per this specification. All required tools and tackles for completing the scope of work as per the specification is also the responsibility of the bidder.
12. The installation of equipment shall be accepted only after installation tests are over.
13. The bidder should ensure while installation of LAN, day-to-day functioning of official work and existing network setup/connectivity/internet connectivity should not get disrupted.

14. The bidder’s proposal shall include the list of tools (such as crimping tool, Krone punch tool) and other accessories, which are required for installation of the connection. No separate charges for fixing/crimping/other connection charges would be paid by HPCL.

15. The scope covers the proposed networking system, inspection / testing, transportation, insurance, and carrying out further activities at sites viz. unloading, storage,(space to be provided by the owner) further handling, erection, testing and commissioning including successful completion of acceptance tests and any other services specified.

16. Client reserves the right for quantity variation due to increase/decrease in requirements. The bidder shall also provide all required equipment which may not be specifically stated herein but are required to meet the intent of ensuring completeness, maintainability and reliability of the total system covered under this specification, including integration and interoperability with the existing LAN.

17. Scope of Work shall also include

a. Powering on equipment after ensuring correctness of terminations interfaces and power supply and making the system ready for testing and commissioning.

b. Testing of LAN Cables after laying, terminations and ferruling at both the ends. All testing tools and instruments shall be brought by the bidder and taken back after the testing.

c. Site acceptance tests to establish satisfactory performance of the equipment's as per specs.

d. Assistance for familiarization and operation of the installed system & services for 6 months after acceptance of system.

E. Onsite warranty for all Installation and Hardware delivered for minimum one year and extended as per OEM guarantee/warranty offered.

18. In case, the quantity of laying cables or fixing wall mount sockets etc. exceeds or is less than the quantity in bid price schedule, the payment for the executed quantity shall be paid on pro-rata basis, for the actual quantities consumed / for which the installation is carried out through the Bidder on Certification by STPI’s Network Engineer.

19. Any other work required for making the network* functional up to the satisfaction of STPI.

20. Each channel shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice Cables shall be tested for continuity, pair reversals, shorts, and opens using a “green light”
type Test set. Twisted-pair data cables shall be tested for all of the above requirements, plus tests that indicate installed cable performance. The balanced copper channels shall be tested using a Level III tester as specified in IEC61935-1. Level IV testers may be used, provided they meet the accuracy level III as specified in IEC 61935-1, when using an 8 position RJ45 modular interface. Level IV testers as specified by IEC 61935-1 are only specified using a Category 7 interface and can therefore not by default meet the accuracy level specified for level III, this verification have to be proven by the manufacturer or by 3rd party certification.

21. CONTINUITY - Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

22. LENGTH - Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel and patch panel to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ISO/IEC 11801 2nd Edition Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multipair cables, the longest pair length shall be recorded as the length for the cable.

23 PERFORMANCE VERIFICATION - Category 6A / Class EA data cable shall be performance verified using an automated test set to ISO/IEC 11801 2ND Edition CLASS EA -CH Channel parameters. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ISO/IEC 11801 2nd Edition Standard and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed and the actual test result achieved.

24. The Customer’s Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the raised access floor or ceiling, to inspect the method of cable routing and support, and the fire stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with CENELEC specifications for jacket removal and pair untwist, compliance with manufacturer’s minimum bend radius, and that cable ends are dressed neatly and orderly.

25. FINAL INSPECTION - Upon completion of the project, The Customer’s Technical Representative will perform a final inspection of the installed cabling system with the Contractor’s Project Foreman. The final inspection will be performed to validate that all horizontal and backbone
cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Customer.

26. TEST VERIFICATION- Upon receipt of the test documentation, The Customer reserves the right to perform 10% spot testing of a representative sample of the cabling system to validate test results provided in the test document. Customer testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found, the Contractor will be notified for resolution.

27. SYSTEM PERFORMANCE - During the three week period between final inspection and delivery of the test and as-built documentation, The Customer will activate the cabling system. The Customer will validate operation of the cabling system during this period.

28. FINAL ACCEPTANCE - Completion of: the installation; in-progress and final inspections; receipt of the test and as-built documentation; and successful performance of the system for a two week period will constitute acceptance of the system.

29. The proposed location for dismantling of existing brick wall has been shown in the enclosed drawings.

30. The removable doors are located in the dismantlable brick wall areas only as shown in the enclosed drawings.

31. Since all the new partitions will be fixed to slab as per specification, as a result, the existing False ceiling in part or in full in many places will have to be removed and newly done.

32. New vitrified tile work will have to be re-done while dismantling of brick wall and related works.

33. The new false ceiling work will have to be done in parts and may in full in some places, to modify the same as required for STPI setup.

34. After partitions & placing work stations the position of the switch boards have to be changed as well as new wirings will be needed for the work stations.

35. Separate switch boards will be fixed for each incubation/partitions hence additional switch boards are required.

36. The lighting arrangements will have to be changed according to the new setup and more luminaries will be required.

37. The existing LAN cablings does not match the new proposed furniture plan, so entire LAN work proposed to be done in fresh, routing above the ceiling and through specially designed Tray to be fixed all along the partitions and brick walls.

38. In addition to existing CCTV cameras of common space of building, new CCTV cameras will be installed for STPI’s own administration covering STPI’s space only.
<table>
<thead>
<tr>
<th></th>
<th>APPROVED MAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Modular Furniture</td>
</tr>
<tr>
<td>2</td>
<td>Plywood (ISI marked) :</td>
</tr>
<tr>
<td>3</td>
<td>Wood preservative :</td>
</tr>
<tr>
<td>4</td>
<td>Laminates (1mm th) :</td>
</tr>
<tr>
<td>5</td>
<td>Veneer</td>
</tr>
<tr>
<td>6</td>
<td>Acoustic Wall Panel</td>
</tr>
<tr>
<td>7</td>
<td>Door Closer- Extended Pelmet :</td>
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<tr>
<td>8</td>
<td>Floor Springs- dual speed :</td>
</tr>
<tr>
<td>9</td>
<td>Locks :</td>
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<tr>
<td>10</td>
<td>Hardware::</td>
</tr>
<tr>
<td>11</td>
<td>Adhesives</td>
</tr>
<tr>
<td>13</td>
<td>PVCum Board- False ceiling</td>
</tr>
<tr>
<td>14</td>
<td>Modular False Ceiling</td>
</tr>
<tr>
<td>15</td>
<td>Float Glass</td>
</tr>
<tr>
<td>16</td>
<td>Patch fittings for glass :</td>
</tr>
<tr>
<td>17</td>
<td>vertical Blinds :</td>
</tr>
<tr>
<td>18</td>
<td>Drawer Channels :</td>
</tr>
<tr>
<td>19</td>
<td>HINGES :</td>
</tr>
<tr>
<td>20</td>
<td>Sun Control Film</td>
</tr>
<tr>
<td>21</td>
<td>Fibre-reinforced Cement board</td>
</tr>
<tr>
<td>22</td>
<td>Panic Device</td>
</tr>
<tr>
<td>23</td>
<td>Texture paint</td>
</tr>
<tr>
<td>24</td>
<td>Wallpaper</td>
</tr>
<tr>
<td>25</td>
<td>Polishes and Paints</td>
</tr>
<tr>
<td>26</td>
<td>CAT-6 cables , IO boxes, Patch Chord etc.</td>
</tr>
<tr>
<td>27</td>
<td>IT Server Rack</td>
</tr>
<tr>
<td>28</td>
<td>Network switch</td>
</tr>
<tr>
<td>29</td>
<td>IP Communication system</td>
</tr>
<tr>
<td>30</td>
<td>Router</td>
</tr>
<tr>
<td>31</td>
<td>IP Phone</td>
</tr>
<tr>
<td>32</td>
<td>UPS</td>
</tr>
<tr>
<td>33</td>
<td>Telepresence System</td>
</tr>
<tr>
<td>34</td>
<td>IP Camera</td>
</tr>
<tr>
<td>35</td>
<td>VIDEO MANAGEMENT SOFTWARE</td>
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<td>No.</td>
<td>Item Description</td>
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<tr>
<td>36</td>
<td>Full HD LED Panel</td>
</tr>
<tr>
<td>37</td>
<td>Ceramic Tiles</td>
</tr>
<tr>
<td>38</td>
<td>Vitrified Tiles</td>
</tr>
<tr>
<td>39</td>
<td>Carpet</td>
</tr>
<tr>
<td>40</td>
<td>Anti-static Raised False floor</td>
</tr>
<tr>
<td>41</td>
<td>Engineered Wood Floors</td>
</tr>
<tr>
<td>42</td>
<td>Fire Doors</td>
</tr>
<tr>
<td>43</td>
<td>Plumbing/Toilet fixtures/faucets</td>
</tr>
</tbody>
</table>
**List of Drawings**

NIT No.& Date: DL/CON/755/612 dated 17.01.2018

Tender for Phase-II works of Repair, renovation & Face Lifting of STPI Building at Borjhar, Guwahati” for creation of state of the art STPI facilities”

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Title of Drawing</th>
<th>Drawing No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground Floor &amp; 1st Floor Plan</td>
<td>STPI/GHY/ FL PLAN/01 (R02)</td>
</tr>
<tr>
<td>2</td>
<td>2nd &amp; 3rd floor Plan</td>
<td>STPI/GHY/ FL PLAN/02 (R01)</td>
</tr>
<tr>
<td>3</td>
<td>False Ceiling Plan, Ground &amp; 1st Floor</td>
<td>STPI/GHY/ FC PLAN/01 (R02)</td>
</tr>
<tr>
<td>4</td>
<td>False Ceiling Plan, 2nd &amp; 3rd Floor</td>
<td>STPI/GHY/ FC PLAN/02 (R01)</td>
</tr>
<tr>
<td>5</td>
<td>Fire Tank</td>
<td>STPI/GHY/ S/01 (R01)</td>
</tr>
<tr>
<td>6</td>
<td>Front Façade</td>
<td>STPI/GHY/ DET/03 (R01)</td>
</tr>
<tr>
<td>7</td>
<td>Side Elevation</td>
<td>STPI/GHY/ DET/04 (R01)</td>
</tr>
<tr>
<td>8</td>
<td>Detail 1-B AL. Cladding</td>
<td>STPI/GHY/ DET/01 (R01)</td>
</tr>
<tr>
<td>9</td>
<td>Detail 1-A, Pergola at 3rd floor</td>
<td>STPI/GHY/ DET/02 (R01)</td>
</tr>
</tbody>
</table>

Note: The drawings enclosed are for general guidance only. The works shall be executed as per the detail drawings to be issued during execution and as per instructions of EPI/Owner.
False Ceiling Area (water Proof)  79.00 SqM
False Ceiling Area (water Proof)  49.00 SqM
False Ceiling Area (water Proof)  12.00 SqM
False Ceiling Area (water Proof)  20.00 SqM
False Ceiling Area (water Proof)  329.00 SqM

Combination of gypsum & 2x2 (item no. 44 & 45)
Water Proof Gypsum False Ceiling
Decorative, Acoustic 2x2 false ceiling
FRAME DETAILS FOR NOS. 36 TO 96

FRAME DETAILS FOR NOS. 1, 2, 4-7, 10-12, 15-18, 21-23, 26-35

FRAME DETAILS FOR NOS. 8 & 9

FRAME DETAILS FOR NOS. 3 & 4

FRAME DETAILS FOR NOS. 13, 14, 24 & 25

FRAME DETAILS FOR NOS. 19 & 20

TYPICAL FRONT ELEVATION