TENDER DOCUMENT

NIT No.: NRO/CON/ALIMCO-FBD/752/677 dated 03.12.2018

FOR

Construction of Boundary Wall, 2 nos. gates & 2 nos. Guard room at ALIMCO’s new manufacturing set up of Aids and assisted devices at village Nawada Tigaon, Block Ballabgarh, district Faridabad (Haryana).

VOLUME – II

ADDITIONAL CONDITIONS OF CONTRACT

TECHNICAL SPECIFICATION

AND

DRAWINGS

EXECUTING AGENCY

ENGINEERING PROJECTS (INDIA) LIMITED

(A GOVT. OF INDIA ENTERPRISE)

Core-3, Scope Complex,
7, Lodhi Road, New Delhi-110003
TEL NO: 011-24361666, FAX NO. 011-24363426
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

1.0 The following Additional Conditions of Contract shall be read in conjunction with General Conditions of Contract. If there are any provisions in these Additional Conditions of Contract, which are at variance with the provisions of General Conditions of Contract, the provisions in these Additional Conditions of Contract shall take precedence.

2.0 INTRODUCTION

Artificial Limbs Manufacturing Corporation of India (ALIMCO) at Kanpur has entrusted the Construction of ALIMCO’s new manufacturing set up of Aids and assisted devices including Boundary Wall, 2 nos. gates & 2 nos. Guard room at village Nawada Tigaon, Block Ballabgarh, district Faridabad (Haryana) to EPI as PMC (Deposit work). EPI on behalf of ALIMCO has invited the NIT as open tender from the eligible bidders as per NIT.

3.0 SCOPE OF WORK INCLUDED IN THE CONTRACT

The scope of work covers the entire Civil and Structural works for Construction of Boundary Wall, 2 nos. gates & 2 nos. Guard room at ALIMCO’s new manufacturing set up of Aids and assisted devices at village Nawada Tigaon, Block Ballabgarh, district Faridabad (Haryana).

The scope of work covers the entire construction work as stipulated above and as mentioned in BOQ/ drawings/ specification and handing over the project to EPIL /Client including the followings:

1. Civil and Structural works.
2. Internal and External Electrical works.
3. Other misc. works as required.

4.0 QUALIFICATION OF TENDERERS

The price bid of short listed tenderers who fulfill the eligibility criteria shall only be opened. The decision of EPI in this regard shall be final & binding on the tenderers.

5.0 DISQUALIFICATION

The tenderers may note that they are liable to be disqualified and not considered for the opening of their Price Bid if;

a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 10 years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their on going / past projects.
c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

d) If the tenderers attempt to influence any member of the committee.

EPI reserves its right to take appropriate action including disqualification of tenderer(s) as may be deemed fit and proper by EPI at any time without giving any notice to the contractor in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the Tenderers.

6.0 The set of tender documents shall contain tender drawings one set of hard copy. The original hard copy of tender drawings shall be returned along with the tender documents duly signed and stamped by the tenderer & shall form part of agreement.

7.0 SPECIFICATIONS

7.1 The work in general shall be carried out as per latest CPWD specifications for Civil Works (updated with correction slips issued upto last date of submission of tender) and latest CPWD specification, unless otherwise specified in the nomenclature of the individual item or in the particular specifications of concerned items of works.

7.2 For items not covered under latest CPWD specification, for Civil Works specification and in particular specification or nomenclature of the individual item as above, the work shall be done as per latest relevant BIS codes of practice.

7.3 In case specification are not covered under para 7.1 & 7.2 above the work shall be carried out as per the provisions of technical specification.

7.4 In case of non availability of any specification in the above paras or any overlapping provisions, non-clarity on any issue, applicability of particular provision out of above, shall be decided by Engineer-in-Charge whose decision shall be final & binding on the contractor.

7.5 Clause no. 8.0 of GCC regarding Mobilization advance is deleted and not applicable for this contract.

7.6 Thermo Mechanically Treated bars conforming to IS: 1786, Fe 500 grade as required, from approved manufacturers viz SAIL/RINL/TISCO or equivalent shall be used. The other provisions of clause 45.2 of G.C.C. remain unchanged.

7.7 The Portland Pozzolona Cement (PPC) as per IS:1489-1991 or ordinary Portland Cement (OPC) as per IS:8112 shall be used in the works, however difference in price of PPC & OPC cement if is there shall be recovered from the contractor. The other provisions of clause 45.1 of GCC remain unchanged.

7.8 Specified material viz: cement, steel, structural steel etc shall be used. Material other than specified shall be used only with prior approval of EPI and recovery at prevailing market rate shall be done if material other than specified used.
8.0 Clause No.69.1 (IV) of GCC stands modified as under:

If the rates for the altered, additional or substituted work cannot be determined in the manner specified in sub-clauses (i) to (iii) of clause 69.1, then the Contractor shall, within 7 days of the date of receipt of order to carry out the work, inform the Engineer-in-Charge the rates which he intends to charge for such class of work, supported by analysis of the rate or rates claimed, and the Engineer-in-Charge shall determine the rate or rates on the basis of prevailing market rates of the material, Labour, T&P etc. plus 15% (Fifteen percent) to cover the Contractors supervision, overheads and profit and pay the Contractor accordingly. The opinion of the Engineer-in-charge as to the current market rates of materials and quantum of labour involved per unit of measurements will be final and binding on the Contractor. However, the Engineer-in-Charge, by notice in writing, will be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner, as he may consider advisable. But under no circumstances, the Contractor shall suspend the work on the plea of non-settlement of rates of items falling under the clause.

9.0 The clause No.72.1 of GCC shall be replaced as under:

The Contractor shall ensure adequate progress during the execution of work according to the detailed Bar Chart / PERT chart prepared by him and mutually agreed within 10 days from the date of LOI.

However, the Contractor shall also maintain monthly progress strictly in accordance with bar chart and / or detailed time schedule that will be worked out on the basis of completion schedule. If the Contractor fails to maintain the above progress or to complete the work and clear the site on or before the contract or extended date of completion, he shall without prejudice to any other right or remedy available under the law to EPI on account of such breach, pay as agreed compensation and not as penalty at the rate of half percent (1/2%) per week or part thereof or delay of the value of the work shown above if there is delay for a particular stage or the entire value of contract if the whole of the work is delayed.

The total amount of compensation payable by the Contractor for delay in stage-wise completion or completion of the whole work shall not exceed 10% of the total tendered value of work as awarded.

10.0 Clause No. 72.4.1 of GCC stands modified as under:

Within 10 (Ten) days of date of Letter of Intent, the contractor shall submit a Time and Progress Chart (CPM/PERT/Quantified Bar Chart) and get it approved by the Engineer-in-Charge. The Chart shall be prepared in direct relation to the time stated in the contract documents for completion of items / scope of the works. It shall indicate the forecast (mile stones) of the dates of commencement and completion of various items trades, sections of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the limitations of time imposed in the contract documents, to ensure good progress during the execution of the work. The physical report including photographs shall be submitted by the contractor on the prescribed format & the intervals (not later than a month) as decided by the Engineer-in-Charge. The compensation for delay as per clause 72.1 (revised as per ACC) shall be leviable at intermediate stages also, in case the required progress is not achieved to meet the time deadlines of the completion period and / or milestones of time and progress chart provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the tendered value of work.
In case entire work is completed within the total time period of completion or extended period of completion allowed, the compensation for delay due to not achieving progress at intermediates stage, if any, shall be refunded without any interest charges.

11.0 Completion Schedule

The contractor will submit bar chart / completion schedule within 10 days from the date of LOI and same shall be approved by the Engineer- In-charge.

12.0 WORK METHODOLOGY

The contractor has to plan the execution of work in professional manners and ensure the necessary arrangement as specified in the BOQ to keep the area dry & clean during construction stage and such arrangement shall be got approved from the Engineer-in-Charge before executing the work. Any other arrangement if required for above shall be deemed as included in the quoted price of the bidder and nothing shall be paid extra for providing such arrangement.

For specialized work, the contractor shall submit the methodology of work for the approval of Engineer-in-Charge before commencement of the work.

The contractor has to deploy resources and plan the work accordingly and nothing extra shall be payable to the contractor on this account. Since the part of the building shall be occupied during construction stage itself the contractor has to ensure safety of the men and material & sufficiently barricade the area so as to avoid any hazard to occupants.

13.0 PRICE VARIATION CLAUSE

No price variation is applicable in this contract.

14.0 PLANT & MACHINERY

All plant & machinery required for execution of work shall have to be arranged by the contractor at his own cost. However, the Contractor has to deploy following minimum plant & machinery at site immediately after award of work:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Total Station</td>
<td>One</td>
</tr>
<tr>
<td>2.</td>
<td>Leveling Instruments</td>
<td>One</td>
</tr>
<tr>
<td>3.</td>
<td>Vibrators (Petrol / Electrical)</td>
<td>Two</td>
</tr>
<tr>
<td>4.</td>
<td>Needles of Vibrator</td>
<td>One</td>
</tr>
<tr>
<td>5.</td>
<td>Concrete Mixers</td>
<td>One</td>
</tr>
<tr>
<td>6.</td>
<td>Weigh batches</td>
<td>One</td>
</tr>
<tr>
<td>7.</td>
<td>DG Set (63 KVA)</td>
<td>One</td>
</tr>
</tbody>
</table>

Note:

a) Any other equipment for site test as outlined in CPWD specification and as directed by the Engineer-in-Charge.
b) The quantities of equipments indicated are tentative and can be increased as per the requirement of work programme 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.

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

15.0 Final Bill

The final bill will be submitted by the contractor within 90 days from the date of acceptance of completion of work accompanied by the following documents:

a) Completion certificate issued by the Engineer-in-Charge specifying the handing over of the work including list of inventories (fittings & fixtures).

b) Computerized stage wise payment schedule.

c) No claim certificate by the contractor.

d) No claim certificate from the sub-agencies / vendors engaged by the contractor.

e) ‘As built’ drawings.

f) Periodical services and measurement books.

g) All statutory approvals from various state / central govt. local bodies, if required for completion & handing over of the work as included in scope of Contractor.

16.0 CONCRETING

16.1 The concreting shall be done using Batching Plant, concrete mixers deployed at the site. The contractor may opt to use Ready Mixed Concrete of reputed firm after obtaining prior written approval from the Engineer-in-charge and no extra payments shall be made on this account.

16.2 The minimum drum capacity of the transit mixers shall be of 4 cum / 6 cum.

16.3 Concreting by crane and buckets will be allowed in rare case with the prior approval of Engineer-in-charge and no extra payments shall be made on this account.

16.4 The contractor shall provide construction joints only at the specified positions and as per BIS codes and the concreting for columns shall be from floor level to beam level in a one lift only, and in case the concreting is to be done in two lifts the minimum height of first lift of columns shall be 2.4 meters.

16.5 The fine aggregates and coarse aggregates of required size and zone shall be from the quarries approved by the Engineer-in-Charge. The samples of the materials shall be got approved along with the concrete mix design.

16.6 Plasticizers of the required specification and make shall only be permitted as per approved mix design. The cost of plasticizers / additives is deemed to be included in the rates of concrete & nothing extra shall be payable on this account.

16.7 Ready mix concrete brought from outside sources shall be as per the approved design mix. The properties of the materials used for ready mix concrete shall be as per the BIS specifications and got approved from the Engineer-in-charge prior to usage.
16.8 The Contractor shall provide all cut outs in RCC work in Co-ordination with other agencies and as per instructions of Engineer-in-Charge and nothing extra shall be payable. In case the same is not provided by the Contractor the same shall be got done at their risk & cost.

16.9 The contractor shall arrange design mix from IIT/Govt. approved labs at his own cost and nothing extra shall be paid for this as per instruction of the Engineer Incharge.

17.0 BRICK WORK

17.1 The bricks should be minimum class designation 75 conforming to IS 1077: 1992.

17.2 The brick work for all external walls should be done from outside. The rigid scaffolding of MS pipe and the supports shall be sound and strong, with horizontal MS pipes. The contractor shall be responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it. Due care shall be taken by the contractor to ensure the execution of brick masonry walls in plumbs from outside. The Contractor shall arrange sufficient quantity of scaffolding for this purpose so as to complete the project within stipulated time.

17.3 All brick works shall be with the bricks of specified grade & source as approved by Engineer-in-Charge and no efflorescence due to salt water shall be allowed. The contractor shall have to give proper treatment in any such case and nothing extra shall be payable and the rates quoted shall be all inclusive.

18.0 CENTERING & SHUTTERING

18.1 Centering & shuttering works for columns shall be made out of laminated shuttering plywood of minimum 12 mm thickness as per BIS, with angle iron frame. The centering, shuttering and staging system shall be got approved from the Engineer-in-Charge.

18.2 The shuttering used for beam shall be of laminated shuttering plywood as per BIS. The support system shall be integrated with the slab. For slabs in case plywood shutters is not used, welded steel plates will be allowed to be placed in uniform pattern. The thickness of plates and pattern to be got approved from the Engineer-in-Charge.

18.3 All joints in the shuttering i.e. plate to plate etc. shall have to be sealed with adhesive / foam, to ensure water tightness of the form work.

18.4 All shuttering work for Architectural features shall be with fiber glass moulds and the rate quoted by the contractor in the schedule of rate shall be inclusive of same.

18.5 All shuttering joints in the slab, beams and lintels etc. shall be treated with tape of required width to make it water tight and the rates quoted for centering, shuttering work shall be all inclusive and nothing extra whatsoever shall be payable over and above the quoted price.

18.6 The shuttering shall be tightened by using runners, tie rods and bracings. No Ghughoo / welded system shall be allowed. Support shall be adequate and proper.
19.0 GENERAL

19.1 Flooring works shall be executed as per the approved drawings / design & specifications. The pattern shown in the tender drawings, if any, can be modified as per the site requirements by Engineer-in-Charge within the proportions of the flooring materials to be provided and nothing extra whatsoever shall be payable over and above the rate quoted.

19.2 The contractor shall be responsible for all protection of electrical fittings & fixture against pilferage, breakage during period of installation until the completion of work and handed over to EPI.

19.3 The electrical works shall be executed only through licensed electrician and the agency shall have to submit the valid license of electricians before starting the work.

19.4 The tenderers shall make necessary safety arrangements at site including as mentioned in GCC and indemnify EPI against any consequence of accident at site.

19.5 EPI is awarding this Contract on behalf of ALIMCO, Kanpur. In case M/s. EPI cease to be an agency for the project, the right and responsibility etc. of EPI in the Contract shall get transferred to ALIMCO Kanpur or their nominated agency shall operate this Contract.

20.0 ARBITRATION:

20.1 Clause no. 76.1 alongwith note

Deleted  - There shall be no Arbitration Clause for this Contract except between Central Public Sector Undertakings inter se / Government of India Departments / Ministries as mentioned in the Clause No. 76.2 below:-

20.2 Clause No.76.2  ARBITRATION BETWEEN CENTRAL PUBLIC SECTOR ENTERPRISES INTER SE / GOVERNMENT OF INDIA DEPARTMENTS / MINISTRIES

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. DPE/4/(10)/2001-PMA-GL-I dated 22.01.2004 of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises, Govt. of India or any modification issued in this regard.

20.3 Clause No.76.3, stands modified as under:

JURISDICTION: The courts in Delhi/ New Delhi alone will have jurisdiction to deal with
matters arising from the contract, to the exclusion of all other courts.

21.0 Deployment of Technical Staff for the work

<table>
<thead>
<tr>
<th>Cost of work (in Rs.)</th>
<th>Contract period (Months)</th>
<th>Requirement of Technical Staff</th>
<th>Minimum experience (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,43,19,470/-</td>
<td>06 Months</td>
<td>i) Graduate/ Diploma Engineer (Civil)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii) Supervisors (Diploma Engineering in Civil or ITI)</td>
<td>1</td>
</tr>
</tbody>
</table>

22.0 Payment Terms

In addition to Cl. No. 37 of General Conditions of Contract, the following shall also govern the terms of payment:

Payment will be made based on measurements entered in Measurement Book (MB) & certification of the same by Engineer – in-charge. The contractor shall remain bound to render all assistance to the Engineer – in-charge or his authorized representative during such checking of the measurements. The payment of running account bills / final bill shall be released on receipt of funds from ALIMCO to EPI. The contractor does not have the right to claim delay in payments due to delay in receipt of funds from ALIMCO.

23.0 MATERIALS MAKES

A list of preferred make is enclosed in this tender. However, contractor is free to choose any other make of materials of equivalent standard from the reputed manufactures with the written approval of Engineer In-charge, but such materials should be ISI mark and as per Indian standard.

24.0 ROAD PERMIT

Road permit for transportation of goods across state border shall not be issued by ALIMCO / EPI and will have to be arranged by contractor on his own. Transit Insurance of the equipment shall be arranged by the contractor. Nothing extra shall be paid on this account. Contractor must get registered with Sales Tax Department of Delhi.

25.0 TESTING OF MATERIALS & CONCRETE AT SITE

All necessary tests shall be carried out by the contractor at their own cost at Govt. approved laboratories. No extra shall be paid for conducting test.
26.0 SECURITY DEPOSIT
In the event of award of “Works”, Contractor shall submit to EPI, Bank Guarantees from a Nationalized Bank / Scheduled Bank towards security deposit @ 5% of the contract value of the accepted tender within 10 days from the date of LOI as per the EPI format enclosed and BG shall be valid upto the defect liability period i.e. 24 months from the date of taking over the project, with claim period of 6 months failing which EPI at his discretion may revoke the LOI & forfeit the EMD furnished along with tender. Security deposit will be returned to the contractor after satisfactory expiry of defect liability period.

27.0 RETENTION MONEY

The Retention Money shall be deducted from each running bill of the Contractor at 5% (five percent only) of the gross value of the Running Account bill. The Earnest Money Deposited by the tenderer in the form of Demand Draft will be treated as part of the Retention Money. The retention money shall be refunded after expiry of defect liability period. Clause no 10.00 & 34.00 of GCC shall also be referred for payment of Retention money.

28.0 Concrete mixed design by using approved admixture shall be carried out by the contractor at his own cost from approved laboratory before starting the work.

29.0 For items not covered under any of the specifications mentioned in Tender Documents, the works shall be carried out as per CPWD Specifications / manufacturer’s specifications/General Engineering Practice and/State Govt. or as per directions of Engineer-in-Charge. The rate for such extra work shall be derived as follows:

   a) If the item is available in DSR 2016, contractor has to execute the item with the same rate below or at par tender percentage.

   b) If the item is not available in DSR 2016 and similar item is available, rate for such extra work shall be derived from the similar item by adding or deleting the differences below or at par tender percentage.

   c) If the rate for any item is not possible to derive as mentioned above, the rate for which shall be derived by analyzing as per the prevailing market rates.

30.0 The Contractor shall procure Reinforcement steel and Structural steel required for the works directly from the Manufacturer/authorized dealer which mandatorily have to be primary procedure re-rolled reinforcement shall be used.

31.0 The contractor should invariably obtain necessary manufacturers test certificates from the suppliers of steel and cement for each and every consignment and furnish them to the Engineer-in-charge before use on works.

32.0 The original bills of procurement should be submitted to the Engineer-in-charge for making payment of the item. The contractor shall purchase the steel and cement on the name of work, the name of contractor and furnish the same to the Engineer-in-
charge. The steel and cement without the above two names will not be accepted on the works.

33.0 If any difference is observed on carriage inwards, carriage outwards and theoretical requirement of steel and cement for finished works, recovery at double the rate will be effected from the contractors bills for the quantity varied above the allowable limits.

34.0 Three sets of As Built Drawings shall be submitted by the contractor in hard and soft copies on completion of work.

35.0 For all Schedule BOQ items the nomenclature /rates/ unit of DSR items shall be followed. In case of any ambiguity is observed in Scheduled BOQ items relevant DSR item will hold good.

36.0 Water and Electricity required for construction activities shall be arranged by contractor at his own cost. Quality of water should be get approved from engineer In-charge as per relevant IS standard.

37.0 The Contractor shall be fully responsible to complete the “Works” in workmen like manner to the satisfaction of Client and EPI by maintaining high standard of quality and precision as per ‘Tender documents’, Agreements, Terms & Conditions, Specifications, Drawings etc., within the contractual completion period and within their quoted rates/amount. In case Client reduces or increases scope of work related to Contractor’s portion of work, the same shall be binding on Contractor and the Contractor has to execute the same at rates quoted by them.

38.0 In case Contractor is awarded the “Works” and fails to execute the same as per agreed schedule of progress of work and as per specified quality and/or lags behind in activities required for timely completion of “Works”, as determined by EPI/Client, then EPI shall give 15 days written notice to Contractor to achieve the specified quality and/or to deploy adequate resources to the satisfaction of EPI, for timely completion of “Works”. Upon expiry of the notice period, if Contractor fails to achieve specified quality and/or fails to take action for timely completion of “Works”, then EPI shall have option to withdraw the remaining work partly or in full from Contractor and get the same executed at the risk and cost of the Contractor from alternative agency/agencies.

39.0 The Contractor confirms that he holds EPF Code number, ESI registration number, PAN (Permanent Account Number of Income Tax), GST registration number etc. and shall be responsible for depositing EPF subscription and contribution for labour and staff employed by it on the “Works” and other taxes, duties and dues etc. as per statutory requirements and documentary evidence of same shall be provided to EPI. The Contractor shall also be responsible for labour welfare and for arranging labour and other licenses/ permits/ clearances etc. for the project at their own cost. The Contractor shall comply with all the requirements as per labour laws/acts. All the records in this regard shall be maintained by Contractor as per statutory
requirements and rules and shall be produced by the Contractor on demand if required.

40.0 The Contractor shall be responsible for obtaining all approvals from EPI/Client with regard to quality of materials & workmanship and measurements etc. for their portion of work. The Contractor shall be responsible for reconciliation of issue material, if any. In case there is any shortfall of free issue items found during reconciliation, recovery at double the cost of materials prevailing at that time of recovery shall be made from the Contractor’s due payment.

41.0 In case of non-approval of Contractor’s association for the Project by the Client and/or by the corporate office of EPI due to any reasons whatsoever at any stage of the “Works”, the Contractor shall have no claim on EPI.

42.0 Income tax shall be deducted as per the prevailing rate of tax as applicable.

43.0 The Contractor shall plan and execute the “Work” in his scope of work in such a manner that the other works, connected with the “Works” of the Contractor, but not included in Contractor’s scope of work do not get affected / delayed.

44.0 The quantities indicated in the BOQ are tentative. However contractor has to execute the works as per drawings and site conditions. Payment will be released for the work executed as per the rates quoted by contractor even if the quantities increases or decreases up to any extent.

45.0 The Contractor shall deploy sufficient plant & equipment of the required capacity and in good working condition for completion of the works in stipulated time with required quality. The equipment should either be owned by the Contractor or hired/leased. The deployment of equipment by Contractor shall be as decided by EPI and the same shall not be less than the minimum deployment stipulated, if any, for execution of “Works” and as per schedule agreed with EPI. The Contractor shall make arrangement for regular maintenance including preventive and breakdown maintenance and maintain stock of essential spares at site/near to site so as to ensure minimum breakdown time of equipment. The equipment once brought to site shall not be allowed to be removed without the consent of EPI. In case the Contractor fails to deploy sufficient equipment to the satisfaction of EPI or in case of prolonged breakdown of equipment, EPI at its sole discretion shall arrange the required equipment and debit all the related costs including ten percent overheads of EPI and shall recover the same from the due payments of Contractor, including from its bank guarantees available with EPI.

46.0 Contractor shall ensure compliance with all Central, State and Local Laws, Rules, Regulations etc. as applicable or may be applicable during the course of execution, maintenance etc. of the “Works” and shall indemnify EPI against any claim or damages whatsoever on such accounts. The Contractor shall keep EPI indemnified at all times against infringement of any Patent or Intellectual Property rights.
47.0 EPI is an IS0-9001 and ISO-14001 Company. The conditions of the ISO as applicable should be followed by the Contractor for implementation & maintaining the established procedures of EPI for this purpose. Following documents have been provided by EPI to Contractor & Contractor confirms receipt of the same:
   a. Quality, Environmental, OH & safety policy
   b. Environmental, Objectives & Targets
   c. Operational control – Noise
   d. Operational control – wastage
   e. Operational control – energy
   f. Operational control – Deforestation
   g. Operational control – Plantation of trees
   h. OH & S. management objects & targets

48.0 Project sign board to be supplied and erected at the site office as per the drawing enclosed.

49.0 The work executed by Contractor shall be subject to audit and quality control checks from Quality Control Division & Technical Audit of EPI, Client, Inspecting Agency of the Client and Chief Technical Examiner of Central Vigilance Commission, Govt. of India. In the eventuality of any defect/ sub standard 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. In case 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 Contractor and shall recover the amount from the dues of the Contractor.

50.0 EPI has agreed to award the work to the Contractor on the basis of details regarding experience profile, financial standing, credentials, fulfillment of statutory obligations, etc. of Contractor submitted by Contractor to EPI. In case, at a later stage if it is found that the Contractor has submitted incorrect, false details and credentials resulting in apprehensions on the capabilities of Contractor with regard to quality & timely completion of works, financial capabilities etc, EPI can terminate this order solely at its option. In this eventuality the Contractor shall be liable for the losses suffered by EPI and further Contractor shall have no claim on EPI, whatsoever.

51.0 FACILITIES TO BE PROVIDED BY PARTY TO EPI
   GCC clause no. 28.3 stand deleted.

52.0 DEFECTS LIABILITY PERIOD
   GCC clause no. 74.0 is amended to the extent as stated under:
   Instead of 12 months defects liability period (DLP) shall be read as 24 months from the date of Handing over of work to client after completion. The defects pointed out during DLP shall be rectified by Contractor at his own cost. if he fails same shall be rectified at his risk and cost.
53.0 TAXES AND DUTIES

Clause no 13.0 of GCC is amended to the extent as stated under:

The following shall be also read with clause no 13 of GCC:

a) The Bidder must be registered with GST in Haryana state and should have valid GST number. In case the bidder does not have valid GST registration number, the same shall be obtained by the successful bidder within one month from the date of LOI or before release of 1st R/A bill whichever is earlier.

b) The Bidder must submit as an compliances of GST Act, the invoices in GST compliant format failing which the GST amount including interest and penalty if any shall be recovered/ adjusted by EPI without any prior notice from the next invoices or available dues with EPI.

c) The Bidders are requested 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 inclusive of all taxes & duties and GST etc. Taxes are to be disclosed separately in Price Bid /BOQ.

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

f) Price bid formats shall indicate “inclusive of all taxes and duties including GST.

In addition to the price bid format, an Annexure to indicate the “breakup of cost and levies such as GST and other taxes” considered in the quoted prices shall be annexed. This Annexure shall have breakup of all taxes/ duties relevant to the contract.

In case of any reduction in rate of GST or other taxes in future or the project getting exemption status prior to the last date of bid submission or afterwards, the sub-contractor shall pass on the benefit to EPIL immediately, failing which EPIL shall have the right to recover the differential amount from the amounts due to the sub-Bidder. Further, in case of any increase in rate of GST or other taxes in future or the project losing exemption status prior to last date of bid submission or afterwards, the said increase of taxes shall be paid / reimbursed to the sub- contractor, subject to the condition that the client reimburses the said increased taxes to EPIL.”.
TECHNICAL SPECIFICATION
PARTICULAR SPECIFICATIONS FOR CIVIL WORK

1.0 All works will be executed in the most substantial and workman like manner both as regards materials and otherwise in every respect in strict accordance with DSR-2014/ Latest CPWD Specifications with up to date correction slips and as per the direction of Engineer of in charge. The decision of Engineer in charge shall be final and binding. All special activities shall be carried out by specialized agency only after approval of Engineer In-Charge.

2.0 EARTH WORK

2.1 Before commencing the earth work, the ground levels shall be taken at 5 to 15m interval or as shall be directed by the Engineer-in-charge. Where local mounds, pits or undulations are met with closer internal shall be adopted.

2.2 The ground levels shall be recorded in the level books and plotted on plan on suitable scale as per direction of Engineer-in-charge. The North direction and position of Bench Mark shall be shown on the plans. The ground levels for building and the sub-soil water level shall be determined with respect to the bench mark approved by the Engineer-in-charge before commencement of the work and these levels shall be recorded in the level book and also indicated on the ‘Plan’ showing ground levels. These plans shall be signed by the Contractor and the Engineer-in-charge before the earth work is started.

2.3 All labour and material for setting out and making profile and taking ground levels shall be supplied by the contractor and nothing extra shall be payable on this account.

2.4 The Bidder shall co-operate and provide all possible assistance to the other agency/agencies executing other works. He shall adjust his execution program to accommodate such essential activities of construction.

2.5 Rate for earth work shall include the following operations:
   a. Setting out works, profiles
   b. Site clearance
   c. Protection measures and putting up caution signs and lights.
   d. Handling useful materials and Antiques.
   e. Bailing out or pumping of rain water out of excavation.

3.0 CONCRETE / REINFORCED CEMENT CONCRETE WORK/ DESIGN MIX CONCRETE

3.1. Cement concrete work using nominal mix concrete shall be executed as per DSR/CPWD Specifications with up to date correction slips.
3.1(a) The item machine batched, machine mixed and machine vibrated design mix concrete used in the nomenclature of “Sub head RCC Work” shall mean the concrete produced in automatic concrete batching and mixing plant and transported by transit mixers (if necessary), placed in position and vibrated by surface vibrator / needle vibrator / plate vibrator as the case may be to achieve required strength and durability.
3.2. All stone aggregate and stone ballast shall be of hard stone variety to be obtained from approved quarries or any other source to be got approved by the Engineer-in-charge.
3.3. Sand to be used for cement concrete RCC work shall not contain silt content by more than 8%.
3.4. Ordinary Portland Cement (OPC) not less 43 grade as per IS: 8112 or Portland Pozzolona
Cement (PPC) as per IS: 1489-1991 shall be used for the entire work. However, necessary deduction towards difference of rates between OPC & PPC cement shall be account for.

3.5. All shuttering shall either be of steel or marine ply. All scaffolding shall be of steel. The contractor will have to manufacture new shuttering so as to obtain exposed concrete surface of even and uniform shade wherever required. Shuttering already used on other work(s) will not be permitted to be used in this work for obtaining exposed concrete surface. The steel / marine ply centering, shuttering and steel scaffolding shall be as per DSR/CPWD specifications.

3.6. Keeping in view the flooring thickness as per nomenclature of the item, the structural drawings shall be reconciled with the architectural drawings to make appropriate adjustment in the level of shuttering for RCC slab so as to achieve the final floor finish level as per Architectural drawing.

**DESIGN MIX CONCRETE**

3.7. The contractor shall exercise “very good” quality control over site conditions for production of controlled concrete by using fresh cement and regular tests employing fully automatic cement batching plant for batching of all materials, grading of aggregate, determination of moisture contents and control of water cement ratio, frequent supervision and by conducting regular workability and strength tests and maintaining adequate field laboratory facilities to maintain the specified quality of concrete consistently.

3.7(a) The aggregate used for RCC work shall be 20mm nominal maximum size aggregate. The minimum cement content and the maximum water cement ratio for various grades of concrete shall be as given below:

<table>
<thead>
<tr>
<th>Grade Designation</th>
<th>Compressive strength 15cm cubes min 7 days (N/mm²)</th>
<th>Specified Characteristic compressive at 28days (N/m²)</th>
<th>Minimum cement content (kg per cubic metre)</th>
<th>Maximum water cement ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-25</td>
<td>AS per Design</td>
<td>25</td>
<td>330</td>
<td>0.50</td>
</tr>
<tr>
<td>M-30</td>
<td>AS per Design</td>
<td>30</td>
<td>340</td>
<td>0.45</td>
</tr>
<tr>
<td>M-35</td>
<td>AS per Design</td>
<td>35</td>
<td>350</td>
<td>0.45</td>
</tr>
</tbody>
</table>

Note: Excess/Less cement content used as per design mix in respect of the above specified limit is payable / recoverable separately.

3.7(b) The concrete mix will be designed for minimum workability as per the table given below:
<table>
<thead>
<tr>
<th>Placing conditions</th>
<th>Degree of workability</th>
<th>Slump (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightly reinforced sections in slabs, beams, walls and columns</td>
<td>Low</td>
<td>25 – 75</td>
</tr>
<tr>
<td>Heavily reinforced section in slabs beams walls and columns</td>
<td>Medium</td>
<td>50 - 100</td>
</tr>
<tr>
<td>Pumped concrete</td>
<td>Medium</td>
<td>75 - 100</td>
</tr>
</tbody>
</table>

3.8. The contractor shall engage one of the following approved laboratories, test houses for designing the concrete mix in accordance with the relevant I.S. Codes and to conduct laboratory tests to ensure the target mean strength and workability criteria for a given grade of concrete

i. I.I.T./ NIT/any Government laboratory

If all the above laboratories express in writing their inability to carry out designing and testing of concrete mixes by a specified date, the contractor may be allowed to engage any other laboratory with prior approval of Engineer-in-charge.

3.9. The source and quality of all ingredients of a concrete mix shall be got approved from the Engineer-in-charge before designing the mixes and their testing and the same shall be maintained during the execution of the work as well.

3.10. Any change in source or characteristic of any ingredient used in the concrete mix during the work execution shall require revised mix design and laboratory testing as per direction of the Engineer-in-charge and no further concrete work shall be proceeded without approval of the revised design mix.

3.11. In the event of use of admixtures to achieve the required workability, the mix shall be designed and tested using the admixture in suitable proportion.

3.12. All cost and charges of designing the concrete mix and its testing by approved laboratory including the redesigning of the concrete mix, whenever required and directed by the Engineer-in-charge, shall be borne by the Contractor and nothing extra shall be payable over the quoted rates.

3.13. The designed mix proportions shall be checked for target mean compressive strength by means of trial batches.

3.14. The quantities of materials for each trial mix shall be sufficient for at least six specimens (cubes) and the concrete required for carrying out workability test.
3.15. The workability of trial mix No. 1 shall be measured and mix shall be carefully observed for freedom from segregation, bleeding and its finishing characteristics. The water content, if required, shall be adjusted corresponding to the required change in the workability.

3.16. With the modified water content, the mix proportions shall be recalculated by keeping with water cement ratio unchanged. The mix proportion, so modified, shall form the Trial Mix No. 2 and tested for the specified strength and workability.

3.17. In addition, trial mix No. 3 and 4 shall be designed by keeping water contents same as that determined for trial mix 2 but varying the water cement ratio by ± 10 percent of the specified value and tested for their design characteristics.

**APPROVAL OF DESIGN MIX CONCRETE**

3.18. Minimum three sets of separate preliminary tests shall be carried out for each trial batch of concrete mix. Each test shall comprise of six specimens and only one test-set of six specimens shall be made on any particular day.

3.19. Of the six specimens of each test-set, three specimens shall be tested at 7 days and remaining three at 28 days.

3.20. The Preliminary tests at 7 days are intended only to indicate the likely strength to be attained at 28 days while the design mix shall be approved only on the basis of test strength at 28 days.

3.21. The contractor shall submit the design mix report from the approved laboratory within 45 days of award of work for approval of Engineer-in-charge. No concreting work shall be executed until the mix design is approved.

3.22. The design mix shall be considered satisfactory and approved if at least three preliminary test-sets individually satisfy the following strength and workability criteria:
   a. The average strength of each test-set is not less than the specified target mean compressive strength.
   b. The strength of any specimen cube is not less than 0.85 times the target mean compressive strength.
   c. The concrete mix is of required degree of workability and acceptable concrete finish.

**PRODUCTION OF CONTROLLED CEMENT CONCRETE**

3.23 Automatic Batching Plant conforming to IS 4925-1968 and minimum 30 cum/ hour capacity shall be used for production of controlled concrete.

3.24 Automatic batcher shall be charged by devices which, when actuated by a single starter switch, will automatically start weighing operation of each material and stop automatically and interlocked when the designated weight of each material has been reached.

3.25 The batching system shall have rated capacity (in terms of concrete in a single batch) to match the maximum rated size of the mixer that could be adopted for use with the plant.

3.26 The mixers shall be free fall tilting type conforming to IS 1791-1968.

3.27 All measuring equipment shall be maintained in a clean and serviceable condition and their accuracy shall be checked at least once a month.
3.28 Only single sized good quality stone aggregate shall be brought to site of work from the approved source. The grading of the stone aggregate shall be controlled by blending the aggregate of different sizes in the required proportions at site of work.

3.29 The aggregate of different sizes shall be stock-piled separately at least a day before use. The grading of coarse and fine aggregates shall be checked as frequently as possible and as directed by the Engineer-in-charge to ensure that the specified grading and quality of aggregate is maintained.

3.30 It is important to maintain the water cement ratio constant at its specified or approved value by making adjustment for the moisture contents of both fine and coarse aggregates.

3.31 The moisture contents in the aggregate shall be determined as frequently as possible in keeping with the weather conditions as per the provisions of I.S 2386 (Part III) 1963.

3.32 All other operations involved in concrete work like laying, placing, compaction and curing etc. shall be done as per CPWD specifications 1996 Volume I to VI with up to date correction slips.

3.33 For RCC Work, the contractor may be permitted to use ready mixed concrete (RMC) procured from the approved suppliers of RMC instead of producing concrete at site. The specifications for RMC shall be same as for Design mix concrete produced at site. The prescribed tests for design mix concrete shall also be carried out for RMC in addition to getting the test report from the supplier. Nothing extra shall be paid for using RMC.

3.33(a) The contractor shall obtain prior approval of Engineer-in-Charge for using RMC, which shall be granted only in exceptional cases like failure of plant or other exigencies.

**SAMPLING AND STRENGTH OF WORK TEST OF CONCRETE**

3.34 Samples from fresh concrete shall be taken as per IS-1199-1959 and the test cubes shall be made, cured and tested in accordance with IS 516-1959.

3.35 Each test sample shall comprise of six test cubes (specimen), three of which shall be tested at 7 days and remaining for tests at 28 days.

3.36 A random sampling procedure shall be adopted to ensure that the sampling is spread over the entire period of concreting and cover all mixing units.

3.37 The concrete work shall be notionally divided into lots as under for the purpose of sampling conditions:

a. Footings, rafts, etc.

b. Columns and walls at all levels

c. Beams at all levels

d. Slabs at all levels

3.38 At least one test sample shall be taken for each lot of concrete work.

3.39 Each grade of concrete shall form different lot of testing.

3.40 The minimum frequency of sampling of concrete of each grade shall be as given below:

<table>
<thead>
<tr>
<th>Qty. of Concrete work (in Cum.)</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>1</td>
</tr>
<tr>
<td>6-5</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></td>
<td></td>
</tr>
</tbody>
</table>
The concrete work shall be assessed on day to day basis and samples shall be taken as specified.

**TEST STRENGTH OF A SAMPLE**

3.41 The test strength of the sample shall be taken as the average of the strength of its three specimens, the individual variation between the three specimens should not be more than ±15 percent of the average test results of the sample.

3.42 If individual variation in strength of three specimens is more than ±15 percent of average, the test results of the sample shall be invalid.

3.43 90% of the total work tests shall be done at the field laboratory established at the site of work and the remaining 10% work tests shall be got done from any Govt. laboratory or the laboratory approved by the Engineer in charge.

**MEASUREMENTS**

3.44 The measurements of work and the allowable tolerances shall be governed by provisions of CPWD specifications read with up to date correction slips.

3.45 The theoretical consumption of cement in designs mix concrete shall be worked out on the basis of proportions approved for Design mix subject to the permissible variations under clause 42 of the tender documents.

**RATE**

3.46 The rate shall include cost of all materials and labour involved in all operations described above including the cost of designing and testing of concrete mix in the approved laboratory including admixture but excluding the cost of centering, shuttering and reinforcement.

**4.0 BRICK WORK**

4.1 The brick work shall be carried out with good quality well burnt bricks of specified designation, free from ash, dust or mud etc.

4.2 Only well wet bricks shall be used for brick work in cement mortar.

4.3 The cement mortar of specified mix shall be uniformly mixed to the required consistency in the Mixer Machine with hopper attached only and measuring boxes shall be used for proper proportion of mortar mix.

4.4 All the joints of brick work both horizontal and vertical shall be filled in completely with cement mortar. The joints shall be of uniform thickness of not more than one cm.

**SPECIFICATION FOR PILES**

A) **PILES**

1.0 **BORED CAST-IN-SITU CONCRETE PILE**

1.01 General
This specification covers the piling work required for the Construction of Boundary Wall at existing Factory area & proposed Township Campus with Watch Towers (02 Nos.) at ALIMCO, Kanpur (U.P.).

In the river bank - Hard clayey silt
In the river Hard clayey silt under lain with very dense silty Sand

Tenderer may carry out additional investigation if felt necessary by him. Claims and objections of site and subsoil conditions shall not be entertained.

1.02.01 Codes

IS:2911 (Part 1/Section 2) – 1979 : ‘Code of practice for design & construction of Bored Cast – in Situ concrete piles’ shall be referred to in conjunction with this specification during the entire design & construction work. If for any material or workmanship, appropriate Indian Standards or Codes are not available or have not been adequately specified in the Technical Specification, such material & workmanship shall conform to other suitable & codes.

1.02.02 Design

The piles shall be bored cast-in-sity cylindrical type RCC piles and shall be founded on suitable approved strata to achieve the design capacity

1.02.03 Materials

All the materials proposed to be used, shall be free from any objectionable substances, shall conform the following stipulation. Any testing required to prove the suitability of such materials should be carried out.

1.02.03.01 Reinforced Cement Concrete for Piles shall be with minimum Cement content of 425 kg/m3 for piles. The slump of concrete for piles shall be between 160 mm to 180 mm. the water-cement ratio shall not exceed 0.45. to achieve the specified slump using specified water cement ratio without compromising with strength, if required, suitable admixture shall be used subject to approval of the Purchaser.

1.02.03.02 Preliminary mix design shall be done in accordance with IS: 10262-1982 & SP:23 subject to approval of the Purchaser. Cube tests, Slump test & other relevant tests for preliminary mix design and Routine cube test, slump test for regular concreting shall be carried out at site/ site laboratory at for regular concreting shall be carried out at / site laboratory at contractor’s own cost. Concrete cube tests shall be done as per IS:516-1959. Frequency of cube test shall be guided by clause 15.2 of IS: ‘456-2000.

Slump tests (apparatus conforming to IS:IS: 7320 -1974) Shall be carried out at least.
once for each pile or more frequently, if desired by the Purchaser.

1.02.04 Equipment & Accessories

The equipment & accessories should be compatible with the type of sub-soil, method of installation, type of founding strata & required penetration in the founding strata.

The capacity of rig shall be adequate so as to bore upto required depth with specified diameter. Rig shall be equipped with suitable chisel to penetrate through any local obstruction/ hard strata.

1.02.05 Construction

1.02.05.01
The permissible positional deviation in horizontal direction shall not be exceed 1.5% form the designed location in more in case of piles having diameter more than 600mm.

1.02.05.02
Stabilisation of the side of borehole shall be done by the use of bentonite slurry. Direct Mud Circulation (DMC) process shall be adopted. In such cases the bentonite slurry must be used at least from the level of sub-soil water, as the hole shall then be always kept almost full with the fluid. The specific gravity of bentonite slurry shall be in the range of 1.05 to 1.10. This shall be checked regularly for each or at any change in its specified consistency. Pressure of slurry pump shall be sufficient enough to clear out all cuttings efficiently from the hole. Prevention of side collapse of bore-holes shall be taken care by with use of temporary casing if necessary. At the last stage of boring or in intermediate hard layers chisel may be used. The piles shall be installed with due consideration for safely of adjacent structures by a method. Which leaves their strength unimpaired, and which develops and retains the required bearing resistance.

1.02.05.03
Reinforcement as required shall be made into stiff cages sufficiently welded to withstand handling without any damage or distortion. Reinforcement shall be placed immediately after cleaning and inspection of the bottom of bore holes. The reinforcement should be supported away from the sides of the shaft by means of suitable space block to ensure concentric alignment in the shaft. Steps shall be taken to ensure correct positioning during concreting of reinforcement in the piles without any distoration.

1.02.05.04
Immediately before placing or reinforcement and concreting, the bored hole shall be cleaned of all the loose material, debris and all the water shall be removed. The pile tip zone shall be thoroughly replace the old bentonite slurry used during the previous operations. This shall be carried out for about 45 minutes in two stages. Cleaning for about first 30 minutes shall be done before lowering of reinforcement cage & cleaning of about 2nd 15 minutes after lowering the reinforcement cage.

Concrete shall be so placed as to fill the entire volume of the tube or bore without the formation of voids caused be the faulty consolidation or entrapped air. Proper care shall be taken to ensure that the fluid alluvial soil does not penetrate between batches of the concrete.

In case of boreholes stabilized by bentonite slurry, concrete shall be placed by means of tenie pipe, which will be suitably closed at bottom at the start of concreting. The tremie pipe must
extend upto the bottom of the borehole at the start and may be withdrawn in sections as the level of concrete rises in the borehole; but its discharge end shall at all times be embedded in the concrete to a minimum depth of 2 m. placing of concrete should be continuous and the pile holes will be maintained full with the bentonite slurry where used throughout the concreting operation. Slurry displaced from the borehole by the concrete shall be channeled away or pumped into suitable mud pond for re-use or disposal to waste.

In case of cased holes. After the required founding level is encountered the bottom shall be sealed with concrete and the reinforcement cage shall be lowered. If the borehole is dry, concrete shall be deposited in such a manner so as to avoid any segregation of concrete followed by gradual withdrawal of casings. If water is present in the borehole, it shall be bailed out by bailer. If it is difficult to dewater by the bailer, concrete shall be placed under water by means of a placer. After the head of water has been neutralized by the head of the concrete. Excess water shall be bailed out and concrete shall then be deposited by direct pouring from the top. As is done, if the borehole is dry.

1.02.05.05 The concreted length of piles shall be measured from the toe of pile to cut off level of pile

1.02.05.06 Temporary stoppage of work may be permitted only during boring stage. Thereafter right form boring or chiseling of final portion of pile length through subsequent activities of flushing, lowering of reinforcement cage, lowering of tremie, pre-concrete, lowering of reinforcement cage, lowering of tremie, pre-concrete flushing & upto concreting of full pile length, no halt whatsoever in the execution of work shall be permitted.

1.02.05.07 Boring for any pile shall not be carried out within a clear distance of four times of pile diameter form the adjacent pile, which has been freshly concreted within past 24 hours.

1.02.05.08 Concreting of Pile shall continue until the pile is fully formed upto a level of not less than 500 mm above cut off level of piles. Extraction of casing wherever used shall be done in such a way that no necking or shearing of the concrete in the shaft takes place. Pile length above cut off level shall not be measured for payment and shall be trimmed off free of cost. Trimming of pile top shall not be permitted before 7 days of concreting in case of mechanical chipping & 3 days in case of manual chipping.

1.02.06 Founding Strata
All the piles shall be founded in specified strata.

- Shall be carried out at founding level for at least one pile at every 10m distance subject to minimum of one test for every 25 piles or part thereof within a pile cap.

1.02.07 **Pile Load Test**

1.02.07.01 Maximum load in case of routing tests shall be limited to 1.05 times of the corresponding safe design load.

For all types of Routine load tests the testing arrangement, procedure & interpretation shall follow relevant criteria set out in IS: 2911 (part 4)–1985 along with the following stipulations:

i) Load test shall be carried out after 28 days from the date of casting unless otherwise directed.

ii) Test load shall be applied at cut-off level, if the test level is below the ground water table. Suitable arrangement for dewatering shall be made.

iii) Loading shall be applied by reaction method consisting of a hydraulic jack placed centrally against a suitable loaded platform / anchorage system. Reaction system shall be well designed & capable of taking 1.25 times of the maximum load to be applied.

iv) Test load shall be applied to pile in a static manner. Stage loading shall be applied in equal increments of 20% of estimated safe design load. Unloading may be done in higher decrements with at least 5 stages. For Cyclic load test, each stage of loading shall correspond to unloading upto zero load. At each stage of loading & unloading, deflection of pile top shall be recorded accurate to 0.02 mm at an interval of 1, 2, 4, 8, 15, 30, 60, 120 minutes upto a time when the deflection rate reduces to 0.1 mm in 30 minutes or 0.2 mm in one hour or till two hours whichever occurs earlier.

v) Increments of loads shall be continued upto maximum load of 1.5 times of safe design load for Routine test or failure (soil–pile yielding or structural failure) whichever occurs earlier.

vi) where failure does not occur, the final test load shall be maintained for 24 hours and deflection records shall be taken at every 6 hours interval, including initial 2 hours detailed records, as mentioned earlier.

vii) Assessment of safe load for different types of test shall follow relevant clauses of IS: 2911 (part 4) – 1985.

viii) After completion of load test, the following records/ reports shall be furnished.

   a) Tabular & Graphical representation of Load vs. Settlement during loading and unloading.
b) Tabular & Graphical representation of the Time vs. Settlement for each load.

c) Graphical analysis of initial cyclic load test results to separate skin friction & end-bearing as per Annexure IS 2911 (part 4)

Remarks concerning any unusual occurrence (if any) during boring installation or testing or piles

1.02.08 Standard of Acceptance

The piles shall be accepted as satisfactory only when the work has been executed in accordance with this specification. IS Codes and the standards stated hereinafter and instructions given by purchaser at site from time to time:

a) The total volume of concrete shall not be less than actual shaft volume and not more than 40% of the calculated volume, the calculated volume for this purpose shall be the cross sectional area in side the bore multiplied by the length of the shaft. The concrete shall show the specified strength as indicated by the cube test results.

b) The toe of pile shall be at approved bearing level in each case.

c) Tolerances specified in clause No. 02.05.01 shall be satisfied.

If an individual pile fails to meet the requirements specified in any of above clause/s, such pile shall be deemed to be defective. When any pile is found defective, one or more pole shall be installed as a replacement of defective pile as necessary.

1.02.09 Record

A record for each pile indicating the following data shall be maintained.

a) The date and time of commencement and completion of the piling operation.

b) The particulars of the equipment and method of boring and concreting.

c) The location and type of pile, pile number, with a reference to approved drawings.

d) The diameter of the pile and verticality.

e) Bored depth, concreted depth, empty boring and nature of stratum at founding level.

f) The volume of concrete poured, quantity of cement, w/o ratio used and slump of poured concrete.

g) Details of reinforcement provided.

h) The sequence of installation of pile groups.
i) During boring operation, a separate record for rate of advancement of borehole in terms of effective time vs. boring depth shall be maintained for each pile. The effective time implies the time required exclusively for boring operation barring the time for other activities such as temporary stoppage, cleaning of hole, in-situ tests, if taken etc.

5.0 Powder coated Aluminum Work for Doors and windows:

5.1 The Contractor shall engage specialized agency for doing the aluminum work and the agency shall be got approved from the Engineer-in-Charge.

5.2 The materials conforming to specifications as mentioned in the nomenclature of item shall only be used for fabrication of Aluminum doors and windows.

5.3 All Aluminum work shall be free from defects impairing strength, durability and appearance. The makes of aluminum sections shall be as given in “List of approved Makes for Civil Work”

5.4 The contractor shall submit shop drawings and samples of each type of doors and windows to the Engineer-in-Charge for approval. The shop drawings shall show full size sections of doors and windows. Shop drawings shall be based on actual dimensions available on site, which should not vary from those on drawings by 1.5mm.

5.5 The glazed aluminum windows shall be made completely water proof to the satisfaction of the engineer-in-charge. Silicon/ Polysulphide sealants etc; shall be provided wherever required to make the window water proof.

5.6 All joints shall be accurately fabricated. The finished surface shall be free from visible defects.

5.7 The Powder coating shall be of approved colour and conform to IS code

5.8 Doors, windows or fixed glazing, frames shall be fixed to concrete/brick work/ base frame with approved metal fasteners. Method of fixing shall be approved by the Engineer-in-Charge before mass fabrication.

5.9 A thick layer of the clear transparent lacquer based Methacrylates or Cellulose Butyrate shall be applied on the powder coated surfaces before they are brought to site. The same shall be removed on completion of erection.

5.10 All screws shall be stainless steel screws.

5.11 The corners of the frame shall be fabricated true to right angle. Both the fixed and openable frames shall be fabricated out of sections, which have been cut to length, mitred and jointed mechanically. All members shall be accurately machines milled and fitted to form hair line joints. The joining accessories such as cleats, brackets, etc shall be such material so as not to cause any bimetallic corrosive action.

All frame members shall be in plumb and level and jointed in such a way that the expansion and contraction shall not cause distortion or leakage. The contractor shall be responsible for their satisfactory performance/operation after fixing is complete.
5.12 Clear glass: The glass shall be float glass of Brand Modi or equivalent. Clear glass used in glazing of openable / fixed doors, windows and ventilators shall provide clear, completely undistorted vision and reflection. It shall be free from any bubbles, waves or blemishes. Glass used shall be of required size as per drawings.

5.13 Tinted Glass: Tinted glass shall have same quality and specifications as indicated above for clear glass. It shall however be transparent glass tinted to Bronze/ Blue/Green/Smoke grey shade as required and would be expected to absorb a greater proportion of sun’s radiant heat and reduce transmission than clear glass.

5.14 Rate: The rate shall include the cost of all materials as mentioned above and in the nomenclature of item, labour and T&P required for proper completion of the work including the sealant but excluding the clear/tinted glass which shall be measured and paid separately under relevant item. For payment purposes, the weight of aluminium sections finished to size as provided in doors and windows excluding the cleats shall only be measured.

5.15 Five years guarantee bond in prescribed Performa ‘B’ attached in Tender Document Volume - I shall be submitted by the contractor which shall also be signed by both the specialized agency and the contractor to meet their liability/ liabilities under the guarantee bond against structural stability, water leakage, faulty materials, workmanship and defective anodized finish.

6.0 Flooring

6.1 Only machine cut Kota stone, sand stone marble, granite slabs shall be used for flooring and veneering work.

6.2 Proper gradient shall be given to flooring for toilets, verandah, kitchen, court, yard etc and shall be determined by providing required gradient in the lean concrete/ sub-grade surface.

6.3 The bed mortar on concrete shall be fully compacted, particularly at the junctions of panels, during laying of flooring so that the finished floor does not give hollow sound.

7.0 Roofing

7.1 The roofing shall be executed as specified in the nomenclature and detailed specifications for the item.

7.2 The work of fixing rainwater pipes, grouting around mouth of rain water pipes and making khurra shall be done before starting the items of roofing. The roofing shall overlap the khurra surface by about 100mm.

7.3 Plastering of parapet wall shall only be done after providing required cement concrete gola at the junctions with horizontal surface of roofing. In case of RCC parapet wall 75 x 75mm cement concrete gola shall be provided after making groove at least 20mm in depth. Cement slurry shall be applied over the groove before laying cement concrete gola. For parapets walls in brick work, the cement concrete gola shall be provided as per operations described in DSR/CPWD Specifications with up to date corrections slips.

8.0 Finishing

8.1 The cement paint, primer, synthetic enamel paint, bitumen, plastic emulsion and distemper etc. of approved manufacturer shall only be brought to the site of work in the original sealed containers. The material brought to the site of work in lots of at least 25% of the total
requirement. The materials shall be kept under the joint custody of contractor and Engineer-in-charge. The empty containers shall not be removed from the site till the completion of the work.

8.2 Nothing extra shall be paid for providing drip course or moldings in RCC projected slabs wherever required.

8.3 The item of glass mosaic tiles included under the sub head of “Road and Path Work“ shall also be executed on building facias in bands of required width as shown in the Architectural drawings and nothing extra shall be paid for the same.

8.4 The rate for relating to stainless steel cramps shall include the cost of 100mmx100mm x100mm cement concrete 1:2:4 (1cement:2 coarse sand:4 graded stone aggregate 20 mm nominal size) blocks in brick masonry wall in which the cramp shall be embedded.

8.5 The rate for to stainless steel cramps of size 15x6mm-16.5cm long shall include the cost of two nos. Wedge expansion type hold fasteners (with threaded dia of size 6mm) for fixing each cramp to RCC / CC backing.

8.6 Nothing extra shall be paid for shuttering and other inputs required at the locations of construction joints in RCC work.

9  **RCC WORK**

9.1 To ensure proper cover only factory made approved cover blocks will be used to avoid displacement of bars in any direction.

9.2 The Steel bars of different diameters should be stored about 30 to 45 cm above ground level to avoid corrosion of steel. No extra payment shall be made on this account.

10  **FLOORING:**

The rate of items of flooring is inclusive of providing sunk flooring in bathrooms, kitchen etc. and nothing extra on this account is admissible. The flooring is to be laid in pattern of various combinations as per architectural drawings. The flooring in treads and risers of stair case is to be laid in single piece. Nothing extra shall be paid on these accounts. The measurement shall be made for finished work of flooring.

**Misc**

1. **Structural glazing**

**Genera**

1) Framing system

Aluminium anodized extruded sections manufactured by reputed manufacturers. For all types of members like brackets, mullions, transom etc.

2) Sealant

As specified in the item of silicon sealant

3) Insulation

50mm thick glass wool of minimum density 48kg/cum sandwiched with black polythene sheet 100 micron on one side and aluminium foil of 100 Micro on the other side or as specified by manufacturer at spandrel area. The surface after fixing insulation shall be plain without any distortion.
SCOPE OF WORK

Preliminary Requirements

(i) The contractor shall design, test, fabricate, deliver, install and guarantee all construction necessary to provide a complete curtain wall system for the proposed building, all in conformity with the drawings as shown.

(ii) Specification and all relevant construction regulations including providing any measures that may be required to that end, notwithstanding any omissions or inadequacies of the drawings.

(iii) The curtain wall system shall also include the following activities:

(a) Metal frames, glass glazing, spandrels, ventilators, finish hardware, copings, metal closure, windows etc.

(b) All anchors attachments, reinforcement and steel reinforcing for the systems required for the complete installations.

(c) All thermal insulation associated with the system

(d) All fire protection associated with the system

(e) All copings and closure and metal cladding to complete the system

(f) All sealing and flushing including sealing at junctions with other trades to achieve complete water tightness in the system.

(g) Isolation of dissimilar metals and moving parts.

(h) Anticorrosive treatment on all metals used in the system.

(i) Polyester powder coating aluminium sections.

(iv) The contractor shall also be responsible for providing the following:

(a) Engineering proposal, shop drawings, engineering data and structural calculations in connection with the design of the curtain wall system.

(b) Mock-ups, samples and test units.

(c) Performance testing of the curtain wall framing and glazing assembly.

(d) Co-ordination with the work of other trade.

(e) Insulation with glass wool 48 kg/ cum at spandrels area.

(f) Protection.

(g) All final exterior and interior cleaning and finishing of the curtain wall system.

(h) As built record drawings and photographs.

(i) Guarantees and warranties.

(j) All hoisting, scaffolding, staging and temporary services.

(k) Conceptualizing and design of a suitable maintenance system for curtain glazing.

(v) The water tightness and structural stability of the whole curtain wall system are prime responsibility of the contractor. Any defect or leakage found within the guarantee period shall be sealed and made good at all the risk and cost of the contractor.

(vi) The curtain wall system shall be designed to provide for expansion and contraction of components which will be caused by an ambient temperature range without causing buckling, stress on glass, failure of joint sealants, undue stress on structural elements or
other detrimental effects, specific details should be designed to accommodate thermal and building movements.

**Quality Consideration and Other Activities**

(i) The contractor while submitting the detailed design calculations should submit the following information on the quality of materials to be used and other aspects as detailed below:

1. Metal quality, finishes and thickness
2. Glass quality, coating and thickness and proposed manufacturer’s brand names
3. Aluminium extruded sections including mullions and transoms together with structural calculations and proposed manufacturer’s brand name and also the name of agency proposed for fabrication work
4. Arrangement and jointing of components.
5. Field connections especially mullion to mullion and transom to mullion.
6. Fixing and anchorage system of typical wall unit together with structural calculations.
7. Drainage system and provision in respect of water leakage in the curtain wall system
11. Wind load and seismic load and any other specific load considered in the design

(ii) Design concept over lightening protection link-up system of the curtain wall for connection and incorporation into the lightening conductor system of the building (Lightening conductor system of the building to be done by any other agency)

(iii) The maximum permissible structural tolerances of the building that the system has been designed to accommodate in case these tolerances exceed those specified in the specification.

**Tolerances**

Any parts of the curtain wall, when completed, shall be within the following tolerances:

1. Deviation from plumb, level or dimensioned angle must not exceed 3mm per 3.5m length of any member or 6mm in any total run in any line.
2. Deviation from theoretical position on plan or elevation, including deviation from plumb, level or dimensioned angle must not exceed 9mm total at any location.
3. Change in deviation must not exceed 3mm for any 3.5m run in any deviation.

**Test of Wind Pressure**

(i) The equivalent load of wind pressure or wind suction shall be given to the test unit as increasing or decreasing the inside pressure in the “pressure chamber” at which the test unit is fixed.

(ii) The static wind pressure shall be applied up to 1.5 kpa at maximum wind pressure.

(iii) The variation of dynamic pressure shall be of any approximate sine curve line.

(iv) Deflection on each observational points of the test unit shall be observed and recorded under static pressure as described above.

(v) Any damage and harmful permanent deformation on any parts except sealing materials shall not be found at maximum wind pressure.
(vi) The deflection on the main structural parts in this condition shall not exceed:

1) 1/175 of the span between supports or 20mm, whichever is less for vertical elements.

2) 1/250 of the span between supports for horizontal elements.

3) The extent of recovery of deformation, 15 minutes after the removal of the test load, is to be at least 95%.

**Test of Lateral Deflection per Floor Height**

(i) Lateral deflection per floor height shall occur on the test unit, when the structural frame which fixes the test unit is deflected horizontally.

(ii) The deflection of every ± 2.5mm shall be increased up to ± 13mm on the test unit (static deflection test)

(iii) The dynamic deflection shall be applied up to ± 13mm.

(iv) The variation of dynamic deflection shall be of an approximate sine curve line, on period of 3 seconds.

(v) The dimensions of the deflection on each observational point of the test unit shall be measured under the condition as described above and the same shall be observed.

(vi) Any damage and harmful permanent deformation shall not be found in any parts of the curtain wall except the damage to sealant at maximum deflection.

**Water Tightness Test**

(i) Water shall be sprinkled to the ‘Test Unit’ under wind pressure.

(ii) Pressure shall not be applied to the test unit

(iii) The volume of the sprinkling water in one minute shall be 5 litres per sqmt minimum (01.gal/ sq.ft.)

(iv) All water leakage and drainage system at the joint and the openable sash of the curtain wall system shall be observed from the outside of the chamber.

(v) Hold the test two times, in sequence as described below, conforming to the above mentioned conditions.

1) Install the test unit.

2) Hold first water tightness test

3) Hold test of wind pressure as described above

4) Hold second water tightness test.

5) Lateral deflection test

(vi) Water leakage shall not be observed inside at all parts of the test unit during first water tightness test.

**Mode of Measurement**

the breadth and the height of the finished work including the openable windows shall be measured in meters and centimetre and the net quantity for payment shall be calculated in sqm up to two place of decimal, the area to be considered for measurement shall be the net area of the exterior face of the curtain wall as fixed including the openable windows if any as part of the curtain wall.

**Rate**

The rate shall include the cost of all operations described above including the cost of materials, labors, designs of drawings, erection and testing, mock-up test units,
fabrication, erection, finishing, scaffolding, undertaking performance guarantee. No other claims of any kind pertaining to this work shall be entertained.

STONE INSTALLATION
Proceed with the installation of the stonework in accordance with Drawings and using skilled mechanics capable of proper handling of the setting of the stone and able to field cut where necessary with sharp and true edges. Set stone with joints uniform in appearance and stone edges and faces aligned tolerances indicated. Clean surfaces that are dirty or stained. Scrub with fiber brushes, and then rinse with clear water. Provide expansion, control, and pressure-relieving joints of widths and at locations shown on Drawings.

Cleaning
After installation and pointing or caulking are completed, the contractor shall carefully clean the granite, removing all dirt, excess mortar, weld splatter, stains, and/or other site incident defacements. Stainless steel wire brushes or wool may be used, but the use of other wirebrushes or of acid or other solutions which may cause discoloration is expressly prohibited. Fabricator should be contacted before cleaners other than detergents are used.

Protection of Finished Work
After the granite work is installed, the granite shall be properly and adequately protected from damage. Boxing or other suitable protection shall be provided wherever required, but no lumber which may stain or deface the granite shall be used. All nails used shall be non-corrosive. All granite work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.

Defective Work
Any area or piece of granite found defective it shall be removed, and to be patched or redressed for use. Nothing extra on this account will be entertained.

Related sections
All work related to this specification section should be coordinated with the works described in other specification sections, including:

Mortar
Joints
Pointing
Curing

Mode of Measurement
The finished work shall be measured correct to a centimetre in respect of length and breadth nearest to two places of decimal. The rate shall include the cost of all operations described above including the cost of materials, labors, designs of drawings, erection and testing, fabrication, erection, finishing, scaffolding, etc. No other claims of any kind pertaining to this work shall be entertained.

Rate
The rate shall include the cost of materials and labor required for all the operations described above.
11 Steel Supplied by the Contractor

a) The Contractor shall furnish to the Engineer all mill orders covering the material ordered by him for this project and also the test reports received from the Mills for his approval and information. It is not intended that all the steel materials to be supplied by the Contractor for the work shall be specially purchased from the rolling mills. The Contractor’s stock material may be used, provided the mill test reports identified with the materials, satisfactorily demonstrate the specified grade and quality. The Engineer shall have the right to test random samples to prove authenticity of the test certificates produced by the Contractor, at the Contractor’s cost.

b) All steel materials supplied by the Contractor shall be in a sound condition, of recent manufacture, free from defects, loose mill scale, slag intrusions, laminations, pitting, flaky rust, etc. and be of full weight and thickness specified.

c) Wherever the Contractor, in order to accommodate his other materials in stock, desires to substitute structural steels or plates for the sizes shown on drawings, such substitutions shall be made only after authorization in writing by the Engineer.

d) The Engineer may direct that substitution be made, when he considers such substitutions is necessary.

12. FABRICATION

a) All fabrication work shall be done in accordance with IS: 800, read in conjunction with relevant codes mentioned therein.

b) Fabrication shall be done in workshops approved by Engineer, unless specifically permitted by Engineer that fabrication can be done at site. Under such circumstances work shall be done on a specially designed and constructed platform. Location, size, specification and construction of such a platform shall have prior approval of Engineer. Loads associated with such platforms shall be provided to Engineer.

c) Mild steel rolled sections and plates shall be cut by shearing/machining and grinding the surfaces to true sizes and shapes. Gas cutting of mild steel may be permitted by the Engineer, provided that every cut face and edge is smoothened by grinding operation. Prior approval of Engineer must be obtained for using gascutting techniques either by mechanized gas cutters or manually operated gas cutters. While, using gas-cutting methods, proper allowance must be made for grinding to bring the cut piece to exact required dimensions.

d) Extensive use of templates shall be made in doing fabrication work. Templates shall be clean and should have true surfaces prepared for every successive use. Reinforcements for the structural steel members if required shall be included. In case actual members are used as templates for similar pieces, it will be at the discretion of the Engineer to decide whether such pieces are fit to be incorporated in the finished structure. Jigs and manipulators shall be used, where practicable, and shall be designed to facilitate welding and to ensure that all welds are easily accessible to the operators.

e) All material shall be straight and free from twist and bends unless required to be curvilinear in from. If necessary the material shall be straightened and / or flattened / straightened by pressure. Heating of rolled sections and plates for purpose of straightening shall not be permitted.

f) Curvilinear members shall be formed by bending with the help of pneumatic press. Final shaping, to a very limited extent, however, may be done by local heat application. This shall be done only on receiving approval from the Engineer.

13. Holing
All holes shall be made at right angles to the surface of the member. Holes shall be clean cut without any torn or jagged edges. Holes shall be done by drilling. Punching shall not be resorted to, unless previously approved by the Engineer. In any case, punching of holes in materials having a thickness in excess of the connector diameter, or, for materials thicker than 16 mm, the hole shall be punched 3 mm less in diameter than the required size and then reamed to the full size. Holes shall not be formed or enlarged by burning or gas cutting under any circumstances.

14. WELDING

14.1 General

a) In general only Automatic submerged arc welding will be used for fabrication. Subject to approval of Engineer, Metal inert gas welding may be done for short length where access to the location of the weld does not permit submerged arc welding. The welding and the welded work shall conform to IS: 816, unless otherwise specified. As much work as possible shall be welded in shops and the layout and sequence of operations shall be so arranged as to eliminate distortion and shrinkage stresses. Unless otherwise specified all weld shall be for full contact for all sides.

b) Electrodes for shielded-arc manual welds shall comply with the requirements of IS:814 and shall be amenable to radiographic tests and shall be of approved make. The electrodes for manual arc welding shall be suitable for use in the position and type of work, as laid down in the above specifications and as recommended by the manufacturers. Electrodes classification group 1 or 2 as given in IS: 814 shall be used for welding steel conforming to IS: 2062. Electrodes shall conform to IS-1442 for steel conforming to IS: 8500. Joints in materials above 20 mm thick, and, all important connections shall be made with low hydrogen electrodes Electrode flux covering shall be sound and unbroken. Broken or damaged coating shall cause the electrodes to be discarded. Covered electrodes for manual arc-welding shall be properly stored in an oven prior to use in a manner recommended by the Manufacturer and only an hour’s quota shall be issued to each welder from the oven.

c) Electrodes larger than 5 mm diameter shall not be used for root-runs in buttweld. Welding plant and accessories shall have capacity adequate for the welding procedure laid down and shall satisfy appropriate standards and be of approved make and quality, the Contractor shall maintain all welding plant in good working order. All the electrical plant in connection with the welding operation shall be properly and adequately earthed and adequate means of measuring the current shall be provided. All welds shall be made only by welders and welding operators who have been properly trained and previously qualified by tests to perform the type of work required as prescribed in the relevant applicable standards. All welds shall be free from defects like blow holes, slag inclusions, lack of penetration, undercutting, cracks etc. All welds shall be cleaned of slag or flux and show uniform sections, smoothness of weld metal, feather edges without overlap and freedom from porosity.

d) Fusion faces and surfaces adjacent to the joint for a distance of at least 50 mm on either side shall be absolutely free from grease, paint, loose scales, moisture or any other substance which might interfere with welding or adversely affect the quality of the weld. Joint surfaces shall be smooth, uniform and free from fins, tears, laminations etc. Preparation of fusion faces shall be done in accordance with the approved fabrication drawings by shearing, chipping, machining or machine flame cutting except that shearing shall not be used for thickness over 8 mm.

e) In the fabrication of cover-plated beams and built up members all shop splices in each component part shall be made before such component part is welded to other parts of the member. Wherever weld reinforcement interferes with proper fit-up between components to be assembled for welding, these welds shall be ground flush prior to assembly.

f) Members to be joined by fillet welding shall be brought and held as close together as possible and in no event shall be separated by more than 3 mm. If the separation is 1.5 mm or greater, the fillet weld size shall be increased by the amount of separation. This shall only apply in the case of continuous welds. The
fit-up of joints at contact surfaces which are not completely sealed by welds shall be close enough to exclude water after painting.

g) The separation between fraying surfaces of lap joints and butt joints with backingplate shall not exceed 1.5 mm. Abutting parts to be butt welded shall be carefully aligned and the correct root gap maintained throughout the welding operation. Misalignments greater than 25 percent of the thickness of the thinner plate or 3 mm whichever is smaller shall be corrected and in making the correction the parts shall not be drawn into a slope sharper than 2 degrees (1 in 27.5).

h) Welding procedures recommended by appropriate welding standards and known to provide satisfactory welds shall be followed. A welding procedure shall be prepared by the Contractor and submitted to the Engineer for approval before start of welding.

i) Approval of the welding procedure by the Engineer shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure.

j) Voltage and current (and polarity if direct current is used) shall be set according to the recommendations of the Manufacturer of the electrode being used, and suitable to thickness of material, joint form etc. The work shall be positioned for flat welding wherever practicable and overhead weld shall be avoided.

k) No welding shall be done when the surface of the members is wet, nor during periods of high wind unless the welding operator and the work are properly protected. In joints connected by fillet welds, the minimum sizes of single run fillet welds or first runs and minimum full sizes of fillet welds shall conform to the requirements of IS: 816 and IS: 823. Fillet welds larger than 8 mm shall be made with two or more passes.

l) All ‘full penetration butt welds’ made by manual arc-welding, except when produced with the aid of backing material or welded in flat position, from both sides in square-edge material, not over 8 mm thick with root opening not less than one-half the thickness of the thinner part joined, shall have the root of the initial layer gouged out on the back side before welding is started from that side, and shall be so welded as to secure sound metal and complete fusion throughout the entire cross section.

m) Butt welds shall be terminated at the ends of a joint in a manner that will ensure their soundness. Where abutting parts are 20 mm or more in thickness, run-on and run-off plates with similar edge preparation end having a width not less than the thickness of the thicker part joined shall be used. These extension pieces shall be removed upon completion of the weld and the ends of the weld made smooth and flush with the abutting parts. Where the abutting parts are thinner than 20 mm the extension pieces may be omitted but the ends of the butt welds shall then be chipped or gouged out to sound metal and side welded to fill up the ends to the required reinforcement.

n) Each layer of a multiple layer weld except root and surface runs may be moderately peeled with light blows from a blunt tool. Care shall be exercised to prevent scaling or flaking of weld and base metal from over-peeling.

o) Before commencing fabrication of a member or structure in which welding is likely to result in distortion and/or locked up stresses, a complete program of fabrication, assembly and welding shall be made and submitted to the Engineer for his approval. Such a programme shall, include, besides other appropriatedetails, full particulars in regard to the following:

i) Proposed pre-bending of components such as flanges and presetting of joints to offset expected distortion.
ii) Make up of sub-assemblies proposed to be welded before incorporation in final assembly.
iii) Proposed joint forms, classification of wire and flux or covered electrodes, welding process including fitting and welding sequence with directions in which freedom of movement is to be allowed.
iv) Proposed number, spacing and type of strong details of jigs and fixtures for maintaining proper fit up and alignment during welding.
v) Any other special features like assembling similar members back to back or stress relief.

14.2 INSPECTION OF WELDS
a) All welds shall be inspected for flaws by any of the methods described in these specifications, and as per IS: 822. The choice of the method to be adopted shall be determined by the Engineer.

b) The Contractor shall arrange for all tests as called for in the schedule of quantities, at his own cost.

c) In case the tests uncover defective work, such tests shall be at the Contractor’s cost and the Contractor shall correct such defects at his own cost, and prove the soundness of rectified work.

d) The correction of defective welds shall be carried out as directed by the Engineer without damaging the parent metal. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means as prescribed by the Engineer shall be used to ensure that the whole of the crack and material up to 25 mm beyond each end of the crack has been removed. Cost of all such tests and operations incidental to correction shall be to the Contractor’s account.

15. FABRICATION TOLERANCES
Unless otherwise shown on drawings, the fabrication tolerances shall generally be as detailed hereunder.

15.1 Straightness
The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852 for indigenous steel and equivalent applicable codes for imported steel. The acceptable limits for straightness (sweep and camber) for rolled or fabricated members shall be: Struts and columns: L/1000 or 10 mm whichever is smaller for all other members not primarily in compression such as purlins, beams, bracings & web members of trusses and latticed girders: L/500 or 15 mm whichever is smaller. Where L is the length of finished member, or such lesser length as the Engineer may specify.

15.2 Twists
a) A limit for twist (prior to erection) in:
   - Box girders and heavy columns: L/1500
   - Other members: L/1000
b) The twist of the member between any two sections shall be measured with the web vertical at one of the sections.

15.3 Camber
Tolerance in specified camber of structural members shall be + 3 mm.

15.4 Length
Tolerance in specified length shall be as follows:

*Type of Member Tolerance*
A column finished for contact bearing: + 1 mm
Other members (e.g., beams) under 10 m: + 0 and - 3 mm
Other members (e.g., beams) 10 m long and over: + 0 and - 5 mm

15.5 Square-Ness at End of Members
a) Beam to beam and beam to column connections where the abutting parts are to be joined by butt welds, permissible deviation from the square-ness of the end is:
   - Beams up to 600 mm in depth: 1.5 mm
   - Beams over 600 mm in depth: 1.5 mm every 600 mm depth, up to a max of 3 mm
b) Where abutting parts are to be joined by bolting through cleats or end plates, the connections require closer tolerance. Permissible deviation from squareness of the end is:
Beams up to 600 mm in depth: 1 mm
Over 600 mm in depth: max of 1.5 mm.

15.6 Butt Joints
For full bearing, two abutting ends of columns shall first be aligned to within 1 in 1000 of their combined length and then the following conditions shall be met:
a) Over at least 80% of the bearing surface the clearance between the surfaces does not exceed 0.1 mm.
b) Over the remainder of the surfaces the clearance between the surfaces does not exceed 0.3 mm. Where web stiffeners are designed for full bearing on either the top flange or bottom flange or both, at least half the stiffener shall be in positive contact with the flange. The remainder of the contact face could have a max. gap of 0.25 mm.

15.7 Depth of Member
Acceptable deviation from the specified overall depth is:
For depths of 900 mm and under: +/− 3 mm
For depths over 900 mm and under 1800 mm: +/− 5 mm
For Depths of 1800 mm and over: + 8 mm; − 5 mm.

15.8 Web Plates
Acceptable deviation from flatness in girder webs in the length between the stiffeners or in a length equal to the girder depth shall be 1/150th of the total web depth.

15.9 Flange Plates
a) Limit for combined warp-age and tilt on the flanges of a built up member is 1/200th of the total width of flange or 1.5 mm whichever is smaller measured with respect to center-line of flange.
b) Lateral deviation between center-line of web plate and center-line of flange plate at contact surfaces, in the case of built up sections shall not exceed 3 mm.

16. INSPECTION
16.1 The Contractor shall give due notice to the Engineer in advance of the materials or workmanship getting ready for inspection.
a) All rejected material shall be promptly removed from the shop and replaced with new material for the Engineer’s approval / inspection. The fact that certain material has been accepted at the Contractor’s shop shall not invalidate final rejection at site by the Engineer, if it fails to be in proper condition or has fabrication in-accraruces which prevent proper assembly. No materials shall be painted or dispatched to site without inspection and approval by the Engineer unless, such inspection is waived in writing by the Engineer.
b) Shop inspection by the Engineer or his authorized representative, or, submission of test certificates and acceptance thereof by the Engineer, shall not relieve the Contractor from the responsibility of furnishing material conforming to the requirements of these specifications. Nor shall it invalidate any claim, which the Engineer may make because of defective or unsatisfactory material and/or workmanship.
c) The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified. For fabrication work carried out in the field, the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the Engineer.

17. PAINTING OF STRUCTURAL STEEL WORK

17.1 Paint
a) All paint delivered to the fabrication shop shall be ready mixed, in original sealed containers, as packed by the paint manufacturers. Addition of thinners shall not be permitted.
b) Opened containers of Paint shall be stirred frequently to keep the pigment in suspension.
c) Apoxi paint shall be used on steel structure as well as on Puff panels to protect it from damage due to Chemicals like in anodizing plant etc.

17.2 Storage of Paints

a) All paints shall be stored strictly in accordance with the requirements laid down by the paint manufacturers. The storage area shall be well ventilated and protected from sparks, flame, direct exposure to sun or excessive heat, preferably located in an isolated room or in a separate building.
b) All paint containers shall be clearly labeled to show paint identification, date of manufacture, batch number, order number and special instructions in legible form. The containers shall be opened only at the time of use. Paints that have expired, gelled or otherwise deteriorated during storage, shall not be used. Paints, for which the shelf life specified by the supplier has expired, shall not be used without inspection and approval by the Engineer.

17.3 Execution
Paint System

a) In general, except where specified otherwise in approved shop drawings, sand blasting of steel surfaces shall be carried out in accordance with SSPC SP 10 or SA 2.5, near to white metal blast.
b) All steel sections used in elevated stations shall be painted with Intumescent Fire Paint rated for minimum of 30 minutes as mentioned below. Any primer and finish applied on the structure to be Fire Proofed shall be compatible with the Intumescent Fire Paint. The approved Fire Paint manufacturer must submit certification to this effect. All the paints used shall be from the same manufacturer to avoid compatibility related problems. The finish paint shall be Acrylic Polysiloxane finish. The Intumescent Fire Paint which will be applied on the steel structure will confirm to BS 476 Part 20-22 1987. The Painting Specifications shall comprise of the following:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>GENERAL SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabrication Shop</td>
<td>External Surfaces</td>
</tr>
<tr>
<td>Surface Treatment</td>
<td>Abrasive Blast to minimum SA 2.5 (ISO 8501-1-1988) or SSPC SP-10 near to white metal blasting</td>
</tr>
<tr>
<td><strong>1st Coat</strong></td>
<td>Two Component Zinc Phosphate Epoxy Primer (selfcuring solvent type) with approximate volume solids 63%. The primer shall be applied by spray only over blasted surfaces. The DFT in a single coat shall be minimum 75 microns.</td>
</tr>
<tr>
<td><strong>2nd Coat</strong></td>
<td>Solvent Based Acrylic Intumescent Paint with approximate Volume Solids 68-74% confirming to BS 476 Part 20-22:1987. This product shall have a Certifier Approval. This product shall have a product weight of approximately 1.3 to 1.5 kg/liter. This product should give a rating of 30 minutes. The thickness determined should be in accordance to the Hp/A given by approved manufacturer. Airless spray of minimum pump ratio 66:1 shall apply the Intumescent Paint. The rating will be for minimum 30 minutes.</td>
</tr>
</tbody>
</table>
3rd Coat

Two components Fast Curing Epoxy Tie Coat with approximate volume solids of 45 to 60%, compatible with previous PFP coat with initial drying of 30 minutes at 250C. DFT-40 microns.

Finish Paint

Two components hi Gloss Hybrid Polysiloxane Finish Paint with Approximate volume solids of 70% or above. The product should exhibit Gloss retention of a minimum 90% after 3000 hrs exposure to UVA Florescent lamp, as per ASTM D 523. The product hard dry time should not be more than 6 hrs @ 250 C and 50% RH. DFT-60 microns

INTERNAL SURFACE = Internal surface are those which will become inaccessible after fabrication and are not prone to humidity and moisture from the atmosphere.
EXTERNAL SURFACE = All other surfaces which are prone to humidity and moisture from the atmosphere.

1. DFT measurement should be done in accordance with Specifications SSPC PA.
2. The entire paint system shall be from the same manufacturer.

Touch-up –
Surfaces to be touched up shall be cleaned as per ST2 and primed with a Surface Tolerant Epoxy and the entire system of paint excluding the primer to be replace thereafter.

17.4 Surface Preparation

a) All surfaces shall be cleaned of loose substances and foreign materials. e.g. dirt, rust, scale, oil, grease, welding flux etc so that the prime coat adheres to the original metal surface. The work shall be carried out in accordance with IS: 1477(Part I). Any oil, grease, dust or foreign matter deposited on the surface after preparation shall be removed and care shall be taken to ensure that the surface is not contaminated with acids, alkalis or other corrosive chemicals. The primer coat shall be applied immediately after the surface preparation is completed.

b) Before the application of any paint the surfaces to be treated shall be thoroughly cleaned freed from all scale, loose paint, rust and other deleterious matters. Oil and grease shall be removed from the surface by washing with solvents or with a detergent solution before blast cleaning operation of metal polish with metalpellets. If any traces of oil or grease remain after blasting they shall be removed by solvent cleaning and the area will be re-blasted thereafter.

c) All welding areas shall be given special attention for removal of weld flux slag, weld metal splatter, weld head oxides, weld flux fumes, silvers and other foreign objects before blasting. If deemed necessary by the Engineer, acid washing and subsequent washing with clean water shall be used.
d) Any rough seams will have to be ground and must be inspected and approved by the Engineer before application of the coatings.

All structural steel to be painted shall be cleaned. Blast cleaning in accordance with SA 2 1/2 Near-White Blast cleaning (equivalent Swedish Standard SIS055900). For SA 2 1/2 the profile should be in the range of 40-70 microns and shall be measured with comparator. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are light stains in the form of spots or stripes. Finally the surface shall be cleaned with a vacuum cleaner or clean dry compressed air.

e) The blast cleaning shall produce a surface roughness complying with the one specified by the paint manufacturer for the primer concerned. If, cleaned surfaces are rusted or are contaminated with foreign material before painting is accomplished they shall be re-cleaned by the Contractor at his own expenses.

f) The surface shall be cleaned by impingement of abrasive materials, such as grit of cast iron, malleable iron, steel or synthetic material, at high velocity created by clean and dry compressed air blast. Prior to application of the blast, heavy deposits of oil and grease shall be removed by solvent cleaning and excessivesurface scale removed by hand tool or power tool cleaning.

17.5 Mixing and Thinning
a) All ingredients in a paint container shall be thoroughly mixed to break-up lumps and disperse pigments, before use and during application, to maintain homogeneity. All pigmented paints shall be strained after mixing to remove skins and other undesirable matters.

b) Dry pigments, pastes, tinting pastes and colours shall be mixed and/or made into paint so that all dry powders get wetted by vehicles and lumps and particles are uniformly dispersed.

c) Additives that are received separate such as curing agents, catalysts, hardeners etc. shall be added to the paint as per the manufacturer’s instructions. These shall be promptly used within the pot life specified by the manufacturers and unused paint thereafter shall be discarded.

d) Thinners shall not be used unless essential for proper application of the paint. Where thinners are used, they shall be added during the mixing process and the type and quantity of thinner shall be in accordance with the instructions of paint manufacturer.

17.6 Paint Application
a) Paint shall be applied in accordance with the manufacturer recommendations, as supplemented by these Specifications. The work shall generally follow IS: 1477-(Part II). Prior approval of the Engineer shall be taken in respect of all primers and/or paints before their use in the works.

b) Paint shall generally be applied by brushing except that spraying may be used for finish coats only when brushing may damage the prime coats. Roller coat or other method of paint application shall not be used unless specifically authorized.

c) Spraying paint shall not be adopted on red lead or zinc rich paints. Daubers may be used only when no other method is practicable for proper application in difficult accessible areas.

d) Paint shall not be applied when the ambient temperature is 10°C and below. For paints which dry by chemical reaction the temperature requirements specified by the manufacturer shall be met with. Also, paint shall not be applied in rain, wind, fog or at relative humidity of 80% and above or when the surface temperature is below dew point, resulting in condensation of moisture. Any wet paint exposed to damaging weather conditions shall be inspected after drying and the damaged area repainted after removal of the paint.

e) Each coat of paint shall be continuous, free of pores and of even film thickness without thin spots. The film thickness shall not be so great as to detrimentally affect either the appearance or the service life of the paint.

f) The first coat of paint shall be applied within 4 hours after surface preparation and/or before rusting or contamination occurs.

g) Each coat of paint shall be allowed to dry sufficiently before application of the next coat, to avoid damages such as lifting or loss of adhesion. Undercoating glossy surface shall be roughened by mild sand papering to improve adhesion of subsequent coats. Successive coats of same colour shall be tinted. Whenever practical, to produce contrasts and help in identifying the progress of the work.

17.7 Brush Application
a) Proper brushes shall be selected for a specific work piece. Round or oval brushes which conform to IS: 487 are better suited for irregular surfaces, whereas flat brushes which conform to IS: 384 are convenient for large flat areas. The width of flat brushes shall not generally exceed 125mm.
b) Paint shall be applied in short strokes depositing a uniform amount of paint in each stroke followed by brushing the paint into all surface irregularities, crevices and corners and finally smoothening or leveling the paint film with long and light strokes at about right angles to the first short strokes. All runs and sags shall be brushed out. The brush marks left in the applied paint shall be as few as practicable.

**17.8 Spray Application**

a) The spraying equipment shall be compatible with the paint material and provided with necessary gauges and controls. The equipment shall be cleaned of dirt, dried paint, foreign matter and solvent before use.

b) The paint shall be applied by holding the gun perpendicular to the surface at a suitable distance no closer than 200mm or more than 600mm and moved in a pattern so as to ensure deposition of a uniform wet layer of paint. All runs and sags shall be brushed out immediately. Areas not accessible to spray shall be painted by brush or dauber.

c) Water trap acceptable to Engineer/ Authorised inspecting agency shall be furnished and installed on all equipment used in spray painting.

**17.9 Shop Painting**

a) The painting system specified in Table shall be followed. Surfaces, which will be inaccessible after field assembly, shall receive the full-specified protective treatment before assembly.

b) Surfaces in contact during shop assembly shall not be painted. Surfaces which cannot be painted but require protection shall be given a rust inhibitive grease conforming to IS: 958 or solvent deposited compound conforming to IS: 1153 or IS: 1674 or treated as specified in the drawing.

c) Surface to be in contact with concrete shall not be painted.

d) The shop coats shall be continuous over all edges, including ends meant for jointing at site by bolting, except where the paint could be detrimental to bolting. In such cases, no paint shall be applied within 50mm, and the unprotected surface shall be given a coat of corrosion inhibitive compound.

e) The unpainted area shall be cleaned prior to welding. The welded joint shall be cleaned and deslagged, and immediately after covered by the same paint as has been used for the remaining surface.

**17.10 Protection of Paintwork**

a) The Contractor shall provide measures as necessary to prevent damage to the work and to other property or persons from all cleaning and painting operations. Paint or paint stains which result in other unsightly appearance on surfaces not designated to be painted shall be removed or obliterated by the contractor at his cost.

b) All painted surfaces that in the opinion of the Engineer/ Authorized inspecting agency are damaged in any way, shall be repaired by the contractor at his cost with materials and to a condition equal to that of the requirements specified in these specifications.

c) Upon painted surfaces that in the opinion of any other work that would cause dust, grease or foreign materials to be deposited upon the painted surfaces, the painted surfaces shall be thoroughly cleaned.

d) The areas for high-strength bolts shall be protected by masking tape against undercoat application at the fabrication shop. Immediately prior to erection any rust in the paint area shall be removed by power wire brushing to a standard equivalent to SA3.

**17.11** Contractor shall make provision for requisite site painting to all fabricated steelwork, as per requirements of related specifications of the painting.

**17.12 Repair of Paint Defects**
All damage to the previous paint shall be repaired. All loose paints shall be removed back to firm edge. Surface irregularities and contaminates shall be removed. Hard, glossy surfaces may require abrading to obtain a suitable surface for painting. Surfaces, which are to be over coated and which have become contaminated shall be either be solvent cleaned in accordance with SSPC-SP-1 “Solvent Cleaning” or high pressure fresh water washed and if required, a suitable detergent may be used.

17.13 Inspection
Testing
The final paint shall be free from obvious defects and shall be tested by the contractor as follows:

a) Film Thickness: All dry-film thickness limits as specified shall be strictly adhered to. It is recommended that, in order to achieve the specified dry-film thickness, frequent checks of et-film thicknesses are to be carried during the paint application with wet-film thickness gauges such as the Elcometer wheel or comb type wheelgauge. The dry-film thickness of individual coats and of the total coating system shall be checked at random over an area representative of the total work. A minimum of 5 readings shall be taken for each 10 m² of coated surface. For a surface area less than 10 m² a minimum of 3 readings shall be taken. Additional readings shall be taken if there has been any changes in application of equipments, spray nozzle size, thinning of paint, etc.

b) Inspection: The application work to be inspected at all stages and finished paintwork shall have the correct shade, degree of gloss and evenness and be free from defects such as cracks, holidays, runs sags, wrinkles, patches, brush or roller marks, other defects that may be detrimental to the quality of the coating. Prior to acceptance of the paintwork a final inspection shall be made.

18. MEASUREMENT
Measurement for payment shall be the plan area of the building calculated on the center lines of peripheral columns. For variation of height increasing/decreasing by 0.5 m over the stipulated height of building, no extra payment shall be made.

19. HEALTH, SAFETY AND ENVIRONMENT
All relevant requirements of the Operational Safety Standards shall be met. Of particular importance are the requirements for blasting and power tool cleaning, for scaffolding access platform and ventilation in enclosed areas. There recommendation for personal protection and for protective equipment, as given in the Publication “Personal Protection advice for the use of Marine Paint and Composition” (Published by the paint makers Association of Great Britain) shall be followed. Storage, handling, mixing and application of the paints and coating materials shall be done strictly in accordance with the manufactures recommended procedures and hardware for assurance of personal safety. Safety precautions shall be clearly described on the technical data sheets of paints and coating materials supplied, as well as on the paint containers. Spray guns and accessories shall be earthed to prevent them from the removal from up and elastomeric charge caused by the movement paint. Procedure approved by the client shall be available for the removal of spillage, collection and disposal of surplus paints, used brushes, scaffolding, equipment, waste etc upon completion of painting/coating activities.

20. HANDLING AND STORAGE
a) Proper storage of steel (sections and fabricated members) at the job site shall be the responsibility of the Contractor.

b) Structural steel shall be stored out of mud and dirt. Proper drainage of the storage area shall be provided. These shall be protected from damage or soiling by adjacent construction operations.

c) Fabricated steel shall not be handled until the paint has thoroughly dried. Careshall be taken to avoid paint abrasions and other damage. Steel work shall be transported in such a way so as not to over stress the fabricated sections. All pieces bent or otherwise damaged shall be rejected and shall be replaced by the contractor at his own cost.

d) Checking and inspection of fabricated structural steel work by the Engineer shall be done at various stages of completion of fabrication work. The contractor is required to ensure that fabricated steel work is properly stacked such that all joints of all members are either visible or accessible for inspection at all
stages of inspection work. Care should also be taken to ensure that fabricated members are not subjected to stresses due to defective stacking.

**Mode of Measurement**

The finished work shall be measured correct to a centimetre in respect of length and breadth nearest to two places of decimal and calculating in kg. The rate shall include the cost of all operations described above including the cost of materials, labors, designs of drawings, erection and testing, fabrication, erection, finishing, scaffolding, etc. No other claims of any kind pertaining to this work shall be entertained.

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**SPECIFICATIONS FOR ELECTRICAL WORKS**

1.0 **GENERAL**

To provide a complete electrical system for the distribution of electric power from the point of supply (SEB), D.G.s to the utilization equipment, all as shown in the drawings and described in these specifications. The quantities mentioned in BOQ are tentative. It will be the bidder’s responsibility to work out the exact quantities from drawings or from work site, which trade provides said equipments, materials, tools and labour.

2.0 **SCOPE**

The bidder shall supply, install and commission along with requisite spare, maintenance tools and tackles the following equipments and system in the Building. The scope also covers the detailed engineering and calculations of the various equipments/system mentioned hereunder and the same shall be approved by the Owner /Architect prior to execution of the job.

- Laying and termination of L.T. cables.
- Distribution Boards / Sub-Distribution Board.
- Complete internal building wiring as per specification.
- Safety to personnel and equipment during both operation and maintenance.
- Reliability of Service.
- Minimum fire risk.
- Case of maintenance and convenience of operation.
- Automatic protection of all electrical equipment through selective relaying system.
- Electrical supply to equipment and machinery within the design operating limits.
- Adequate provision for future expansion and modification.
- Maximum interchange ability of equipment.
- Fail-safe feature.
- Suitability for applicable environmental factors.

This specification defines the basic guidelines to develop a suitable electrical system as necessary for the Non residential campus. All data required in this regard shall be taken into consideration to develop a detailed engineering of the system. Site conditions as applicable are mentioned elsewhere.

Compliance with these specifications and/or approval of any of the Contractor’s documents shall in no case relieve the Contractor of his contractual obligations.
All work to be performed and supplies shall be affected as a part of contract requires specific approval/review of Owner or his authorised representative. Major activities requiring approval/review shall include but not be limited to the following:

The engineering activities shall comprise the submission for approval of the following:

- Basic engineering documents e.g. overall single line diagram, area classification drawing, overall cable layout, testing, type test report, guaranteed particulars of all equipments and maintenance manuals.
- Quality assurance procedures.
- Field testing and commissioning procedures.
- Basic engineering calculations viz. load analysis; load flow, fault level calculations, and voltage drop calculations during motor start-up/re-acceleration etc.
- Control and protection schemes.
- Load sharing and annunciation scheme.
- Sizing calculation for cable trays/cable trenches.
- Area-wise illumination level calculation and preparation of power supply distribution drawing.
- Calculation for earthing system and lightning protection.

Bidder shall be responsible for:

- Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, lighting layouts, cabling layouts, earthing and lightning protection layouts, including equipment installation and cable termination details etc. prior to start of work.
- Preparation of bill of materials for cabling, lighting, earthing and miscellaneous items etc.
- Cable schedule.
- Lighting/power panel schedule.
- Interconnection drawing.
- Protection co-ordination drawings/tables for complete power system.
- Shop inspection and testing procedures.
- Field testing and commissioning procedures.
- Preparation of as built drawings for all services.

Bidder shall also be responsible for:

- Any other work/activity which is not listed above however is necessary for completeness of electrical system.

3.0 CODES & STANDARDS

The design engineering manufacturing and the installation shall be in accordance with established codes, sound engineering, practices, and specifications and shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities’ e.g. Electrical inspector, pollution control boards, SEB as applicable before commissioning of electrical/DGs.

- Indian Electricity Act.
- Indian Electricity Rules.
- Factory Act.
- Pollution Control Act.

IS-732 : Code of practice for electrical wiring installation system voltage not exceeding 650V.
IS-3043 : Earthing.
IS-2309 : Code of practice for the protection of buildings and allied structure against Lightning
IS-7689 : Guide for control of undesirable static electricity.
IS-3716: Insulation co-ordination application guide.
IS-8130: Conductors for insulated electrical cables and flexible cords.
IS-5831: PVC insulation and sheath of electric cables.
IS-3975: Mild steel wire, strips & tapes for armouring cable.
IS-3961: Current rating of cables
IS-694: PVC insulated (heavy duty) electric cables for working. Voltage up to and including 1100 volts.
IS-424-1475 (F-3): Power cable flexibility test.
IEC-439/IS-7098: Specification for cross linked polyethylene insulated PVC sheathed cable for working voltage up to 1.1 KV.
IS-1554: PVC insulated cables up to 1100 volts.
IS-10810: Test procedures for cables.
IS-6121: Cable glands.
IS-10418: Cable drums.
IEC-754(1): FRLS PVC insulated cable.

ASTM-D-2843: Standard test method for measuring the density of smoke from burning or decomposition.
ASTM E-662/IEC 754(A)
Standard test method for specific optical density of smoke generated by solid materials.
IEEE-383: Standard for type test class-IE, electric cables, field splicers and connections for power generation station.
IS 13947/IEC 947: Air circuit breaker/moulded case circuit breaker. IS-8623: Specification for factory built assemblies of switch gear and control gear for voltage upto and including 1000vac/1200vdc
IS 1018: Switchgear and control gear selection/installation and maintenance
IS-1248: Direct acting indicating analogue electrical measuring instruments and testing accessories.
IS-13779: Digital measuring instruments and testing accessories.
IS-3156: Voltage transformer.
IS-2705: Current transformer for metering and protection with classification burden and insulation.
- IS -2147: Degree of protection provided by enclosures for low voltage.
PART 1,11,111 Switchgear and control gear
IS-3427: Metal enclosed switchgear and controlgear
BS-162: Safety clearance
IS-3202: Code of practise for climate proofing of electrical equipment.
IS-375: Marking and arrangement for switchgear, busbars, main connections and auxiliary wiring.
IS-722: AC electric meters
IS-3231: Electrical relays for power system protection.
IEC-255
IS-5082: Electrolytic copper/aluminium bus bars
IS-2834: Capacitors
IS-2713: Steel tubular pole
IS-335: Specification for insulating oil
IS-3837: Specifications for accessories for rigid steel conduit for electrical wiring.
IS-2026&335: Distribution transformer
(PART I,II,III)GI/STEEL/PVC conduit pipe for electrical wiring.
IS-2274: Code of practise for electrical wiring installation system voltages exceeding 650 volts.
IS-6665: Code of practise for industrial lighting
IS-3646: Interior insulation part 1&2
IS-1944: Code of practise for lighting of public through fares.
IS-7752: Guide for improvement of power factor consumers installation.
IS-13346: General requirement for electrical for explosive gas atmosphere.
IS-13408: Code of practise for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres
IS-12360: Voltage and frequency for ac transmission & distribution system.
IS-5572: Classification of hazardous area for electrical installations.
IS-5571: Guide for selection of electrical equipment for hazardous area.
IS-4201: Application guide for Current Transformer
IS-4146: Application guide for Voltage Transformer
IS-10028: Code of practise for installation and maintenance of transformer
IS-8478: Application guide for on load tap changer
IS-10561: Application guide for power transformer
IS-1646: Code of practise for fire safety of buildings electrical installation
IS-3034: Code of practise for fire safety of industrial building-electrical generating and distribution station
IP-30: National electrical code (NEC) BIS publication.
IS-4722: Rotating electrical machines.
IS-4889: Method of determination of efficiency of rotating electrical machines.
IS-325: Three phase induction motors.
IS-4729: Measurement and evaluation of vibration of rotating electrical machines.
IS-900: Installation and maintenance of induction motors.
IS-4029: Air break switches.
IS-2208-9224: HRC cartridge fuses.
IS-2959: Contactors.
IS-9537: Rigid steel conduit.
IS-1601/BS-649: Performance & testing of Internal Combustion (IC) engines for general purpose.
AIEE-606(1959): Recommended specification for speed governing of I.C. engine generator units.
BS-5514/IS-3046 8528(Part-2): Reciprocating IC engine driven A.C. generators.
Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.

In case of any deviation /conflict of this specification with the codes & standards, the following order of precedence shall govern.

**PAINTING:**

All steel work shall be pretreated in tanks and finally powder coated of approved shade of the levels not less than 100 microns.

**TESTING & INSPECTION**

Four copies of all test certificates and certificates from sub-vendor shall be furnished. After completion of all work at the manufacturer’s works the switchboards shall be inspected and tested in presence of Purchaser’s/Consultant’s representative. However, stage inspection may be carried out from time to time to check progress of work and workmanship. The following tests shall be carried out:

i) All routine tests specified in relevant Indian/British Standards shall be carried out on all circuit breakers.
ii) Test for protective relay operation by secondary injection method.

iii) Operation of all meters.

iv) Secondary wiring continuity test

v) Insulation test with 1000 Volts megger, before and after voltage test.

vi) HV test on secondary wiring and components on which such test is permissible (2 KV for one minute)

vii) Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.

viii) Measurement of power required for closing/trip coil of the breaker.

ix) Pick up and drop out voltages for shunt trip and closing coils.

x) CT Polarity test.

xi) Power frequency voltage withstand test.

Vendor shall provide all facilities such as power supply, testing instruments and apparatus required for carrying out the tests. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from Sub-Vendor for the components procured from them are to be submitted before dispatch of switch boards.

**DRAWINGS AND INFORMATION**

The Vendor shall furnish following drawings/documents in accordance with enclosed requirements:

i) General Arrangement drawing of the Switchboard, showing front view, plan, foundation plan, floor cut-outs/trenches for external cables and elevations, transport sections and weights.

ii) Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, bus bars, current transformers, cable boxes, terminal boxes for control cables etc.

iii) Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc.

iv) Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.

v) Relay wiring diagrams.

vi) Equipment List.

vii) Bus bar sizing calculations.

Vendor shall furnish required number of copies of above drawings for Purchaser’s review, fabrication of switch boards shall start only after Purchaser’s clearance for the
same. After final review, required number of copies and reproducibles shall be furnished as final certified drawings.

The information furnished shall include the following:

i) Technical literature giving complete information of the equipment.

ii) Erection, Operation and Maintenance Manual complete with all relevant information, drawings and literature for auxiliary equipment and accessories, characteristics curves for relays etc.

iii) A comprehensive spare parts catalogue.

TOOLS

One complete set of all special or non-standard tools required for installation, operation and maintenance of the switchboard shall be provided. The manufacturer shall provide a list of such tools individually priced with his quotation.

SPARES

Contractor shall also quote separately for the maintenance spares for 2 years normal operation for owner to decide for placement of order at a later date. The quote shall remain valid at least for 6 months. The manufacturer/tenderer shall also supply a complete list of commissioning spares and tools. The same shall be included in the bid price. No extra payment shall be made on account of non-availability of spares during commissioning.

QUALITY ASSURANCE

Quality Assurance shall follow the requirements of Owner/ Consultant as applicable. Quality Assurance involvement will commence at enquiry and follow through to completion and acceptance thus ensuring total conformity to Purchaser’s requirements.

DEVIATIONS

Clause wise deviation for the specification must be stated in writing at the quotation stage. In absence of such a statement, it will be assumed that the requirements of the specifications are met without exception.

4.0 INTERNAL ELECTRICAL WORKS

4.01 Conducting (M.S Conduit)

All conduits shall be of heavy gauge solid drawn ERW welded manufactured out of 16 (1.6mm) gauge MS Sheet up to 32mm dia and of 14 (2 mm) gauge for sizes higher than this. Both inner and outer surfaces shall be smooth without burrs, dents and kinks. Conduits shall be black stove enameled inside and outside. The cross section of conduit shall be uniform throughout. The welding shall be uniform such that welded joints do not yield when subjected to flattening test. Welded joint shall not break when threaded or bent at an angle. Conduit shall conform to specifications of IS: 9537 (Part-II) and the capacity of conduits shall be in accordance with the standards and shall never be exceeded. The minimum size of the conduit shall be 20mm dia. Care shall be taken to
ensure that all conduits are adequately protected while stored at site prior to erection and no damaged conduit shall be used.

4.02 PVC Conduit
All conduits shall be high impact rigid 2mm thickness PVC heavy duty type and shall comply with I.E.E. regulations for non-metallic conduit 2mm thick as per IS-9537/1983 (Part-III). All sections of conduit and relevant boxes shall be properly cleaned and glued by using epoxy resin glue and the proper connecting pieces. Inspection type conduit fittings such as inspection boxes, drawn boxes, fan boxes and outlet boxes shall be M.S. or otherwise mentioned. Conduit shall be terminated with adopter/PVC glands as required.

4.03 Accessories
Conduit accessories such as normal bends, unions, circular junction boxes and pull boxes, locknuts etc. shall be heavy gauge type and approved make. Conduit accessories shall conform in all respects to IS: 3837-1966 with latest amendment. Wherever several conduits are running together, adequately sized adoptable boxes common to all runs shall be used to avoid inserting inspection boxes in the individual run. Where it is necessary to segregate wiring metal filler shall be fixed with in the box.

Conduits shall be laid before casting in the upper portion of a slab or otherwise, as may be instructed or in accordance with approved drawings, so as to conceal the entire run of conduits and ceiling outlet boxes. Vertical drops shall be buried in columns or walls. Wherever necessary, chases will be cut by the contractor with the help of chase cutting m/c or by hand. Nothing extra shall be paid to the contractor on this account. In case of exposed brick/ rubble masonry work special care shall be taken to fix the conduit and accessories in position along with the building work. Sufficient depth of the chases will be made to accommodate the required number of conduits. The chase will be filled with cement, coarse sand mortar (1:3) and properly cured by watering for one week.

If a chase is cut in an already finished surface the contractor shall fill the chase and finish it to match the existing finish. Contractor must not cut any iron bars to fix conduits. Conduits shall be kept at a minimum distance of 100mm from the pipes of other non-electrical services. Where the conduit is to be embedded in a concrete member it shall be adequately tied to the reinforcement to prevent displacement during casting, conduits in chases shall be held by steel hooks of approved design at maximum of 100 cm centres. The embedding of conduits in walls shall be so arranged as to allow at least 12mm plaster cover the same. All threaded joints of conduit pipes shall be treated with some approved ‘preservative compound’ to secure protection against rust.

Suitable expansion joints fittings of approved make and design shall be provided at all the points where the conduit crosses the expansion joint in the building. (Preferably with Pilca metallic watertight conduits). Conduits shall cross at right angles of the joints only.

Separate conduit shall be used for:

1) Normal light, fan call bell
2) 16 A power outlets
3) Emergency Light Point
4) Fire alarm System
5) Computer Outlets
6) P.A System
7) Telephone system
8) TV Network
9) Or any other services not mentioned here.
Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc. shall be installed in flexible conduits. Flexible conduits shall be formed from a continuous length of spirally wound interlocked wire steel with a fused zinc coating on both sides. The conduit shall be provided with approved type adoptor. A separate and accessible earth connection shall bond across the flexible conduit.

Conduit runs on surfaces shall be supported with metal 1.2 mm thick saddles, which in turn are properly secured on to GI spacer to the wall or ceiling. Fixing screws shall be with round or cheese head and of rust proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building and shall be painted in color matching the adjoining area. Unseemly conduit bends and offsets shall be avoided by using better appearance. Cross cover of conduits shall be minimum and entire conduit installation shall be clean and with good appearance. For surface work, the boxes shall be raised back pattern type, designed for use with distance saddles to give clearance of 6mm between the back of conduit and the fixing surface.

Where conduits are run on steel work, they will be fixed by means of purpose made GI Caddy clips in manner meeting with the approval of the Engineer prior to the installation being carried out. Other methods of fixing may be agreed in special circumstances, but approval must first be obtained from the site engineer.

The spacing of saddles shall be not more than 600mm centers for up to 32mm diameter conduits and at 750mm for conduit sizes of 40mm diameter and above in case of MS conduit and not more than 600 mm for PVC conduit. In addition, saddles shall be fixed at each side of any bend/Tee, or set at a distance of 200mm from the bend/Tee. The holes in the brickwork or concrete for fixing plugs shall be neatly drilled by means of a masonry drill of the appropriate size.

All the GI sheet steel /passivated boxes used for housing switches, plugs, fan regulator etc. shall be five sided conforming to IS: 5133 Part I-1969. Suitable size of boxes shall be provided a minimum of 2 adjustable fixing lugs on vertical sides. Suitable earth terminal inside each box shall be provided. All fixing lugs shall be threaded to receive standard machined chromium plated brass screws. Sufficient number of knockouts shall be provided for conduit entry. Conduits carrying wires of different circuit can terminate in common J.B having metal compartments. Necessary GI pull wires shall be inserted into the conduit for drawings wires. In case conduit pipe is required to cross any RCC beam special adopter boxes shall be provided for crossing & nothing shall be paid extra.

Where conduits are used for non air-conditioned space to air-conditioned space or into a fan chamber or duct, a junction box shall be installed to break the continuity of such conduit at the point of entry or just outside and conduit shall be sealed around the conductors.

Particular care shall be taken during the progress of the work to prevent the ingress of dirt and rubbish such as plaster droppings into erected conduits. Conduit which has become so clogged shall be entirely freed from these accumulations or will be replaced. Screwed plastic or metal caps or turned wooden plugs shall be employed to protect all open ends. Plugs of waste wood, paper, cotton or other fibrous matter shall not be used. All unused conduit entries shall be blanked off in an approved manner and where conduits terminate in adaptable boxes, all removable box covers shall be firmly secured to provide complete enclosure. If considered necessary by the Engineer-in-charge, the conduits shall be swabbed out by drawing swabs of rag through the conduit to remove moisture prior to any cables being drawn in.
All conduit installations must be completed and erected in their totality before they are wired and must be fully rewirable from outlets to distribution boards or trunking systems etc. to which they connect. No wiring of any part of the installation shall be commenced until instructions are received to do so by the Engineer-in-charge at such time as he is satisfied that the wiring will not be damaged due to building operations.

Conduits shall be installed so that they are self draining in the event of ingress of moisture due to condensation or any other reason. A suitable drainage hole shall be drilled at the bottom of the lowest conduit box in every 9-meter of horizontal run.

PVC bush of good quality shall be used in each conduit termination in a switch box, draw box, lighting fixtures and circular junction boxes.

Exposed conduits running above false ceilings shall be suitably clamped independently along with the dropped ceiling. Perforated straphangers or twisted attachment shall not be acceptable. In no case shall raceways be supported or fastened to other pipe for repair and maintenance. They shall be arranged symmetrically and in the cost compact design, in no way unduly criss-crossing each other. Proper spacing shall be maintained when two or more conduits run side by side. The layout of the pipes shall be co-ordinated with other services if any. The junction boxes and conduits used in hazardous areas shall be flameproof type with cast iron construction complete with threaded covers. The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirements by means of special approved type of earthing clamp efficiently fastened to conduit pipe in a workman-like manner for a perfect continuity between the earth and conduit.

The conduit system shall be so laid out that it will obviate the use of tees, elbows and sharp bends. No length of conduit shall have more than the equivalent of two-quarter bends from inlet to outlet. The conduit itself being given required smooth bend with radius of bends suiting to the site conditions but not less than 6 times overall diameter.

Outlet boxes shall be of heavy-duty sheet steel installed as to maintain continuity throughout. These shall be so protected at the time of laying that no mortar finds its way inside during concrete filling or plastering. For fluorescent fittings, the outlet boxes heavy duty shall be provided 300mm off centre for a 1200mm fitting and 150mm off centre for a 600mm fittings or as per B.O.Q.

Draw boxes of ample dimensions shall be provided at convenient points to facilitate pulling of long runs of cables. They shall be completely concealed with MS covers flush with plasterwork painted to match the wall. These boxes will be as few as possible and located where found suitable by the consultant.

4.04 Switch Boxes
The switch boxes shall be zinc passivated & shall not be less than 18 SWG thick or shall be as called for in BOQ. It will be so designed that accessories could be mounted on integral pedestals or on adjustable flat iron mounting straps with tapped holes by brass machine screw. Leaving ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on either side of their walls. These shall be completely concealed leaving edges flush with wall surfaces. Earthing terminal inside box shall be provided.

Moulded plate switches screw less as specified in item of work shall be provided. No timber shall be used for any supports. Boxes, which come within concrete, shall be installed at the time of casting. Care shall be taken to fix the box rigidly so that its position is not shifted while concreting.

4.05 Wiring

All the wiring installation shall be as per IS: 732 with latest amendment. PVC insulated copper conductor cables as specified in bills of quantity shall be used for sub-circuit runs from the distribution boards to the points and shall be pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 660/1100 volts grade. Colour Code for wiring shall be followed.

Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the consultant. No reduction of strands is permitted at terminations. No wire smaller than 1.5 sq.mm shall be used and shall be as per B.O.Q. Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for submains sub-circuit wiring. The ferrules shall be provided at both end of each submain and sub-circuit.

Where single-phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single-phase switches connected to different phase shall be mounted within one box.

All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.

Industrial sockets shall be of moulded plastic BoQ and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have self-adjustable spring loaded protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.
Maximum number of PVC insulated 650/1100 V grade/copper conductor cable conforming to IS: 694-1990.

<table>
<thead>
<tr>
<th>Conduit size</th>
<th>20mm</th>
<th>25mm</th>
<th>32mm</th>
<th>40mm</th>
<th>50mm</th>
<th>60mm</th>
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</thead>
<tbody>
<tr>
<td>Wire size in sq.mm.</td>
<td>S</td>
<td>B</td>
<td>S</td>
<td>B</td>
<td>S</td>
<td>B</td>
</tr>
<tr>
<td>1.50</td>
<td>7</td>
<td>5</td>
<td>12</td>
<td>10</td>
<td>20</td>
<td>14</td>
</tr>
<tr>
<td>2.50</td>
<td>6</td>
<td>5</td>
<td>10</td>
<td>8</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>3</td>
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<td>6</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>5</td>
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</tr>
<tr>
<td>10</td>
<td>2</td>
<td>-</td>
<td>4</td>
<td>3</td>
<td>6</td>
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<tr>
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<td>-</td>
<td>-</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>7</td>
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<tr>
<td>25</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
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</tbody>
</table>

Notes:

1) The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.

2) The columns heads ‘S’ apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns heads ‘B’ apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.

3) Conduit sizes are the nominal external diameters.

**List Of Preferred Makes**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Item</th>
<th>Civil and Interior Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GREY CEMENT OPC/PPC</td>
<td>ACC, ULTRATECH, JK, INDIACEMENT, JP</td>
</tr>
<tr>
<td>2</td>
<td>WHITE CEMENT</td>
<td>J.K, BIRLA OR EQUIVALENT</td>
</tr>
<tr>
<td>3</td>
<td>REINFORCEMENT STEEL (TMT BARS)</td>
<td>TATA, SAIL, RASHTRIYAISPAL NIGAM (RINL)</td>
</tr>
<tr>
<td>4</td>
<td>STRUCTURAL STEEL SECTIONS</td>
<td>SAIL, VIZAG, TATA</td>
</tr>
<tr>
<td>5</td>
<td>CONCRETE ADDITIVES</td>
<td>FOSROC, CHOKSEY, KUNALCONCHEM, SIKKA</td>
</tr>
<tr>
<td>6</td>
<td>ANTI TERMITE CHEMICAL</td>
<td>PEST CONTROL INDIA LTD., PEST CON INDIA, OR EQUIVALENT</td>
</tr>
<tr>
<td>7</td>
<td>MS CONDUIT / GI CONDUIT (ISI MAR</td>
<td>BEC / AKG / ATUL</td>
</tr>
<tr>
<td></td>
<td>PVC CONDUIT (ISI MARKED)</td>
<td>CONDUCTOR FRLS WIRE</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>8</td>
<td>PVC INSULATED COPPER</td>
<td>CONDUCOR POLYPACK/ AKG/ATUL</td>
</tr>
<tr>
<td>9</td>
<td>PVC INSULATED COPPER</td>
<td>FINOLEX / HAVELLS/ SKYTONE</td>
</tr>
<tr>
<td>10</td>
<td>PLATE TYPE - SWITCHES /</td>
<td>M.K/ LEGRAND/ ANCHOR-ROMA</td>
</tr>
<tr>
<td></td>
<td>SOCKETS / TV &amp; TELEPHONE</td>
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<td>SOCKETS AND ALL OTHER WIRING</td>
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<td></td>
<td>ACCESSORIES</td>
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<tr>
<td>11</td>
<td>ACCESSORIES FOR METALIC / GI</td>
<td>SHRMA STEEL CORPORATION / PRAKASH ENGINEERING</td>
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<tr>
<td></td>
<td>CONDUIT ( ISI MARKED )</td>
<td>WORKS / SUPER SALES CORPORATION</td>
</tr>
<tr>
<td>12</td>
<td>PVC INSULATION TAPE</td>
<td>STEEL GRIP/ ANCHOR</td>
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<tr>
<td>13</td>
<td>PHENOL LAMINATED SHEET</td>
<td>HYLUM/ FORMICA</td>
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<tr>
<td>14</td>
<td>RACEWAYS &amp; CABLE TRAY</td>
<td>PILCO/ SLOTCO/ VENUS/ RICCO</td>
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**LIGHTING DBs & MCBs**

<table>
<thead>
<tr>
<th></th>
<th>MCB,10KA</th>
<th>DISTRIBUTION BOARD</th>
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<tbody>
<tr>
<td>1</td>
<td>MDS/ SIEMENS/ HAGER/ MERLIN GERIN</td>
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</tr>
<tr>
<td>2</td>
<td>MDS/ SIEMENS/ HAGER/ MERLIN GERIN</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MDS/ SIEMENS/ HAGER/ MERLIN GERIN</td>
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**LIGHTING FIXTURES & FANS**

<table>
<thead>
<tr>
<th></th>
<th>BULK HEAD FITTINGS</th>
<th>EXHAUST FANS / CEILING FAN /</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CROMPTON/ PHILIPS/WIPRO/FUTURE LIGHT</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CROMPTON/ POLAR/ ALMONARD</td>
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</tr>
<tr>
<td>3</td>
<td>WALL MOUNTED FAN</td>
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<tr>
<td>4</td>
<td>LIGHTING FIXTURES</td>
<td>PHILIPS/ FUTURE LIGHT/ WIPRO</td>
</tr>
<tr>
<td>5</td>
<td>LIGHTING CONTROL SYSTEM</td>
<td>SCHNIDER/ PHILIPS/ LUTRON</td>
</tr>
<tr>
<td>6</td>
<td>EXTERNAL LIGHTING FIXTURES</td>
<td>PHILIPS/ FUTURE LIGHT/ SCHREDER</td>
</tr>
</tbody>
</table>
NOTES:

1. All the materials should be ISI marked as specified in the schedule of quantities as shown in schedule of approved makes (i.e. whenever “as per ISS” whether in S.O.Q. or elsewhere this would be construed to mean “ISI branded”).

2. The Contractor shall produce samples before procurement of the material for approval of the Engineer Incharge for all materials required for works. The material of the makes out of the above as approved by the Engineer Incharge shall be used on the work.

3. In respect of materials for which approved makes are not specified as above, the same shall be decided by the Engineer Incharge and shall be as per sample got approved from Engineer Incharge before procurement.

4. The Contractor shall submit data sheet of all materials before the date of start of work for approval from the Engineer Incharge.

5. Any one of the brands in the list above may be used in the work after approval of the same from the Engineer Incharge.

6. In addition to above contractor can suggest any other equivalent makes as per relevant IS standard for approval of Engineer Incharge before use in work in case above listed makes are not available.