ENGINEERING PROJECTS (INDIA) LTD.
(A Govt. of India Enterprise)

NOTICE INVITING TENDER

Tender No ERO/MMD/674/1036 dated 20.10.2015

TENDER FOR

VERTICAL EXTENSION OF THREE FLOORS ABOVE (G+ 4) OF CENTRE FOR RAILWAY RESEARCH BUILDING AT IIT Kharagpur

EPI is constructing Centre for Railway Research Buildings (G+4) for Indian Institute of Technology (IIT), Kharagpur. Now, IIT, Kharagpur intends for construction of vertical EXTENSION OF THREE FLOORS ABOVE (G+ 4) OF CENTRE FOR RAILWAY RESEARCH BUILDING AT IIT Kharagpur.

Sealed percentage rate tenders in two bid system (Techno Commercial and Price bid) are invited by Engineering Projects (India) Ltd. (EPI) on behalf of Indian Institute of Technology (IIT), Kharagpur from eligible & experienced contractors for the following works:

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of Work</th>
<th>Qty.</th>
<th>Estimated Cost</th>
<th>Earnest Money Deposit</th>
<th>Completion Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>VERTICAL EXTENSION OF THREE FLOORS ABOVE (G+ 4) OF CENTRE FOR RAILWAY RESEARCH BUILDING AT IIT, Kharagpur</td>
<td>01 Job</td>
<td>Rs. 8,00,21,798.00 (Rupees Eight Crore Twenty One Thousand Seven Hundred Eighty only)</td>
<td>Rs. 16,00,436.00 (Rupees Sixteen Lakh Four Hundred Thirty Six only)</td>
<td>09 (Nine) months</td>
</tr>
</tbody>
</table>

Apart from above, any other services not covered above but required as per direction of EPI are deemed to be included in the scope of work. The work is to be carried out on item rate basis as per bill of quantities and tender conditions.

The detailed scope of work is given in the tender document.

Time schedule of tender activities.

i) Date & Time of sale/downloading of Tender Document: From 21/10/2015 to 03/11/2015 between 11:00 Hrs. IST to 17.00 Hrs. IST

ii) Last Date & Time of Submission of Tenders: 04/11/2015 upto 15.00 Hrs.IST

iii) Date & Time of Opening of Envelope-1 (Techno-Commercial Bid): 04/11/2015 at 15.30 Hrs. IST
In case any unscheduled holiday takes place on the last day of issue of Tender/submission of tender, the next working day will be treated as scheduled day and time for issue/submission of tender.

1.0 Contractors who fulfill the following basic qualifying criteria are eligible to participate in this tender. Joint ventures are not accepted.

a. Should have completed following similar works during last seven years ending 30.09.2015:

   i) Three similar works each of costing minimum 40% of the estimated cost of this work.

   OR

   ii) Two similar works each of costing minimum 50% of the estimated cost of this work.

   OR

   iii) One similar work costing minimum 80% of the estimated cost of this work.

   One similar work of any nature (either part of i to iii) or a separate one costing not less than the amount equal to 40% of the estimated cost put to tender with Central/State Government Organization / Central Autonomous Body / Central Public Sector undertaking.

   - The ‘similar works’ shall mean “construction of multistoried buildings including electrical, plumbing, fire fighting works and infrastructural works”.

   - The cost of free issue materials shall not be included in the completion cost of works.

   - For evaluation purpose, the completion cost of works mentioned in the completion certificate shall be enhanced by 7% per annum till the end of month prior to date of NIT.

b. Should have had Average Annual Financial Turnover of not less than 30% of the estimated cost of the work in the last three consecutive financial years ending 31.03.2015 duly certified by a Chartered Accountant.

c. Should not have incurred any loss in more than two years during the immediate last five consecutive financial years ending 31.03.2015. Copies of balance sheet / certificate from Chartered Accountant to be submitted.

d. Should have a solvency of 40% of the estimated cost put to tender issued by a Bank. The Solvency Certificate should not have been issued earlier that one year of last date of submission of the tender.

e. Should have valid Permanent Account Number of Income Tax and service tax registration number.

f. Should have valid PF Registration No.
g. It is desired that the bidder should have valid VAT Registration number in the State of West Bengal. In case the bidder do not have valid VAT 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.

h. Should have latest Sales Tax Clearance Certificate.

i. The bidding Capacity of the contractor should be equal to or more than the estimated cost of the work put to Tender. The bidding capacity shall be worked out by the following formula:

\[ \text{Bidding Capacity} = [A \times N \times 2] - B \]

Where,

\( A = \text{Maximum value of construction works executed in any one year during the last five years taking into account the completed as well as works in progress.} \)

\( N = \text{Number of years prescribed for completion of work for which bids has been invited} \)

\( B = \text{Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited.} \)

2. Even though an applicant may satisfy the eligibility criteria, EPI reserves the right for not issuing the tender document if he has record of poor performance such as abandoning work, not properly completing the work, delay in completion of work, poor quality of work, financial failure/weakness etc.

3. The experience certificates issued by Government Organizations / Semi Government Organizations / State Government Public Works Department / Central Government / Public Sector Undertakings / Autonomous Bodies / Municipal Bodies / Public Limited Companies listed on BSE / NSE and private party shall be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company & Private Party must be supported by TDS certificates / Turnover Certificate from Chartered Accountant in support of value of work done by the tenderer.

4. Completion certificates from the client shall be in the name of the company who is submitting the tender. The contractor has to produce original documents for the verification as and when demanded. The tender of any tenderer shall be rejected if in the detailed scrutiny; documents submitted along with the tender are found to unsatisfactory / forged. The decision of EPI in this regard shall be final and binding the tenderer.

5. The contractor has to produce documents satisfying qualifying criteria for the verification at the time of purchase of Tender Documents. Issuance of Tender Documents to any tenderer shall, however, not construe that the tenderer is considered to be qualified for the tender work and the same may be rejected if on detailed scrutiny, the documents submitted along with the tender are found to be unsatisfactory / forged.

6. EPI's empanelled contractors can also participate in the tender provided they fulfill the above qualifying criteria.
7. Tenderers have to submit confirmation letter whether they are registered under MSME Act or not, if yes, then to submit relevant copies of the registration letter (in the form of Memorandum -2 with the concerned DIC) in envelop-1 i.e. Techno-commercial part and the party will be exempted from submission of tender fee and EMD.

8.0 Tender documents comprising of the following are available on the website of EPI: www.epi.gov.in and CPP Portal: www.eprocure.gov.in

i) Notice Inviting Tender (NIT)
ii) Instruction to Tenderers, General Conditions of Contract (available in EPI's website),
(iii) Addendum to Instruction to Tenderers, Memorandum, Form of Tender & Letter of Undertaking
iv) Additional Conditions of Contract.
 v) Technical Specifications, Approved list of Materials
vi) Price Bid (Quoting sheet & BOQ)
vii) Tender Drawings

9.0 The complete tender documents can be downloaded by the intending bidders directly from EPI website www.epi.gov.in and cpp portal www.eprocure.gov.in. The tender fees of Rs.10,000.00 (Rupees Ten thousand only) (Non-Refundable) by Crossed Demand Draft /Pay Order favouring “Engineering Projects (India) Ltd.”, payable at Kolkata shall be submitted by the bidder alongwith their bid in Envelope-1. Relevant experience certificates and other documents as mentioned above Cl 1.0 (a) to 1.0 (i) duly attested by Gazetted Officer not below the rank of Executive Engineer or equivalent or Notary Public fulfilling the qualifying criteria shall be enclosed in Envelope-1. Completion Certificates from clients shall be in the name of the Company who is submitting the tender. The bidder has to produce original documents for verification at the time of opening of tender or as and when demanded. The Tender of any tenderer shall be rejected if on detailed scrutiny, documents submitted along with the tender are found to be unsatisfactory. The decision of EPI in this regard shall be final and binding on the tenderer.

Tender documents can also be obtained from General Manager (MMD), Engineering Projects (India) Ltd. 50, Chowringhee Road Kolkata-700071 from 11:00 Hrs to 17:00 Hrs IST on all working days (Monday to Friday) except Public Holidays, on submission of request letter along with tender fees of `10,000.00 (Rupees Ten thousand only) (Non-Refundable) by Crossed Demand Draft favouring “Engineering Projects (India) Ltd.”, payable at Kolkata and relevant experience certificates and other documents as mentioned above (Cl.1.0. (a) to 1.0 (i) duly attested by Gazetted Officer not below the rank of Executive Engineer or equivalent or Notary Public fulfilling the qualifying criteria. Issuance of Tender Documents shall, however, not construe that the tenderer is considered qualified for the tender work and the same may be rejected if on detailed scrutiny, the documents submitted alongwith the tender are found to be unsatisfactory. Decision of EPI in this regard shall be final and binding of the Tenderer.

10.0 All Tenders shall be accompanied by Earnest Money Deposit as stated above. This can be in the form of Crossed Demand Draft or Pay Order of any Nationalized Bank / Scheduled Bank for the full amount of EMD payable favouring, “Engineering Projects (India) Ltd.”, payable at Kolkata or in the form of Bank Guarantee of any Nationalized
Bank / Scheduled Banks, in accordance with the prescribed format of EPI (given at page no. 100 of GCC, favouring “Engineering Projects (India) Ltd.”. The EMD shall be valid for a minimum period of 150 days (One Hundred Fifty Days) from the last day of submission of Tender. Tenders submitted without tender fee (in case of downloaded) and EMD or with inadequate amount of tender fee & EMD shall be rejected.

11.0 The Terms & Conditions contained in this NIT and tender documents shall be applicable.

12.0 In case of tie-tender, where two firms are bidding lowest, EPI reserves the right to split the work among these bidders and / or EPI will reserve the right to award the tender to any one of such bidder.

13.0 EPI reserves the right to accept any tender of reject any or all tenders or annul this tendering process without assigning any reason and liability whatsoever and to re-invite tender at its sole discretion.

   The tenderer is required to submit all the documents duly signed and stamped on each page as token of acceptance.

14.0 The corrigendum or addendum, extension, cancellation of this NIT, if any, shall be hosted on the EPI’s website www.epi.gov.in /CPP portal www.eprocure.gov.in. The bidders are required to check EPI’s website/CPP Portal regularly for this purpose, to take into account before submission of tender.

15.0 All corrigendum and addendum shall be part of the tender document and are to be submitted duly signed and stamped by tenderer. Even if tenderer fails to submit corrigendum and addendum duly signed by him, it will be deemed that the tenderer have gone through such corrigendum /addendum, if any, and no claim shall be entertained by EPI on account of any omission /error on his part.

16.0 The price bid of those bidders whose bid has been technically accepted on the basis of documents submitted shall be opened with prior intimation to them. However, it is made clear that the offer of the L-1 (Lowest) bidders shall be accepted subject to the confirmation of authenticity of the PQ documents/ EMD/Tender fee/BG from the concerned department /bank.

17.0 The tender documents shall be issued by and submitted to:

   General Manager (MMD),
   Engineering Projects (India) Ltd.
   9th Floor,
   50 Chowringhee Road
   Kolkata-700071
   Tel No. +91-33-22824426

GM (MMD)
Date: 20.10.2015
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
EPI is constructing Centre for Railway Research Buildings (G+4) for Indian Institute of Technology (IIT), Kharagpur. Now, IIT Kharagpur intend to construct Vertical Extension of another Three Floors above (G+4) of Centre for Railway Research Building at IIT Kharagpur.

3.0 SCOPE OF WORK INCLUDED IN THE CONTRACT

The brief scope of work included in this tender shall include (but not limited to) Civil, Structural, Plumbing, Internal & External Electrical Sanitary, Drainage, Fire Fighting & Prevention System etc. for additional three floors beyond (G+4) level and Land development.

Apart from the above, any other services not covered above but required as per direction of Engineer In-charge of EPI are deemed to be included in the scope of work. The work is to be carried out as per bill of quantities and tender conditions.

4.0 CO-OPERATION / CO-ORDINATION

Works of the Centre for Railway Research (CRR) building upto (G+4) is still going on. The bidder has to execute the work with proper coordination with the executing contractor/sub-agencies working there.

However, if due to negligence, non cooperation of the bidder or his associates during execution of the work of the CRR building upto (G+4) suffers damage, loss etc. if any, the same should be got rectified/made good by the bidder at his own cost failing which EPI may get the said rectification/making good done by other agencies and the cost of the same will be recovered from the bidder. The decision of EPI regarding extend of rectification and cost thereof will be final and binding on the bidder.

5.0 DISQUALIFICATION

The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if;
a) Representation in the forms, statements and attachments submitted in the prequalification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 7 years such as abandoning the work, rescinding of contract of 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 EPI.

5.1 EPI reserves its right to take appropriate action including disqualification of tenderer(s) and forfeiture of the earnest money deposited by him/them as may be deemed fit and proper by EPI at any time without giving any notice to the tenderer(s) in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the tenderers.

5.2 The set of tender documents shall contain tender drawings (one set of hardcopy). 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.

6.0 SPECIFICATIONS

6.1 The work in general shall be carried out as per latest CPWD specifications, New Delhi for Civil Works, Internal Electrical works and Firefighting (updated with correction slips issued up to last date of submission of tender) and latest CPWD specification, New Delhi for electrical works (updated with correction slips issued up to last date of submission of tender) unless otherwise specified in the nomenclature of the individual item of the particular specifications of concerned items of works.

6.2 For items not covered under latest CPWD specification for Civil Works/ latest CPWD specification for Electrical Works, Fire fighting works 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.

6.3 In case any specification is not covered under para 6.1 & 6.2 above the work shall be carried out as per the provisions of technical specification attached with this tender.
6.4 In case of non availability of any specification in the above paras or any overlapping provisions, non-clarity of 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.

6.5 Thermo Mechanically Treated bars conforming to IS: 1786, Fe 500 grade as required, from approved manufacturers viz SAIL/RINL/TISCO shall be used. Incase of non availability of steel of these makes, TMT bars of other manufacturers as per IS 1786, Fe 500 grade as required, may be allowed to be used with the prior approval of Engineer-in-charge. In case TMT bars from manufacturer other than SAIL/RINL/TISCO is allowed to be used, a deduction of RS. 2 (two) per Kg shall be made from the bills of the contractor. The other provisions of clause 45.2 of GCC remains unchanged.

6.6 Ordinary Portland Cement (OPC) as per IS :8112 shall be used on the works. In case of non-availability of ordinary Portland cement, the Portland Pozzolona Cement (PPC) as per IS:1489-1991 can be used. However, in case of using Portland Pozzolona Cement prior approval is to be taken from Engineer-in-charge. The other provisions of clause 45.1 of GCC remain unchanged.

7.0 **CLAUSE NO 69.1 OF GCC STANDS MODIFIED AS UNDER:**

If the rates of the altered, additional or substituted work cannot be determined in the manner specified in sub-clauses (i) to (iii) above, then the Contractor shall, within 7 days of the date of receipt of the order 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 hemay 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.

8.0 **THE CLAUSE NO. 72.1 OF GCC SHALL BE REPLACED AS UNDER:**

The contractor shall ensure satisfactory progress during the execution of work according to the detailed Bar Chart/PERT chart so that the activities are completed in the period allowed in the completion schedule as given at Sl. No.11.0 of Additional Conditions of Contract (ACC). The contractor should submit the weekly progress report as per format approved by Engineer-in-
charge. 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 for various stages mentioned at Sl. No. 9.0 of ACC. If the Contractor fails to maintain the required progress in terms of clause no 72.4 of GCC or relevant clause of additional conditions of contract to complete the work and clear the site on or before the completion date 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 compensation the amount calculated at the rate of 1% per week or part thereof subject to 10% of the total contract value as awarded.

9.0 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 (milestones) 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.

10.0 ARBITRATION:

10.1 Clause no. 76.1 alongwith note of GCC- Deleted

10.2 Clause no.76.2 of GCC - 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
10.3 Clause No.76.3 of GCC, stands modified as under:

JURISDICTION:

The courts in Kolkata alone will have jurisdiction to deal with matters arising from the contract, to the exclusion of all matters.

11.0 COMPLETION PERIOD

The completion period for the total work is 9 (Nine) months to be reckoned from the 10th day from the date of issue of LOI/ Work Order

12.0 PLANT & MACHINERY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
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<tbody>
<tr>
<td>1.</td>
<td>Concrete Batch Mixer (Min 4 Bag capacity)</td>
<td>One</td>
</tr>
<tr>
<td>2.</td>
<td>Concrete Pump</td>
<td>One</td>
</tr>
<tr>
<td>3.</td>
<td>Leveling Instruments</td>
<td>One</td>
</tr>
<tr>
<td>4.</td>
<td>Vibrators (Petrol / Electrical)</td>
<td>Two</td>
</tr>
<tr>
<td>5.</td>
<td>Needles of Vibrator</td>
<td>Six</td>
</tr>
<tr>
<td>6.</td>
<td>Concrete Mixers alongwith weigh batcher</td>
<td>Two</td>
</tr>
<tr>
<td>7.</td>
<td>DG Set (63 KVA)</td>
<td>One</td>
</tr>
<tr>
<td>8.</td>
<td>Builder hoist</td>
<td>Two</td>
</tr>
<tr>
<td>9.</td>
<td>Lighting Equipment</td>
<td>As per Requirement</td>
</tr>
<tr>
<td>10.</td>
<td>Electrically operated Concrete Cube Testing Machine with Digital Indication</td>
<td>One</td>
</tr>
</tbody>
</table>

Note:

a) Any other equipment for site test as outlined in CPWD/BIS 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 OR as per the direction of Engineer-in-Charge. The above equipment list is indicative and not complete. The contractor has to deploy...
all the required equipment to complete all the works within stipulated specifications & time period as contract documents.

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

13.0 TECHNICAL MANPOWER REQUIREMENT

<table>
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<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Minimum numbers required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Site-in-Charge, Engineering graduate with eight years of experience / DCE with ten years of experience</td>
<td>One</td>
</tr>
<tr>
<td>2.</td>
<td>Site Engineer, DEE with five years of experience</td>
<td>One</td>
</tr>
<tr>
<td>3.</td>
<td>Site Engineer, DCE with five years of experience</td>
<td>One</td>
</tr>
<tr>
<td>4.</td>
<td>Billing Engineer, DCE with five years of experience</td>
<td>One</td>
</tr>
<tr>
<td>5.</td>
<td>Quality control and Survey Engineer, DCE with five years of experience</td>
<td>One</td>
</tr>
<tr>
<td>6.</td>
<td>Safety Officer (with 5 year Experience)</td>
<td>One</td>
</tr>
</tbody>
</table>

If the contractor fails to deploy the technical manpower stated above, EPI reserves the right to deploy the technical manpower and the cost of the same shall be recovered from the contractor.

14.0 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 issue 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 contactor.

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

e) ‘As built’ drawings.

f) Periodical services and measurement books.

g) Drawings for layout of underground cables and details showing location of electric cable joints etc.
h) All operation and maintenance manuals.

i) 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.

j) Manufacture's guarantee of various machines / equipments installed as part of works.

15.0 CONCRETING

15.1 The concreting shall be machine mixed with equipment as approved by Engineer-in-Charge. The contractor may opt to use Ready Mixed Concrete of repute make after obtaining prior approval from the Engineer-in-Charge.

15.2 The contractor shall provide construction joints only at the specified positions and as per BIS codes for columns. In case the concreting is to be done in two lifts the minimum height of first lift of columns shall be 1.5 meters.

15.3 The stone aggregate and sand of required zone shall be from the quarries as approved by Engineer-in-Charge. The samples of the materials shall be got approved along with the mix design.

15.4 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.

15.5 Ready mix concrete brought from outside sources or produced at site shall have minimum quantity of cement as specified in BIS specifications and as per approved design mix.

15.6 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.

16.0 BRICK WORK.

16.1 The brick should be minimum class designation 75 conforming to IS 1077:1992.

16.2 The brick work for all external wall should be done from outside. The rigid scaffolding of MS pipe and the supports shall be sound and strong, with
horizontal MS pipe. 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 sufficient quantity of scaffolding for this purpose so as to complete the project within stipulated time.

16.3 Fly ash brick works shall be with the bricks of specified grade & source as approved by Engineer-in-Charge and no efflorescence due to salt peter 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.

17.0 CENTERING & SHUTTERING

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

17.2 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 ply wood 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.

17.3 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.

17.4 All shuttering work for Architect features shall be with fiber glass mould sand the rate quoted by the contractor in the schedule of rate shall be inclusive of same.

17.5 All shuttering joints the slab, beams and lintels etc shall be treated with tape or 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.

17.6 The shuttering shall be tightened by using runners, tie rods and bracing etc. Supports shall be adequate and proper.

18.0 GENERAL

18.1 Flooring works shall be executed as per the approved drawings / design & specifications. The pattern shown in the tender drawings, if any, and 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.

18.2 The water proofing for the terraces, underground tanks / toilet floor etc, shall be executed only through the authorized applicators of the manufacturers and the guarantee for the same shall be in the name of EPI / owner for a period of ten years after the expiry of defect period liability on the prescribed format given in the GCC.

18.3 Plumbing & Sanitary work to be executed by licensed plumber and the plumbing scheme / drawing to be got approved from statutory authorities through the appointed licensed plumber without any extra cost. The agency shall have to submit the valid license of plumbers before starting the work.

18.4 CI pipes for sanitary and GI pipes for water supply if fixed in RCC members like columns, beams etc. shall be fixed with scrub plugs.

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

18.6 Welding wherever required in the work like in grill, railing etc. shall be done in full length of the contract area and grinding shall be done properly to get an even surface, SGRC covers for manholes etc. if provided, shall have name of owner / client and year of manufacturer as engraved.

18.7 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.

18.8 It will be the sole responsibility of contractor to obtain all statutory approvals / compliance required for construction / implementation of the project including right of way Forest clearance and completion clearance from the all relevant statutory bodies for plumbing, sewerage, sanitary and PHE work, fire department for fire protection, fire fighting, fire fighting installation, electrical works etc. and for all other services as included in the scope of contract etc. From the concerned department as required within the stipulated time frame. Liaison work on behalf of EPI / owner with the local bodies will also have to be done by the contractor. Nothing extra shall be payable to contractor on this account.

18.9 The contractor shall make necessary safety arrangements at site including as mentioned in GCC and indemnity EPI against any consequence of accident at site.
18.10 The tenderer shall engage specialized agency having adequate technical Capability & experience of having executed Fire Fighting & Fire Alarm works. The specialized agency for the work shall be got approved by Engineer-in-charge well before actual commencement of the respective items of work.

18.11 The contractor shall erect GI sheet fencing along the periphery of the site as per drawing of EPI with proper colour as directed by the Engineer-in-charge and name/logo, safety slogan etc. written at appropriate places within ten days of issue of LOI. The contractor shall be responsible for daily cleaning of this fencing with water etc. to keep the fencing in neat & clean condition at all times. The damaged fencing should be replaced immediately by the contractor. The cost of MS sheet fencing, its maintenance etc. is deemed to be included in the quoted rates. The contractor shall engage sufficient number of security guards at his cost to ensure controlled entry to site and not to allow unauthorized personnel at site.

18.12 The contractor shall have to execute the work in pace and in such a way to facilitate agencies engaged simultaneously for execution of other works required for completion of the Building. No claim shall be entertained due to work being executed in the above circumstances.

18.13 Unless otherwise specified in the schedule of quantities, the rates tendered by the Contractor shall be all inclusive and shall apply to all heights, floors including Terrance, leads and depths and nothing extra shall be payable on this account.

18.14 On completion of work, the tenderer shall submit at no extra payment four prints of “as built” drawings to Engineer-in-Charge.

19.0 QUALITY ASSURANCE PROGRAMME

The following paragraph shall be added to clause no 81.0 of General Conditions of Contract (GCC) as under:

The quality testing of materials are to be done as per the frequency of sampling & testing prescribed in relevant code of different items of works, all mandatory tests of materials shall be conducted at site laboratory and the tests not possible at site shall be tested outside through reputed laboratories like Regional Engineering College (NIT)/Government Engineering College /National Test House / IIT/ M/s Shriram Test lab. Private Engineering College & polytechnic college are not allowed for testing.

20.0 MOBILIZATION ADVANCE:-
Clause 8.0 of General Conditions of Contract is deleted.

21.0 FACILITIES

The sub-clause 28.3 of the clause no. 28 of General Conditions of Contract (GCC) for Furnished Office Accommodation & Mobility and Communication to be provided by the Contractor to EPI shall be replaced and read as under:

The contractor shall make his rates in Bill of Quantities sufficiently comprehensive to cover the cost of the facilities as per details shown below and the contractor shall not be entitled for any extra payment for the same.

<table>
<thead>
<tr>
<th>Description</th>
<th>Unit</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. OFFICE WITH FACILITIES – The contractor is to provide Office with following facilities till defect liability period.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) OFFICE ACCOMMODATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furnished air-conditioned office accommodation at one or more locations as per direction of Engineer-in-Charge with basic amenities like toilets, drinking water arrangement, lights, other facilities for winter and summer season etc. for exclusively EPI's Engineer &amp; Staff and maintenance of the same till Defect Liability Period</td>
<td>Sq.Ft</td>
<td>1000</td>
</tr>
<tr>
<td>(ii) FURNITURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office Tables</td>
<td>Nos.</td>
<td>4</td>
</tr>
<tr>
<td>Office Chairs</td>
<td>Nos.</td>
<td>8</td>
</tr>
<tr>
<td>Executive Table &amp; Chair Set</td>
<td>Nos.</td>
<td>2</td>
</tr>
<tr>
<td>Steel Almirah (Big)</td>
<td>Nos.</td>
<td>1</td>
</tr>
<tr>
<td>File Cabinet</td>
<td>Nos.</td>
<td>02</td>
</tr>
<tr>
<td>B) (OFFICE EQUIPMENT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Computer system (latest edition) with minimum 500 GB HDD, DVD Writer, along with UPS &amp; Operator (In case computer operator is not provided by the contractor, recovery of Rs. 10,000/- per month shall be made from the Contractor’s bill in this regard) and latest Version of Software’s like MS Project, Windows 7 OS, MS Office 2007 or latest Auto CAD etc.</td>
<td>No.</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>No.</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>ii)</td>
<td>Laser Printer or any other Printer of equivalent amount (A3 size) / Photocopy machine (CANON NP 3050 or equivalent model)</td>
<td>01</td>
</tr>
<tr>
<td>iii)</td>
<td>Internet Facilities No 1</td>
<td>01</td>
</tr>
<tr>
<td>iv)</td>
<td>Refrigerator (230 Ltrs) or any other gadget of equivalent cost as decided by EPI.</td>
<td>01</td>
</tr>
<tr>
<td>v)</td>
<td>Aqua Guard (Drinking water) or any other gadget of equivalent cost as decided by EPI.</td>
<td>01</td>
</tr>
<tr>
<td>vi)</td>
<td>Digital Camera Sony make Digital still camera 10.0 Mega Pixel W-series 3 x optical zoom cyber shot (Black) or any other gadget of equivalent cost as decided by Engineer-in-Charge.</td>
<td>01</td>
</tr>
<tr>
<td></td>
<td>Running and maintenance of the equipment mentioned above are to be done by the contractor at his own cost</td>
<td></td>
</tr>
</tbody>
</table>

**C) CONSUMABLES**

All consumables like Stationary ink etc. for a value of Rs. 5,000/- per month (Approx) shall be provided by PARTY till end of the defect liability period. (Stationary items are inclusive of visiting cards, rubber stamps, letter pads, photocopy papers, all accessories of computer including ink cartridge & any other items of daily office use).

**D. CONVEYANCE AND OTHER FACILITIES**

Vehicle:

Brand New Indigo/Swift Dezire vehicle or Equivalent with Driver, fuel, spare parts and maintenance. Distance of travel will be 3500 KM (approx.) per Month. If these facilities are not provided, Rs. 50,000/- per month for each vehicle shall be charged from the contractor from the date of issue of LOI/work order till the end of defect liability period.

**E) TELEPHONE**
b) Mobile phone: Mobile connection with set. Cost of each mobile set will be Rs. 6,000/- (Approx.). Monthly operational charge for each will be Rs. 2,000/- (Approx.) per month

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Nos.</th>
<th>02</th>
</tr>
</thead>
</table>

F) Office Boy on full time basis only for EPI.  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>No.</th>
<th>01</th>
</tr>
</thead>
</table>

G) 800 VA Inverter  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>No.</th>
<th>01</th>
</tr>
</thead>
</table>

The vehicle shall be brand new and shall be provided with driver on full time basis. Consumables like diesel/petrol/oil lubricants and spare parts etc. shall be provided by the tenderer at their cost. The vehicles shall be maintained in good working condition. In case of breakdown, replacement of vehicle shall be provided by tenderer. In case a vehicle is not required by EPI or failed to provide by the contractor, a recovery of Rs. 50,000/- per month per vehicle shall be made from the tenderer for this purpose till the end of defect liability period. In case Driver, POL, maintenance is not required by EPI for any vehicle, recovery of Rs. 25,000.00 per month per vehicle shall be made from the tenderer for this purpose till the end of defect liability period. The above gadgets facilities should be brand new and or reputed make and all facilities shall be provided and maintained properly (including payment of water & electricity bill etc. for office accommodation only) by the tenderer at Project site or at any other office related with execution of this project till completion of work including defect liability period in all respect at his own cost. The tenderer shall also make stand-by arrangement for water & electricity to ensure uninterrupted supply. The equipment/item shall be the property of PARTY at the end of contract. The tenderer shall be responsible for watch and ward of site office and another facilities etc. In case of theft/damage of any equipment/items, the tenderer shall immediately replace the same within a maximum period of two days. The tenderer shall provide ‘Sign Board(s)’ as per design approved by EPI and/or Client.

In case the above facilities are not provided by the tenderer within 10 (ten) days of award of work or replacement is not provided within the specified period, EPI shall arrange the same at the risk and cost of the tenderer and make the recoveries from the bills of the tenderer for the same. The decision of EPI shall be final and binding on the tenderer in this regard.

22.0 SITE LABORATORY

22.1 As part of the contract the contractor shall establish and maintain a site laboratory for the testing of construction material under the direction and general supervision of Engineer-in-charge. The laboratory room shall be constructed and installed with the required and appropriate facilities. Temperature and humidity controls shall be made available wherever necessary during the testing of samples.
All equipment as required shall be provided by the contractor so as to be compatible with the testing requirements specified. The contractor shall maintain the equipment in good working conditions for the duration of the contract. The Contractor shall provide approved qualified personnel to run the laboratory for the duration of the contract. The number of staff and equipment available must at all times be sufficient to keep pace with the sampling and testing program as required by Engineer-in-charge. The contractor shall fully service the site laboratory and shall supply everything necessary for its proper functioning including all transport needed to move equipment and samples to and from sampling points on the site etc. The contractor shall re-calibrate all measuring devices whenever so required by the Engineer-in-charge and shall submit the results of such measurements without delay.

23.0 ALTERATION IN SPECIFICATION, DESIGN AND DRAWING

The Engineer -In-Charge shall have power to make any alterations in, omissions from, additions to or substitutions for, the original Specifications, Drawings, Designs and Instructions that may appear to him to be necessary during the progress of the work, and the contractor shall carry out the work in accordance with any instructions which may be given to him in writing signed by the Engineer-In-Charge and such alterations, omissions, additions or substitutions shall not invalidate the contract and any altered, additional or substituted work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work. The rates for such additional, altered or substituted work under this clause shall be worked out in accordance with the provisions stipulated in the clause no. 69.0 of the General Conditions of Contract.
<table>
<thead>
<tr>
<th>SL.No</th>
<th>NAME OF ITEMS</th>
<th>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CIVIL</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cement</td>
<td>ACC/ Lafarge/ Ultratech/Grasim</td>
</tr>
<tr>
<td>2</td>
<td>Reinforcement Bars (Fe500 as per IS 1786)</td>
<td>TATA/ SAIL/RINL</td>
</tr>
<tr>
<td>3</td>
<td>White Cement</td>
<td>Birla/ J.K</td>
</tr>
<tr>
<td>4</td>
<td>Ceramic Floor Tiles</td>
<td>Premium quality KAJARIA/ NITCO/ JOHNSON/ SOMANI</td>
</tr>
<tr>
<td>5</td>
<td>Ceramic Tiles for Dado</td>
<td>Premium quality KAJARIA/ NITCO/ JOHNSON/ SOMANY.</td>
</tr>
<tr>
<td>6</td>
<td>Vitrified/ Rectified Tiles</td>
<td>Premium quality KAJARIA/ NITCO/ JOHNSON/ SOMANI</td>
</tr>
<tr>
<td>7</td>
<td>Float Glass</td>
<td>Saint Gobin/Asahi India/ Modi</td>
</tr>
<tr>
<td>8</td>
<td>Concrete Interlocking Pavement Tiles and Concrete Paver Block</td>
<td>Wondercrete/ Eurocon/ AP Galaxy/ Ultra/ Stylish Interlocking Pvt. Ltd.or equivalent</td>
</tr>
<tr>
<td>9</td>
<td>Flush Door</td>
<td>Centurydoor/ Greendoor/ Truwood door/ Duradoor</td>
</tr>
<tr>
<td>10</td>
<td>Block Board/Pre laminated particle board/ Plywood/ decorative veneers</td>
<td>Kit ply/ Sarda Ply/ Greenply/ Uro ply</td>
</tr>
<tr>
<td>11</td>
<td>Cylindrical locks/ locks</td>
<td>Godrej or equivalent</td>
</tr>
<tr>
<td>12</td>
<td>Fire Door</td>
<td>Godrej ,Shakti met ,ahada, radiant</td>
</tr>
<tr>
<td>13</td>
<td>Extruded Aluminum sections</td>
<td>JINDAL/HINDALCO/NALCO</td>
</tr>
<tr>
<td>14</td>
<td>Reflective Glass for Structural Glazing/windows</td>
<td>Pilkington/ Asahi India / Saint Gobian</td>
</tr>
<tr>
<td>15</td>
<td>Mineral board false ceiling</td>
<td>Armstrong/ OWA/Daiken</td>
</tr>
<tr>
<td>16</td>
<td>UPVC rain water pipes with fittings</td>
<td>Oriplast/ Supreme/ Prince/Finolex</td>
</tr>
<tr>
<td>17</td>
<td>Exterior type acrylic based paint</td>
<td>Excel of Nerolac/ Apex ultima of Asian Paint or equivalent of ICI/Berger</td>
</tr>
<tr>
<td>18</td>
<td>Wall Putty</td>
<td>Birla/ JK /Berger</td>
</tr>
<tr>
<td>19</td>
<td>Distemper</td>
<td>Asian Paint/ Berger/ ICI/ Nerolac</td>
</tr>
<tr>
<td>20</td>
<td>Plastic emulsion Paint</td>
<td>Asian Paint/ Berger/ ICI/ Nerolac</td>
</tr>
<tr>
<td>21</td>
<td>Synthetic Paint</td>
<td>Asian Paint/ Berger/ ICI/ Nerolac</td>
</tr>
<tr>
<td>22</td>
<td>Zinc Chromate Primers</td>
<td>Shalimar/ Asian Paint/ Berger/ ICI</td>
</tr>
<tr>
<td>23</td>
<td>Chemical / Mechanical Anchor Fasteners</td>
<td>HILTI/ FISCHER</td>
</tr>
<tr>
<td>24</td>
<td>Hydraulic door closer</td>
<td>Hardwyn/ Garnish/Dorma</td>
</tr>
<tr>
<td>25</td>
<td>Floor spring for aluminum door</td>
<td>Hardwyn/ Garnish/Dorma</td>
</tr>
<tr>
<td>26</td>
<td>Fittings for Aluminum doors and windows.</td>
<td>Ebco/ Doorline</td>
</tr>
<tr>
<td>27</td>
<td>Water Proofing Compound/ Admixtures</td>
<td>Choksey/ Sika Qualcrete/ Pidilite/ Fosroc</td>
</tr>
<tr>
<td></td>
<td>Epoxy Grout for tile fixing</td>
<td>Laticrete/ Bal endula or equivalent.</td>
</tr>
<tr>
<td>---</td>
<td>-----------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>29</td>
<td>Door/Window SS fittings</td>
<td>Magnum, Door fit or equivalent</td>
</tr>
<tr>
<td>30</td>
<td>Structural glazing works, A C P fabrication</td>
<td>Alien Curtain Walls Pvt Ltd./ Alunilite Pvt Ltd/ Alumax Designtech System/ Annex Window covering and Dressings/ McCoy Architectural Systems Pvt Ltd. / FabCon Engineering or Approved by Client/Engineers Incharge</td>
</tr>
</tbody>
</table>

**SANITARY ITEMS**

<table>
<thead>
<tr>
<th></th>
<th>Sanitary Fittings and Fixtures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Porcelain Goods (Vitreous China and Fire Clay Sanitary wares)</td>
</tr>
<tr>
<td>3</td>
<td>PVC Cistern (with all fittings and accessories):</td>
</tr>
<tr>
<td>4</td>
<td>Plastic Seat Covers with frame</td>
</tr>
<tr>
<td>5</td>
<td>CP fittings and Accessories</td>
</tr>
<tr>
<td>6</td>
<td>Stainless-Steel Sinks (with or without drain-board and having integrated waste fittings)</td>
</tr>
<tr>
<td>7</td>
<td>Soil Pipes and Fittings:</td>
</tr>
<tr>
<td>8</td>
<td>Centrifugally Cast (spun) Iron Pipes &amp; fittings</td>
</tr>
<tr>
<td>9</td>
<td>Sand Cast (spun) Iron Pipes &amp; fittings (conforming to IS: 1729)</td>
</tr>
<tr>
<td>10</td>
<td>Pig Lead (for caulking of joints)</td>
</tr>
</tbody>
</table>

**Water Supply Pipes and Fittings:**

<table>
<thead>
<tr>
<th></th>
<th>G.I. Pipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>TATA/ JINDAL/ BANSAL</td>
</tr>
<tr>
<td>12</td>
<td>GI fittings</td>
</tr>
<tr>
<td>13</td>
<td>Centrifugally Cast Iron Pressure Pipes (LA class) and Fittings with connection pieces for flanged connection where required.</td>
</tr>
<tr>
<td>14</td>
<td>UPVC pipes</td>
</tr>
<tr>
<td>15</td>
<td>Gunmetal Valves</td>
</tr>
<tr>
<td>17</td>
<td>Lift Pump set</td>
</tr>
<tr>
<td>18</td>
<td>Submersible Pump set</td>
</tr>
<tr>
<td>20</td>
<td>Pressure Gauge &amp; Pressure Switch</td>
</tr>
<tr>
<td>23</td>
<td>Electrical accessories to Motor</td>
</tr>
</tbody>
</table>
### Control Panel

<table>
<thead>
<tr>
<th>SL.No</th>
<th>NAME OF ITEMS</th>
<th>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Control Panel</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Sewerage and drainage</td>
<td>Hind Ceramic/ Orind or equivalent.</td>
</tr>
<tr>
<td>25</td>
<td>Stoneware pipes and fittings</td>
<td>Hind Ceramic/ Orind or equivalent.</td>
</tr>
<tr>
<td>26</td>
<td>Mirror</td>
<td>Akoi/ Atul/ Silver/ Fish/ Jolly</td>
</tr>
<tr>
<td>27</td>
<td>Valves</td>
<td>Leaders/ Kent/ Zoloto</td>
</tr>
<tr>
<td></td>
<td>Soil, Waste &amp; Rainwater pipe and fittings</td>
<td>Oriplast/ Suprime/ Finolex</td>
</tr>
<tr>
<td>28</td>
<td>Unplasticised-PVC</td>
<td>Oriplast/ Suprime/ Finolex</td>
</tr>
<tr>
<td>29</td>
<td>Sand Cast</td>
<td>RIF/ BIG/ NECO</td>
</tr>
<tr>
<td>30</td>
<td>Stoneware Pipes &amp; Gully</td>
<td>Perfect/ Burn</td>
</tr>
<tr>
<td>31</td>
<td>RCC Pipe</td>
<td>Locally available best quality material upon approval from IIT/ EPIL</td>
</tr>
<tr>
<td>32</td>
<td>C.I. S/S Pipes</td>
<td>IISCO/ Kesoram/ Electro Steel</td>
</tr>
<tr>
<td>33</td>
<td>PVC Tank</td>
<td>Sintex/ Patton or equivalent</td>
</tr>
</tbody>
</table>

### ELECTRICALS

<table>
<thead>
<tr>
<th>SL.No</th>
<th>NAME OF ITEMS</th>
<th>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MCCB</td>
<td>Siemens/Schneider/Hager/ Legrand</td>
</tr>
<tr>
<td>2</td>
<td>MCB/Isolator</td>
<td>Siemens/Schneider/Hager/ Legrand</td>
</tr>
<tr>
<td>3</td>
<td>MCB DB with accessories</td>
<td>Siemens/Schneider/Hager/ Legrand</td>
</tr>
<tr>
<td>4</td>
<td>SDFU</td>
<td>Siemens/ Larsen &amp; Toubro/ standard</td>
</tr>
<tr>
<td>5</td>
<td>Ceiling Rose</td>
<td>Anchor/SSK</td>
</tr>
<tr>
<td>6</td>
<td>Rigid PVC Conduit/Pipes</td>
<td>Precision/Prestoplats/Suprime(3mm thick HMS pipe recommended)</td>
</tr>
<tr>
<td>7</td>
<td>Auto Change over cum current limiter</td>
<td>Siemens/L&amp;T/Schneider</td>
</tr>
<tr>
<td>8</td>
<td>Terminal block</td>
<td>Elmex/Connectwell</td>
</tr>
<tr>
<td>9</td>
<td>1.1KV Grade A2XFY cable (ISI marked)FLRSH</td>
<td>Havells/Gloster/NICCO/KEI</td>
</tr>
<tr>
<td>10</td>
<td>1.1KV Grade PVC Insulated Cu. wire (FLRSH)</td>
<td>Finolex/Gloster/Havells(FRLSH)</td>
</tr>
<tr>
<td>11</td>
<td>PVC Insulated Telephone wire</td>
<td>Ploycab/Finolox/R.R.Cable/NETCO</td>
</tr>
<tr>
<td>12</td>
<td>Co-Axial cable(RG-6)</td>
<td>Finolex/ Gloster/Havells</td>
</tr>
<tr>
<td>13</td>
<td>Modular type switch, Socket etc.</td>
<td>Legrand(Arteor)/MK( Blenge)</td>
</tr>
<tr>
<td>14</td>
<td>Polythene pipe</td>
<td>Super dalda/cobra/textile</td>
</tr>
<tr>
<td>15</td>
<td>Paint</td>
<td>Burger/ICI</td>
</tr>
<tr>
<td>16</td>
<td>LT Panel</td>
<td>As per client</td>
</tr>
<tr>
<td>17</td>
<td>Ammeter, Voltmeter</td>
<td>L&amp;T/AE/Legrand/Hager</td>
</tr>
<tr>
<td>18</td>
<td>Selector switch</td>
<td>Scheduled as per IS</td>
</tr>
<tr>
<td>19</td>
<td>Push button/Indicating lamp</td>
<td>Siemens/L&amp;T/BCH</td>
</tr>
<tr>
<td>20</td>
<td>CT Resin Cast</td>
<td>KAPPA</td>
</tr>
<tr>
<td>No.</td>
<td>Item</td>
<td>Brand(s)</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>21</td>
<td>Contactors &amp; Relays</td>
<td>GE/SIEMENS/L&amp;T/Schneider/Alstom</td>
</tr>
<tr>
<td>22</td>
<td>Control fuse</td>
<td>GE/SIEMENS/L&amp;T</td>
</tr>
<tr>
<td>23</td>
<td>ATS</td>
<td>Siemens/L&amp;T/LeGrand</td>
</tr>
<tr>
<td>24</td>
<td>Piano key switch, socket</td>
<td>Not permitted</td>
</tr>
<tr>
<td>25</td>
<td>generators</td>
<td>JACKSON/KIRLOS/AR green/United machinery</td>
</tr>
<tr>
<td>26</td>
<td>MS Conduits</td>
<td>AKG/Supreme</td>
</tr>
<tr>
<td>27</td>
<td>Industrial sockets/Industrial socket DB</td>
<td>Legrand/Siemens/Hager/L&amp;T</td>
</tr>
<tr>
<td>28</td>
<td>Buzzer/call bell with indicator</td>
<td>Legrand/Havells/Anchor</td>
</tr>
<tr>
<td>29</td>
<td>G.I. Pipe (Heavy Gage)</td>
<td>TATA/bansal/Jindal</td>
</tr>
<tr>
<td>30</td>
<td>Casing capping</td>
<td>Precision/Prestoplast/Supreme</td>
</tr>
<tr>
<td>31</td>
<td>KWH meter</td>
<td>L&amp;T/AE/GEC</td>
</tr>
<tr>
<td>32</td>
<td>Fan-1200 mm and 1400 mm (BE 5 star rated)</td>
<td>Orient- G, Orient-Summer Crown/Crompton Greaves -WWHE Plus</td>
</tr>
<tr>
<td>33</td>
<td>Non LED Light fittings</td>
<td>Havelles/CG/PHILIPS</td>
</tr>
<tr>
<td>33A</td>
<td>LED Light Fittings</td>
<td>Havelles/SYSLA/PHILIPS/wipro</td>
</tr>
<tr>
<td>34</td>
<td>Wire mesh cable trays</td>
<td>Cablofil(LeGrand)/Levitor/Cope</td>
</tr>
<tr>
<td>35</td>
<td>Bus risers / trunking systems</td>
<td>Legrand/GE/ C &amp; S</td>
</tr>
<tr>
<td>36</td>
<td>Floor raceway systems</td>
<td>Legrand/L&amp;T/GE/OBO/MK</td>
</tr>
<tr>
<td>37</td>
<td>Gland &amp; sockets</td>
<td>Commet/Dwell</td>
</tr>
<tr>
<td>38</td>
<td>LA Systems with tripod earthing</td>
<td>ABB/ERICO/Indelec/Protec</td>
</tr>
<tr>
<td>39</td>
<td>Manual change over switch</td>
<td>Legrand/ABB/Siemens/L&amp;T</td>
</tr>
<tr>
<td>40</td>
<td>Area lighting pole with medium gauge pipe</td>
<td>Calcutta pole/Utkarsh/Bengal pole/Bajaj</td>
</tr>
<tr>
<td>41</td>
<td>Lift</td>
<td>Otis / Schindler/ Kone/ThyssenKrupp/Mitsubieshi</td>
</tr>
<tr>
<td>42</td>
<td>ACB (L&amp;T Make C Power-CNCS Microprocessor base release with SR18G or equivalent)</td>
<td>L&amp;T / Siemens/ Schneider</td>
</tr>
<tr>
<td>43</td>
<td>MFM (with RS 485 Communication Port- Quasar Meter)</td>
<td>L&amp;T</td>
</tr>
<tr>
<td>44</td>
<td>Exhaust fan</td>
<td>EPC/Orient/ Crompton greaves</td>
</tr>
<tr>
<td>45</td>
<td>Stepped type electronic fan regulator</td>
<td>Legrand(Arteor)/Crabtree(Platinum)/MK(Blenges)</td>
</tr>
<tr>
<td>46</td>
<td>Surge protection device</td>
<td>Legrand /crabtree/Hager/Schneider</td>
</tr>
<tr>
<td>47</td>
<td>Capacitor bank</td>
<td>L&amp;T / EPCOS/</td>
</tr>
<tr>
<td>48</td>
<td>APFC Relay</td>
<td>L&amp;T / EPCOS/</td>
</tr>
<tr>
<td>49</td>
<td>Raceway J.B.</td>
<td>Legrand / MK</td>
</tr>
<tr>
<td>SL.No</td>
<td>NAME OF ITEMS</td>
<td>LIST OF APPROVED MANUFACTURERS / BRAND / APPLICATORS</td>
</tr>
<tr>
<td>-------</td>
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<td>------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td><strong>FIRE FIGHTING AND PREVENTION WORKS</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MS/ GI pipes</td>
<td>TATA/Jindal</td>
</tr>
<tr>
<td>2</td>
<td>Sluice/NRV</td>
<td>Kalpana / H.Sarkar / Venus / Audco</td>
</tr>
<tr>
<td>3</td>
<td>Air Release Valve</td>
<td>Sukan / Leader</td>
</tr>
<tr>
<td>4</td>
<td>Fire Hydrant Valve</td>
<td>Newage/Ghosh Engg./Asco Strumech</td>
</tr>
<tr>
<td>5</td>
<td>GM Coupling</td>
<td>Ghosh Engg. / ISI Marked</td>
</tr>
<tr>
<td>6</td>
<td>Fire Pump / Jockey Pump Pumps</td>
<td>Kirloskar or Mather &amp; Platt or K.S.B.</td>
</tr>
<tr>
<td>7</td>
<td>Electric Motor</td>
<td>Kirloskar / Crompton / Siemens</td>
</tr>
<tr>
<td>8</td>
<td>Fire Extinguisher</td>
<td>Deflame / Bharat / Newage.</td>
</tr>
<tr>
<td>9</td>
<td>Rubber tube for hose reel</td>
<td>Dunlop / Jyoti</td>
</tr>
<tr>
<td>10</td>
<td>Paint</td>
<td>Asian / J &amp; N / Berger</td>
</tr>
<tr>
<td>11</td>
<td>Anti vibration elimentors</td>
<td>Dunlop / Kanwal / Resitoflox</td>
</tr>
<tr>
<td>12</td>
<td>GM Sismese connection</td>
<td>Ghosh Engg. / Zenith</td>
</tr>
<tr>
<td>13</td>
<td>Pressure Switch</td>
<td>Indfoss / System Sensor.</td>
</tr>
<tr>
<td>14</td>
<td>Pressure guage</td>
<td>H.Guru / Feibig</td>
</tr>
<tr>
<td>15</td>
<td>Wire</td>
<td>Finolex / National / Rajanigandha</td>
</tr>
<tr>
<td>16</td>
<td>PVC Conduit</td>
<td>BEC / Steelcraft / Precision</td>
</tr>
<tr>
<td>17</td>
<td>Switch gear</td>
<td>L &amp; T / EE / Siemens</td>
</tr>
<tr>
<td>18</td>
<td>Foot Valve with Strainer</td>
<td>H.Sarkar / Venus</td>
</tr>
<tr>
<td>19</td>
<td>Motors</td>
<td>ABB / Crompton / GEC / KEC</td>
</tr>
<tr>
<td>20</td>
<td>Cables</td>
<td>CCI/Universal/Fortgloster</td>
</tr>
<tr>
<td>21</td>
<td>Cable end termination</td>
<td>Dowell / Comet</td>
</tr>
<tr>
<td>22</td>
<td>Manual Call Points</td>
<td>Philips/ Agni/ Minimax</td>
</tr>
<tr>
<td>23</td>
<td>Detector Smoke</td>
<td>APOLLO/ HOCHKI/ FIRE SCAN/ Systems Sensors</td>
</tr>
<tr>
<td>24</td>
<td>Detector Fire</td>
<td>Apollo/U.K. or System Sensor/ U.K.</td>
</tr>
<tr>
<td>25</td>
<td>HOOTER</td>
<td>Philips/ Minimax/ Agni</td>
</tr>
<tr>
<td>26</td>
<td>Panel for fire alarm system</td>
<td>Philips/ Agni/ Minimax</td>
</tr>
<tr>
<td>27</td>
<td>Zonal Panel</td>
<td>Philips/ Agni/ Minimax</td>
</tr>
<tr>
<td>28</td>
<td>Main panel with ACB’s – (Febricator)</td>
<td>L&amp;T/GE Power Control/ Siemens</td>
</tr>
<tr>
<td>29</td>
<td>C.I. Valves</td>
<td>H. Sarkar / KSB / Audco / Kalpna</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Sluice / Butter Fly / Non-return / Check)</td>
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<td>---</td>
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</tr>
<tr>
<td>30</td>
<td>M.S. / G.I. Pipe</td>
<td>Jindal or Tata.</td>
</tr>
<tr>
<td>31</td>
<td>G.M. Valves. (gate / globe / check)</td>
<td>Leader or bearing ISI mark.</td>
</tr>
<tr>
<td>32</td>
<td>Hydrant / Landing Valve</td>
<td>Ghosh Engineering / Asco Strumech</td>
</tr>
<tr>
<td>33</td>
<td>63mm Fire Fighting Hose</td>
<td>C.R.C. or Newage or B.R.G.</td>
</tr>
<tr>
<td>34</td>
<td>20mm Rubber Hose</td>
<td>Dunlop or Diamond or Padmini.</td>
</tr>
<tr>
<td>35</td>
<td>Pump Starting Panel</td>
<td>L &amp; T / Electro Allied / Siemens</td>
</tr>
</tbody>
</table>
TENDER DOCUMENT

NIT NO. :

EXTENSION OF THREE FLOORS ABOVE (G+ 4) OF CENTRE FOR RAILWAY RESEARCH BUILDING AT IIT Kharagpur

ISSUED TO

________________________________

________________________________

ENGINEERING PROJECTS (INDIA) LIMITED
(A GOVT. OF INDIA ENTERPRISE)
1. Introduction

1.1 Information about the site:
The site for Proposed Centre for Railway Research Building is located inside the campus of Indian Institute of Technology, Kharagpur. All tenders are advised to visit the site and collect necessary information from site with prior approval from EPIL prior to submission of the tender.

1.2 SCOPE OF WORK
The proposed building comprises of the following:

I. Centre for Railway Research:- Ground floor to Four floor.
All floors are basically to house different Laboratories, Class rooms, faculty rooms, administration sections and other activities as required for concern departments.
The scope of work covers the entire construction including the followings:
   1. Civil and Structural works excluding foundation work building.
   2. Complete Internal and External Finishing Works
   3. Internal and External Electrical works.
   4. Internal and external Sanitary, water supply and drainage works.
   5. Installation of passenger lift
   6. Fire fighting and Prevention systems.
   7. Area development, UGR, Septic Tanks, roads and pavement.
   8. Other misc. works as required for making the building functional.

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 /IIT.

2.0 GENERAL SPECIFICATION
2.1 The work in general shall be carried out as per CPWD specifications, 2012, (volume I to IV) (updated with correction slips issued up to last date of submission of tender), general specification 2005 for Electrical works (updated with correction slips issued up to last date of submission of tender).
2.2 All Electrical installation shall comply with the requirements of Indian Electricity rules, 1956 and Indian Electricity Act-1910 as amended up to date and bye laws of authority of State Government or any other department.
2.3 All mechanical works related to Public Health Engineering will conform to the requirements of manual of Water Supply by the Ministry of Urban Development and various Indian Standards as listed there-in.
2.4 All electrical works will conform to various Indian Codes as listed in the Technical Specifications.

2.5 For the items not covered under the specifications as stated above, the work shall be done as per relevant IS Codes.

2.6 For the items not covered under any of the specifications stated above, the work shall be executed as per Manufacturer’s specifications/ General Engineering Practice and / or as per direction of Engineer in Charge.

3.0 ADDITIONAL PARTICULAR SPECIFICATION

In the absence of any definite provisions or any particular issue in the aforesaid specification, reference to be made to the latest codes and specifications of BIS, IRC, BS, ASTM, AASHTO and CAN/CAS in that order. Where even these are silent, the construction and completion of works shall conform to sound Engineering practice as approved by Engineer in Charge. In case of any dispute arises out of the interpretation of the above, the decision of the Engineer in charge shall be final and binding on the contractor.

Where ever reference is made in the contract to specific standard codes to be met by the materials, plants and other supplies to be furnished and work performed and tested, the latest edition or revision of the relevant codes in effect shall apply, unless otherwise explicitly stated in the contract. Where such standards and codes are national, or related to a particular country of region, other internationally recognized standards which ensure a substantially equal or higher performance than the standards and codes specified will be accepted subject to the Engineer in charge prior review and written approval. Differences between standards must be fully described in writing by the contractor and submitted to the Engineer in Charge at least 15 days prior to the date when contractor desires the Engineer in Charge’s approval. If the Engineer in Charge determines that such proposed deviation do not ensure substantially equal performance, the contractor shall comply with the standards specified in the documents.

3.1 RECTIFIED TILES

The fixing procedure of tiles will be as specified in CPWD specifications for fixing of ceramic floor tiles. The tiles shall conform relevant IS standard. The size and thickness of tiles will be as specified in Bill of Quantities. Only matt finished tiles will be used.

3.2 EXPANSION JOINT SEALENT

The specified gap of the expansion joint to be made uniform by cement mortar of appropriate strength, after curing is over, the mortar surface to be cleaned from all dust, dirt, lump of mortar, any grease materials etc. The depth of the expansion joint is to be adjusted as per specified depth with suitable filler board. The surface of the expansion joint to be painted with manufacturer’s approved primer. Polysulphide based sealant compound shall be used as per specified width X depth to seal the joint. The total process of execution shall be as per
manufacturer’s specification and instruction of Engineer in Charge. The work shall be carried out only through authorized vendors/applicators of the manufacturer.

3.3 DECORATIVE INTERCONNECTED FLOOR / PAVEMENT TILES
Interconnected tiles will be of cement concrete of minimum crushing strength of 45 kg/sqm with air entraining or other admixture, approved colouring pigment etc. high pressed with hydraulic pressing machine. The tiles should have sufficient strength to with stand traffic load. The surface of block shall be non skid and abrasion resistance. The thickness of tile shall be min. 25mm.
The tiles will be fixed over 25mm thick base of cement mortar 1:4 (1 cement : 4 coarse sand) and all the joint to be filled with white cement and matching colour pigment.

3.4 STAINLESS STEEL RAILING:
Staircase railing shall be made with Stainless steel seamless tube of grade 304, continuously welded and grinded smooth polished smooth/rough, bend/curved at turning as per design, fixed/welded with the Stainless steel balusters complete as per architectural drawing. All members of railing shall be machine cut, machine polished to get the best finishing. The balusters to be fixed with floor/wall as the case may be with hidden type metal fasten of approved make and approved size. Base of baluster shall be covered with 2mm thk SS covering as per design.

3.5 STRUCTURAL GLAZING
The Structure of the structural glazing will be designed with powder coated aluminium section of HINDALCO/JINDAL make. The spacing of mullions and transoms will be in accordance with the elevation drawings provided by B&R. However the maximum spacing of the mullions shall not be more than 1000mm C/C. The vendor to submit structural design calculation as per latest revision of IS code along with shop/fabrication drawings with all details and get it approved by B&R/NITA prior to execution of the work.
Structural Glazing system to be provided as per drawing and BOQ. Tempered glass of specified make and colour shall be provided as per specification for both single and double Glazing. Glazing to be fixed with aluminium section with structural silicon, either DOWCORNING 995 or WAKER SG-18 or similar equivalent. However the contractor to take previous approval of the structural silicon. The run of sealant to joint between the frame and structure shall not be less than 6mm or three forth of the gap, whichever is more. Joint fillers and backup materials shall be Polyethylene foam or sponge neoprene for each specific application. Glass wool of required thickness, of density not less than 48kg./cum, covered by indestructible tissue on one side and aluminium foil on other side, to be provided to arrest the heat gain.
Fasteners including all screws, bolts, nuts, anchor fasteners and other similar items required for connecting aluminium to aluminium shall be fabricated from stainless steel. GI coated MS brackets to be fixed as per drawing at every floor/slab level.

EPDM structural gaskets with high resistance to aging, prolong period of compressive strength, ability to recover from compressive or deformation and to allow joint movement to be used.

Top hung openable casement glazing panels (windows) to be provided matching with the elevation and overall glazing pattern with associated fittings like stainless steel friction stay hinges of appropriate size, EPDM gaskets, window handle with latching arrangement (all fittings and assessories will be of Ebco make) and no exposed aluminium sections would be visible from outside. Glazed door wherever indicated in elevation of glazing to be provided with floor springs, locking arrangement, door handle and it shall be matching with the glazing system. Both windows and doors will be with toughened double glazing system.

The glazing will be perfectly water proof and there would not be any leakage whatsoever from the glazing or betweens the joints of openable portion of glazing or between wall/civil structure and the glazing, during rain, storm, thunder shower etc. Aluminium flushing to be provided where external glazing terminates and elsewhere as required to make it a completely water-tight installation.

The contractor to execute the glazing work through any of the approved specialist vendor and submit drawings, designs, detailing etc to be prior to start of work and necessary approval may be taken from EPIL.

3.6 Vetrified Tile Facia Cladding

Vetrified tile facia (Topaz basalt / Topaz Basal / Topaz slate or simillar colour and texture of Pavit or equivalent make) to be provided over rough base plaster (1:4) of min. 12mm thickness. The tiles to be fixed on the rough plaster with adhesive of approved quality (Latecrete / Balendura /Sika seram or equivalent). Joints shall be filled with matching coloured grouting compound (Latecrete / Balendura). Size of tiles will be 300x300/ 400 x 400 as approved. Work will be executed by trained masons having expertise in similar works and all lines and levels of cladding work shall be perfect and best of aesthetic quality.
### 5. TECHNICAL SPECIFICATION FOR 10 PASSENGER AESTHETIC GEARLESS ELEVATOR

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load – Kgs</td>
<td>680 (10-Persons)</td>
</tr>
<tr>
<td>Speed – mps</td>
<td>1.50</td>
</tr>
<tr>
<td>Travel</td>
<td>Ground Floor to Seventh Floor</td>
</tr>
<tr>
<td>Stops &amp; Openings</td>
<td>8 Stops, 8 Openings (All openings on the same side)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>400 Volts 3 Phase 50 Hertz. Alternating Current</td>
</tr>
<tr>
<td>Control</td>
<td>A.C. Variable Voltage Variable Frequency</td>
</tr>
<tr>
<td>Operation</td>
<td>Duplex Full Collective (with/without Attendant)</td>
</tr>
<tr>
<td>Machine</td>
<td>Gearless, Machine room less elevators</td>
</tr>
<tr>
<td>Car Panels</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Handrails on three sides</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>False Ceiling</td>
<td>Stainless steel panels with diffuse lighting and noise less fan.</td>
</tr>
<tr>
<td>Flooring</td>
<td>Vitrified tiles or similar</td>
</tr>
<tr>
<td>Car Entrance</td>
<td>Protected by centre opening sliding stainless steel door.</td>
</tr>
<tr>
<td>Size ( W x H) – mm</td>
<td>900 x 2000</td>
</tr>
<tr>
<td>Hoistway Entrances</td>
<td>Protected by centre opening sliding stainless steel door.</td>
</tr>
<tr>
<td>Size ( W x H) – mm</td>
<td>900 x 2000</td>
</tr>
<tr>
<td>Door Operation</td>
<td>Automatic with ACVVVF Door Operator &amp; Multi Ray Electronic Door Detector System</td>
</tr>
<tr>
<td>Details</td>
<td>1. Combined luminous hall button with digital hall position indicator at all floors</td>
</tr>
<tr>
<td></td>
<td>2. Full height Car operating panel with luminous buttons, seven segment digital car position indicator combined with direction arrows, overload warning indicator</td>
</tr>
<tr>
<td></td>
<td>3. Battery Operated Alarm Bell &amp; Emergency Light</td>
</tr>
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<td></td>
<td>4. Fireman’s switch at main lobby</td>
</tr>
<tr>
<td></td>
<td>5. Automatic Rescue Device</td>
</tr>
</tbody>
</table>
6. TECHNICAL SPECIFICATION FOR ELECTRICAL WORK

SCOPE

This specification covers supply of materials, fabrication, and erection, testing and commissioning of Electrical Switch boards, wiring system, light fittings and other associated items required for successful completion of the work. Any equipment, device, component or work not specifically mentioned in this specification but considered essential for proper design and operation shall be included by the tenderer in his offer. Applicable provisions and conditions of contract shall govern the work under the Section.

GENERAL

All supply and installation work shall be carried out as per specification and in accordance with the construction drawings and shall conform to requirements called for in the Indian Electricity Rules 1956 with its latest amendment, Indian Electricity Acts and all relevant codes and practices issued by the Bureau of Indian Standards as amended up-to-date. The work shall also comply with the provisions of the general or local set of legislatures and regulations of any local or other statutory authority which may be applicable.

The Contractor for electrical work must possess valid Electrical contractor’s License endorsed by the Licensing Board, Directorate of Electricity of concerned State Government for the type of work he shall execute.

The work to be provided for by the Contractor, unless otherwise specified, shall include but not limited to the following:

i: Furnish all labour, supervision, services, materials, supports, scaffolds, construction equipment, tools, plants and transportation etc required for the proper execution of the job as per drawings, specification and schedule of items and get all necessary tests on materials and work conducted at their cost.

ii: Not withstanding the electrical layout shown in the drawing, the contractor shall obtain further approval of the layout at site from the Engineer-in-Charge before commencement of the work.

iii: Furnish samples of materials on display board at site for approval including arranging necessary tests on samples, as directed by the Engineer-in-Charge in an approved Laboratory.
iv: To extend facilities to the Engineer-in-Charge to inspect work and assist them to obtain samples, if they so desire.

v: Furnish general arrangement drawings of the switchboard and other fabrication items, which the Engineer-in-Charge may direct for their approval.

vi: To employ a full time experienced supervisor having electrical supervisor's certificate of competency endorsed by the Licensing Board, Directorate of Electricity of concerned State to supervise the work. The Engineer-in-Charge have the right to stop the work if the contractor's supervisor is not present when the work is being carried out.

vii: To keep the appropriate Electrical Inspector & supply authority be informed from time to time as per the execution programme of the work shall be the responsibility of the contractor and he shall be responsible to ensuring that all work passes their approval.

viii: To provide all incidental items not shown or specified in particular but necessary for proper execution of works in accordance with the drawing, specification and schedule of items.

ix: To maintain the work and keep them maintained till handed over to the owner in proper working condition.

x: Co-ordinate with all agencies including those engaged by the owner for proper execution of the job.

MATERIALS

Materials shall be of the approved make & quality. A list of materials of approved brand and manufacturer is indicated in the annexure. If the list of materials mentioned above stipulates two or more or alternative brands/makes of any product, the decision as to which brand/make shall be used in the work shall be taken by the Engineer in charge and the contractor shall provide the brand/make so selected without any extra cost.

In case, materials are required to be obtained from any manufacturer other than those listed on account of non-availability then prior approval from Engineer-in-Charge will be necessary, supported by relevant test certificates qualifying the required standard. Further tests as directed by the Consultant shall also be carried out by the contractor at their own cost, if required.

Contractor shall obtain approval from the Engineer-in-Charge of sample of all materials before placing order and the approved sample shall be carefully preserved on the display board in an appropriate manner at the site office for verification by the Engineer-in-Charge.

For standard bought out items, the sizes manufactured by the firms listed shall prevail when there is discrepancy in the sizes mentioned in the schedule without any financial adjustment.
SPECIFICATIONS

Unless specifically mentioned otherwise, all applicable codes and standards published by the Bureau of Indian Standard and all other such publication as may be published by them after construction work starts, shall govern in respect of design, workmanship, quality and properties of material and method of testing.

SAFETY

All equipment shall be complete with approved safety devices wherever a potential hazard to personnel exists and with provision for safe access of personnel to and around equipment for operation and maintenance functions.

Special care shall be taken to ensure against entry of rats, lizards and other creeping reptiles, which may create electrical short circuit inside live equipment.

DRAWINGS

On completion of all work the contractor shall furnish three copies of Ammonia print along with the original tracing of the following “As built” drawings to the Engineer-in-Charge without any extra cost.

I: Wiring diagram for final power / lighting distribution system showing the rating/ size of switchgear, cables, conduits, lighting fixtures and all accessories for individual installation.

ii Detailed general arrangement drawings of the switchboard complete with dimension in metric units.

iii Drawings showing the route of conduits and cables with sizes, lengths, sources and destination of all cables with the circuit designation number, etc.

iv Drawings showing the balancing of phases with connected load in each circuits, etc.

TEST CERTIFICATES AND INSTRUCTIONS

Unless specifically mentioned otherwise, the contractor shall furnish, in duplicate, Manufacturer's Test Certificate with the delivery of the equipment to the Engineer-in-Charge and Instruction Manual in English for operations and maintenance of equipment wherever required.

TESTING AND COMMISSIONING

Before each field test, the contractor shall obtain the permission from the Engineer-in-Charge and all tests shall be conducted in the presence of duly authorised representative. Records of each test shall be prepared immediately after the test and this record shall be signed by contractor's representative conducting the test and the site engineer attending the test. Copies of their record in quadruplicate shall be handed over to the Engineer-in-Charge.

A certificate in quadruplicate shall be furnished by the contractor countersigned by the certified supervisor under whose direct supervision the installation was carried out and the Engineer-in-Charge. This certificate shall be in the prescribed forms in addition to the test certificate required by the Local Electric Supply Authorities.
COMPLETION OF WORK

Each item of the electrical work shall be considered as complete in all respects only after obtaining permanent service connection from local power supply authority, energising, testing and final commissioning of the complete installation as directed by the Engineer-in-Charge.

Payment on each item of electrical work shall be made as per measurement and proportionate to the quantum of work completed. In the event of any dispute with regard to the proportion of work complete, the decision of the Engineer-in-Charge shall be final and binding to the contractor.

PREAMBLE TO THE SCHEDULE OF WORK

The successful tenderer shall carefully go through the Clauses of Invitation to Tender, Specification, Schedule of Work and drawings and shall include in his rates any sum he may consider necessary to cover the fulfillment of the various clauses contained therein. Unit prices stated in the schedule of work against the item of work shall be inclusive of all installation, accessories and consumables necessary to complete the said work within the contemplation of the contract. Beyond the unit prices no extra amount will be paid for incidental contingent work and materials.

The quantities mentioned in the schedule of work are probable quantities and it must be clearly understood that the contract is not a lump sum contract, that the probable quantities, the value of the entire tender are only indicative and Employer does not in any way assure the tenderer or guarantee that the actual quantity of work would correspond to the probable quantities in the tender.

No change in unit rate will be admissible on any variation of quantity.

PARTICULAR TECHNICAL SPECIFICATION FOR WIRING SYSTEM

SCOPE

This specification covers supply of materials, erection and commissioning of distribution wiring, connection to distribution boards, cable laying, earthing and miscellaneous items. Applicable provisions and conditions of contract shall govern the work under the section.

GENERAL

Work to be provided for by the Contractor, unless otherwise specified, shall include but not be limited to the following:

i: Furnishing of labour, materials, supports, scaffolds, transportation, etc required for the work.

ii: To provide all incidental items not shown or specified in particular but reasonably be implied or necessary for successful completion of the work in connection with the drawings, specification and schedule of items.

iii: To provide all supervision for proper execution of the work.

iv: To conduct and bear all costs in respect of any test advised.
After completion of supply and installation of wiring system and earthing, if any defect in the material or workmanship is found by the Engineer-in-Charge, the contractor shall remove the same and supply better and approved materials at his own cost.

All precaution against theft and fire shall also be taken by the contractor.

MATERIALS

3.1 All materials used in the work shall be ISI approved quality and in its absence conforming to the IS Specification.

WIRING SYSTEM

The electric load of all lights, power outlets, etc. shall be balanced across the three phases.

Generally the final loading of any sub-circuit for lights and fans shall not exceed 800 watts and shall not be connected to more than total 10 fans, lights, socket outlets, etc. Bell push if operated at low voltage shall be fed from a separate circuit of distribution board.

The 16 Amps sub-circuit for power shall be connected to a maximum one 16 Amp. socket outlet or two 6 Amp. socket outlets.

A power circuit shall always be originating from a distribution board or MCB DB and the same shall run in a separate conduit.

The point wiring shall mean wiring from one way of distribution board to point of utilisation of electricity i.e. where the load is applied and this shall include complete wiring from distribution board, supply and fixing of switch board, controlling switches, ceiling rose, batten holder and socket outlet, etc.

Insulated or covered earthing conductors where used, shall have green insulation braiding or covering as appropriate. Under no circumstances shall the colour green be used for other than earthing conductor. In addition where it is required, cables of different colours be used. For identification purposes the following system shall be employed:

<table>
<thead>
<tr>
<th>Red or any colour (other than black or green)</th>
<th>For phase or switch wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>For Neutral</td>
</tr>
<tr>
<td>Green</td>
<td>For earth</td>
</tr>
</tbody>
</table>

Unless otherwise mentioned in the schedule of quantities, single way porcelain/ bakelite terminal connectors with nickel plated brass inserts and screws to suit the conductor size shall be used for intermediate wiring/ joints in junction boxes and in switch boards or by any other method approved by the Consultant/ Engineer-in-Charge.

Distribution wiring in conduit to light, fan, plug points etc. shall be done in looping in system. In this system, no joints or connections shall be made anywhere of the system except at terminating points such as, at terminals of switches, ceiling roses, etc. and in case of socket outlets, at the socket terminals. Intermediate wiring joints of neutral wire in junction boxes will not be permitted.

In the looping back system of wiring on hard wood batten, the wiring shall be done without any junction or connector boxes on the line. All intermediate joints or connections shall be made in the switch board only. Intermediate wiring joints of neutral wire in the junction box will not be permitted.
CONDUIT WIRING

All conduit shall be ISI marked and finished with galvanised or stove enamelled surface. All conduit accessories shall be conforming to IS:2667-1988 and be threaded type. Conduit less than 20mm in diameter shall not be used. All conduits shall be 1.4 to 1.8 mm thickness below 32 mm dia. and 1.6 to 2.2 mm thickness for 32 mm dia. and above.

The conduit for each circuit shall be erected complete with necessary bushes before drawing in of any wire. Galvanised M.S. Spacer of 3 mm thick minimum shall be used between the conduit saddle and fixing surface. The saddle shall be fixed at an interval of not more than 750 mm apart for vertical run and 600 mm apart for horizontal run.

The joint in conduits shall be made by means of threaded couplers and threaded accessories only to ensure electrical continuity throughout. All pipes after cutting, the threading shall be carefully reamed out with special reamer to remove any burr and then painted immediately with an anti-corrosive preservative after removing all traces of oil or grease. Junction boxes shall be provided with gasketed covers to render them dust and damp proof. The conduit accessories having pull outlet for conductors shall only be used in all conduit installation.

Where specified, P.V.C. conduit conforming to IS: 7537 (Part-III) shall be used. The thickness of P.V.C.conduit shall be adequate to withstand mechanical injuries. PVC conduit accessories conforming to IS: 3419-1976 shall be used along with P V C conduit.

The entire conduit system shall be effectively earthed by means of suitable earthing conductors and the resistance from any point to earth shall not be more than one OHM.

After installation of conduit pipes and fittings are completed in all respects, the exposed outer surfaces of the conduit and accessories shall be painted with two coats of approved enamel paints or aluminium paint over a coat of red oxide primer as required to match the surrounding wall finishing. To protect against rust the bare thread portion shall be painted with anti-corrosive preservative.

CONCEALED WIRING

Making of chase : The chase in the wall shall be filled up neatly made and be of ample dimensions to permit the conduit to be fixed in the manner desired. In case of buildings under construction, chases shall be provided in the wall, ceiling etc. at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall. Specially for ceiling, conduit shall be laid before casting.

Fixing of conduit in chase : The conduit in chase in the wall shall be fixed by means of staples or by means of saddles not more than 60 cm apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing of PVC insulated wires. All threaded joints of conduits shall be treated with some approved preservative compound to secure protection against rust.

Inspection boxes : Suitable inspection boxes shall be provided to permit periodical inspection and to facilitate removal of wires, if necessary. These shall be provided with inspection box covers.

Types of accessories to be used : All outlets, such as switches, wall sockets, etc. may be either flush mounting type or of surface mounting type.

The outlet box shall be mounted flush with the wall. The metal box shall be effectively earthed with conduit by an approved means of earth attachment.
Fish wire: 1 x 18 SWG G.I. wire inside the conduit and accessories to be provided with an extension of 250 mm at both the conduit ends.

Conduit laying in floor/ roof slabs before casting: M.S./ G.I./ rigid PVC/ polythene conduit shall be laid straight as far as practicable and properly placed including binding with the steel reinforcement rods with 22 SWG G.I. binding wire so that proper positions of conduits are maintained.

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

All precaution must be taken while laying the conduits in the slabs, R.C. walls, columns, etc. and the contractor shall rectify at his own cost, if any defects are found during process of drawing cables through the concealed prelaid conduits.

Each M.S. / G.I. conduit shall be provided with protruding length of 150 mm on free end of the conduits with sockets under the bottom level of slab/ beam.

Each rigid PVC/ polythene conduit shall be provided with protruding length of 150 mm on free end of the conduits under the bottom level of slab/ beam.

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

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

It will be mandatory for the contractor to get the layouts approved by the Engineer-in-charge/Consultant, measurements are checked when the conduits are laid and bound to steel reinforcement rods, before he can release the work for casting of slabs/ floor/ beams etc.

Connector Boxes, Draw-in-Box, Junction Boxes:

These shall be constructed from 16 SWG M.S. sheet and have M.S. cover. Minimum size for connector box is 150mm x 100mm and for Draw-in-Box is 100mm x 100mm with required depth upto 80mm.

Fan Hook Box: These shall be 100mm dia x 80mm depth, constructed from 14 SWG M.S. sheet and provided with one 12 mm dia. M.S. rod of 300mm long having 'U' bend inside the box.

Painting: Both inside & outside wall of switch board, connection box, draw-in-box and other M.S. accessories shall be painted with two coats of anti-corrosive paint in addition to other painting instructions given elsewhere.

Wires

Unless otherwise mentioned in the schedule of quantities, only single core PVC insulated / PVC insulated & sheathed cable consisting of multistrand / flexible copper conductor and of approved manufacturers conforming to relevant I.S. shall be used for wiring in conduit system.

The maximum number of wires drawn in one conduit shall not be greater than the recommended number given in the Table – 1 given in this section.
INSTALLATION AND WIRING OF DISTRIBUTION BOARD/ MCB DISTRIBUTION BOARD.

Where fixing of distribution board/ MCB DB on double teak wood board is specified only hinged type wooden board with brass hinge shall be provided and the size of the board shall be such as to match the size of the Distribution board/ MCB DB. A minimum margin of 25 mm shall be provided on all sides of the distribution board/ MCB DB. The outgoing circuit shall be taken out through a horizontal slot at the rear side of the distribution board/ MCB DB enclosure.

Where fixing of Distribution board/ MCB DB on M.S. frame is specified, the frame shall have sufficient mechanical strength to carry the weight of the DB./ MCB DB.

Where fixing of Distribution board/ MCB DB will be of concealed type, the chase in the wall shall be neatly made and be of ample dimensions to permit the DB to be recessed in wall and flushed with finished wall surface.

The cable/ wires shall be connected to the terminal only by soldered or crimped lugs, unless the terminal is of such a form that it is possible to securely clamp them without cutting away of cable strands.

All bare conductors shall be rigidly fixed in such a manner that a clearance of at least 25 mm is maintained between conductors and material other than insulating material.

CABLES

TYPE AND QUALITY OF CABLES

Unless otherwise specified in the Schedule of Quantities all wiring cables shall be PVC insulated and PVC sheathed conforming to relevant IS Standard. The conductor of cable shall be of stranded wires of aluminium or copper as specified. All power cables shall be 1100 volts grade, PVC insulated, PVC sheathed and armoured with stranded aluminium conductor. Materials should be obtained from the approved list of manufacturers/ brands as indicated in the document.

HANDLING OF CABLES

It shall be ensured that both ends of the cables are properly sealed to prevent ingress/ absorption of moisture by the insulation.

When the cable drums have to be moved over short distances, they should be rolled in the direction of the arrow marked on the drum. While removing cables, the drum shall be properly mounted on jacks or on a cable wheel or any other suitable device, making sure that the spindle, jack, etc. are strong enough to take the weight of the drum.

DEFECTIVE CABLES

Cables with kinks and straightened kinks or with similar apparent defects like defective armouring, etc. shall not be installed.

BENDING RADIUS

Cable runs shall be uniformly spaced, properly supported and protected in an approved manner. All bends in runs shall be well defined and made with due consideration to avoid sharp bending and kinking of the cable. The minimum safe bending radius for all types of P V
C cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius shall be adopted.

LENGTH OF CABLES

All cables shall be laid in one length. No joint shall normally be made at any intermediate point in through runs of cables, unless the length of the run is more than the length of the standard drum supplied by the cable manufacturer. In such cases where jointing is unavoidable, the same shall be made by means of standard cable joint boxes/kits. Before cutting the cables, the requisite length between terminals (including extra length required at loops) shall be carefully measured.

STRIPPING OF OUTER COVERING

While cutting and stripping the outer covering (i.e., sheathing of the cable), care shall be taken that the sharp edge of the cutting instrument does not cut or damage the inner insulation of the conductor. The protective outer covering of the cable shall be stripped off near the connecting terminal, the protective covering being maintained up to a point as close as possible to the connecting terminal.

CABLE LAID IN TRENCHES

Cables shall be laid generally in accordance with Indian Standard Code of Practice IS: 1255.

SIZE OF TRENCH

Unless otherwise mentioned in the Schedule of Quantities, the minimum width and average depth of trench for laying a single cable in ground shall be 460mm and 760mm for L.T. and 1000 mm for H.T. cable respectively. For laying of multiple 11 KV and 6.6 KV grade power cables, horizontal axial spacing shall be 250mm. For 1100 volt grade power cables, the horizontal axial spacing shall be 150mm. However, communication cable shall not be taken in a common trench. Where more than one cable are to be laid in the same trench in horizontal formation, the width of trench shall be increased according to the above stated inter-axial spacing between the cable, (except where otherwise specified). There shall be a clearance of at least 150 mm between the trench edge and axis of the end cable.

EXCAVATION OF TRENCH AND PREPARATION OF BED

The trench shall be excavated in reasonably straight line. Where there is a change in direction, suitable curvature shall be provided. Where gradients and changes in depth are unavoidable, these shall be gradual.

Adequate precautions shall be taken during excavation not to damage any existing cables, pipes or similar installations in the proposed route. Where bricks, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.

The bottom of the trench shall be level across the width and free from stone, brick bats, etc. The trench shall be then provided with a cushion of fine sand, the thickness of the cushion being not less than 75mm.

LAYING OF CABLES

All cables shall be tested for proper insulation prior to laying. The cable drums shall be transported on wheels to the place of work. The cables shall be laid out in proper direction as indicated on the drum using cable drum lifting jacks. In case of higher size cables, the laid out cables shall run over rollers placed at close intervals and finally transferred carefully on to the trenches and racks, care shall be taken so that kinks and twists or any mechanical
damage does not occur in cables. Only approved cable pulling grips or other devices shall be used. The entire length of cable shall, as far as possible, be paid in one operation. However, if this is not possible, the remainder of the cable may be shifted from position by ‘flaking’ i.e. by making one long loop in the reverse direction. For crossing water, gas or sewerage pipes, etc, cables shall be taken above the pipes where minimum 500 mm clearance is not available. The cable shall cross these pipes through RC/ GI pipes at a minimum depth of 750 mm from finished ground level keeping the distance between the utility pipes and pipe carrying cables 300 mm minimum.

While laying cables parallel to building, railway track, utility pipe lines, drainage, sewerage, etc. the minimum clearance shall not be less than 1000mm.

Adequate length of cables shall be pulled inside the switch boards, control panel terminal boxes, feeder pillar etc. so as to permit neat termination of each core.

SURPLUS CABLE

At the time of original inspection, approximately 1 meter of surplus cable (in the form of a loop or otherwise) shall be left at each entry or exit of the cable at a pole or at the pillar box, or near any terminal as may be directed by the Consultant/Engineer-in-Charge.

PROTECTIVE COVER FOR CABLES DIRECTLY BURIED IN GROUND

Except where otherwise directed by the Consultant/Engineer-in-Charge, the cable (for the entire length in trench) shall be protected by a layer of bricks laid flat on top and shall be provided at least by 75 mm sand cushioning both at top and bottom. This brick protection shall cover all the cables in the trench (single cable or multiple cables, in horizontal formation). In case of a single cable, the brick protection shall consist of one brick flat (with the length along the width of the trench) and supported on two lines of brick-on-edge, one on each side of the cable (with the length of the bricks along the length of the trench).

For multiple cables in horizontal formation, in addition to the two outer lines of brick-on-edge, there shall be additional lines in between adjacent cables. The top cover of brick flat shall extend to cover all the cables, each brick being supported on the lines of brick-on-edge.

BACK FILLING OF TRENCH

After laying of cables the remaining portion of the trench shall be back filled with good excavated soil and well rammed in successive layers not exceeding 300 mm depth each and duly compacted to the satisfaction of the Consultant/Engineer-in-Charge. Surplus soils of excavation shall be removed or disposed of as per direction of the Engineer-in-Charge.

All material like sand, brick and clamp, etc. shall be supplied by the contractor. The cable laying rate shall be inclusive of all these items.

CABLES LAID THROUGH PIPE SLEEVES

Entry of cable from underground trenches to the building or tunnel shall be through pipe sleeves. Necessary precaution shall be taken to make entry point fully water tight by properly sealing the pipe sleeves in a manner approved by the Engineer-in-Charge.

Where cables are required to cross roads, railway tracks and surface drains, they shall be taken through pipe sleeves at a minimum depth of 1000 mm.

LAYING OF CABLES ON RACK/ TRAY/ BRACKET/ HOOKS/ MASONRY TRENCH

Where cables are required to be laid directly along structure walkway, walls, ceiling, they shall generally be taken exposed on brackets, cable racks, trays, hooks laid along building
structure. Spacing of saddles/ hooks shall be such that the cables are straight and shall not exceed 750 mm.

The cable rack/ trays shall be ladder type / pre-fabricated perforated type and bends / curvature shall be smooth and suitable for bending the largest cable running in the rack / tray. The cable rack/ trays shall be suitably installed on the building structure with proper support at regular intervals.

Cable rack/ trays shall be so arranged that they do not obstruct or impair clearance of passage way.

Where there is possibility of mechanical damage cable racks / trays shall be adequately protected by sheet steel cover.

Unless otherwise specified in the schedule of quantities the rack/ trays shall be painted with corrosion resistant paint and finished with enamel paint of shade battleship grey or any other colour shade acceptable to Consultant/ Engineer-in-Charge.

**CABLE ROUTE MARKER**

Cable route markers shall be provided at each joint, entry to buildings, each turn, either side of the road crossings and at 30 meter intervals for straight cable runs and at location directed by the Engineer-in-Charge.

The cable marker shall be of cement concrete slab of R.C.C.type (1:2:4) and of size 600mm x 300mm at the bottom and 500 mm x 200 mm at the top with a thickness of 100 mm with marking ‘CABLE’ and shall be laid flat at finished ground level centered over the cables for easy identification.

Unless otherwise specified in the schedule of quantities, galvanised Iron type cable route marker of size 100mm dia 50 mm thick G.I. Plate with marking ‘CABLE’ thereon welded to 35 mm x 35mm x 6mm angle iron 600mm long fixed in a rigid manner may also be used as approved by the Engineer-in-Charge.

All materials like cable route marker, sand and cement, etc. for fixing the same to be supplied by the contractor. The cable laying rate shall be inclusive of all these items.

**CABLES TERMINATION**

Power cable termination shall be carried out in such a manner as to avoid strain on the terminals by providing suitable clamp near the terminals. All power cables shall be terminated to the circuit breaker, switch fuse units, busbars, etc. by means of suitable sizes crimping type cable socket / lugs / ferrules and pvc tape upto palm of the cable lug. Control cables shall be terminated by crimping or directly clamped in the terminal blocks by screws.

When pinching the smaller size conductor directly in the terminal bore of the switches, the individual strands shall be fanned out and cleaned by wire wool or emery paper and the cleaned surface shall be coated with a thin layer of oxide inhibiting grease. The conductor shall be tightened fully to the terminal bore but over tightening shall be avoided.

For connection to busbars and other terminals, brass or cadmium plated nuts/ bolts and washers shall be used. Copper cables shall never be terminated directly on aluminium busbar. Suitable measure shall be taken to avoid heating due to bimetallic contacts.

A selection chart of crimping type cable lugs for various combination of cables/ busbar/ fuse switch terminals is shown below:
<table>
<thead>
<tr>
<th>Material of busbar/ switch terminals</th>
<th>Material of Cables</th>
<th>Material of crimping lug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium</td>
<td>Aluminium</td>
<td>Aluminium over tin plated copper</td>
</tr>
<tr>
<td>Copper</td>
<td>Aluminium</td>
<td>Aluminium lug with copper plated palm</td>
</tr>
<tr>
<td>Silver/tin plated copper</td>
<td>Aluminium</td>
<td>Aluminium or tin plated copper</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Copper</td>
<td>Tin plated copper</td>
</tr>
<tr>
<td>Copper</td>
<td>Copper</td>
<td>Copper or tin plated copper</td>
</tr>
</tbody>
</table>

**EARTHING**

All non current carrying metallic part of various electrical equipments as well as cable armouring, metallic conduit, cable racks/ trays, brackets, supporting structures, etc. shall be effectively earthed by not less than two separate and distinct earth connection in accordance with Indian Electricity Rules, and the relevant Indian Code of Practice for earthing 3043-1987.

**EARTH ELECTRODE**

**PIPE ELECTRODE**

The earth electrode for earthing station shall comprise G.I. pipe 'B' Class of 50mm internal diameter and 3 Mtr long in one single piece with holes 12mm dia on all sides at 150 mm centre, upto a minimum height of 2.5 metre from bottom. Removable caps / wire mesh funnel shall be provided at the top of pipe to facilitate pouring of water. Suitable clamps made of 40mm x 6mm galvanised M.S. flats complete with bolt and nut shall be provided with the electrodes at 100 mm from the top end for connecting earth conductor. No joints will be allowed in the earth electrode. The electrode shall be driven at least 2 metre clear from masonry structure and the distance between two electrode shall be not less than 2 metre when installed in parallel and preferably placed twice the length of the electrode i.e. 6 metre. A masonry inspection pit of inside dimension 300mm x 300mm x 300mm deep (unless otherwise stated) shall be built with 125 mm thick cement mortar (6:1) brick work both inside and outside plastered with 20mm thick and neatly cemented 1.5 mm thick, inside top and outside around the top of the earth pit, so that the top of the G.I. pipe is 250 m below the finished ground level and the opening on top shall be provided with C.I. manhole ring having lockable C.I. cover fixed & flush with the outside finished ground level.

**PLATE ELECTRODE**

Where plate electrode for earthing is to be employed, the size of the plate shall not be less than 600 mm x 600 mm x 6.3 mm for G.I. plate in thickness and 600 mm x 600 mm x 3.15 mm thickness in case of copper plate.

The plate shall have a drilled hole 14 mm dia. at the centre. The G.I. flat of not less than 40 mm x 6 mm (1 no. 25 mm x 6 mm G.I. flat for lightning conductor installation) should be connected to the plate by means of a 65 mm long 12 mm dia galvansised bolt, double nuts using double galvansised washers. In case of copper plate, copper flat of not less than 25 mm x 6.0 mm shall be used as the earth lead. The flat shall first be fastened on one side of the plate, leaving adequate length of flat, which shall be taken over to the other side i.e. to the earth busbar, switchboard, pole, continuous earth wire for O.H. line, service bracket, lightning arrester or the object to be earthed and be fastened as per the details of IS:3043-1987. No joint on the earth lead conductor is permitted. Every care shall be taken to ensure that the ends of the wire/ flats have been securely clamped by the bolt on cleaned surface of the plate and establish a good electrical contact.
The plate shall be buried vertically at a minimum of 3.6 M below the ground level for sandy soil and 2.0 m below the ground level for normal soil. In order to place the same at the prescribed depth, the dimension of pit to be excavated shall be 900 mm x 900 mm x 4 m deep. The G.I. plate shall be placed in position by the contractor only after the inspection of excavated pit and approval is obtained from the Consultant/ Employer.

After placing the plate the earth lead conductor shall be protected by means of a continuous length of G.I. pipe (Class B) having 50 mm dia (minimum) bore or route depending upon the size of the lead, right from the plate upto a height of 600 mm metre (2 ft.) above ground level. The whole length of pipe shall be filled with bituminous compound of approved make and brand. The molten compound shall be poured from the top end of the pipe and topped upto overflowing.

A masonry inspection pit for the earth station of inside dimension approximately 300 mm x 300 mm x 300 mm depth (unless otherwise stated) shall be built with 125 mm thick cement mortar (6:1) brick work with 1st class bricks, both inside and outside plastered with 20 mm thick and neatly cemented 1.5 mm thick, inside, top and outside around the top of the earth pit. The opening on top shall be provided with C.I. manhole ring having lockable C.I. cover fixed and flush with the outside finished ground level.

Electrodes shall be buried at least 2 meter away from masonry structure/ building/ pole or object to be earthed. However, earthing electrodes for L.C. installations should be as close to the down conductors as possible. Electrodes when installed in parallel, shall not be placed less than 2 meter apart and preferably placed at distance greater than 6 meters.

All the excavations shall be duly back filled, dressed and rammed.

**EARTH BUSBAR**

**GALVANISED M.S. FLAT**

Unless otherwise specified in the schedule of quantities, the earth bus bars shall be of heavily galvanised M.S. Flat of cross section 50mm x 6mm having adequate number of drilled holes with 10mm galvanised steel bolts, nuts, plain and spring washers for securely connected the earth leads and the continuity of conductor. The bulb shall be fixed on wall, having clearance of 6mm from wall with spacing insulators with 13mm dia G.I. rag bolts, spaced about 50mm apart.

**COPPER FLAT**

To be used, as specified in the schedule of items, where earthing requirements are more stringent, with use of brass bolts, nuts, washers for connections.

**EARTH LEAD CONDUCTOR**

The earth lead for each electrode shall be 7/10 S W G stranded G.I. wire connected securely to the earth electrode and earth bulb. The earth lead shall be mechanically protected with a continuous length of 25mm dia G.I. Pipe (Class ‘B’) right from the electrode to the earth bulb and the pipe shall be filled with bituminous compound.

Galvanised M.S. Flat earth conductor directly buried in ground shall generally be taken at a depth of 600 mm and shall be provided with one coat of bituminized paint, one layer of half lapped bituminized tape and a final coat of bituminized paint to prevent corrosion.

The earth conductor when laid inside building/ sub-station shall be taken either exposed on cable racks/ trays, walls, ceiling, etc. or embedded in concrete depending on installation. Galvanised M.S. saddles clamped to M. S. flat spacers with tapped holes shall be used for
clamping earth conductor. Flats shall be supported at intervals not exceeding 500 mm and stranded wires at intervals of 300mm.

Connection of earthing leads to earth electrodes and termination of flat earth continuity conductor to equipment shall be made by means of bolting. Connection of stranded earth wire to earth bus as well as to equipment shall be made through crimping type lugs and bolting. Jointing and tapping of flat earth conductor shall be done by means of welding.

The earth resistance from any point of the earthing system shall not be more than one ohm.

WORKMANSHIP AND INSTALLATION WORK

The workmanship shall be of good commercial quality and all supply material and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.

PARTICULAR TECHNICAL SPECIFICATIONS FOR LIGHTNING PROTECTION SYSTEM

SCOPE

This specification covers supply of materials, fabrication and erection of Lightning protection system comprising air terminations, horizontal conductors, down conductors and earth electrodes. Applicable provisions and conditions of contract shall govern the work under the section.

GENERAL

Work to be provided for by the Contractor, unless otherwise specified, shall include but not be limited to the following:

i: Furnishing of labour, materials, supports, scaffolds transportation, etc required for the work.
ii: To provide all incidental items not shown or specified in particular but reasonably be implied or necessary for successful completion of the work in connection with drawings, specifications and schedule of items.
iii: To provide all supervision for proper execution of the work.

After completion of supplying and installation of lightning protection system, if any defect in the material or workmanship is found by the Engineer-in-Charge the contractor shall remove the same and supply better and approved materials at his own cost to the satisfaction of the Engineer-in-Charge.

All precaution against theft and fire shall also be taken by the contractor.

MATERIAL

All material used for lightning conductors, down conductors, earth termination network, etc. of the protection system shall be reliably resistant to corrosion or be adequately protected against corrosion and generally conforming to IS:2309.

The entire lightning protection system shall be mechanically strong to withstand the mechanical forces produced in case of a lightning stroke.

HORIZONTAL AIR TERMINATION CONDUCTOR

Unless otherwise specified air termination shall be horizontal conductor. The horizontal air termination shall be so inter-connected that no part of the roof is more than 9 meters away from the nearest horizontal conductor. For flat roof horizontal conductor shall generally be provided along the outer periphery of the roof. The conductor shall be exposed to atmosphere.

All metallic protections, vent pipes, railways etc. on or above the main surface of the roof shall be properly bonded to the air termination network.
DOWN CONDUCTOR
Down conductors shall follow the most direct path possible connecting the horizontal air termination conductor and the earth termination i.e. the ground electrode avoiding sharp bends, up-turns and kinks. Joints shall as far as possible be avoided in down conductors.

JOINTS
The joints in the lightning protection system shall be avoided as far as possible. There shall be no joints in the down conductor below ground level. Where joints are necessary they shall be mechanically and electrically effective and shall be so made as to exclude moisture completely.

The joints may be soldered, riveted or bolted and mentioned in the schedule of work. With over-lapping joints the length of the overlap shall not be less than 50 mm for all types of conductor. Contact surface shall first be cleaned and then inhibited from oxidation with a suitable non-corrosive compound. Strips shall be tinned, soldered, welded or brazed and at least double riveted. Bolted joints shall not be used on test points or on bonds to existing metal. For rust protection the welded joints shall be treated with barium chromate. Welded surface shall then be painted with red lead and aluminium paint.

TESTING POINTS
Each down conductor shall be provided with a testing point in a position convenient for testing but inaccessible for interference. No connection, other than one direct to an earth electrode shall be made below a testing point.

EARTH TERMINATIONS
Each down conductor shall have an independent earth termination and arrangement of isolation for testing purposes. The earth termination shall be located as close as practicable to the down conductor. Inter connections with other termination of the conductor system and with other buried metal services and earth terminations shall be made with G.I. tape laid directly at an average depth of 700 mm below finished ground level for the purpose of equalising the potential distribution in the ground.

EARTH ELECTRODE
Earth electrode shall be constructed and installed as specified in Part-B. The pipe/plate electrode shall be driven into the ground as close as practicable but outside the circumference of the structure.

FIXING OF CONDUCTOR
Unless otherwise mentioned in the Schedule of Quantities the wall shall be drilled and plugged with teak wood pins of not less than 50mm long by 25mm square inner and 19 mm square outer surface. The void shall be finished according to the nature of wall surface with cement plaster.

Conductors shall then be securely attached to the building to be protected by galvanised steel fasteners of 2mm thick which shall be substantial in construction and wood screws and approved by the Engineer-in-Charge.

EARTH RESISTANCE
Properly made earth connections are essential for effective functioning of a lightning protection system and every effort shall be made to provide ample contact with the earth so that the earth resistance can be kept as low as possible.

The whole of the lightning protection system shall have a combined resistance to earth not exceeding 1 ohm.

WORKMANSHIP AND INSTALLATION WORK
12.1 The workmanship shall be first class and all supply material and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.
CONTRACTORS RATE TO INCLUDE

Apart from other factors mentioned elsewhere in this contract, the rates for the above shall include for the following:

i: All labour, materials, tools and construction equipment required for proper execution of job

ii: Scaffolding including erection and removal

iii: Making good of all damaged civil work, if any

TECHNICAL SPECIFICATION FOR ELECTRICAL EQUIPMENT

SCOPE
This specification covers supply of materials, fabrication, erection, testing and commissioning of switch boards, Distribution boards, Meter board, Lighting equipment, Switches, socket outlets and miscellaneous items. Applicable provisions and conditions of contract shall govern the work under the section.

GENERAL
The contractor shall have to submit manufacturer’s Test Certificate for switchboards, switch fuse units, meters, fuse fittings, circuit breaker, isolating switches and other items as directed by the Engineer-in-Charge.

After completion of such supply and installation work of the electrical equipment, if any defect in the material or workmanship is found by the Engineer-in-Charge, the contractor shall remove the same and supply better and approved materials at his own cost.

All precaution against theft and fire shall also be taken by the contractor.

The contractor shall provide complete supervisions for proper execution of the work.

MATERIALS
All materials used in the work shall be of ISI marked wherever available, and of approved make and quality and in its absence conforming to the I.S. Specification.

For fabricated equipment, special care shall be taken to make the enclosed equipment proof against entry of creeping reptile, which may create electrical short circuits inside the live equipment.

L.T. MAIN DISTRIBUTION SWITCH BOARD /DIST. SWITCH BOARD
The 415 Volt main distribution switch board shall have incoming unit fed from L.V. side of transformer/ main distribution board.

STANDARDS
The equipment shall be designed to confirm to the requirements of I.S: 4237, I.S: 2147 and I.S: 375.

CONSTRUCTION
The main L.T. P.C.C board shall be of totally enclosed, topicalised, vermin proof, free standing, cubical type dead front minimum 2.0 mm thick sheet steel construction housing incoming ACB/ MCCB/ SDFU, requisite number of outgoing ACB, MCCB, fuse switch or switch fuse units, busbars, Switch board shall be readily extensible on both sides. The manufacturer of LT PCC board shall CPRI Testing certificate for 50KA rms short circuit withstanding capacity in similar type of panel.
The incoming and outgoing functional units shall be arranged in multi-tier formation, to provide a compact switch board having a pleasant appearance. Each unit shall be accommodated in a separate compartment having gasketed hinged door which shall be interlocked with the operating mechanism so as to prevent opening of the door when the switch is in the 'ON' position and also to prevent closing of the switch with the door not properly secured.

The 'ON' and 'OFF' positions of the switch handle shall be distinctly indicated by proper marking. Modular construction shall be adopted to cater for different units with each cubicle having a busbar chamber and cable compartment. The maximum height of the devices on the panel shall not exceed 2000mm.

Suitably engraved identification levels shall be provided on each unit.

When switch board of floor or wall mounting type is specified instead of cubicle type with incoming and outgoing Fuse switch units or switch fuse units, the board shall comprise a suitable length of Busbar chamber. The board shall have provision for future extension. The floor stands or wall bracket shall have sufficient mechanical strength to carry the weight of the entire switch board.

The height shall be such that maximum operating height of the top unit shall not exceed 1800mm.

**BUSBAR**
The main horizontal busbar shall be air insulated and made of high conductivity, high strength aluminium alloy or electrolyte copper complying with the requirements of grade E 91 E of IS 5082. The current density in each busbar shall not exceed 160 Amp. per sq. cm. for copper of 125 amp. per sq. cm. for aluminium.

The main phase busbar shall have continuous current rating throughout the length of power control centre and the neutral busbar shall have a continuous rating of the power busbar.

Large clearance and creepage distance shall be provided on the busbar system to minimise the possibility of a fault.

The busbar and vertical risers horizontal connectors shall be fully insulated with PVC sleeve or tape to prevent accidental touch.

The busbar including neutral and earth bar shall be short circuit tested for fault withstand of 60 KA RMS for one second as per IS:8623 for factory Built Assemblies.

In no case, the rating of busbars shall be less than the Incoming Circuit Breaker or switch.

Busbar should be supplied with insulating material such as Permali, Hylam, and support shall be sufficient close and robust and support should permit - sufficient movement for compensation of comparative stress in the event of short circuit.

**AIR CIRCUIT BREAKER**
The circuit breaker would be constructed in modular construction or would be enclosed in cassettes, designed for easy Switch Board Construction. The formed and welded steel construction should be given corrosive resistance treatment following fabrication work.

The breaker would have three distinct position, service/ test/ isolated within the cubicle, achieved by a racking cam and slide rails, simplifying inspection and from this position breaker should be able to withdrawn from housing. With door closed, the breaker should be withdrawn to test and isolated position.

The contact system should be designed to ruggedly and to effectively utilize the magnetic force generating in the current path ensuing high short time withstand current and interrupting
capacity and reducing the let through energy. The ACB should be provided with separate set of arcing contacts and main contacts ensuring high mechanical and electrical life. Arc chutes on arcing contacts with de-ionisation plate should be provided. The contact tips should be made of Silver Nickel Alloy and arcing contact tips are of Silver Tungsten Alloy.

ACB should be suitable for manual or Motor wound stored charge spring closing mechanism. ACB should be provided with micro-processor based trip release, inherent safety interlocks, such as safety shutters and door interlock, "OFF" & "ON" indicator auxiliary switches and contacts. ACB should be complete with overload protection, short circuit protection, auxiliary contacts and instruments as specified in the schedule.

The ACB should comply with Indian Standard Specification I.S. 2516-1977 and IEC 157 and should be certified by CPRI.

MOULDED CASE CIRCUIT BREAKER
The MCCB should comprise of a switching mechanism, contact system, arc extinguishing device and the tripping unit, contained in a compact moulded case and cover.

The insulating case and cover shall be made of high strength, heat resistant, flame retardant thermo setting material, providing interphase insulation of a very high dielectric strength and an insulated enclosure with high withstand capability against thermal and mechanical stresses with protection against any fire hazards.

The trip free toggle mechanism should ensure that the trip command overrides all other commands.

MCCB should employ a maintenance free contact system designed to minimize the let through energies while handling abnormal currents. The special sintered contact tip should provide a wiping action, high resistance to erosion during interruption and a stable contact for normal service current.

A series of grid plates should be mounted in parallel between supports of insulating material. The profile of the de-ion steel plates extends directly over the contacts and draws the arc from the moving contact up into the divider chamber, thus confining, dividing and extinguishing the Arc.

The rotary handle position should give positive indication of whether the MCCB is 'ON' (top), 'OFF' (bottom) or 'TRIPPED' (midway).

The tripping element provided on each pole of the MCCB should operate on a common trip bar because of which it does not create single phasing in the event of a fault on any of the phases.

The base design ambient temperature of the MCCB should be 40 degree C.

When specified the MCCB should be fitted with under over load protection, short circuit and earth fault protection, alarm & auxiliary switch etc.

FUSE SWITCH UNIT
The fuse switch units shall be of double break type suitable for load break duty, with quick make and break mechanism and front drive mechanism, generally conforming to IS:4064 -1978 having fully shrouded contacts. All switch contacts shall be self aligning, spring loaded, silver plated. The isolators shall be connected on the busbar side or incoming side and fuses on the load side. However, fully withdraw able carriage to facilitate quick fuse link replacement is preferred.
The individual fuse switch units shall be either triple pole and neutral or single pole and neutral as specified with a front operating handle. The fuse links shall be non-deteriorating HRC type complying with IS:2208-1962 and having rupturing capacity of 80 KA at 415 Volts.

The units which are to be installed separately should be totally enclosed fully shrouded sheet steel clad/cast steel casing.

INSTRUMENTS
The measuring instruments shall comply with IS:1248 in all respects.

Moving iron, square, flush mounting type instruments shall be used for measuring A.C. Voltage and currents.

The instruments shall normally be mounted on the hinged door of an all welded fabricated sheet steel housing of rigid construction to allow easy access to small wirings. Circuits shall be protected by H R C type fuse links complying with IS: 9224 (Part-II) -1979. The fuses shall be mounted near the tap-off point from the main connections so that a fault in the instrument wiring does not affect the main supply. Small wiring shall be of 660 Volt grade single core flame retardant low smoke PVC insulated cable with copper conductor having minimum size 2.5 sq. mm. These shall be coloured coded for identification of circuits. The instruments shall be of approved make & acceptable to the Consultant/ Engineer-in-Charge.

CABLE TERMINATIONS
Separate cable compartment with doors having bolted cover plates shall be provided to facilitate cable termination to individual units. The design shall ensure generous availability of space for easy installation and maintenance of cabling and adequate safety for working in one vertical section without coming into accidental contact with live parts in an adjacent section. The compartments shall have detachable cover plate with gaskets at the bottom of the cable compartment unless specified otherwise. Cable glands and lugs of suitable sizes shall be provided for cable termination. Suitable arrangements shall be provided in the compartment for clamping of the cables.

EARTHING
G.I./copper flats shall run the entire length of the switch board. Two bolted type earthing terminals shall be provided in the board for connecting to the earth grid.

METAL TREATMENT
All steel materials used in the construction of the switch board shall undergo a rigorous rust proofing process comprising alkaline digressing, descaling in dilute sulphuric acid, cold rinsing, recognised phosphating process. Passivating and drying with compressed air in dust free atmosphere. It shall then receive two coats of highly corrosion resistant enamel paint of approved shade.

DISTRIBUTION BOARD
The distribution board shall comply with IS: 2675-1983 and B.S. 214 in all respects.

The distribution board shall be housed in a dust and vermin proof metallic enclosure fabricated from 2mm thick all welded sheet steel suitable for wall / column mounting and complete with a door of rigid construction fitted with dust protecting gasket, and robust fasteners. The enclosure shall have suitable provision for fixing of switch fuse units, fuse fittings and neutral bar on high grade rigid insulating support. The fuse fittings shall be connected by a tinned copper busbar. Each fuse bank shall be provided with a cable socket for the incoming cable. The socket shall be situated centrally and must be covered by an insulating shroud for safety. Phase separation barriers made out of arc resistant materials shall be provided between the fuse banks. All bare current carrying parts shall be protected with a bakelite sheet of 3.5 mm thick to prevent accidental contact.
The distribution board of single phase and neutral type shall be fitted with an earth bar for termination of each continuity conductor of outgoing circuits.

In case of concealed system, the boxes are to be flushed with the wall and the cover shall be made from 5 mm thick opal acrylic sheet or 3 mm thick decorative white top bakelite Electrical switch board cover of Hylam make.

The sheet steel parts shall undergo a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulphuric acid, cold rinsing and a recognised phosphating process. The steel work shall then receive two coats of high corrosion resistant primer paint before final painting by application of synthetic enamel paint.

MINIATURE CIRCUIT BREAKER DISTRIBUTION BOARDS (MCBDB)

SPN MCB DISTRIBUTION BOARDS (SPN MCBDB)

The SPN MCB Distribution Board (SPN MCBDB) shall be housed in rust protected sheet steel enclosure shall be designed to provide protection against ingress to IP42 of IS:2147. This shall also be provided with the add-on acrylic door/ double door (Metallic) when specified. The MCB DB shall be supplied complete with tinned copper busbar of adequate rating and incorporating Isolator; MCB or equivalent RCCB as incomer. MCB’s shall be mounted onto specially designed din channel. The special mounting channel shall permit easy removal - even of - MCB in the middle of the bank without disturbing other MCBs.

The incomer phase shall accept 35 sq.mm cable while the neutral shall accept 16 sq.mm cables. The consumer unit shall have provision of 20 mm/ 25 mm knockouts at top and bottom and two 32mm/ 25 mm knockout on sides facilitates wiring space making for flexibility and convenience of wiring.

TPN MCB DISTRIBUTION BOARD (TPN MCBDB)

The TPN MCB Distribution Board (TPN MCBDB) shall be fabricated from CRCA sheet. This shall be painted in aesthetically appealing two-tone powder coated finish. The TPN DB shall have provision for incorporating isolator, MCB or RCCB as incomer. The busbar shall be integral type single piece busbar (Cu) and coupling links. The MCBs shall be arranged in two vertical banks with switch lever operating in horizontal plane for on-off switching. Specially designed mounting channel for quick shop fitting and easy removal shall be fitted.

The sheet steel enclosure fitted with add-on acrylic door/ double metallic door shall be provided with protection against ingress IP42 or IS:2147. The incomer phase shall accept upto 35 sq.mm cable while the neutral shall accept 16 sq.mm cables.

Two conduit entry plates at top and bottom shall be provided to facilitate drilling conduit holes at site to suit site requirements. The TPN DB shall conform to IS: 8623 for factory built assembly

METER BOARD

Unless otherwise mentioned in the schedule of quantities the Meter Board shall house a kwh meter in a dust and vermin proof metallic enclosure fabricated from 2 mm thick all welded sheet steel suitable for wall mounting. The door shall be secured by fasteners, enabling dust protecting gasket to be compressed easily. The kWh meter shall be of approved make and the same shall be mounted on a rigid insulating support. There must be a viewing aperture on the M.S. door covered with a 2mm thick clear acrylic sheet for easy meter reading and it shall be possible to seal the enclosure against unauthorised opening.

The sheet steel enclosure shall undergo rust proofing process and painting as specified in Part-B.
FUSE CUT OUTS
The fuse cut outs shall be totally enclosed, metal clad suitably for mounting on flat vertical surface and shall be provided with a screwed top cover. It shall be possible to seal the enclosure against unauthorised opening.

PUSH BUTTONS AND CONTROL SWITCHES
All push button switches shall be of sturdy design suitable for all types of control circuit. Unit construction shall be adopted so as to have any desired arrangement of contact.

Control and selector switches shall be of sturdy design with modular construction comprising rotary type switch with pistol grip or twist type operating handle and a number of switching elements operated by a single shaft and shall have suitable position indicator to show that the switch is in selected position.

The push button and control switch shall be of approved make.

CONTACTOR UNITS
The contactor unit shall comply with IS:2959 in all respects.

The main contactor unit shall be of robust in design having double break bounce free type contacts and pressure type terminal clamps. The contacts shall be made of antiweld silver cadmium oxide. The coil shall be vacuum impregnated, backed with inter-layer paper insulation and finally moulded in hard resin.

The contactor units shall be of approved make.

LIGHTING EQUIPMENT
The luminaires for fluorescent lamps shall be shop assembled, fully wired and suitable for 1 No. 4 ft. tube or 2 Nos. 4 ft. tubes as the case may be. The salient features of these luminaires are basic channels/rails, 240 volt ballasts with copper winding wire, spring loaded bi-pin type lamp holders, glow type starters and condensers. Reflectors and/or decorative covers shall be supplied as specified in the Schedule of Quantities.

The luminaires for incandescent lamps shall be as specified in the schedule of quantities and approved by the Engineer-in-Charge before the same is used.

The incandescent Bulkhead type fittings shall be of cast aluminium alloy body, finished by application of synthetic enamelled silver grey paint outside, white insides, with front glass, wire guard, tropicalised gasket, B.C. Lamp holder and suitable for use with 100 Watt G.L.S. Lamp. The fittings shall have tapped 19mm E.T. for conduit entry.

The Highbay luminaires for sodium/mercury vapour/metal halide lamps shall be integral type unit having a spun aluminium canister at the top for housing control gear, terminal block for the incoming supply, earthing terminal and suspension arrangement. The luminaire shall have reflectors of spun anodized aluminium with a secular finish and suitable for use with 150/250/400 watt HPSV/HPMV lamp as the case may be.

The Post-top lantern type luminaires shall have a die-cast aluminium electrical unit/housing with provision for pipe entry from below, a canopy made of spun aluminium and an opal white acrylic diffuser resistant to ultraviolet radiation and heat. The luminaire shall be rain proof, insect tight and fully wired upto the terminal block and suitable for use with 70/80/125 watt HPMV or 100 watt GLS Lamp as specified in the schedule of quantities.

The flood lighting luminaires shall have a rugged construction housing made of cast aluminium alloy of low copper content for corrosion resistant, highly polished and anodised aluminium reflector for beam control, a heat resistant front glass with gasket and terminal block. To
facilitate aiming and fixing, bracket shall be provided on the housing. The luminaire shall be rain proof, and suitable for use with 1000 W tungsten halogen lamp or 250 / 400 Watt HPSV lamp/ metal halide lamp as specified in the schedule of quantities.

The ballasts for fluorescent tube shall conform to IS: 1534 & IS:1534(Part-I) 1977 and the same for high intensity discharge lamps shall conform to IS:6616-1982 and these shall have high grade synthetic enamelled copper winding wires, quality grade insulation materials, good quality low hysteresis loses electrical stampings, and complete unit shall have polyester filling. The ballasts shall be suitable for use on single phase 240 Volts 50 Hz. A.C. system and of approved make.

The capacitors shall comply with IS: 1569-1976 and be of hermetically sealed type.

EXHAUST FANS

The Exhaust fans shall conform to IS:2312-1967 and suitable for operation on 230/240 Volt single phase. 50 Hz. A.C. system. The fans shall be ring mounted type designed to give maximum air volume changes under free air flow conditions.

SOCKET OUTLET AND PLUG

These shall be of 3 pin type and of rating 6 amps (for light) and 16 amps. (for power). Each socket outlet shall be complete with controlling switch and plug top. Protective fuse links shall be provided with 16 amps. power socket outlet. The socket outlets shall have piano-key type switches of approved make and acceptable to the Engineer-in-Charge. The socket outlet and plug shall comply with the relevant I.S. specifications.

TUBULAR POLE/G.I. PIPE POLES

Where tubular steel pole are specified (either swaged or stepped), the same should be manufactured and supplied as per I.S. 2713 part I to III - 1980. Where G.I. pipe pole are specified the same should be approved to I.S.

LOOP-IN JUNCTION BOX

The junction boxes shall be drip proof type dust and vermin proof construction fabricated from 2mm thick sheet steel having internal dimensions of 200 x 150 x 130mm depth for single phase distribution system and 250 x 200 x 130 mm depth for three phase distribution system. These shall have moulded Bakelite base connector block with anti-vibration nickel plated brass terminals of suitable size and rating and porcelain fuse fittings.

MANUFACTURER’S DRAWING

The successful tenderer shall submit for approval General arrangement and dimensioned drawings for Power and Lighting distribution switch board, Motor Control centre, Bus-duct arrangement, Miniature circuit breaker distribution board, Distribution board, Interlocked Switch socket outlets, Clock switch control panel, T P Power Cable junction box and cable rack etc. as required in three sets before commencing manufacture.

WORKMANSHIP AND INSTALLATION WORK

The workmanship shall be of good commercial quality and all supply materials and installation work shall be completed to the full satisfaction of the Engineer-in-Charge.
<table>
<thead>
<tr>
<th>SL. No</th>
<th>Item Description</th>
<th>Nature of Test</th>
<th>Approved Specification</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>L.T. Switch Board, Dist. Board, Power Control Panel, Feeder Board</td>
<td>a. Shop Test</td>
<td>IS: 237</td>
<td>2500V to withstand for 1 min. and clearance and creepage to be check.</td>
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<td></td>
<td></td>
<td>b. Site Test</td>
<td>IS: 5039</td>
<td>Do</td>
</tr>
<tr>
<td>2</td>
<td>A.C.B</td>
<td>a. Shop Test</td>
<td>IS 2516 (Part I &amp; II)1985</td>
<td>Shop test to be witnessed by NBCC. Test certificate to be produced.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>Do</td>
<td>Operation of the breaker: Operation of protective devices; Indicating lamp to be checked.</td>
</tr>
<tr>
<td>3</td>
<td>MCCB</td>
<td>a. Shop Test</td>
<td>IS: 2516 (Part I &amp; II)1985</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Site Test</td>
<td>Do</td>
<td>Operation of the breakers to be tested.</td>
</tr>
<tr>
<td>4</td>
<td>RCCB</td>
<td>a. Shop Test</td>
<td>IS: 12640</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td>6</td>
<td>Wires/ Cables</td>
<td>a. Shop Test</td>
<td>IS : 694 IS : 1554</td>
<td>Manufacturers Test Certificate to be furnished</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. Diameter of each strand of wires/ cables</td>
<td>IS: 8130</td>
<td>Diameter to be measured at site before use to confirm the correctness of the wire/ cables.</td>
</tr>
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<td></td>
<td></td>
<td>c. Overall diameter</td>
<td>IS: 694 IS: 1554</td>
<td>Do</td>
</tr>
<tr>
<td></td>
<td></td>
<td>d. Resistance</td>
<td>IS: 8730</td>
<td>Resistance of 100M of wires/cables to be measured.</td>
</tr>
<tr>
<td>7</td>
<td>Conduit Thickness</td>
<td></td>
<td>IS: 9537</td>
<td>Only ISI marked conduit to be used.</td>
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<tr>
<td>8</td>
<td>Earthing Earth Electrode Resistance.</td>
<td></td>
<td>IS: 3043-1978</td>
<td>Resistance to be measured.</td>
</tr>
</tbody>
</table>
SECTION-1 HYDRANT SYSTEM

GENERAL SPECIFICATION

INTRODUCTION
The complete fire safety system for CENTRE FOR RAILWAY RESEARCH, OF INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR, comprising of fire suppression (Hydrant, Wet riser system, sprinkler system), Addressable Fire Alarm System, Portable Extinguishers etc..

DESIGN CRITERIA
Fire protection system has been designed to meet the requirement / norms as laid down in provisional NOC from West Bengal Fire Service Department. Apart from the above, guidelines of Indian Standards rules have been considered in design from the point of good engineering.

For Sprinkler System to be provided, the design basis has been adopted as per the recommendation of applicable of TAC rule.

Portable fire Extinguishers have been envisaged for the overall complex for manual fighting against any outbreak of fire during the incipient stage.

DESIGN BASIS

The system has been envisaged with pumps and pipeline for yard hydrant, wet riser & Sprinkler System.

Two numbers horizontal centrifugal main fire pump driven by electric motor, one number Jockey Pump shall be provided for the hydrant / wet riser / sprinkler system. One number Electric Motor driven pump of same capacity shall also be provided as common standby. Piping arrangement for the yard hydrant shall be laid in ring mains to facilitate the availability of adequate water at required pressure at all yard hydrant point and at all landing valves of wet riser system. Isolation is to be provided to ensure availability of the water supply as required near location of fire.

STANDARD / CODES

IS : 3844 1984 : Code of practice for installation of Internal fire Hydrants in multistoried building

National Building Code : NBC Part - IV


SYSTEM DESCRIPTION / WRITE UP

The proposed systems comprise of the following:

i) Hydrant / Wet Riser System

ii) Sprinkler System

iii) Portable Fire Extinguisher

iv) Analog Addressable Fire Alarm System

HYDRANT / WET RISER & SPRINKLER SYSTEM

The Hydrant system shall basically consist of network pipes covering the complex. The layout is such that water can flow to each hydrant through at least two independent paths from the pump header so that supply can be ensured even if one pipe section in cut off for maintenance. Suitable isolating valves have been envisaged to isolate a damaged section of piping to facilitate maintenance work.
In the event of a fire, the outdoor hydrant / landing valve at staircases nearest to the seat of fire shall be opened and the resulting fall in header pressure shall start AC motor driven fire water pump through pressure switch automatically to ensure a continuous supply of water till satisfactory operation of fire fighting.

In case of failure of motor driven main fire pump owing to any reason, the standby fire pump shall come into operation automatically by actuation through another pressure switch. In addition to automatically starting of the pump sets, provision shall be kept for manual starting as well. However stopping of all the fire pump sets shall only be manual.

The Hydrant valves located in the yard shall be provided with hydrant accessories like hose, branch pipes and nozzle to be kept inside hose boxes located in the yard. For internal hydrant at staircases, such accessories shall be housed in hose boxes with glass fronts, located alongside each landing valve.

Centralized pumping has been provided to feed the various external / internal hydrants and hose reels.

For meeting the water requirement for hydrant / wet riser & Sprinkler System, there shall be Two (2) horizontal centrifugal electric motor driven pumps for wet riser/ hydrant system and Sprinkler System. Another pump driven by Electric Motor, having same capacity has been provided to act as common stand by pump. The system is also provided with one (1) no electric motor driven common jockey Pump set to maintain constant pressure in the supply header. The capacity of fire pump (Hydrant, Sprinkler & standby pump) shall be 2850 liters / Min at a total dynamic head of 80M (approx). The capacity of Jockey pump shall be 180 liters. / Min at a total dynamic head of 80M (approx).

PRESSURISATION SYSTEM

The water in the main header for hydrant / wet riser system up to the hydrant valves and Sprinkler System up to QB Sprinkler shall be kept pressurized by the pressurization system.

The pressurization system shall consist of one (1) no. Jockey pump in each loop. The Jockey pump is connected to the main hydrant header through isolation and non return valve. The Jockey pump will maintain the working pressure in the header by making up for any loss due to leakage in the system. The operation of Jockey pump shall be controlled by pressure switch fitted on the main header.

In case of any water leakage in the system, there shall be a pressure drop in the system. When the pressure reaches a predetermined value the Jockey pump shall come in to operation automatically through the actuation of the pressure switch. The Jockey pump shall continue to run till water pressure reaches the preset level where it actuates another pressure switch to stop the Jockey pump automatically. There shall also be a provision to start the Jockey pump manually. An Electrical interlocking arrangements shall be provided in the system to avoid parallel operation of both the fire pump and Jockey pump at a time and the Jockey Pump shall be stopped automatically when the fire pump comes into operation.

PORTABLE FIRE EXTINGUISHER

A number of portable type fire extinguishers shall be provided in the complex at strategic location / staircases to arrest small fires at their incipient stage. Based on the class of fire the following type of extinguisher are proposed to be installed a suitable location in the respective areas.

a) Water expelled type extinguishers 9 liters. Capacity as per IS: 15683.
b) Dry chemical powder extinguishers 5 kg. Capacity as per IS: 15683
c) Carbon di – oxide type extinguishers 4.5 kg capacity as per IS: 15683
d) Foam type extinguisher 9 liters. Capacity as per IS: 15683
e) ABC Powder Type Extinguisher 6 kgs Capacity as per IS: 15683
All extinguishers shall be provided with initial fill, mounting and accessories, brackets, nut bolts, nozzle etc.

CONTROL PHILOSOPHY

HYDRANT SYSTEM:

In the event of fire taking place, when the hydrant valves are opened in any part of the network the resulted fall in header pressure shall activate the start (star – Delta) controlling the automatic starting equipment of the electric motor driven pumping set, thus bringing the electric motor driven pump into operation automatically to supply water to the hydrant / wet riser system & Sprinkler System.

On failure to start the pump on demand or on further fall in header pressure the standby pump set shall automatically start to supply water to the system.

The stopping of these pump sets shall only be manual. Provision shall also be kept for manual starting / testing of all fire water pumps through push – button switches to be provided in the panel for which individual selector switch shall be provided for changing over from auto – to – manual and vice – versa.

INTERLOCKING

Jockey Pump shall not start / shall trip when main pump comes into operation.

ANNUNCIATION AT MAIN PANEL / MCC

1. Power line healthy
2. Fire Hydrant pump on / off
3. Standby pump On / Off
4. Jockey Pump On / Off

SCOPE OF WORK:

The scope of work under this part of specification is briefly given below and is detailed in the subsequent paragraphs of this part and other sections of specifications.

All system, equipment and works covered under this specification shall comply with all currently applicable status, regulations and safety codes in the locality where the equipment will be installed. All the equipment shall comply in all respects with the requirements of the latest edition of codes and standards. All items should have ISI /UL/FM certification mark as applicable.

Co-ordination with local fire authority and obtaining final N.O.C from the Authority.

Supply transport and delivery to site of fire pumps such as Sprinkler, Main Fire, Jockey and Standby pump along with base frame, coupling, coupling guard and together with their respective prime movers.

Supply, transport, delivery to site and fabrication of suction and discharge piping, distribution header along with isolation valves, check valves, strainers, instruments, such as pressure gauges, pressure switches, hardware such as, bolts, nuts, gaskets, supporting steel as required.

Supply, transport, and delivery to site of hydrants, orifices, landing valves, hoses, couplings, hose nozzles, hose boxes/cabinets etc.

All electrical work including supply, transport and delivery to site of Motor Control Center (MCC) with main incoming/outgoing MCCB and all power and control cabling, controls, instruments, earthing, cable trays between MCC panel and motors, other panels, other components and instruments etc. shall be in the scope of contractor. Incoming feeder from sub station to the panel (MCC) will be arranged by the Purchaser.
Erection of the equipment, pipelines, valves, hydrants, instruments, control panel and electrical items to be supplied under scope of this part of the specification. Excavation, Backfilling, RCC/masonry supports for the underground piping, coating and protection of underground piping, waterproof concrete valves chambers, provision of concrete hume pipes for road crossings etc. if required are included under this specification alongwith the supply and erection of required material.

Civil foundations for the pumps shall also be carried out by Fire Fighting contractor in the pump house. Civil work if necessary for completing entire installation such as making valve chambers, making trenches, excavation, backfilling, supports, breaking and making goods of openings required in masonry etc. shall be in the scope of contractor.

Testing of the entire system. Arranging the inspection of statutory bodies and successful commissioning of the entire system. Final painting of above ground piping is also in the scope of contractor.

First fill of grease, lubricants, oil, etc. and also upto handing over of system.

Start-up spares.

Operation and maintenance manual (6 copies)

The scope of work has been broadly specified and is not limited to the above. Any other item as required to complete the system shall be supplied and erected by the contractor. Transport, handling and storage of materials at site are also a part of this contract.

DRAWINGS:

Enclosed project drawings generally indicate the overall site layout for the proposed Complex. Bidder shall study carefully the entire requirement and bring out his deviation or suggestion to satisfactorily complete the total job in all respects. Contractor shall modify the requirements only after consultations with Owner / Architect/ Consultant.

Contractor shall make regular installation drawings / sketches for actual job execution and obtain approval from the owner /Architect/consultant on the same prior to installation.

DESIGN AND PERFORMANCE REQUIREMENTS:

The fire fighting system shall be designed to supply water at a minimum residual pressure of 3.5 kg/cm² at the hydraulically remote hydrant in the system. The system designed and laid shall be the most modern in accordance with the latest practices.

Orifice plates shall be designed and installed as required at the hydrant valves so as to restrict pressure upto 3.5 kg/cm² at any hydrant.

NOTE: The whole installation shall be aesthetically compatible with the building architecture, contractor shall take special precaution to meet this objective.

TESTING AND COMMISSIONING:

Apart from shop tests/ inspection at Manufacturer's work contractor shall test complete system as a whole at site covering:
Visual inspection for defects in various joints.
Visual checks on instrumentation connections
Hydrostatic pressure test at 1.5 times the maximum design pressure (or 1.5 times of Pump shut-off Head whichever is higher)
Holiday test shall be carried out for wrapping & coating of underground pipe as per IS: 10224
Further, vendor shall get the installation cleared/ approved from Local fire Authority.

GENERAL SPECIFICATIONS OF FIRE PROTECTION SYSTEM:

**Drivers:**

**Motors:** Motor shall be rated for 415 V (+10%), 3 phase, 50 Hz (+5%) system (combined variation +/- 10%) and be of squirrel cage totally enclosed fan cooled (TEFC) type with IP 54 protection and class F insulation

Motor shall be epoxy painted with approved colour shade.

Motor shall meet the duty requirement of the fire water pump and its overall performance shall comply with the requirements of IS: 325.

**Pumps:**

The pumps shall be horizontal centrifugal type with CI casing as per IS: 210, GR FG 260 and complete with base frame. Main Pump rated speed shall be 2900 RPM or as specified in BOQ.

The impeller material shall be bronze IS. 318 LT B 2

The shaft and shaft sleeve shall be of SS AISI - 410 materials.

The Pump shall have capacity to operate at 150% of Design capacity at which the developed head shall be not less than 65% of the duty head. The pump shut off head shall not be more than 120% of design duty head.

**Pipes & Fittings:**

Pipes shall be of the following specifications.

Upto & including 150 mm dia IS: 1239 Part I, M.S. ‘C’ class pipe with welded joints.

Fittings shall conform to IS 1239 dimensions butt welding type. Thickness shall be the same as per the corresponding pipes. Bolts and Nuts for the piping shall be ISI 367 - Cl. 4.6/4.

The carbon steel slip-on plate flanges shall be used only where necessary to install flanged valves or other flanged accessories. Flanges should be as per IS: 6392 of required.

Pressure rating IS: 226 plate shall be used for thickness upto 18 mm and IS: 2062 plate shall be used for higher thickness.

Branch pipe shall confirm to IS: 903 and shall be of 63 mm size in stainless steel having instantaneous type inlet and outlet nozzle.

The hose shall be of Reinforced Rubber Lined type as per I.S.636 and shall be with male and female couplings.
Valves & Fittings:

The Gate Valves shall be non rising stem type and flanged type and IS /UL/FM certified having class PN-1.6
The gaskets shall be of soft rubber as per IS : 638 class I.

Oblique hydrants with outlet angled towards ground shall be used. The hydrant couplings shall be of the instantaneous spring lock (female) type of 63 mm dia and valves shall be of screw down type.

Hydrant valves shall conform to IS: 5290 Type A and shall be of make approved by TAC. The body and trim shall be of stainless steel . Matching flanges are required for internal hydrants. The supply of bolts, nuts and gaskets is included along with hydrant valves.

The check valves of size 65 mm NB and larger shall be of C.I. flanged type and IS/UL/FM CERTIFIED. The check valves of size 50 mm NB and smaller shall be of Bronze screwed type and conforming to IS - 778 CI.2

Hose Boxes:
The hose boxes shall be of wall mounted type and shall be fabricated from 18 gauge MS sheet with glass panel front doors. The size of the hose box shall be approx 750 mm x 600 mm x 250 mm

Piping Work:

Suction and discharge piping: It shall include suction and discharge mains including accessories like sluice valves, non return valves, test main with valve and pressure gauge of 100mm dial gauge. The instrumentation of the pumps will be as shown in the flow diagram and as described in the subsequent clauses of this specification.

Above ground System:

The entire above ground piping shall be painted after cleaning by wire brushing, by two coats of red oxide primer and two finish coats of synthetic enamel paint
Steel pipe supports: Clamps, hangers, U-bolts, steel brackets etc required for supporting above ground pipes shall be supplied without any extra cost. The grouting of pipe supports (above ground) is included under this specification. Mains above ground shall be adequately supported at regular intervals not exceeding 3.5 m.

HOSE PIPE

All hose shall be of 63 mm diameter rubber lined woven jacketed complying with type A (Reinforced Rubber Lined) as per IS : 636.
The hose should be fitted with instantaneous spring lock type ISI Marked coupling (stainless steel) at both ends. Hose shall be fixed to the coupling ends by copper rivets and the joints shall be reinforced by 1.5 mm galvanized mild steel wire and leather bands.
Hose should be capable of withstanding a internal pressure not less than 35 kg / cm² without bursting. It should also withstand a pressure of 21 Kg. / cm² without leakage.

HOSE REEL

Hose reel should be swinging wall mounted type. complete with M.S.wall bracket,. G.M. swivel joint, M.S.side reel, M.S.supporting bracket, M.S.Pipe, G.M.shut of nozzle of 6 mm Bore, high pressure rubber tube stop valve & to be painted with two coats of red enamel paint over a coat of primer
BRANCH PIPE AND NOZZLE:

Branch pipe shall be gun metal to fit into the instantaneous coupling. Nozzle shall be Diameter of not less than 20mm. Branch pipe & Nozzle shall be of instantaneous pattern Conforming to IS: 903.

WELDED JOINTS :

In general pipes having size over 50 mm dia shall be joined by but welding. Pipes having 40m dia or less shall be joined by socket welding. The joints must be perfectly water tight without using any sealing compound. Flange joints shall be used for connections to vessels, equipment flange valves and also on suitable straight length of pipe line at strategic points to facilitate erection and subsequent maintenance work.

Before welding, the ends shall be cleaned by wire brushing, filing or grinding. Each weld run shall be cleaned of slag before the next run is deposited. Welding shall be done by certified welders only. Welding at any joint shall be uninterrupted. If this cannot be followed for some reason, the weld shall be done by manual oxy – acetylene or manual shielded metal arc process with approval of consultant / employer. Socket weld joint shall be done with low hydrogen type covered electrodes with manual shielded metal are process. Welding should be done in down hand position. Combination welding process to age of electrodes of different classes or make in a particular joint shall be done only after the welding procedure has been duly approved the consultant / Client. No backing ring shall be used in circumferential but weld.

Defective welds shall be removed and a portion of the pipe shall be cut off if required prior to the welding of joints.

Electrode size for tack welding shall be selected depending upon the root opening tacks shall be equally spaced as follows :

For 65 mm dia NB and smaller pipes  
2 Tacks

For 80 mm dia NB to 300 mm dia NB pipes  
4 Tacks

Root shall be made with respective / filler wires. The size of the electrodes shall not be greater than 3.25 mm (10 SWG) and should preferably acetylene welding recommended. The root of but joints shall be such as to achieve full penetration with the complete fusion of root edges. At least two runs shall be made on socket or other fitting welded joints.
SECTION-2 SPRINKLER SYSTEM:

Scope :

Scope of work under this section comprises of furnishing all labour, material, equipment and appliances necessary and required to install/ modify Automatic Sprinkler System as required by the drawings, specified herein or as given in the schedule of quantities.

Without restricting to the generality of foregoing, the sprinkler system shall include the following:

Mild steel (heavy class) main sprinkler distribution piping complete with fittings, flanges, supports, hangers all required accessories and appurtenances.

Installation of control valves, Drain valve, Test valve and all connecting pipes and fittings.

Sprinkler heads

Connections to risers and appliances.

General Requirements

All materials shall be confirming to specifications and subject to the approval of the Owner/Consultants.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in neat workman like manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shaft, passages etc.

Pipes shall be securely fixed to brick/ RCC walls and ceilings by suitable steel clamps at intervals specified and to the satisfaction of Owner/Consultant. Only approved type of anchor fasteners shall be used.

No additional payment shall be made for cutting holes or chases in walls or floors or columns and making good the same to the satisfaction of Owner/Consultant and making connections to pumps, various equipment and appliances to complete the work.

Pipes and fittings shall be fixed truly vertical or in slopes as required in a neat and workmanlike manner, the installation being free of leakages.

Pipes and Fittings

Pipes for header shall be Mild Steel confirming to IS:1239 (heavy class) and shall have flanged/ welded joints.

Pipes for sprinkler system network shall be mild steel confirming to IS:1239 (heavy class) with screwed/welded joints.

Fittings for steel pipes shall be of heavy class forged steel fitting of socket/butt weld construction be used.

Pipe Protection
All pipes above ground & in exposed locations shall be painted with one coat of red oxide primer & two or more coats of synthetic enamel paint of approved make & shade.

All underground M.S. Pipes must be protected with anticorrosive treatment as per IS:10221 to the satisfaction of Owner/Consultant.

Pipe Supports

All pipes shall be adequately supported at an approved interval from ceiling or walls and from existing inserts if available, by structural clamps/hangers fabricated from M.S. structural e.g. rods, channels, angles and flats to the prior approval of Consultant. All clamps shall be painted with one coat of red lead and two coats of black enamel paint of approved quality. Where existing inserts are not available, the contractor shall provide anchor fasteners.

Pipes shall be measured by linear meter and shall include all fittings, flanges, jointing, clamps, hangers, and all other material necessary and required whether specified or not to complete the system including painting, testing and commissioning.

Sluice Valves & Non-Return Valves

Sluice valves 80mm dia. and above shall be of Double flanged type with non rising spindle. Sluice valves below ground shall be provided with caps suitable for operations by a key. Sluice Valves in exposed locations e.g. pump house etc. shall be provided with Cast Iron Wheels. Sluice valves shall be IS/UL/FM certified class PN-1.6 and tested to 20 kg/sqcm. Pressure. Non-return valves shall be of IS/UL/FM certified.

Valves on M.S. Pipes 65mm and below shall be heavy pattern gun-metal valves (with cast iron wheel) tested to 20kg/sq.cm. Pressure. Valves shall confirm to and marked IS:778.

Valves shall be measured by numbers and shall include matching flanges, rubber gaskets, bolts, nuts, washers and all items necessary and required and as given in the specifications to complete the work to the satisfaction of Owner/Consultant.

Globe Valves

The contractor shall provide 15mm dia. Gun-Metal Globe Valve with G.I. pipe as per IS:1239 heavy class for testing and draining any water in the system in low pockets wherever required. This item shall be measured by numbers and shall include 15mm dia. globe valve, 15mm dia. G.I. pipe (max. 6M length), fittings, tees, elbows, unions, supports, hangers and all other items necessary and required to complete the work.

Sprinkler Heads

Sprinkler heads shall be provided at appropriate spacing to cover 14 sq.m. (maximum) per sprinkler head. The spacing shall however be in conformity with Section 1.0 'General Description' the drawings and properly co-ordinated with electrical fixtures and air-conditioning ducts, diffusers and grills and other ceiling services. The detailed layout drawings for sprinkler system shall be prepared by Contractor and submitted to Owner/Consultant for approval before starting the work.

Sprinkler heads shall be of gun-metal quartzoid bulb type with a temperature rating of 68 degree C. Sprinkler head shall be of type and make approved by the Consultant. The inlet shall be
screwed for 15mm dia. as specified. The sprinkler head shall have TAC/ FOC/ UL/ FM approval or listing & shall generally conform to IS:9972.

The Sprinkler heads installed in the system shall be measured by numbers.

Installation Control Valve

Installation Control Valve for Sprinkler system shall consist of a vertical alarm valve complete with 50mm dia. drain & 15mm test valve with a provision to install water operated turbine alarm. A butterfly Valve shall be provided on upstream of alarm valve,. The size of alarm valve & butterfly valve shall be as indicated in BOQ.

One water operated turbine alarm motor with gong to be provided for each sprinkler installation control valve on the sprinkler main. The alarm shall operate and sound a gong on the drop of pressure and flow of water in the mains. Turbine alarm shall be approved by the Consultant and installed at approved locations. The alarm shall be provided with suitable test cock. Both alarm valve and turbine alarm must have TAC/ FOC/ UL/ FM approval/ listing.

Installation Control valve shall be measured by numbers and shall include upstream C.I. Sluice Valve, Alarm Valve, Alarm Motor and gong, Drain Valve, Test Valve, Drain piping (50 mm dia G.I. upto 5 M) and all fittings including 2 Nos. pressure gauges required to complete the work.

Testing

All piping in the system shall be tested in the presence of Owner/ Consultant to a hydrostatic pressure of 14 Kg/sq.cm. or twice the design pressure (whichever is higher) without any drop in pressure for at least 2 Hours and thereafter the entire system shall be hydraulically tested at 3.5 Kg/cm² above the pump shut-off pressure or 12 Kg/cm² (whichever is higher) for 24 hours without any drop in pressure.

Contractor shall rectify leakage, if any, and replace all defective components and retest the system as per above requirements to the satisfaction of and Owner/ Consultant.

If required by Consultant, at least 10% of all the welded joints shall be radio graphically tested by the contractor and half the joints radio graphed shall be field joints. It will be contractor’s responsibility to arrange radiography.
SECTION-3 CONTROL CABINET (MOTOR CONTROL CENTER):

It shall comply with general requirements covered under relevant IS codes.

It shall be suitable for start / stop/ control of fire water pump through selection switches.

It shall have two sources of 415 V, 3 phase, 50 Hz incoming supply arrangement with necessary MCCB, DOL/ Star – Delta starters for pumps, meters, lamps etc as per requirements.

The panel shall be fabricated from 14 G / 16 G sheet steel compartments and shall be painted with epoxy primer and finished coat of suitable shade.

Cabling shall be done from bottom side with Al - PVC armoured Power Cables and Cu - PVC - A armoured control cables.

This specification covers the design, material, construction features, manufacture, inspection and testing at the contractor’s, Sub-contractors works, delivery to site and performance testing of control cabinets upto 415 V associated with various system.

Codes and Standards:

The design, material, construction, manufacture, inspection testing and performance of control cabinets shall comply with all currently applicable statues, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable Indian Standards.

Supply items which are bought out by the contractor shall be procured from approved manufacturers acceptable to the purchaser /Consultant.

Construction Features:

Control cabinets shall be sheet steel enclosed and shall be dust, weather and vermin proof providing a degree of protection of IP 52 for indoor use. Sheet steel used shall be cold rolled and at least 2.0 mm thick and properly braced to prevent wobbling.

Control cabinets shall be provided with hinged door (s) with padlocking arrangement and suitable brackets / channels shall be suitable provided for the type of mounting required at site.

All doors, removable covers and plates shall be gasketed all around with neoprene gaskets. All accessible live connections shall be shrouded and it shall be possible to change individual fuses, switches, without danger of contact with live metal.

All live parts shall be provided with at least phase to phase and phase to earth clearance in air of 25 mm and 20 mm respectively.

Adequate interior cabling space and suitable removable cable gland plate shall be provided. Necessary number of compression type cable glands shall be supplied and fitted on to this gland plate. Cable glands shall be screwed on type and made of brass.

Two earthing terminals shall be provided to suit the Client’s earthing conductor.

All sheet steel work shall be degreased, pickled and then applied two coats of zinc chromate primer and two coats of finishing synthetic enamel paint, both inside, of colour as specified. Epoxy paints shall be used.
Main Busbars:

Busbars shall be insulated and of copper alloy of 99.95% purity and shall have adequate cross section to carry the required continuous currents such that the operating temperature of the busbars does not exceed 8.5 degree C.

Motor Feeders:

Each motor to be controlled from the control cabinet shall be provided with 3 pole / 2 pole MCCB, contactors with thermal overload relays and other equipment required for satisfactory control of motor. When schematic drawing / bill of material is enclosed all equipment shown shall be supplied by the Vendor. The isolating switch and contactor shall be rated at least 20% more than the connected motor full load current.

Unless otherwise specified motors rated 0.5 K.W and above being controlled from the control cabinet will be rated for 415 V, 3 Phase, 50 Hz and motors rated below 0.5 kW will be 240 V, 1 phase, 50 Hz.

4.1. Switches:

Switches shall be hand operated, air break, heavy duty, quick break type conforming to applicable standards.

The rating of switch shall be so chosen as to get complete protection by associated O/L relay or fuse under all normal / abnormal conditions such as full load, overload, locked rotor, short circuit etc. MCCB’s shall be provided with standard overload short - circuit protective device.

Contactors:

Contactor type motor starters shall be of the full voltage, direct-on-line, air break, single throw, electro-magnetic type unless otherwise specified. Automatic star delta type starters shall be provided when specified.

Contactor shall be provided with at least 2 NO and 2 NC auxiliary contacts.

Contactors shall be provided with a three element, positive acting, ambient temperature compensated time lagged, hand reset type thermal overload relay with adjustable settings to suit the rated motor current.

4.2. Fuses:

Fuses shall be generally of the HRC cartridge link type, mounted on plug-in type of fuse bases having a reputed capacity of 50 KA

Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded, and it shall be possible to change fuses with the circuit alive, without danger of contact with live metal.

4.3. Instrument Transformer:

Current and voltage transformers when used shall be dry type. Unless otherwise specified, it shall be the responsibility of the vendor to ensure that the class and VA burdens of the instrument transformers provided are adequate for the relays and meters connected to them. Facilities shall be provided for short circuiting and grounding the CT secondary at the terminal blocks. Test links shall be provided in the CT secondary leads to carryout current and phase angle measurement tests with CTs in service. Voltage transformers shall be provided with suitably rated primary and secondary fuses. The details of the instrument transformer are subject to the Client's approval.

4.4. Control & Auxiliary Power Supply:
All control equipment shall be suitable for operation on 240V AC, 1 phase, 50Hz system. This supply may be obtained from phase and neutral when 4 wire 415V main supply is available. Otherwise, or when control voltage, other than 240V is specified, a suitable transformer shall be provided by the vendor. The control transformer shall be complete with isolation facilities and primary and secondary HRC fuses.

Separate circuits with switches, fuses etc. of adequate rating shall be provided for control of space heater, lighting etc.

4.5. Relays:

Necessary auxiliary relays for alarm, time-delay relays, voltage relays as required for control and protection shall be mounted inside the cabinet. Relays shall be equipped with externally reset, positive action operation indicator. Voltage relays shall have sufficient thermal capacity for continuous energisation, using external resistors, if necessary.

Auxiliary relays shall be rated to operate satisfactorily between 80% and 110% of the rated voltage.

Each relay shall be provided with atleast two potential free contacts for the Client’s use.

Make and type of relay shall be subject to the Client’s approval.

4.6. Control & Selector Switches:

Control and selector switches shall be of the rotary type provided with properly designated escutcheon plates clearly marked to show the operating positions. Control switches shall have momentary contacts, spring return to centre with pistol grip handle. Selector switches shall have stay put contacts with oval handles. The number of contacts and their operation in each switch shall be as indicated in control schematic (when enclosed) or shall be as per the requirements of the connected circuit. The switches shall be rated for minimum 10A at 240 V A.C. and 1A inductive break at 220V D.C.

4.7. Push Buttons:

All push buttons shall be of push to actuate type having 2 “NO” and 2 “NC” self reset contacts. They shall be provided with integral escutcheon plates, engraved with their functions. Push buttons contact shall be rated for 10 Amps at 240 V A.C. and 1 Amp inductive breaking at 220 D.C.

4.8. Indicating Lamps:

Indicating lamps shall be of the filament type with low watt consumption. Lamps shall be provided with series resistors. thermostat to cut off the heaters at 45 C

4.9. Cabinet Internal Wiring:

Control cabinets shall be supplied completely wired, ready for the Client’s external connections at the terminal blocks. All wiring shall be carried out with 650 V grade, colour coded PVC insulated, stranded conductors. Power circuits shall be wired with stranded aluminium conductors of adequate size to suit the rated circuit the minimum size shall be 2.5 sq.mm. Control, alarm and indication circuits shall be wired with stranded copper conductors of sizes not smaller than 1.5 sq.mm. C.T. circuits shall be wired with stranded copper conductor of size not smaller than 2.5 sq.mm.
Engraved identification ferrules marked to correspond with the wiring diagram shall be fitted at both ends of each wire. All wiring shall be terminated on terminal blocks. Terminals shall be adequately rated for the circuit current, the minimum rating shall be 20A.

4.10. **Labels and Diagram Plate:**

Every equipment mounted in the cabinet shall be provided with the individual labels with equipment designation / rating. Also the cabinet shall be provided on the front with the designation of the cabinet as furnished by the Client

Inside of the door a circuit diagram engraved on non rusting metal / PVC shall be fixed for reference.

4.11. **Drawings and Data:**

As part of the proposal, the BIDDER shall furnish the following drawings and data for scrutiny.

- Control cabinet general arrangement drawing showing dimensioned views, cable, entry location and mounting details.
- Schematic wiring diagram of the control cabinet.
- Bill of material listing equipment designation, make type, ratings etc of the various equipment mounted on the control cabinet.

4.12. **Tests & Test Reports:**

Acceptance and routine tests for all supply equipment /component parts shall be carried out as per the relevant standards of the respective equipment. These test reports and available type test reports shall be submitted to the PURCHASER before dispatch of the equipment.

Control cabinet shall be subjected to following tests:

1. High voltage test (2000 volts for 1 minute)
2. Meager test
3. Electrical control, interlock and sequential operation tests

4.26 **PERFORMANCE TESTS AND GUARANTEES:**

a. The test will essentially include the following:

b. Shop tests of all equipments like pumps, motors, diesel engine, piping, valves & specialties, electrical panels, controls and instrumentation, fire extinguishers etc shall be conducted as per requirements stipulated in this, specification and as per applicable codes / standards.

c. All test certificates and reports shall be submitted to the PURCHASER / CONSULTANT for approval.

d. The completed piping shall be hydraulically tested at 1.5 times the design pressure or shut - off head of pumps whichever is higher. Wrapping and coating of weld joints for under ground piping shall be done after this testing.

e. The contractor shall guarantee the satisfactory performance of all equipment, material of construction and workmanship for a period of 12 months from the date of handing over after commissioning and satisfactory tests NOC clearance from WBFES.
### List Of Makes Of Materials

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<tr>
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<th>Description</th>
<th>Manufacturer</th>
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<tbody>
<tr>
<td>1</td>
<td>M.S.Pipes class &quot;C&quot;</td>
<td>TATA/JINDAL</td>
</tr>
<tr>
<td>2</td>
<td>Fittings</td>
<td>R - brand / Shree Krishna engg</td>
</tr>
<tr>
<td>3</td>
<td>NRV</td>
<td>H. Sarkar/ Koley/Hawa</td>
</tr>
<tr>
<td>4</td>
<td>C.I. Sluice Valve</td>
<td>H. Sarkar/Koley/Hawa</td>
</tr>
<tr>
<td>5</td>
<td>Butterfly Valve</td>
<td>Audco/ Crawley &amp; Ray/Weflo</td>
</tr>
<tr>
<td>6</td>
<td>G.M. Hydrant Valve</td>
<td>Fire shield/Asco</td>
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<tr>
<td>7</td>
<td>Fire Brigade Breaching</td>
<td>Fire shield/Ghosh Engg.</td>
</tr>
<tr>
<td>8</td>
<td>Fire Brigade Service Inlet</td>
<td>Fire shield/Ghosh Engg</td>
</tr>
<tr>
<td>9</td>
<td>Fire Pumps</td>
<td>Kirloskar / KSB /Wilo</td>
</tr>
<tr>
<td>10</td>
<td>Extinguisher</td>
<td>Eversafe/ Ceasefire/ Fire shield</td>
</tr>
<tr>
<td>11</td>
<td>Fire Hose</td>
<td>CRC / Fire shield</td>
</tr>
<tr>
<td>12</td>
<td>Hose Reel</td>
<td>Fire shield/Ghosh Engg</td>
</tr>
<tr>
<td>13</td>
<td>Pressure Switches</td>
<td>Danfoss / Switzer</td>
</tr>
<tr>
<td>14</td>
<td>Sprinklers</td>
<td>TYCO/HD fire/ Viking</td>
</tr>
<tr>
<td>15</td>
<td>Flow Switches</td>
<td>Switzer/ Honeywell</td>
</tr>
<tr>
<td>16</td>
<td>Sprinkler Alarm Valve</td>
<td>TYCO/HD fire/ Viking</td>
</tr>
<tr>
<td>17</td>
<td>Pressure Gauges</td>
<td>H Guru/ Fiebig</td>
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A.1 SCOPE OF WORK

A.1.1 These specifications shall cover the Residual Design, Supply, Erection, Testing, and Commissioning of Analog Addressable Fire Alarm Systems.

A.1.2 The work is to be carried out is illustrated in the drawings attached.

A.1.3 The tender drawings indicate only the general scheme of requirement and the extent of work covered in this contract. The equipment and their associated works such as Cabling, etc. may be re-arranged in the space allotted subject to the approval of Engineer-in-charge. It is the Contractor’s responsibility to ensure that his work is coordinated with the work of other agencies.

A.2 SCHEDULE OF REQUIREMENTS

A.2.1 Analog Addressable Fire Alarm System requirements are shown in the tender drawings and described briefly in other chapter of these specifications.

A.2.2 Tenderers are advised that the quantities of detectors and other accessories etc. as given in these specifications are indicative and for tenderers guidance.

A.2.3 It is the intent of these specifications to define a state-of-art integrated Fire Alarm System, which is user friendly, modular, flexible and expandable. The system is to be installed, customised, tested, commissioned and supported by a local office or agent of the manufacturer by manufacturer’s Engineer skilled in providing functional and efficient solutions to the needs of the Engineer in charge of the project.

A.2.4 All system components and sub-systems are to be fault tolerant and provide satisfactory operation without damage at \( \pm 10\% \) of the rated voltage and at \( \pm 3 \) Hz variation in line frequency.

A.3 TECHNICAL DATA

A.3.1 The Tenderer shall submit comprehensive technical information for all the equipment and material.

A.3.2 Technical catalogues of all equipment and machines must be submitted with the offer.

A.4 PERFORMANCE GUARANTEE & TESTING

A.4.1 The Contractor shall execute the work on the basis of indicative designs hereby given and accepted by him with or without modifications or new designs submitted by him at the tender stage and accepted by Engineer in charge, as the case may be. All Variations, i.e. additions, omissions or substitutions necessitated at anytime for any reason whatsoever, shall be deemed to have been accepted by the Contractor as not vitiating the performance based nature of this contract. If any such variations, irrespective of whether such variations are intended to be executed by other agencies employed by the Engineer-in-charge, have any bearing on the performance of this Contract, the same shall immediately be brought to the notice of Engineer-in-charge by the Contractor in writing. In any case the Contractor shall have to guarantee for due and proper performance of the works agreed to be so erected.

A.4.2 The Fire Detection installation shall be designed and guaranteed to perform as indicted in other parts of these specifications and drawings read in conjunction with statutory requirements.

A.4.3 All equipment shall be tested at manufacturer's Works as per latest relevant BIS specifications or in the absence of IS specification approved testing methods shall be followed and Test Certificates/ Reports submitted to the Engineer-in-charge. The contractor shall intimate in advance the probable date of such tests to the Engineer-in-charge to enable their
representatives to witness the tests if they so desire. But under no circumstances shall this absolve the Contractor of his responsibility for Performance of the Equipment or System.

A.4.4 In addition to the above, all equipment and systems shall be tested after installation as required by various statutory authorities, certifying agencies and as required by various sections of these specifications.

A.4.5 The Contractor shall take full responsibility for proper operation of the entire system including debugging and proper calibration of each component and sub-system.

A.4.6 The Contractor shall leave necessary provisions required for fixing instruments, gauges, meters, etc. for testing the installation even if these are not shown on the drawings. All such instruments, services etc. needed for the tests shall be arranged by the Contractor at his own cost.

A.4.7 The Contractor shall intimate in writing to Engineer-in-charge as and when individual components of the installation are ready for tests required for further progress of erection. All such tests shall be carried out as per these specifications and/or as directed by Engineer-in-charge and recorded in the presence of Engineer-in-charge or his authorized representatives.

A.4.8 On completion of erection, the contractor shall thoroughly clean all the equipment, inspect and check the entire installation for correctness and completeness and furnish a detailed report on all components of the installation to Engineer-in-charge.

A.4.9 The Contractor shall intimate in writing to Engineer-in-charge, the proposed date of initial startup.

A.4.10 The Contractor shall, on approval of Engineer-in-charge, proceed with necessary pre-commissioning activities and tests and put the installation initial operation and start-up during which preliminary adjustments and addressing shall be carried out.

A.4.11 Based on preliminary observations during the initial operation described above, necessary modifications/repairs/replacements/etc. if any shall be carried out by the Contractor to the entire satisfaction of Engineer-in-charge. On successful completion of initial operation, the Contractor shall proceed with trial runs.

A.4.12 All equipment shall be capable of performing the duties specified in these specifications without damage, distortion or failure of any component.

A.4.13 All test instruments shall be calibrated for accuracy prior to taking the performance tests.

A.5 CODES & STANDARDS

A.5.1 The Fire Alarm system shall comply with latest requirements of relevant standard

A.5.2 In general the system and all components shall have EN54/VDS/UL/LPCB Approval.

A.6 INSTALLATION:

A.6.1 Installation shall be in accordance with the local and state codes, as shown on the drawings, and as recommended by the equipment manufacturer.

A.6.2 All fire detection and alarm system devices, control panels and remote enunciators shall be flush mounted or surface mounted as per instructions of the Engineer-in-charge.

A.6.3 Manual call boxes shall be suitable for surface mounting or semi-flush mounting and shall be installed at a height of not less than 1,000 mm, or more than 1200 mm above the finished floor level.

A.6.4 At the final inspection, a factory-trained representative of the manufacturer shall demonstrate the major equipment the proper system functions in every respect.

A.7 DEMONSTRATION:
A.7.1 The Contractor shall completely check out, calibrate and test all connected hardware and software to ensure that the system performs in accordance with the approved specifications and sequences of operations.

A.7.2 This demonstration shall consist of the following:

a) Display and demonstrate each type of data entry to show site specific customizing capability.
b) Demonstrate parameter changes.
c) Demonstrate scan, update and alarm responsiveness.

A.8 MANUALS

The following manuals shall be provided at the time of Handing over:

A.8.1 An Operator’s Manual shall contain graphic explanations of keyboard use for all operator functions specified under Operator Training.

A.8.2 Computerized printouts of all data file layouts including all point processing programming details, flowcharts, etc.

A.8.3 On completion of works "As Built" drawings for completed installation shall be prepared by the Contractor and (5) Five copies of the same shall be supplied to the Engineer-in-Charge. In addition, (5) Five sets of all Operation Manuals, Technical Literature for the various components of equipment, Controls and Accessories installed, Recommended Spares and Services Manuals shall be supplied by the Contractor to the Engineer-in-charge.

A.9. TRAINING & HANDING-OVER

A.9.1 All training by the Contractor shall utilize manuals and as-built documentation and the on-line help utility.

A.9.2 Operator training shall include:

a) Sequence of Operation review
b) Sign ON - Sign OFF
c) Selection of all displays and reports
d) Commanding of points, keyboard
e) System initialization
f) Trouble shooting of sensors (determining bad sensors)
g) Password modification

A.9.3 Supervisor training shall include:

a) Password assignment/modification
b) Operator assignment/modification
c) Operator authority assignment/modification
d) Point disable/enable
e) Terminal and data segregation/modification

A.10 GUARANTEE

A.10.1 The contractor shall guarantee the entire Intelligent Addressable Fire Alarm system installation as per specifications both for components and for system as a whole. All equipment shall be guaranteed for One year from the date of handing over to the Client against unsatisfactory performance or breakdown due to defective manufacture and/or installation. The installation shall be covered by the conditions that the whole installation or any part thereof found defective within one years from the date of completion shall be replaced or repaired by the contractor free of charge as decided by the Engineer-in-Charge.

A.10.2 The guarantee shall cover the following:-
a) Quality, strength and performance of materials used.

b) Safe mechanical and electrical stress on all parts under all specified conditions of Operation.

c) Satisfactory operation during the guarantee period.

d) Performance figures and other particulars as specified by the tendered under

A.10.3 Labour to trouble shoot, repair, reprogram or replace system components shall be furnished by the contractor at no charge to the Engineer-in-charge during the guarantee period.

A.10.4 All corrective software modifications made during guarantee period shall be updated on all user documentation.

A.11. MISCELLANEOUS:

A.11.1 The onus of obtaining necessary approval for the fire alarm systems shall rest fully with the Contractor.

A.11.2 The installation shall be carried out using new Equipment/ Materials complying with applicable standards in a workmanship like manner. Engineer-in-charge reserves the right to reject any part of installation having poor workmanship.

A.11.3 All minor Masonry, Carpentry and Civil works such as cutting / opening in Masonry Walls/ Internal Partitions, Chasing on Walls, etc. and making good the same to match existing surface shall be done by the Contractor, wherever asked for by the Engineer-in-charge or his authorized representative. No extra payment shall be made on this account.

CHAPTER B: SYSTEM DESCRIPTION

The work shall comprise entire labour including supervision and all materials necessary to make a complete installation to the entire satisfaction of the department. The term complete installation shall mean, not only major items of equipment covered by these specifications, but also incidental sundry components necessary for complete execution and satisfactory performance of the installation, with all labour charges. The work shall include data entry, programming, start up test and demonstration, training of personnel for maintenance and operation, submission of construction and installation drawings and wiring diagrams, as built documents and system guarantee.

B.1.1 The Contractors’ scope of work shall include all items of work as per these specifications, drawings, terms and conditions of contract etc. and briefly described in schedule of quantities. This shall include, but not be restricted to the following:-

a) Analog Addressable Multi sensor Smoke Detectors

b) Analog Addressable rate of rise cum fixed temp. Thermal Detectors

c) Addressable Manual Call Points (Resetting Type)

d) Microprocessor Based Modular Intelligent Addressable Main Fire Alarm Control Panel for connecting and monitoring the Fire Detectors and other devices.

e) Low /High Intensity Hooters activated from the Panel.

f) Providing suitable compatibility in the Main Fire Alarm Control Panel for the Public Address System, audio Amplifiers, speakers & required wiring.

g) Electrical works, including Cabling, Earthling etc. for the installation.

h) All other works associated with above items as per specifications, drawings and conditions of contract.
B.1.2 Unless otherwise indicated in Schedule of Quantities and drawings, the Contractor’s scope of work will exclude only the following items of work and services, which shall be arranged by client

a) Provisions of adequate AC, single/ three phase, 230/415 V, 50 HZ supply with earthing for
Fire Control Panels etc.

B.2 GENERAL DESCRIPTION OF ADDRESSABLE FIRE ALARM SYSTEM

The project is a Warehouse.

While designing the system, both actual & future requirement (Below false ceiling areas) i.e, the complete area has been considered under Fire Alarm System.

The MCP mainly shall be placed at the entry areas of common places of Gr. & other Floors.

B.2.1 The detectors shall be Addressable detectors.

B.2.2 The number of detectors and location shall confirm to relevant standards. Addressable intelligent Multicriteria detectors shall be used. The detectors shall give the visual and audible alarm at the respective control Panel. The panels shall be located in the ground floor control rooms.

B.2.3 The fire alarm panel shall operate 240V+ 10% 50Hz. The FDAS shall also be provided with a dedicated standby power supply system (battery and charger) capable of maintaining the system for a period of not less than 24 hours after failure of ac power supply after which sufficient battery shall remain to provide full load operation for at least 30 minutes in line with IS 2189.

B.2.4 The FRLS cables shall be used from detectors to the alarm panel confirming to the relevant IS and from reputed manufacture. The system should be able to detect any type of smoke, fire and heat in the respective site area.

B.3. DETAILED DESCRIPTION OF THE SYSTEM COMPONENTS:

BASIS OF DESIGN

An Intelligent Modular/ Expandable Fire Alarm System (FAS) shall be provided to effect total control over the life safety services required in the building.

The system shall be provided with Addressable fire alarm initiating, annunciating and control devices.

The addressable and intelligent system shall be such that smoke sensors, thermal sensors, manual call points, etc., can be identified with point address.

The FAS shall be able to recognize normal and alarm conditions, below normal sensor values that reveal trouble condition, and above normal values that indicate either an alarm condition or the need of maintenance.

Read-out or address an actual detector location. The operator shall also be able to adjust alarm and alarm thresholds and other parameters for the smoke sensors.

Provide a maintenance/pre-alert/fault alarm capability at smoke sensors to prevent the detectors from indicating a false alarm due to dust, dirt etc.

Provide local numeric point address and LED display of device and current condition of the point.

Each detector shall use state-of-the-art Microprocessor Circuitry, detector self-diagnostics and supervision programs.

The detection of the fire shall be taken at the detector level.

Multi-Criteria Detectors shall be offered where by the system logic activation is based on any three inputs from the detector i.e. smoke, fixed heat or rate of rise heat.
Provide outputs that are addressable, i.e. outputs shall have point address. The operator shall be able to command such points manually or assign the points to Logical Point Groups (Software Zones) for pre-programmed operation.

In the event of a fire alarm, but not in a fault condition, the following action shall be performed automatically.

a. The System Alarm LED on the main fire alarm control panel shall flash.

b. A local sounder shall be sounded.

c. The LCD display on the fire alarm control panel shall indicate all information associated with Fire Alarm condition including the type of alarm point and its location within the premises.

d. All system output programs assigned via control-by-event programs that are to be activated by a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

**FIRE ALARM CONTROL PANEL (FACP)**

The Addressable Fire Alarm Control Panel (FACP) shall have its own microprocessor, software and memory. The panel should be modular microprocessor based in nature.

FACP shall supervise detection circuits and shall generate an alarm in case of abnormal conditions.

FACP shall provide general purpose inputs for monitoring such functions as low battery or AC power failure. FACPs shall provide tamper protection and commendable outputs, which can operate relays or logic level devices.

Smoke detectors shall be powered using the FACP-based smoke detection circuits. FACPs shall provide for resetting smoke detectors, fault-isolation and sensor loop operation. It shall be possible to mix different fire devices within the same FACP to optimize field wiring.

It shall be possible for the panel to have a loop length with different modules offering up to 3 km Loop length of devices from the panel.

FACPs shall provide monitoring and control of one floor or area or for multiple floors or areas. FACPs shall meet the following requirements to assure the integrity and reliability of the system:

a. The FACP shall be UL/LPCB listed independently as a fire alarm control panel.

b. The FACP should have integrated power distribution module and fixed cabling done internally to guarantee a clear and tidy cable feed.

c. The panel should have a LCD touch screen Megapixel screen with white background lighting and keypad. The display should enable a flexible design of the operating menu with variable keys and message windows.

d. FACP should have menu Based operation.

e. All materials and components used in the panel are specified as per UL/LPCB/ VDS Certification.

f. The panel should have a 230V AC power supply unit in plug-in design with rack and panel connector is a 24VDC/6A single output power supply. The module should be protected against overvoltage and reverse polarity. The output voltage is monitored and regulated externally.

g. LCD display at the FACP shall be provided to indicate point in alarm or trouble. In such systems, means for manually scanning the points in trouble shall be provided and a trouble and alarm LED shall be used to indicate that there are points in alarm/trouble.

h. It shall be possible to command test, reset and alarm silence from the FACP. FACP should have freely configurable detector zone displays.
i. FACP should have a programmable software timer for automatic switching of day operation mode to night operation mode, switching of mode of operation of automatic multi-criteria fire detectors.
   - FACP one freely programmable key switch with 2 switch positions for code mode, day operation, switch-off and reset

j. Programmable software timer for automatic switching of day operation mode to night operation mode, switching of mode of operation of automatic multi-criteria fire detectors

k. Individual detector and detector zone switch-off

l. Output of stored messages in plain text on touch screen.

m. One freely programmable key switch with 2 switch positions for code mode, day operation, switch-off and reset

n. The FACP shall have Drift Compensation facility to compensate for environment.

o. The display on FACP shall provide indication for AC Power, System Alarm, System Trouble/Security Alarm, Display Trouble and Signal Silence. This would mean that in the event of change of any logic, detector / zone sequence alteration, the operator can initiate these by use of the LCD touch pad & alpha-numeric keys on the FACP panel to reconfigure the above parameters.

DETECTORS & ADDRESSABLE DEVICES

General features common to all detectors:
- Built-in-response indicator: Each detector shall incorporate indicator “LED” at the detector which shall blink in normal condition and glow steady on actuation of the detector to locate the detector which is operated while on fire. The detector shall not be affected by the failure of the response indicator lamp. The Led should be visible from a 360 deg view
- Maintenance: All detectors shall be fitted either with plug-in system or bayonet type connections only, from the maintenance and compatibility point of view.
- Construction: The components of the detectors must not be damaged by static over voltage.

Addressable Optical/Thermal Smoke Detectors
Smoke detectors shall be addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel loops. The detectors shall be ceiling mounted type

Addressable Thermal Detectors
Thermal detectors shall be intelligent and addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel loops.

The detectors shall use an electronic detector to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel.

Addressable Multi Criteria Detectors
Smoke detectors shall be addressable devices, and shall connect with two wires to one of the Fire Alarm Control Panel loops. The detectors shall be ceiling mounted type The main function of the detector is to detect smoke and heat sensing capabilities and when used in a combined mode are more selective to real fire conditions.

The detectors shall provide electronic address-setting by means of configuration software. The area covered by each smoke/heat detector shall be as per EN - 54 guidelines.

Addressable Manual call Stations
Addressable manual stations shall be provided to connect to the Fire Alarm Control Panel loops. The manual stations shall on command from the Control Panel send data to the panel representing the state of the manual station.

Stations shall be suitable for surface mounting.
**Addressable Monitor Modules**
- Programming of the input normal state "open" or "closed" independently selectable for each input
- Pulse contact monitoring for detection of high resistance contacts
- Monitoring of contacts for "open" and "closed" states on lines
- For flush mounting in standard electrical boxes
- Addressing of interface either automatically or via code switch (allowing unique assignment of installation location to address)

**Addressable Control Module**:
- Output should electrically isolated from loop
- Switching of currents and voltages up to 1 A at 30 V DC & Max of 6 A/30 V DC or 10 A at 120 VDC/230V AC/24V DC
- owner supply to interface via two-wire line (line supply)
- Addressing of interface either automatically or via code switch (allowing unique assignment of installation location to address)

**Response Indicators**
Remote Response Indicator shall be installed outside the areas normally kept closed to identify the detectors response even if the room is locked. These indicators shall be able to indicate the status of the corresponding detectors in these areas.

**Installation**
Installation shall be in accordance with the IS 2189, NEC, NFPA 72, EN 54, local and state codes, and as recommended by the major equipment manufacturer.
All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted or surface mounted as per direction given by Engineer In charge
Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting.
Commissioning Procedure shall be carried out in a methodical sequence as follows
Start-up,
Configuration,
Operability adjustment, Stable operation, Final adjustment
The Contractor shall finalize captured FDAS data to be recorded and the manner in which the data is to be taken.

**LIST OF APPROVED MAKE OF MATERIALS**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>DESCRIPTION</th>
<th>MAKE</th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>Detector</td>
<td>Notifier/IAS Morley/Essar</td>
</tr>
<tr>
<td>29.</td>
<td>Cables/Wires</td>
<td>Havells /Finolex/National</td>
</tr>
<tr>
<td>30.</td>
<td>Modules/MCP</td>
<td>Notifier/IAS Morley/Essar</td>
</tr>
</tbody>
</table>

**Note**: Contractor shall seek approval of specific make of equipment out of above options before commencement of work.