ANISO9001&14001COMPANY

TENDERDOCUMENT

TENDER No: NERO/CON/790/362 Dated: 31.10.2019

FOR

Tender for Interior works at Assam Water Centre,
Basistha, Guwahati, Assam

VOLUME–II

NOTICE INVITING e-TENDER

ADDITIONAL CONDITIONS OF CONTRACT

TECHNICAL SPECIFICATIONS

DRAWINGS
Tender for Interior works at Assam Water Centre, Basistha, Guwahati, Assam

Engineering Projects (India) Ltd., invites percentage rate open e-Tenders through e-tendering from the eligible contractors/firms who fulfill the eligibility criteria as per the brief particulars of scope for Interior works at Assam Water Centre, Basistha, Guwahati, Assam in single stage Two Bidding system (Technical bid & Price bid) for the following works:

<table>
<thead>
<tr>
<th>NAME OF WORK</th>
<th>Interior works at Assam Water Centre, Basistha, Guwahati, Assam</th>
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</thead>
<tbody>
<tr>
<td>ESTIMATED COST</td>
<td>Rs. 11,42,03,564.00 (Rupees Eleven Crore Forty Two Lakhs Three Thousand Five Hundred Sixty Four Only)</td>
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<tr>
<td>EARNEST MONEY DEPOSIT (EMD)</td>
<td>Rs. 11,42,036.00 (Rupees Eleven Lakhs Forty Two Thousand Thirty Six Only)</td>
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<tr>
<td>TENDER FEE</td>
<td>Rs. 23,600 /- (Rupees Twenty Three Thousand Six Hundred only) (GST @ 18% included)</td>
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<tr>
<td>COMPLETION PERIOD</td>
<td>05 (Five) Months</td>
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The brief scope of work in this tender shall include (but not limited to) providing all labour materials, tools and plant, transportation to site storage and safe custody of the materials, erection, testing, commissioning all complete such as interior and allied works, Sanitary & plumbing, Electrical, Modular work Station, Furniture’s, LAN, CCTV, Video Conferencing, Fire Fighting, Audio Video System works etc., rectification, maintenance during defect liability period for the project of “Interior works at Assam Water Centre, Basistha, Guwahati, Assam” all complete except those which are specifically mentioned to be excluded elsewhere in tender documents in the buildings mentioned above. Apart from above, any other service not mentioned above but required as per direction of EPI is deemed to be included in the scope of work. The work is to be carried out on percentage rate basis as per bill of quantities and tender conditions. The detailed scope of work is given in tender document.

Time schedule of Tender activities:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Date &amp; Time</th>
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<tbody>
<tr>
<td>Last Date &amp; Time for Downloading of tender documents:</td>
<td>21.11.2019 upto 11:00 am.</td>
</tr>
<tr>
<td>Last Date &amp; Time of submission of Tenders (online and physical documents):</td>
<td>21.11.2019 upto 11:00 am.</td>
</tr>
<tr>
<td>Date &amp; Time of online opening of tenders (Techno-Commercial Bid):</td>
<td>21.11.2019 upto 03.00 pm.</td>
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<tr>
<td>Pre-Bid Meeting (Offline)</td>
<td>11.11.2019 at 03.00 pm.</td>
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</table>

The tenderers shall submit his query for the pre-bid meeting on or before 12.11.2019 by 12.00 hours to nerocontracts@gmail.com or by post to the address given at sl. No. 14 below.

Contractors who fulfill the following requirements are eligible to participate in this tender. The joint ventures/Consortium are not accepted.
a) The bidder must have experience of having satisfactorily completed following “similar works” during the last 7(seven) years ending last day of month previous to the one in which applications are invited.

Three similar works each costing minimum 40% of the estimated cost put to tender

OR

Two similar works each costing minimum 60% of the estimated cost put to tender

OR

One similar work costing minimum 80% of the estimated cost put to tender

i. The “similar works” shall mean works comprising Civil, Electrical and Internal Finishes etc. in Building work. Furniture works, Networking, Audio-Video will be added advantage.

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

iii. 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.

iv. 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 shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company can be considered only if they are supported by TDS certificates in support of value of work done by the tenderer. TDS certificate for full contract value as mentioned in the work order must match failing which the same shall not be considered.

d) Should have had average annual financial turnover of at least 50% of the estimated cost put to tender during the immediate last three consecutive financial years ending on 31.03.2019 duly supported by annual financial report (i.e. audited copies of balance sheet and profit and loss statement) or certified by Chartered Accountant along with Income Tax return for last 03 financial years. Turnover means income from construction works only.

c) Should not have incurred any loss in more than two years during the immediate last five consecutive financial years, ending 31.03.2019, Copies of balance sheet/ Certificate from Chartered Accountant duly self attested by the tenderer shall be submitted.

d) Should have a Solvency of 40% of the estimated cost issued by his bankers in the name of the bidder. The Solvency Certificate should not have been issued earlier than Six Months of last date of submission of the tender.

e) Should have valid Permanent Account Number of Income Tax and GST registration certificate.

f) Should have valid PF Registration number. In case the bidder does not have this registration number, he shall remain bound to obtain them within one month from the date of LOI or before release of 1st R/A bill whichever is earlier.

b) Bid Capacity: The bidding capacity of the tenderer 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,

\[A = \text{Maximum value of construction works executed in any one year during the last five years taking into account the Completed as well as works in progress ending last day of the month previous to the one in which applications invited.}\]

\[N = \text{Number of years prescribed for completion of work for which bids have been invited}\]
B = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited. The Tenderer is requested to furnish the existing commitments of works under execution along with stipulated period for completion of remaining for each of the work should be furnished in an affidavit on non-judicial stamp paper of value of Rs. 100/- duly certified that the particulars furnished are correct as per the Performa in Annexure-A.

h) Site visit for the subject tender is mandatory. The bidders shall visit the site to Study/assess the tendered work and also acquaint themselves of the prevailing local conditions & detail requirement of the project work before submitting their bid. Bidder has to enclose a certificate counter signed by EPI official or furnish undertaking for having visited the site.

i) Bidders who intend to get exemption from submission of Tender fee and EMD shall submit confirmation letter whether they are registered under MSME Act or not and if yes, then relevant copies of the registration letter (Registered under single point registration scheme of NSIC, Govt. of India, Ministry of MSME, New Delhi) vide Gazette Notification dated 26.03.2012 along with the form of Memorandum-2 (with the concerned DIC) certificate in the appropriate category and limit as applicable under the present tender to be enclosed in Technical Bid and a request letter for exemption from submission of Tender fee and EMD.

j) 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 execution of work, poor quality of work, financial failure / weakness etc.

k) 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 shall only be accepted for assessing the eligibility of the tenderer. However, the certificates issued by Public Limited Company and Private Party can be considered only if they are supported by TDS certificates/Turnover Certificate from Chartered Accountant in support of value of work done by the tenderer.

l) 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 their verification as and when demanded by EPI. The tender of any tenderer shall be rejected if on detailed scrutiny; documents submitted along with the tender are found to be unsatisfactory / forged. The decision of EPI in this regard shall be final and the binding on the tenderer.

m) Relevant experience certificates and other documents as mentioned above fulfilling the qualifying criteria duly self-attested by the tenderer shall be uploaded. 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.

n) 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 pre-qualification document are proved to be incorrect, false and misleading.
b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor, inordinate delay in completion, consistent history of litigation / arbitration awarded against the contractor or any of its constituents or financial failures due to bankruptcy etc. in their ongoing / past projects.
c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.
d) If the tenderers attempt to influence any member of the selection committee.

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

The credentials of the Bidders shall be verified and inspection of the works, if required, to be carried out by EPI. If not found satisfactory, their bid will be considered non-responsive.

2.0 Tender documents comprising of the following are available on the website of EPI:
www.engineeringprojects.com, CPP-Portal: www.eprocure.gov.in and as well as on
MSTC portal https://www.mstcecommerce.com/eprochome/EPIL.

Volume I: Instructions to Tenderers, Addendum to Instructions to Tenderers, Special
Instructions to Bidders for e-Tendering & General Conditions of Contract
(ITT&GCC) of EPI

Volume II:  
<p>| | |</p>
<table>
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<tr>
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<tbody>
<tr>
<td>a)</td>
<td>Notice inviting Tender</td>
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<tr>
<td>b)</td>
<td>Additional Conditions of Contract</td>
</tr>
<tr>
<td>c)</td>
<td>Technical Specifications</td>
</tr>
<tr>
<td>d)</td>
<td>Tender Drawings</td>
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</tbody>
</table>

3.0 Interested bidders have to necessarily register themselves on the portal
http://www.mstcecommerce.com/eprochome/EPIL through M/s MSTC Ltd., Kolkata to participate in the bidding under this invitation for bids. It shall be the sole responsibility of the interested bidders to get themselves registered at the aforesaid portal for which they are required to contact M/s MSTC Ltd., Kolkata at following address to complete the registration formalities:

M/s MSTC Limited,
30 / 31A, 1st Floor, Jeevan Vikas Bhawan,
Asaf Ali Rd, New Delhi,
Delhi-110006
Contact No.: 033-22901004, 011-23212357, 011-23215163, 011-23217850
Availability: 10 AM to 5:30 PM on all working days. Email-ID: mstcnro@mstcindia.co.in

They may obtain further information regarding this tender from DGM (Contracts) at the address given at Clause No. 14.0 below from 10:00 hours to 17:00 hours on all working days till the last date of online submission of Bidding Documents.

For proper uploading of the bids on the portal namely
http://www.mstcecommerce.com/eprochome/EPIL (hereinafter referred to as the 'portal'),
it shall be the sole responsibility of the bidders to apprise themselves adequately regarding all the relevant procedures and provisions as detailed at the portal as well as by contacting M/s MSTC Ltd., directly, as and when required, for which contact details are mentioned above. The EPI in no case shall be responsible for any issues related to timely or properly uploading/submission of the bid in accordance with the relevant provisions of Section Instruction to Bidders of the Bidding Documents.

4.0 Bidders can download the bid document from the portal without paying document fees in advance; however, interested bidders have to pay tender fees for participating in the tendering and submitting the bid. For this purpose the interested bidders shall be required to pay `23,600/- (Rupees Twenty Three Thousand Six Hundred only) (GST @ 18% included), the GSTIN of EPI for Assam is 18AAACE0061C1ZC as non-refundable document fees in the form of Demand Draft in favour of “Engineering Projects (India) Ltd.” payable at Guwahati.

The fees to be paid to MSTC are separate.

6.0 E-Bids must be submitted/uploaded along with scanned copies of relevant documents as mentioned at “Addendum to Instructions to Tenderers” on the MSTC portal on or before last date & time of online bid submission. Late bids will not be accepted.

The bid must be accompanied by Earnest Money Deposit (EMD) of Rs. 11,42,036.00 (Rupees Eleven Lakhs Forty Two Thousand Thirty Six Only). This shall be in the form of Crossed Demand Draft or Pay Order (in CTS form) of any Nationalized Bank/Scheduled Bank for the full amount of EMD payable favouring “Engineering Projects (India) Ltd.”, payable at Guwahati. The EMD shall be valid for minimum period of 150 days (one hundred fifty days) from the last day of submission of tender. Tenders submitted without EMD or inadequate amount of EMD shall be rejected. The bid shall be valid for 90 days from date of opening of Price Bid.

Tender fee, EMD (In original), Power of Attorney, NSIC/MSME (Registered under single point registration scheme of NSIC, Govt. of India, Ministry of MSME, New Delhi vide Gazette Notification dated 26.03.2012 along with the form of Memorandum-2 with the concerned DIC) certificate as per Clause No.1 (i) if bidder is claiming EMD/Tender fee exemption must be submitted in physical form at the address given at Clause No. 14.0 below as stipulated under Time Schedule of Tender Activities. If the above documents are not received in time then their offer shall not be considered and EPI shall not be responsible for any postal delay in respect of submission of hard copy part of the bids.

7.0 The Terms & Conditions contained in the NIT and tender document shall be applicable.

8.0 The tenderers should note that the credentials such as value and volume of works completed, as submitted by the tenderers along with their offers shall be forwarded by EPI to Client for his opinion. The offer of tenderers against whom client does not give satisfactory remarks shall be rejected by EPI.

9.0 The corrigendum or addendum, extension, cancellation of this NIT, if any, shall be hosted on the EPI”s website/CPP portal as well as on MSTC portal https://www.mstcecommerce.com/eprochome/EPIL the bidders are required to check these websites regularly for this purpose, to take into account before uploading/submission of tender. All Corrigendum and addendum are to be uploaded duly signed & stamped with tender documents as bid Annexure.
10.0 The tenderers should note that the credential such as value and volume of works completed as submitted by the tenderers along with their offers may be forwarded by EPI to the owner, DGAR for his opinion. The offer of the tenderers against whom the Owner does not give satisfactory remarks shall be rejected by EPI.

11.0 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 bidder shall be accepted subject to the confirmation of the authenticity of the PQ documents/BG from the concerned department/Bank.

**Hence the intending bidders must furnish their e-mail id and contact phone number along with the techno-commercial part.** In case the PQ documents such as work experience certificate, bank solvency certificate etc. submitted by a bidder is found to be fake the EMD submitted by him shall be forfeited by EPI without making any reference to him. Further such a tenderer shall be at a risk of losing his right to participate in any tender called by EPI for a minimum period of one year.

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

13.0 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.

14.0 Tender documents shall be issued by and submitted to:

Dy. General Manager  
Engineering Projects (India) Ltd.  
North Eastern Regional Office  
4th Floor, Hindustan Tower,  
Jawahar Nagar, National Highway No.37,  
Guwahati (Assam) -781022  
(Tel No. 8486653300)

15.0 Contact details for only site/project related quarries:

Shri D. Dash, DGM  
Mobile No: 9831405999

Shri Anjan Das, Site In-charge  
Mobile No: 9435747734

For more information on EPI, visit our website at: [http://www.engineeringprojects.com](http://www.engineeringprojects.com)  
For more information on the e-tender, visit website of M/s MSTC LTD: [https://www.mstcecommerce.com/eprochome/EPIL](https://www.mstcecommerce.com/eprochome/EPIL)

Dy. General Manager (Contracts)
## BID CAPACITY

Tender for Interior works at Assam Water Centre, Basistha, Guwahati, Assam

**NIT No: NERO/CON/790/362 Dated: 31.10.2019**

**ESTIMATED COST PUT TO TENDER** : Rs. 11,42,03,564.00

Bid Capacity: 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,

- \(A\) = 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
- \(N\) = Number of years prescribed for completion of work for which bids have been invited
- \(B\) = Value of existing commitments and ongoing works to be completed during the period of completion of work for which bids have been invited (Format enclosed)

**BID CAPACITY CALCULATION BY BIDDER**

SIGN & STAMP OF BIDDER
ANNEXURE-A

AFFIDAVIT

(To be typed on Rs. 100/- non-judicial stamp paper)

I/We .......................................aged ..............years son of .......................................do hereby solemnly affirm and declare as follows for and on behalf of the Firm:

LIST OF EXISTING COMMITMENT AND ONGOING WORKS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Works</th>
<th>Client Name &amp; Address</th>
<th>Work Order Value (in Rs)</th>
<th>Work Executed till Date (Rs)</th>
<th>Balance Amount of work to be completed (Rs)</th>
<th>Balance period to complete the works (Total months)</th>
<th>Work to be completed in 05 months (Rs)</th>
</tr>
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Balance Commitments during 05 months as per NIT

Rs.

It is certified that the above particulars furnished are true and correct. If any information given is found to be concealed at a later date, the Contract will be terminated forthwith without prejudice to the rights thereon consequent on termination and the bidder will be blacklisted. I/We agree for debarring tendering for one year if any facts are suppressed.

SIGN AND STAMP OF BIDDER
ADDITIONAL CONDITIONS OF CONTRACT (ACC)

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

2.0 Engineering Projects (India) Limited (EPI) has entered into an agreement for execution of the work for “Interior works at Assam Water Centre, Basistha, Guwahati at FREMAA, Basistha, Guwahati”. The tender shall include (but not limited to) providing labour, tools and plants, machineries, transport and all other components including all materials (except those which are specifically excluded from scope/present tender as spelt out elsewhere in the tender documents) required for completion of construction work in the buildings as mentioned in the NIT.

3.0 The work site is located at Basistha, Guwahati, Assam. This is accessible by road via Jalukbari or Khannapara.

4.0 The word “Contractor” appearing anywhere in the GCC and the other tender document shall mean the ‘sub-contractor’ i.e. the successful tenderer on whom the work under the present tender is awarded by EPI.

5.0 Clause no 3.0 of GCC shall stand amended as below:

The items of work given in the tender documents are for general guidance of the contractors and the works shall be carried out by the contractor on percentage rate basis in conformity with the detailed drawing, scope of work, technical specifications, additional conditions of contract (including any addition/modification/alteration/deletion made from time to time therein found essential for completion of works). The contractor shall be deemed to have satisfied himself before tendering as to the sufficiency and correctness of his tender for the works and of the rates and prices quoted in the brief specifications, drawings, scope of work and payment (billing) schedule, which rates and prices shall, except as otherwise provided, cover all obligations under the contract and all matters and things found necessary for proper completion and maintenance of the works. It shall be responsibility of the contractor to incorporate the changes that may be in the scope of work envisaged at the time of tendering and as actually required to be executed. The contractor has quoted his rates after clearly studying the scope of work given in Tender Documents availed by him by downloading from the website at the tendering stage itself and getting fully satisfied with the various items and technical intricacies involved in the work under his scope of work as envisaged in the tender. EPI shall not entertain any claim of the contractor on account of error or omission by him in this respect except what is admitted by the client.

6.0 MOBILIZATION ADVANCE: DELETED

7.0 SECURITY DEPOSIT CUM PERFORMANCE GUARANTEE:

Clause no 9.0 of GCC shall stand amended as below:

Contractor shall submit to EPI a Security Deposit cum Performance Bank Guarantee in the form appended, from any nationalized Bank / Scheduled Bank equivalent to 10% (Ten Percentage) of the Contract value.

8.0 RETENTION MONEY:

The clause no. 10.0 of GCC shall stand amended as below:
An amount @10% (Ten percent) of the gross value of the running bill shall be deducted from each running bill by way of retention money until completion of the whole of the works. In case the EMD has been deposited by the contractor in the form of demand draft, the said amount of EMD shall be adjusted first towards the retention money and further recovery of retention money shall commence when the upto date amount of retention money exceeds the amount of EMD deposited in the form of demand draft. The retention money shall become refundable upon the issue of a Certificate of completion of the works by the Project Manager, FREMMA, in accordance with GCC 69.1 (Completion) at section 7 at page 7-25, half the total amount retained shall be repaid to the Contractor and half when the Defect Liability Period has passed the Project Manager of FREMAA/EPI has certified that all Defects notified by FREMAA/EPI to the Contractor before the end of this period have been corrected, if any, pertaining to the contractor’s scope of work, the contractor has demolished and removed all structures including foundations and withdrawn fully from the worksite and EPI has received the clearance certificate from the concerned Labour Enforcement Officer/RLC pertaining to the labour etc. deployed by him at the worksite or there is nothing on record against him in the local market affecting functions of EPI. In case EPI has been required to make any expenditure on any of these accounts EPI will keep the retention money till the time all these matters are settled in full including recovery of the expenses, if any, made by EPI from the retention money. Further the contractor has to furnish a ‘No Claim’ certificate to EPI in confirmation of his having no claim on getting refunded the retention money to EPI at the time of claiming refund of retention money.

Further retention money deducted in such manner shall be released against furnishing of Bank Guarantee of equivalent amount as per EPI’s prescribed format valid upto DLP+90 Days from completion of the work.

9.0 The following shall added to clause no. 11.0 of GCC:

Water: The contractor shall arrange water fit for the purpose of drinking and construction at his own cost. (Boring is permitted at site)

Power: Owner will supply power at a point near the work site at his discretion from where the contractor will make his own arrangement for distribution. All the works of the contractor shall be done as per Indian Electricity Act and Rules framed there under and approved by the Engineer-in-Charge. The temporary lines will be removed forthwith after the completion of the work or if there is any hindrance caused to the other work due to the alignment of these lines, the contractor will re-route or remove the temporary lines at his own cost. The contractor at his own cost will also provide suitable electric meters, fuses, switches etc. These shall be in the custody and control of the Owner. The cost of power supply shall be payable to the Owner every month at the prevailing rates from time to time or will be deducted from the running account bills.

Owner, however, does not guarantee uninterrupted power supply and this does not relieve the contractor of his responsibility for the timely completion of various works as stipulated, nor any compensation shall be paid to the contractor for any failure or short supplies of Power. The contractor shall therefore make his own arrangement for standby power supply at his own cost.

The coarse and fine aggregates shall conform to the grading as mentioned in the Technical Specification.

Materials to be used for the subject work shall be got approved by EIC before incorporation in the permanent works.

The Contractor shall remain bound to construct and maintain proper storage arrangement for safe and proper custody of these materials including their unloading and local handling, keeping watch and ward and proper inventory of such materials.

For sanitary and plumbing works the contractor shall engage a person having valid license for carrying out PHE works.
10.0 Work in monsoon and dewatering

The completion of the work may entail working in monsoon also. The Contractor must maintain minimum labour force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered such work in monsoon.

During monsoon and other period, it shall be the responsibility of the Contractor to keep the construction work site free from water at his own cost.

11.0 Work on Sundays and holidays

For carrying our work on Sundays and holidays, the Contractor will approach the Engineer-in-Charge or his representative at least two days in advance.

12.0 General conditions for construction and erection mark

Works to be carried out as per state / central labour regulations/guidelines. Shift working at 2 or 3 shifts per day will become necessary and the sub-contractor should take this aspect in to consideration for formulating his rates for quotation. No extra claims will be entertained by the EPI on this account.

The Sub-Contractor must arrange for the placement of workers in such a way that delayed completion of the work or any part thereof for any reason whatsoever will not effect their proper employment. EPI will not entertain any claim for idle time payment whatsoever.

13.0 Setting out works

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

The Contractor shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and centre line marks, either existing or supplied and fixed by the sub-contractor. The work shall be set out to the satisfaction of the Owner. The approval thereof or joining with the sub-contractor by the Owner in setting out the work shall not relieve the sub-contractor or any of his responsibilities.

Before beginning the works, the sub-contractor shall at his own cost, provide all necessary reference and level posts, pegs, bamboo, flags, ranging rods, strings and other materials for proper layout of the work in accordance with the scheme for bearing marks acceptable to the Owner. The Centre, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct marks at the centre to enable a theodolite to be set over it. No work shall be started until all these points are checked and approved by the Engineer-in-Charge in writing but such approval shall not relieve the sub-contractor of any of his responsibility. The Contractor shall also provide all labour, material and other facilities, as necessary, for the proper checking of layout and inspection of the points during construction.

Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the sub-contractor.

14.0 Responsibility for level and alignment

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

All the drawings provided at the tendering stage are for general guidance only and the works shall be carried out as per the drawings and instructions issued by the Owner from time-to-time. EPI shall not entertain any claim of the sub-contractor on account of any omission or any error by him on this account.

Further even though EPI shall take all care to attach all the drawings as issued by the client it shall be the responsibility of the sub-contractor to interpret the drawings for completion of the works under this contract. EPI shall not give any design or bill of quantities except what are being provided with the tender documents. EPI shall not entertain any claim of the sub-contractor on account of any omission or any error by him on this account.

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

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

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

c) The bidder/contractor are required to update/upload the GST/Taxes data periodically so as to avail ITC credit by EPI failing which it shall be recovered/adjusted by EPI without any prior intimation

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

e) Incase of any reduction in rate of GST or other taxes in future or the project getting exemption status prior to the last date of Bid submission or afterwards, the subcontractor shall pass on the benefit to EPIL immediately, failing which EPIL shall have the right to recover the differential amount from the amounts due to the subcontractor. Further in case of any increase in rate of GST or other taxes in future or the project losing exemption status prior to last date of bid submission or afterwards, the said increase of taxes shall be paid/reimbursed to the subcontractors, subject to the condition that the client reimburses the said increased taxes to EPIL.

All the above reimbursements shall be admitted to the extent these are admitted by the Owner.

f) If the bidder quotes abnormally low rate/s compared to estimated cost put to tender, in such cases the rate/s of the lowest bidder if found in rate/s of the item/s are abnormally low, then additional performance bank guarantee/s equivalent to the difference of quoted rate/s and justified rate/s of the item/s shall be required to be furnished by the bidder before issue of LOI
of the work. Additional Bank Gurantee/s obtained in these context shall be returned to the bidder after the satisfactory execution (duly certified by Site In-charge) of work at site.

16.0   TECHNICAL STAFF FOR WORK: is modified as

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

The contractor, within 10 days of issuance of LOI (Letter of Intent) to him shall depute at least one graduate civil engineer with 5 years of post-qualification experience & 3 years experience in similar works and two persons having diploma in civil engineering with 3 years of post-qualification experience & 2 years experience in similar works. The contractor shall also depute at least one graduate electrical engineer with 5 years of post-qualification experience & 3 years experience in similar works and a safety Engineer with 3 years of post-qualification experience. Contractor fail to provide them within such period or as directed by the Engineer-in-charge, EPI shall be at liberty to recover an amount @30,000.00 per month per person till handing over of the project.

17.0   FURNISHED OFFICE ACCOMMODATION & MOBILITY AND COMMUNICATION TO BE PROVIDED BY CONTRACTOR TO EPI:

The clause no 28.3 of the GCC shall stand amended as below,

On acceptance of Tender, the Contractor at his own cost will provide suitable furnished office with office boy / helper for housekeeping, security, internet, mobile, photocopier, Computer/Laptop, printer, regular electricity, drinking water, air conditioning etc. till handing over of project site to Client and a vehicle with driver exclusively for EPI staff on full time basis. Consumables like diesel/petrol/oil lubricants and spare parts etc shall be provided by the Contractor at their cost. The vehicles shall be maintained in good working condition. In case of breakdown, replacement of vehicles shall be provided by the Contractor immediately. In case Contractor fail to provide a vehicle, recovery of Rs 50,000/- per month shall be made from the Contractor for this purpose till handing over the work to Client. The Contractor shall also make sufficient arrangement for photography / videography preferably by maintaining a camera/video camera at site, whenever asked to do so.

18.0   SECURED ADVANCE:

GCC clause no. 35.0 stands DELETED.

19.0   ARBITRATION: CLAUSE NO. 76.1 OF GCC SHALL STAND AMENDED AS BELOW:

Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part III of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

i) Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the Specifications, Design, Drawings and Instructions herein before mentioned and as to the quality of workmanship or materials used in the work or as to any other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the Contract, Designs, Drawings, Specifications, Estimates, Instructions, or these conditions or otherwise concerning the works of the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitrator appointed by the Chairman & Managing Director (CMD) of Engineering Projects (India) Limited (EPI) or any other person discharging the functions of CMD of EPI. The person approached for appointment as Arbitrator shall disclose in writing circumstances, in terms of Sub-Section (1) of Section (12) of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 as follows:
a) Such as the existence either direct or indirect, of any past or present relationship with or interest in any of the parties or in relation to the subject- matter in dispute, whether financial, business, professional or other kind, which is likely to give rise to justifiable doubts as to his independence or impartiality; and

b) Which are likely to affect his ability to devote sufficient time to the arbitration and in particular his ability to complete the entire arbitration within a period of twelve months.

The Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

ii) If the arbitrator so appointed resigns or is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman & Managing Director aforesaid or in his absence the person discharging the duties of the CMD of EPI may appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

iii) It is a term of the contract that the party invoking the arbitration shall specify the disputes, differences or questions to be referred to the Arbitrator under this clause together with the amounts claimed in respect of each dispute.

iv) The Arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceedings.

v) The work under the contract shall continue as directed by the Engineer-In-Charge, during the arbitration proceedings.

vi) Unless otherwise agreed, the venue of arbitration proceedings shall be at the venue given in the 'Memorandum' to the 'Form of Tender'.

vii) The award of the Arbitrator shall be final, conclusive and binding on both the parties.

viii) Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 as amended by Arbitration and Conciliation (Amendment) Act, 2015 or any statutory modifications or re-enactment thereof and the Rules made there under and for the time being in force shall apply to the arbitration proceedings and Arbitrator shall publish his Award accordingly.

19.1: CLAUSE NO 76.2 OF GCC SHALL STAND AMENDED AS UNDER

“In the event of any dispute or difference relating to the interpretation and application of the provisions of commercial contract(s) between Central Public Sector Enterprises (CPSE) / Port Trust inter se and also between CPSE and Government Departments / Organisations (excluding disputes concerning Railways, Income Tax, Customs and Excise Departments), such dispute or differences shall be taken up by either party for resolution through AMRCD as mentioned in DPE OM No. 4(1)/2013-DPE(GM)/FTS-1835 dated 22.05.2018”

20.0 The clause nos. 17.0, 18.0 & 19.0 of GCC of EPI shall stand amended as under:

Insurance charges for insurances to be taken by EPI for the project like Contractor’s All Risk Policy, Erection All Risk Policy including transit and third party liability shall be borne by the sub-contractor or to the price asked by EPI in the name of Client / or the charges towards this shall be recovered/reimbursed to EPI for this CAR policy charges. However, the sub-contractor shall take insurance cover at its own cost towards Workman Compensation Act for its own workers and employees engaged by it for the works under the present tender/sub-
contract within 10 days of issuance of Letter of Intent by EPI and shall furnish documentary proof of the same to EPI. In case the sub-contractor fails to do so, EPI shall be at liberty to withhold all payments to the sub-contractor till the submission of such documentary evidence or take the required insurance policy under the Workman Compensation Act and recover the cost of the insurance premium(s) paid in this respect by EPI to the insurance company from the sub-contractor’s bill(s). Notwithstanding payment of such insurance premiums and the resulting recovery thereto the sub-contractor shall remain bound to assist EPI in follow up with the insurance company in case of any claim related to the sub-contractor’s scope of work. EPI is not liable to pay any claim of the sub-contractor if it is not paid by insurance company due to any reasons whatsoever. The insurance company providing such insurance cover must be approved by IRDA.

Employee State Insurance Act

The sub-contractor agrees to and does hereby accept full and exclusive liability for compliance with all obligations imposed by the Employees State Insurance Act, 1984, and the sub-contractor further agrees to defend, indemnify and hold Owner harmless from any liability or penalty which may be imposed by the Central, State or Local authority by reason of any asserted, violation by sub-Contractor of the Employees State Insurance Act, 1948, and also from all claims, suits or proceeding that may be brought against the Owner arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of the sub-contractor, by third parties or by Central or State Government authority or any political sub-division thereof.

The sub-contractor agrees to fill in with the Employee’s State Insurance Corporation, the Declaration Forms, and all forms which may be required in respect of the sub-contractors’ employees, whose aggregate remuneration is such amount as prescribed under the Employees State Insurance Act, 1948 from time to time and who are employed in the work provided for or those covered by ESI from time to time under the Agreement. The sub-contractor shall deduct and secure to deduct the employee’s contribution as per the first schedule of the Employee’s State Insurance Act from wages and affix the Employee’s contribution Cards at wages payment intervals. The sub-contractor shall remit and secure the to remit to the State Bank of India, Employee’s State Insurance Corporation Account, the Employees contribution as required by the Act. The sub-contractor agrees to maintain all cards and records as required under the Act in respect of employees and payments. Any expenses incurred for the contributions, making contributions or maintaining records shall be to the sub-contractor's account.

The Owner shall retain such sum as may be necessary from the total contract value until the sub-contractor shall furnish satisfactory proof that all contributions as required by the Employees State Insurance Act, 1948, have been paid.

(For labours INR 1 Lakh per each labour deductible if contractor fails to provide.)

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

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

22.0 The following shall stand added to Clause no 21.0 and 23.0 including their sub-clauses of the GCC:

Notwithstanding the fact that EPI may have obtained or may be in the process of obtaining a valid license under the Contract labour (Regulation and Abolition) Act 1970 and Contract Labour Act (R & A) Central Rules 1971 and amended from time to time and registration under Building and other Construction Works (Regulation of Employment and Conditions of Service) Act 1996 and Building and Other Construction Workers’ Welfare Cess Act 1996 from the relevant office of the RLC and continues to have them until the completion of work including the maintenance and defect liability period, the sub-contractor shall at all times remain bound to comply with and observe the provisions of the all laws and regulations pertaining to the
The deployment of contract labour. He shall also extend all assistance to EPI during inspection of the officials of such law enforcing agencies including the rectification of defects/observations (if any) made/pointed out during the visit(s) of the officials of the said ALC/RLC under jurisdiction of whom the work site shall be covered.

23.0 The following shall stand added to the clause no 31.0 of the GCC:

The sub-contractor shall take a suitable policy in compliance with the Workmen’s Compensation Act 1923 within 10 days of issuance of LOI and keep it valid till completion of works or till the time he is required to keep his workmen at the worksite whichever is later and produce a copy of the receipts of the premium paid by him in this regards as and when asked by EPI.

24.0 The following shall be added to the clause no 36.0 of the GCC:

The measurement of the works as certified/recorded by the client for the portion of works executed by the sub-contractor shall be final and binding on the sub-contractor. The contractor shall remain liable to provide all assistance at the time of recording the measurements by the client.

25.0 Payment’s: The clause no 37.0 of the GCC stands modified as under:

Payments as and when received by EPI from the Client for the sub-contractor’s portion of work shall be released to him within seven working days of its receipt by EPI and after making the recoveries towards facilities & others, if any mentioned at relevant clauses and other recoveries.

All running payments shall be regarded as ‘on account’ payments only and not as payments for work actually done and completed and/ or accepted by EPI or Owner and shall not preclude the recovery for bad, unsound work and imperfect or unskilled work to be removed and taken away and reconstructed or re-erected or to be considered as an admission of the due performance under the agreement or the accruing of any claim nor shall it conclude, determine or affect in any way the powers of EPI under these conditions or any of them as to the final settlement and adjustments of the accounts or otherwise or in any other way vary/affect the contract.

The final bill payment to the sub-contractor shall be released only after receipt of corresponding payment from client and when the sub-contractor submits all other clearances, approvals, certificates etc. as per agreement of EPI with the client for the “Works” and as per statutory requirement.

The sub-contractor shall have no claim on EPI in case the payments are delayed by the client due to any reason whatsoever and works shall be completed within schedule time and shall indemnity EPI towards this.

26.0 The following provisions shall supersede that of clause no 69 of GCC wherever applicable:

Claim on account of extra / substituted / variation of items etc. pertaining to the sub-contractor’s portion of work will be payable subject to acceptance and paid by Client to EPI. Any claim by the sub-contractor, if not paid by the Client, whatsoever be the reason shall not be admitted by EPI. The amount, if at all admitted and paid by the Client for the sub-contractor’s portion of work, shall be paid to him after making a provision of 10% (ten percent) towards EPI’s overhead and administrative charges. The provision of this clause shall equally apply to the decrease in the rate of item by the owner. EPI’s decision in this respect shall be final and binding on the sub-contractor. But under no circumstances sub-contractor shall suspend the work on the non-settlement of rates under this clause.

Further the quantity given in the Price Bid/ Bill of Quantity can vary up to ±25% of the contract price without any change in the rates.

27.0 Responsibility of materials
The sub-contractor shall be responsible for obtaining all approvals from Client with regard to quality of materials & workmanship and measurements etc. for their portion of work. All such approvals shall be in the name and title of EPI. The sub-contractor shall be responsible for reconciliation of issued material with Client/EPI, if any, and the sub-contractor shall make arrangements for safe up keeping / custody of the material and final reconciliation is also to be done by the sub-contractor. In case there is any shortfall of any issued items during reconciliation, recovery at double the cost of materials prevailing at that time of recovery shall be made from the sub-contractor’s due payment. EPI is not responsible for any pilferage or theft of materials / equipments at the site. Required numbers of security personnel shall be deployed for this.

28.0 Dealing with Owner etc

The sub-contractor will not deal directly with Client and all the correspondence in matters regarding bills, claims, interpretation of the specifications, conditions and all matters related to the contract with Client, Client’s Consultants, all other agencies including Government and Statutory bodies etc. shall be done through EPI only. The sub-contractor shall prepare and submit expeditiously all bills, claims, details, clarifications, documents, information, etc. as required by EPI/ Client for proper execution and successful completion of the “Works”.

29.0 Interpretation

Issues related to interpretation and claims, if any, related to the sub-contractor’s scope of work, arising out of contract between EPI and Client shall be referred with full justification by the sub-contractor to EPI for settlement with Client including arbitration with Client, if inescapable, and outcome of such a settlement shall be binding on the sub-contractor. EPI at its option may associate the sub-contractor in the above process of settlement for his portion of work. The cost & expenses on arbitration with Client shall be shared by EPI and the sub-contractor in proportion of his offer and EPI’s mark up towards its overheads & profits. In case the award/settlement with the Client is in favour of EPI, ninety percent of the award/settlement amount shall be shared between EPI and sub-contractor in proportion of sub-contractor’s contract price with EPI and EPI’s mark up towards its overheads & profits. The balance ten percent of the award/settlement amount shall be retained by EPI towards its administrative charges. In case the award/settlement is against EPI, the entire damages/counterclaims imposed, if any, shall be borne by the sub-contractor alone and the sub-contractor shall have no claim whatsoever against, EPI in such a settlement. Further, EPI shall have no liability towards any claim of the sub-contractor, which is not paid by the Client.

30.0 No claim for non-approval

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

31.0 Inspection and responsibility

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

32.0 Actions for false information

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

33.0 Non-applicability of concessions or exemptions

However, if EPI is granted some concession or exempted from certain obligations by Client, by virtue of EPI being a Public Sector Company, the same concessions / exemptions shall not be applicable to the sub-contractor. The decision of EPI in this regard including interpretation of terms & conditions shall be final & binding on the sub-contractor.

34.0 Care and Supply of Documents

34.1 The Specification and Drawings shall be in the custody and care of the EPI/ Owner. Contractor will make copies at own cost.

34.2 Each of the Contractor’s Documents shall be in the custody and care of the Contractor, unless and until taken over by the EPI/ Owner. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor’s Documents.

34.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor’s Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer’s Personnel shall have the right of access to all these documents at all reasonable times.

34.4 If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

35.0 Compliance with Laws

35.1 The Contractor shall, in performing the Contract, comply with applicable Laws.

35.2 Unless otherwise stated in the Particular Conditions,

   a) EPI/ Owner shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the which (i) such authorities or undertakings require the EPI/ Owner to obtain in the Employer’s name, and (ii) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the EPI/ Owner of their respective obligations under the Contract.

   b) The Contractor shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor’s and Subcontractor’s personnel and entry permits for all imported Contractor’s Equipment. The Contractor shall acquire all other permits, approvals, and/or licenses that are not the responsibility of the EPI/ Owner and that are necessary for the performance of the Contract. The Contractor shall indemnify and hold harmless the EPI/ Owner from and against any and all liabilities, damages, claims, fines, penalties, and expenses of whatever nature arising or resulting from the violation of such laws by the EPI/ Owner or its personnel, including the Subcontractors and their personnel.

36.0 Other Contractors

The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the EPI/ Owner between the dates given in the Schedule of Other Contractors. The Contractor shall also provide facilities and services for them as described in the Schedule of owner. The EPI/ Owner may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.
37.0 Contractor’s Risks

From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not EPI/Owner’s risks, are Contractor’s risks.

38.0 Designs by Contractor and Approval by the Project Manager

38.1 The Contractor shall carry out design. The Contractor shall promptly submit to EPI/Owner all designs prepared by him. The Contractor shall not construct any element of the permanent work designed without approval from EPI/Owner. Design that has been rejected shall be promptly amended and resubmitted. The Contractor shall resubmit all designs commented on, taking these comments into account as necessary.

38.2 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, who is to approve them if they comply with the Specifications and Drawings.

38.3 The Contractor shall be responsible for design of Temporary Works.

38.4 The Project Manager’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

38.5 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

38.6 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

39.0 Safety

The Contractor shall be responsible for the safety of all activities on the Site.

40. Instructions, Inspections, and Audits

40.1 The Contractor shall carry out all instructions of the Project Manager, which comply with the applicable laws where the Site is located.

40.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and subconsultants to keep accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.

40.3 The Contractor shall permit ADB to inspect the Contractor’s accounts, records, and other documents relating to the submission of bids and contract performance and to have them audited by auditors appointed by ADB. The Contractor shall maintain all documents and records related to the Contract for a period of three (3) years after completion of the Works. The Contractor shall provide any documents necessary for the investigation of allegations of fraud, collusion, coercion, or corruption and require its employees or agents with knowledge of the Contract to respond to questions from ADB.

41.0 Time Control Program

41.1 After the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

41.2 An update of the Program shall be a program showing the actual progress achieved on
each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

41.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted.

41.4 The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

The period between program update is 15 days. The amount to be withheld for late submission of an updated program is 0.001% of the contract value.

42.0 Delays Ordered by the Project Manager

The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

43.0 Quality Control

43.1 Identifying Defects, The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

43.2 Tests, If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

43.3 Correction of Defects, The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

43.4 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

43.5 Uncorrected Defects, If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

44. Liquidated Damages

44.1 The Contractor shall pay liquidated damages to the Employer at the rate 0.1% per day. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.

44.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.

45. Operating and Maintenance Manuals
45.1 If “as built” Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them. The date by which operating and maintenance manuals are required is 30 days from the date of completion of the work.

The date by which as built drawings are required is 30 days after the completion. The amount to be withheld for failing to produce as built drawings and/or operating maintenance manuals by date required is 10% of the value of the corresponding item of work executed.

45.2 If the Contractor does not supply the Drawings and/or manuals by the dates, or they do not receive the Project Manager’s approval, the Project Manager shall withhold the amount stated from payments due to the Contractor.

46. Termination

The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

47. Property

47.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the EPIL/Client if the Contract is terminated because of the Contractor’s default.

47.2 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the PCC. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

47.3 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager’s notice.

Note: 

a) Un-prized BOQ Annexed as Annexure-I with BOQ, may have to be carried out by the Contractor subject to acceptance of rates by EPI. EPI has liberty to engage separate agency for this and the agency has no right to claim any amount towards this and the other terms of Contract shall be abide by the agency.

b) In case any conflict arises in this contract, owner’s/client decision will be final and binding on contractor.
GENERAL REQUIREMENTS

1. The detailed specifications given hereafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards.

2. It may also be noted that the specification is of supplementary in nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.

3. The work also includes all minor details of construction which are obviously and fairly intended, and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard engineering practice.

4. The Consultants, PMC and the Employer shall be the sole deciding authority as to the meaning; interpretations and implication for various provisions of the specifications and their decision in writing shall be final and binding on all concerned.

5. In case any difference or discrepancy between the tender specifications and the description in the bill of quantities, the precedence between the two would be decided by the Client.

6. In case any difference or discrepancy between the tender specifications and the tender drawing, the precedence between the two would be decided by the Client.

7. Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.

8. These specification shall be read in conjunction with the latest IS specification. In case this specification are found wanting in any way the relevant C.P.W.D. Specifications shall apply.

9. Sample Approval: All material sample must be approved before procurement. The contractor will have to provide all necessary documents to prove the specification compliance along with samples for the client’s approval.

10. STANDARDS: Except where otherwise specified and permitted by the client, all materials shall conform to the latest edition of Indian standard specification.

11. Approved Makes: The contractor will supply material from within the approved make list. In case the contractor proposes to use any equivalent make instead of approved, then make item specific approval for all such items will have to be taken from the client. The proposed make and its sample has to meet the quality and the aesthetic requirement of the project.
A. TECHNICAL SPECIFICATION OF INTERIOR WORK

1.1 Timber: Timber shall be second class hard wood. The timber, seasoning and treatment shall be done as per IS 1141-1973 and IS 402-1962.
(a) Timber for use in unframed clean sawn wood work for wooden plugs, rough grounds fillets or the like shall be first class hard wood.
(b) The surface of wood sections, boards, ply cutting if touching or embedded in walls etc. shall be treated with colorless wood preservative on all surfaces of an approved quality and make. Nails and spikes shall not be used in joinery works, but instead bamboo wood pins of proper size shall be used.
(c) Where length of any member exceeds 3.00 meters, approved type of joint shall be provided without any extra cost.
(d) Timber surface of all carpentry and joinery work shall be wrought and prepared smooth.
(e) Wooden plugs for fixing timber fixture and fittings and the like shall be built into walls. Alternatively fill plugs made of asbestos cement powder or PVC plugs sleeves shall be used wherever specified.
(f) Vertical members of timber door (cup board / cabinets / lab tables / lab counters) frames shall be embedded at floor level if indicated. The bottom of shutters shall be 5 mm above the finished floor level.

1.2 Door shutters: All door shutters (internal or external except steel shutters) for all blocks shall be factory made flush door shutters confirming to IS specifications. Doors shutters shall be of the following specifications:
(a) **Flush door shutters:** Flush door shutters shall be of specified thickness / solid core type / no decorative factory made confirming to IS 2202 and ISI marked with block board core (confirming to the requirements as per IS-1659 1969) with internal hard wood lipping and both faces commercial ply veneered.
(b) Adhesive used shall be Phenol formaldehyde synthetic resin conforming to BWP types specified in IS-848-1974.
(c) Contractor shall obtain the approval for the name of the manufacturer of the flush door shutters from the Consultant / PMC before placing the supply order. While asking for the approval, copy of the "Bureau of Indian Standard" letter under which manufacturer has been authorized to mark the product with ISI marking should be attached. Consultant/PMC before giving the approval shall ensure that the validity date of license has not expired.
(d) **Testing of flush door shutters:** On receipt of the shutters at site the Consultant / PMC shall be entitled to get the samples of door shutters tested in any approved laboratory.
From each lot of approximately 500 shutters, one shutter shall be selected at random by the Consultant / PMC. The balance shutters from the lot shall not be installed until the lab report is received confirming that the sample complies with the requirement of IS. The cost of replacement of the door shutters selected as samples, their transportation to the laboratory and cost of testing by the laboratory shall be borne by the contractor and shall be deemed to be included in the lump sum rates quoted.

1.3 Adhesives

(a) **Nature of the surface to be bonded** when bonding to walls, the regularity of the age of plaster or cement screeds should be particularly noted. The area to be bonded together with the size of panels, tiles, etc, should be stated.

(b) **Location of the installation** Not only should mention be made of internal and external locations. But the actual conditions of service, i.e. maximum temperature, Humidity, structural movement, etc should also be assessed.

(c) **Assembly technique** Possible conditions of site assembly should be noted and restrictions on technique assessed, i.e. whether it is possible to apply adhesive to both surfaces, whether it is necessary to position the assembly after making the bond etc. Furnished with these facts, most adhesive suppliers will suggest suitable products from their range for the purpose in mind and give assembly details and costing.

(d) **Application**: the required preparation of the surfaces to be bonded should also be carried out carefully. All surfaces should be firm and free from dust. Loosed material on brickwork, etc, should be removed by thorough use of a wire brush. Surfaces with a high gloss should be roughened with sandpaper or emery. It is usually necessary to make sure that the surfaces are dry, and to protect the job from rain if necessary during assembly.

(e) **Clean tools should always be used for applying the adhesive.** When making an overall bond (e.g. with contact adhesive) care should be taken to obtain an even film of adhesive. On porous surfaces it may be necessary to apply two coats to ensure an adequate dry film on the surface.

(f) A large number of adhesion failures are caused by using an incorrect drying time. When a two-way dry-stick is used it is essential that the manufacturers’ instructions are closely followed on this point. If the drying time is too long, then the two adhesive films will not fuse completely and once again a poor bond will result. A similar effect will be obtained once again a poor bond will result. A similar effect will be obtained if the adhesive films are not thoroughly pressed into contact With most adhesives high pressure to the assembly to bring the two bonding surfaces into intimate contact must be removed before applying adhesive.

1.4 Plywood
(a) The plywood will be Boiling Water Proof (BWP), Borer and termite proof with a 20-year warranty from the manufacturer.

(b) The plywood will be as per IS-710.

(c) It must comply with European standard for indoor air quality (IAQ), confirming to E1 Emission norm.

(d) Product / Manufacturer must have the following certifications:
   • OHSAS 18001:2007,
   • IGBC
   • ISO 14001:2015
   • ISO 9001:2015
   • NSF Certified
   • PEFC Chain of Custody Certificate
   • Greenguard Gold
   • Forest Stewardship Council
   • Greenlabel Singapore

1.5 Block Board

(a) The block board will be Boiling Water Resistant (BWR-AA), Borer and termite proof with a 7-year warranty from the manufacturer.

(b) The plywood will be as per IS-303.

(c) Product / Manufacturer must have the following certifications:
   • OHSAS 18001:2007,
   • IGBC
   • ISO 14001:2015
   • ISO 9001:2015
   • NSF Certified
   • PEFC Chain of Custody Certificate
   • Greenguard Gold
   • Forest Stewardship Council
   • Greenlabel Singapore

1.6 Decorative Veneer

(a) The Veneer will be as per IS-1328.

(b) The thickness of the veneer faced plywood will be 4mm unless otherwise specified.

(c) The design/shade/surface finish of the veneer will be as per selection of the Consultant.

(d) The species of timber for the decorative face veneer in decorative plywood shall be as
Decorative veneers shall be rotary cut or sliced and shall be 1.0 mm in thickness. The veneers shall be spliced or taped at the edges. The veneers may have end grain joints in cases of special matching like centre-matching, v matching, etc.

The Veneer will be natural veneer unless specified otherwise.

Product / Manufacturer must have the following certifications:
- OHSAS 18001:2007,
- IGBC
- ISO 14001:2015
- ISO 9001:2015
- NSF Certified
- PEFC Chain of Custody Certificate
- Greenguard Gold
- Forest Stewardship Council
- Greenlabel Singapore

1.7 Laminate
(a) The laminate will be as per IS-2046.
(b) The thickness of the laminate will be minimum 1mm unless otherwise specified.
(c) The design/shade/surface finish of the laminate will be as per selection of the Consultant.
(d) Product / Manufacturer must have the following certifications:
- OHSAS 18001:2007,
- IGBC
- ISO 14001:2015
- ISO 9001:2015
- NSF Certified
- PEFC Chain of Custody Certificate
- Greenguard Gold
- Forest Stewardship Council
- Green label Singapore
- UL Certified

1.8 Acrylic Solid Surface
(a) The acrylic solid surface must be 100% Acrylic Solid Surfaces made with a composition of Methyl Methacrylate (MMA) and Polymethyl Methacrylate (PMMA) resin filled with Alumina-Trihydrate and other specialized formula.
(b) The product must have passed chemical and stain resistance testing as per ASTM-D & NEMA standards

(c) The product must be NSF51 certified.

(d) The product must have Green Guard certification for Indoor Air Quality

(e) The product must be bendable. It Must have a non-porous surface that prevents dirt and stains from penetrating the material. It must be easy to clean.

(f) The design/shade/surface finish of the veneer will be as per selection of the Consultant.

1.9 Wooden Door Frames: The works covered under this specification consist of providing, making and fixing of wooden frames for doors in accordance with these specifications and drawings.

(a) APPLICABLE CODES & SPECIFICATIONS:

(b) The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

List of Indian Standards

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(c) TEAK WOOD FRAMES:

• Door frames shall be of quality timber of C.P. teak wood or as specified in
the BOQ and brought and put up to section as indicated on the drawings or as directed by the Architects.

- They shall be properly framed and mortised and tongued together at right angles and set correctly in the masonry or concrete.
- The door frame shall rest on structural slabs and not on finished floor level.
- M.S. holdfasts 230 mm long, 40 mm wide and 3 mm thick shall be fixed as shown in drawing or as directed by the Architects to hold the teakwood rough ground frames/door frames firmly in the masonry.
- Where the rough ground/frames are placed by the side of concrete surface they shall be fixed firmly against the concrete surface by means of teak wood gutties and screws.
- All m.s. hold fast shall be fastened to the frame using adequate number of M.S. screws all other door frames shall be fixed as per fixing details shown in relevant drawings.
- The surfaces of frames in contact with masonry or concrete shall be painted with two coat of bituminous paint.
- The frame shall be as per drawing and shall be provided with triangular keys for the plaster if indicated in the drawing.
- All frames shall be protected with one coat of approved wood primer as specified.
- While fixing the frames in position, the vertical members shall be held rigid temporarily by means of wooden battens to avoid bending or distortion of members and to keep door frame exactly in plumb.
- The teakwood beading/cover mould/stopper of the specified sizes shall be fixed on to the frame as shown in the drawings and shall be fixed on to the frame as shown in the drawings and shall be free from knots and sap wood.

1.10 **SPECIFICATIONS FOR FLUSH DOOR SHUTTER:** The works covered under this specification consist of providing and fixing block flush door shutter in accordance with the specification and drawings.

(a) **APPLICABLE CODES & SPECIFICATIONS:** The relevant I.S. specifications, standards and codes given below are made a part of this specification. All standards, specifications, code of practices referred to herein shall be the latest edition including all applicable amendments, revisions and additional publications.

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(b) BLOCK BOARD FLUSH DOOR SHUTTER:

- Flush door shutter shall have a solid core and may be of the decorative or non-decorative type conforming to I.S. 2202.
- The thickness and type of shutter shall be as specified in item of schedule of quantities.
• Width and height of shutter shall be as shown in the drawings or as directed by the Architects. All four edges of shutter shall be square.

• The shutter shall be free from twist or wrap in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 percent when tested according to I.S. 1708.

• The core of flush door shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. The width of the stiles and rails shall not be less than 75 mm and not more than 100 mm. The width of each wooden strip shall not exceed 25 mm. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles.

• End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails shall be of one species of timber. Wooden strips shall also be one species only but it may or may not be the same species as that of the stiles and rails.

• The face panel shall be formed by gluing by the hot-press process on both faces of the core either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the plywood shall be between 0.5 mm and 1.5 mm for commercial veneer and between 0.5 and 1.0 mm for decorative veneers. The direction of the veneer adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture.

• Lipping where specified, shall be provided internally on all edges of the shutters. Lipping shall be done with battens of first class teakwood or as specified. Joints shall not be permitted in Lipping.

• The shutters shall be single leaf or double leaves as shown in the drawings or as directed by the Architects. In case of double leaves shutters the meeting at stiles shall be rebated by one third the thickness of the shutter. The rebating shall be either splayed or square type.

• Wherever specified the opening for glazing of size as shown in drawing or as directed shall be made in the shutter for vision panel and or louver. Opening for glazing shall be made in the shutter for vision panel and or louver. Opening for glazing shall be lipped internally with teakwood batten of specified size.

• Tolerance on width and height shall be (+ or -) 3 mm and on thickness it shall be (+ or -) 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when
• Adhesive used for bonding various components like core, core frame, Lipping, cross bands, face veneers plywood etc. of flush door shutters and for bonding plywood shall be phenol formaldehyde synthetic resin conforming to I.S. 848.

• Samples of flush door shutters shall be subjected to following tests in accordance with I.S. 2202 (Part – I & II):
  - End immersion test
  - Knife test
  - Glue adhesion test

• All the sample shutters when tested shall satisfy the requirements of the tests as laid down in I.S. 2202 (Part – I & II) if the number of samples found unsatisfactory or a test is two or more the entire lot shall be considered unsatisfactory.

(c) TEAK WOOD GLAZED SHUTTERS: The specifications for teak wood paneled shutter shall generally apply to glazed Shutters for frame, sties etc. The sash and beading required for glazing shall be of the best teak wood and shall be fixed as per the design shown in relevant drawing. Any mouldings, carvings shown shall be worked out from the teak wood member of bigger size.

(d) GLAZING: Glazing shall be generally with 5.5 mm/8 mm/12 mm or as specified in the BOQ. Thick plain sheet glass/bajra glass unless otherwise mentioned in the schedule of quantities. The detailed specifications for glazing given hereafter shall be followed generally.

(e) MISCELLANEOUS: Wherever mentioned in the Schedule of quantities, vision panels, Venetians, plastic laminates, push plates etc. shall be provided in all doors. The vision panels shall be of size mentioned in the drawing and shall be provided with teak wood lipping all-round the glass. The glass shall be of required thickness as specified of best quality, free from defects.

(f) Teak wood Venetians or louvers shall generally conform to relevant specifications of timber. Necessary grooves and rebate in frames shall be provided as per drawing. Formica or approved equivalent plastic laminate of required design, required shade and colour shall be provided and fixed on flush door to the required size on any side of the shutter as shown in drawing. It shall be fixed with Fevicol or any other approved adhesive. Fixing shall be done in such a way that there shall not be any air gap, warpage or undulations on the surface. Finished surface of Formica shall be cleaned with wax polish. The shutters shall be painted on commercial facing side with two coats of synthetic/flat oil paint of approved shade and make over an approved coat of primer. The decorative veneer side of the shutter shall be wax or French polished with two or more coats so as to render a satisfactory surface.
The flush doors shall be single leaf or double leaf type as mentioned in the schedule of quantities. In case of double leaf shutters, the meeting of the stiles shall be rebated 20 mm. And it shall be either splayed or square type or the T.W. lipping around the meeting shall not be less than 35 mm. deep. The meeting stiles shall be in single piece.

Sufficient care shall be taken to prevent any damage and loss of shape during handling, transporting, stacking, fixing etc. The door shutters shall be handled with utmost care to prevent any surface damage, warping etc.

1.11 SPECIFICATIONS FOR FITTINGS AND FIXTURES: The works covered under these specifications consist of supplying different types of fittings and fixtures required for doors, windows, ventilators etc. The supply shall be in accordance with the specification, drawings / approved samples. Samples of various fittings and fixtures proposed to be incorporated in the work shall be submitted by the contractor for approval of the Architects and Employer before order for bulk supply is placed.

(a) GENERAL: All fittings and fixtures shall conform to relevant IS code and made of oxidized brass, anodized aluminium, iron oxidized (M.S.) or as specified. These shall be well made reasonably smooth and free from sharp edges, corners, flaws and other defects. Screw holes shall be counter sunk to suit the heads of the specified screws. All hinges pins shall be of steel for brass hinges and aluminium alloy NR-6 or steel pins for aluminium hinges with nylon washers or as specified. All riveted heads pertaining to hinge pins shall be well formed. Screws supplied for fittings shall be of the same metal and finish as the fittings. However brass cadmium plated/chromium plated screws shall be supplied with aluminium fittings. Samples of each fixture/ fitting shall be furnished by the contractor for approval of the Architects and Employer. Order for procurement of fittings and fixtures in bulk shall be placed only after approval by the architects and Employer.

(b) The fittings and fixtures to be incorporated in the work shall be strictly according to the approved sample. Fittings shall be fixed in proper position as shown in the drawing and as directed by the Architects. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with a screwdriver and not hammered in. Recess shall be cut to the exact size and depth for the counter sinking of hinges. The fittings and fixtures shall be fixed in a workman like manner and any damages done either to fittings and fixtures or to the shutter frames etc. should be rectified by the contractor at his own cost. Fittings shall be of Mild steel, Stainless steel, aluminium, brass or as specified. The fittings shall be well made, smooth, and free from sharp edges and corners, flaws and other defects.

(c) Mild steel fittings shall be bright satin finish black stone enameled or copper oxidized (black finish), nickel chromium plated or as specified.

(d) Aluminium fittings shall be anodized to natural matt finish or dyed anodic coating less than grade AC 10 of IS: 1868
(e) Stainless steel fittings shall be non-magnetic, rust & moisture proof, strong & sturdy. Pin of hinges shall also be of stainless steel.

(f) BUTT HINGES: Oxidized Brass and aluminium hinges shall be manufactured from the extruded sections and shall be free from cracks and other defects. M.S. butt hinges shall be free from cracks and other defects. M.S. butt hinges shall be cranked and manufactured from M.S. Sheets. All butt hinges shall conform to latest I.S. specifications butt hinges shall generally conform to releval I.S viz IS 1341 (M.S.) IS : 205 (Cast brass & aluminium, IS : 362 (Parliament hinges); IS : 453 sprig hinges, IS : 3818 (Piano hinges) etc. The size of butt hinges shall be taken as the length of the hinge. Width of the hinge shall be measured from the centre line of hinge pin to end of flange.

(g) PARLIAMENTARY HINGES: These shall be manufactured from extruded section for oxidized brass and anodized aluminium and from M.S. sheets for iron oxidized and shall be free from cracks and other defects. The size of the parliamentary hinges shall be taken as the width between open flanges, while the depth shall be as specified.

(h) PIANO HINGES: These shall be generally conformed to I.S. 3818 and shall be made of brass oxidized, aluminium anodized, iron oxidized (M.S.) or as specified. Piano hinges shall be fixed in the entire length of the cupboard shutters in a single piece. No joints shall be allowed. Crank

(i) BOX HINGE: These shall be manufactured from screw on nickel plated steel with opening angle 95 degree, cup diameter 35mm. These shall be 16mm cranked. The size of butt hinges shall be taken as the length of the hinge.

(j) TOWER BOLTS: These shall generally conform to IS 204 (Part II & I). They shall be well made and shall be free from defects. The tower bolts shall be of the following types:

- MS semi barrel tower bolt with ms sheet pressed barrel and G.I. bolt or with ms barrel and MS Sheet bolt.
- Oxidized brass barrel tower bolt with brass sheet barrel and rolled or drawn brass bolt Anodized aluminium tower bolt with barrel and bolt of extruded sections of aluminium alloy.
- In case of M.S. tower bolt plates and straps after assembly shall be firmly riveted or spot welded properly. The knobs of brass tower bolts shall be cast and the bolt fixed into the knob firmly as per I.S. specifications. The tower bolt shall be finished to correct shape and pattern so as to have a smooth action. Wherever specified, aluminium barrel tower bolts shall be manufactured from extruded sections of barrel & bolts. Knobs shall be properly screwed to the bolt and riveted at the back. The size of the tower bolt shall be taken as the length of barrel without top socket.

(k) DOOR LATCH: This shall be of MS, cast brass or as specified shall have smooth sliding
action. MS Latch shall be copper oxidized (black finish) or as specified. Brass Latch shall be finished bright, CP or oxidized or as specified

(l) ALDROPS: These shall be oxidized brass or anodized aluminium, iron oxidized or as specified and shall be capable of smooth sliding action and shall be as per relevant I.S. Brass sliding door bolt (aldrop) shall be made from rolled brass generally confirming to IS : 2681. M.S. sliding door bolt shall generally conform to I.S. 281. The hasp shall be of cast brass and screwed to the bolt in a workman like manner. Alternatively the hasp and the bolt may be in one piece. Bolts shall be finished to shape and threaded with worth standard and provided with round brass washers and nuts of square or hexagonal shape. All components shall be smooth and polished. The leading dimensions of aldrop shall be as the length of the bolt and specified diameter.

(m) DOOR HANDLES: BOW/PLATE HANDLES: These should generally conform to IS: 208. Unless otherwise specified door handles shall be of 100 mm size & windows handles of 75 mm size. These shall be of cast brass of specified size, shape and pattern as approved by the Architects. All edges and corners shall be finished smooth and correct to shape and dimensions. Brass handles shall be bright, chromium plated or oxidized as specified. Anodized aluminium or iron oxidized (M.S.) handles shall be of specified size, shape and pattern. The size of the handle is taken as the inside grip of the handle. In case of iron oxidized handles, the same shall be manufactured from M.S. sheet pressed into oval section as per I.S.

(n) MORTISE LOCK & LATCH: This should generally conform to I.S. 2209. Handles shall conform to IS 4992. Mortise lock with latches and a pair of level handles shall be 6 levers, with zinc alloy pressure die cast/brass or as specified body of approved quality, and shall be right or left handed as specified. The pair of handles shall be either brass chromium plated or anodized aluminium of approved shape and pattern or as specified. It shall be of the best Indian make of approved quality. The size of the lock shall be determined by its length. The lock for single leaf door shall have plain face and that for double leaf door a rebated face. Level handles with springs shall be mounted on plates and shall be of approved quality, anodized aluminium or as specified.

(o) DOOR CLOSER: Shall be as specified in the BOQ and list of approved make of materials. The contractor shall provide for all the incidentals required for fixing these fixtures and fittings such as cadmium plated screws etc. Fittings and fixtures shall be fixed securely in a workman like manner all as directed by the Engineer-in-charge. Any of the fixtures damaged during the fixing shall be removed and new one fixed in their place and the surface of joinery made good where affected, at his own expense. Mortise plates shall be used over holes where the bolts enter in the wood work. Metal sockets

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shall be provided to all bolts where the shoot enter brick, stone, concrete etc. The incidental Fixtures like mortise plates, metal sockets, screws etc. shall not be paid for separately.

(p) **MORTICE NIGHT LATCH:** This is a mortice lock having a single spring bolt withdrawn from the outside by using the key and from inside by turning the knob and with an arrangement whereby the lock can be prevented from being opened by its key from outside while the night latch is used from inside the room. This should generally conform to IS: 3847. It shall be cast or sheet brass, cast or sheet aluminium alloy or mild steel as specified and of approved make. These shall be bright finished or copper oxidized (black) finish as specified. Normal size of the latch shall be denoted by the length of the face over the body in millimeters.

(q) **FLOOR DOOR STOPPER:** The floor door stopper shall conform to IS: 1823. This shall be made of cast brass of overall size as specified and shall have rubber cushion. The shape and pattern of stopper shall be approved by the Architects. It shall be of brass finished bright, chromium plated or oxidized or as specified. The size of door stopper shall be determined by the length of its plate. The body of the door stopper shall be cast in one piece. All parts of the door stopper shall be of good workmanship and finish and free from surface and casting defects. Aluminium stopper shall have anodic coating of not less than grade AC-10 of IS 1868.

1.12 **SPECIFICATIONS FOR GLASS AND GLAZING:** The work covered by this specification include furnishing and fixing the glass panes to teak wood or steel doors and windows, strictly in accordance with these specifications and drawings.

(a) **Glass:** The glass shall be special selected/selected ordinary quality of approved make, as specified and it shall be free from bubbles, flaws specks, waves, air holes, distortion, scratches or other defects. The glasses in bulk quantities shall be brought to site in Makers original packings and Makers guarantee shall be produced if called for by the Architect PMC and Employer. The glass shall be of required thickness as mentioned in the items of schedule of quantities and/or drawing or as directed by the Architects. The contractor shall submit the sample of the glass which he proposes to use on the work and only such approved quality of glass shall be used in the works. The glass brought to site shall be protected against damages. Wherever frosted (obscure) glass is mentioned in the item of schedule of quantities and/or shown in drawings, the glass shall be of sand blown pattern and shall also be got approved by the Architect and Employer.

(b) **Beading:** The beading shall be of teak wood of superior quality timber in case of teak wood doors and windows and/or required sizes mentioned in the items of schedule of quantities and/or shown in drawing. In case of steel doors and windows, the beading shall be anodized aluminium beading of channel section as per sizes mentioned in the item and/or shown in the drawing. The junction of the beading shall be mitre jointed.
(c) **WORKMANSHIP:** The glass shall be cut to the required sizes of panels where it is to be fitted, and it shall be so cut that it fits properly in the frames without rattling. Pre-measurement of each panel prior to the cutting of glass is essential. The beading shall then be fixed to glass panes and screwed at close intervals not more than 10 cm. from each corner and the intermediate not more than 20 cm. apart. When glass panes are fixed with wooden beadings having mitred joints or aluminium beading thin layer of glazier putty shall be applied covering the area in contact between the glass and sashbars and beadings. In case of louvers, all the exposed edges of the glass shall be ground properly.

(d) **GENERAL:** After the inspection is over and permitted by the Architects, glass panes shall be cleaned off any labels, paints smears and spots and shall be washed from both the sides and all glazing left clear, perfect and free from rattling. The contractor shall provide all the scaffolding, tools and plants for fixing the glass panes at his own cost. In case of steel windows, any hardware if fixed in position, shall be removed temporarily before fixing the glass panes and which shall be re fixed back in position, all at the contractors cost.

1.13 **SPECIFICATIONS FOR PAINTING:** The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here-in-after with the item of schedule of quantities.

(a) **MATERIALS:** Paints, oils, varnishes etc. Of approved brand and manufacture shall be used. Ready mixed paints as received from the manufacturer without any admixture shall be used. If for any reason, thinning is necessary in case of ready mixed paint, the brand of thinner recommended by the manufacturer or as instructed by the Architects shall be used. Approved paints, oils or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The materials shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnights work. The materials shall be kept in the joint custody of the contractor and the Employer. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Architect and Employer.

(b) The contractor shall associate the chemist of paint manufacturers before commencement of work, during and after the completion of work who shall certify the suitability of the surface to receive painting and the paint before use etc.

(c) **Scaffolding:** Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being painted. Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage.
or scratches to walls. For painting of the ceiling, proper stage scaffolding shall be erected.

(d) Painting shall not be started until and unless the Architects/Employer has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

(e) Painting, except the priming coat, shall generally be taken in hand after all other builders work, practically finished.

(f) The rooms should be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

(g) **The surface shall be thoroughly cleaned.** All dirt, rust, scales, smoke and grease shall be thoroughly removed before painting is started. Minor patches if any in plastered/form finished surfaces shall be repaired and finished in line and level in C.M. 1:1 and cracks & crevices shall be filled with approved filler, by the contractor at no extra cost to the Department. The prepared surface shall have received the approval of the Architects after inspection, before painting is commenced.

(h) **APPLICATION:** Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its containers. When applying also, the paint shall be continuously stirred in the smaller containers so that consistency is kept uniform.

(i) The external surfaces of the buildings under reference including the R.C.C. Jalli, fins and the panels above and below the window etc. Shall be finished in different colours of approved shade. The contractor will make suitable samples at site for Departments approval before taking up the work in hand and they will be allowed to proceed with the work only after getting Departments approval for the same.

(j) The painting shall be laid on evenly and smoothly by means of crossing and laying off, the later in the direction of the grain in case of wood. The crossing & laying off consists of covering the area with paint, brushing the surface hard for the first time and then brushing alternately in opposite directions two or three time and then finally brushing lightly in direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying will constitute one coat.

(k) Where so stipulated, the painting shall be done with spraying. Spray machine used may be (a) a high pressure (small air aperture) type or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner. Spraying should be done only when dry condition prevails.

(l) Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation.
(m) Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

(n) Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned of dust before the next coat is laid.

(o) No left over paint shall be put back into the stock tins. When not in use, containers shall be kept properly closed.

(p) The final painted surface shall present a uniform appearance and no streaks, blisters, hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

(q) In case of cement based paints/primers, the absorbent surfaces shall be evenly damped so as to give even suction. In any weather, freshly painted surfaces shall be kept damp for at least two days.

(r) In painting doors and windows, the putty around the glass panes must also be painted, but care must be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out while painting. Perspect covers of electrical switch boxes have to be painted from inside by removing them. Care shall be taken while removing them in position after painting with respective approved paints. In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

(s) The additional specifications for primer and other coats of paints shall be as in accordance to the detailed specifications under the respective headings.

(t) Any damage caused during painting work to the existing works/surfaces shall be made good by the contractor at his own cost.

(u) BRUSHES AND CONTAINERS: After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers, when not in use, shall be closed, kept air tight and shall be kept at a place free from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean & can be used again.

(v) PRECAUTIONS: All furnitures, lightings, fixtures, sanitary fittings, glazing, floors etc. shall be protected by covering and stains, smears, splashing, if any shall be removed and any damage done shall be made good by the contractor at his cost.

(w) RATES: Rates shall include cost of all labour and materials involved on all the operations described above and in the particular specifications given under the several items.

(x) The primer for wood work, iron work or plastered surface shall be as specified in the description of the item.

- Primer for Wood work / Iron & Steel / Plastered / Aluminium surfaces shall be as specified below:
<table>
<thead>
<tr>
<th>SN</th>
<th>SURFACES</th>
<th>PRIMER TO BE USED</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Wood work (hard &amp; soft wood):</td>
<td>Pink conforming to I.S.3536-1966</td>
</tr>
<tr>
<td>b</td>
<td>Resinous wood and ply wood:</td>
<td>Aluminium primer</td>
</tr>
<tr>
<td>c</td>
<td>Iron &amp; Steel, Aluminium and galvanised Steel work:</td>
<td>Zinc chromate primer conforming to I.S. 104-1962.</td>
</tr>
<tr>
<td>d</td>
<td>Plastered surfaces, cement brick work, Asbestos surfaces</td>
<td>Cement Primer</td>
</tr>
</tbody>
</table>

- The primer shall be ready mixed primer of approved brand and manufacture.

(y) Preparation of surface:
- Wood work: The wood work to be painted shall be dry and free from moisture.
- The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with same shade as paint shall be used where so desired by the Architects.
- The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty and wood putty - refer as mentioned here-in-before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

(z) BEES WAXING OR POLISHING WITH READY MADE WAX POLISH:
- Materials: The polishing shall be done with bees waxing prepared locally or with ready made wax polish of approved brand and manufacture, as stipulated in the description of item.
- Where bees waxing is to be prepared locally, the following specifications for the same shall apply:
• Pure bees wax free from paraffin or stearing adulterants shall be used. Its specific gravity shall be 0.965 to 0.969 and melting point shall be 63o C. The polish shall be prepared from a mixture of bees wax, linseed oil, turpentine and varnish in the ratio of 2: 1.5: 1: 0.5 by weight.

• The bees wax and boiled linseed oil shall be heated over a slow fire. When the wax is completely dissolved, the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and the entire mixture shall be well stirred.

• Preparation of surface: Preparation of surface will be as mentioned here-in-under para 32.20.2 with the exception that knotting, holes and cracks shall be stopped with a mixture of fine saw dust formed of the wood being treated, beaten up with sufficient bees wax to enhance cohesion.

• Application: The polish shall be applied evenly with a clean soft pad of cotton cloth in such a way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour.

• When the surface is quite dry, a second coat shall be applied in the same manner and rubbed continuously for one hour or until the surface is dry.

• The final coat shall then be applied and rubbed for two hours (more if necessary) until the surface has assumed a uniform gloss and is dry showing no sign of stickiness.

• The final polish depends largely on the amount of rubbing which should be continuous and with uniform pressure, with frequent changes in the direction.

• Other details: The specifications for painting (General) as mentioned here-in- before shall hold good as far as they are applicable.

(aa) FRENCH SPIRIT POLISHING: (ON NEW WORK WITH A COAT OF WOOD FILLER):

• Polish: Pure shellac varying from pale orange to lemon yellow colour, free from resinor dirt shall be dissolved in methylated spirit at the rate of 140 gm. of shellac to 1 litre of spirit. Suitable pigment shall be added to get the required shade.

• Preparation of surface: The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted off. Knots if visible shall be covered with a preparation of red lead and glue size laid on while
hot. Holes and indentations on the surface shall be stopped with glazier's putty. The surface shall then be given a coat of wood filler made by mixing whiting (ground chalk) in methylated spirit at the rate of 1.5 kg. of whiting per litre of spirit. The surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.

- Application: The number of coats of polish to be applied shall be as described in the item. A pad of woolen cloth covered by fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly dampened with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

(bb) CONSUMPTION OF PAINT FOR DIFFERENT PAINTING ITEMS: COVERAGE PER SQM ACHIEVED PER LITRE PAINT: (Note: Coverage per Kg is mentioned with respective item)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Brief Description of painting work</th>
<th>Consumption per 10 sqm of net area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oil Bound Distemper on plastered surfaces:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Cement Primer (one coat).</td>
<td>0.91 litres.</td>
</tr>
<tr>
<td></td>
<td>b) Two finishing coats.</td>
<td>1.60 kg.</td>
</tr>
<tr>
<td></td>
<td>c) Three finishing coats.</td>
<td>2.40 kg.</td>
</tr>
<tr>
<td>2</td>
<td>Flat oil paint to plastered surfaces:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) Cement primer (one coat).</td>
<td>0.91 ltr.</td>
</tr>
<tr>
<td></td>
<td>b) Cement primer (two coats).</td>
<td>1.82 ltrs.</td>
</tr>
<tr>
<td></td>
<td>c) Two finishing coats.</td>
<td>1.72 ltrs.</td>
</tr>
</tbody>
</table>
### Acrylic Emulsion Paint:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Paint</th>
<th>Area coverage for one coat (Old work)</th>
<th>Area coverage for two coats (Old work)</th>
<th>Area coverage per addl. coat</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>a) Cement primer (one coat)</td>
<td>0.91 ltr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Two finishing coats</td>
<td>0.87 ltr.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c) Three finishing coats</td>
<td>1.30 ltrs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cement Paint (old surfaces):

- a) Two coats on sand faced plastered surface: 4.10 kg.
- b) Two coats on rough cast plastered surface: 7.70 kg.

### Cement Paint (New surfaces):

- a) Two coats on sand faced plastered: 4.50 kg.
- b) Two coats on rough cast plastered: 8.50 kg.

### Enamel Paint to wood/steel:

- a) Wood primer (one coat): 0.90 ltr.
- b) Steel primer (one coat): 0.75 ltr.
- c) Two finishing coats on wood: 1.40 ltrs.
- d) Two finishing coats on steel: 1.35 ltrs.

### Flat Oil Paint to wood/steel work:

- a) Wood primer (one coat): 0.90 ltr.
- b) Steel primer (one coat): 0.75 ltr.
- c) Two finishing coats on wood: 1.70 ltrs.
- d) Two finishing coats on steel: 1.70 ltrs.

### External Painting with flat oil paint:

- a) Cement primer (one coat): 1.00 ltr.
- b) Two finishing coats: 1.74 ltrs.
- c) Two coats of enamel paint: 1.35 ltrs.
<table>
<thead>
<tr>
<th></th>
<th>Paint Type</th>
<th>Coverage per kg</th>
<th>Coverage per kg</th>
<th>Coverage per kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Synthetic enamel paint</td>
<td>14 sq.m.</td>
<td>8.5 sq.m.</td>
<td>18 sq.m.</td>
</tr>
<tr>
<td>2</td>
<td>Plastic emulsion paint</td>
<td>14 sq.m.</td>
<td>8.5 sq.m.</td>
<td>18 sq.m.</td>
</tr>
<tr>
<td>3</td>
<td>Oil Bound distemper</td>
<td>10 sq.m.</td>
<td>6.0 sq.m.</td>
<td>12 sq.m.</td>
</tr>
<tr>
<td>4</td>
<td>Dry distemper</td>
<td>10 sq.m.</td>
<td>6.5 sq.m.</td>
<td>12 sq.m.</td>
</tr>
<tr>
<td>5</td>
<td>White Wash: Note: Following things to be added in lime (i)Adhesive (DDL/SDL) -5% of lime, (ii)Neel (Blue) - 3 gm per kg of lime, (iii) Water - 5 kg of water per kg of lime</td>
<td>5 sq.m.per kg of Lime</td>
<td>3.5 sq.m.per kg of Lime</td>
<td>10 sq.m.per kg of Lime</td>
</tr>
<tr>
<td>6</td>
<td>Cement based paint</td>
<td>4.5sq.m. per kg</td>
<td>2 sq.m. per kg</td>
<td>6 sq.m. per kg</td>
</tr>
<tr>
<td>7</td>
<td>Aluminium paint</td>
<td>20 sq.m.</td>
<td>12.5 sq.m.</td>
<td>28 sq.m.</td>
</tr>
<tr>
<td>8</td>
<td>Bitumen paint / Black Japan</td>
<td>14 sq.m.</td>
<td>14 sq.m.</td>
<td>28 sq.m.</td>
</tr>
<tr>
<td>9</td>
<td>Oil based putty as per manufacturer’s specification.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>Red oxide metal primer</td>
<td>16 sq.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Cement primer</td>
<td>12 sq.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Wood primer</td>
<td>13 sq.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Wax polishing of new wood work with ready made polish</td>
<td>20 sq.m. per kg</td>
<td>20 sq.m. per kg</td>
<td>20 sq.m. per kg</td>
</tr>
<tr>
<td>14</td>
<td>French or spirit polish</td>
<td>10.5 sq.m.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Varnish</td>
<td>14 sq.m.</td>
<td>8.5 sq.m.</td>
<td>18 sq.m.</td>
</tr>
<tr>
<td>16</td>
<td>Requirement of paint per coat in Structural steel work on tonnage basis Truss and Lattice girder work - 4.5 litres per tonne. Plane Beam/plane girder work - 2.5 litres per tonne</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre
ELECTRICALS WORKS

1. GENERAL

These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

This tender shall act as a guide to the type of system desired for the project. The specifications described in this tender are as per the 'Basis of Design' and are the minimum required from the tenderer. The features offered over and above those mentioned in the tender shall be given due credit.

Standard literature, not complying to the format and requirement of this tender, submitted by the contractor, shall not be considered or evaluated.

2. SCOPE OF WORK (SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF THE WORK AS PER BOQ IN ACCORDANCE TO TECHNICAL SPECIFICATION AND CONFORMING TO ELECTRICAL ACT).

The general character and the scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities. The Tenderers shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner’s site representative. The tenderer shall furnish all labour, materials and equipment (except those to be supplied by the Owner’s) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete electrical system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The electrical system shall comprise of following:

a. All conduit work including junction boxes, outlet boxes and wiring for lighting and power.

b. Switches, plug sockets, cover plates and other wiring accessories.

c. Cables (HT / LT), Mains and Sub-Mains.

d. Bus Ducts & Rising Mains.

e. LT Panel, Main Distribution / Sub distribution panels & Capacitor Panels.

f. Final Distribution panels.

g. Cables on cable trays and / or within suspended ceiling spaces including installation, cable trays, hangers, supports, cable terminations and all fixing accessories.

h. Earthing (Grounding) System.

j. Advance Lightning Protection System.

k. Supply & Installation of Lighting Fixtures (Common Areas only)

l. Supply and installation of conduits / cabling and wiring for Voice & Data Network in common area.
m. Supply, installation, testing & Commissioning of HT switchgear and transformers
n. Sub Station earthing
o. Installation of Landscape / external lighting fixtures supply and installation of cabling, feeder pillars, earthing.
p. Supply and installation of conduits / cabling and wiring for MATV & PA system.
q. Supply and installation of UPS for common Services.
r. Training of Owner’s staff and preparing of quality control document at each stage.

3. ASSOCIATED CIVIL WORKS

Following civil works associated with Electrical installation are excluded from the scope of this contract except for all minor civil work like wall chasing by chase cutter, making holes etc. for installation of conduits/cables and making good as it was as earlier. These shall be executed by other agencies in accordance with approved shop drawings of, and under direct supervision of the electrical tenderer.

a. RCC Trenches inside Sub-station and LT panel room for laying of LT cables.
b. PCC foundation blocks with angle iron frame work edging for all motor control centre.
c. Air-tight fire doors with minimum one hour fire rating for DG Room, Electrical rooms, UPS rooms and other equipment rooms as per requirement of CFO.
d. Repair of all disturbed surfaces/openings made by Electrical Tenderer.

e. RCC foundation with angle iron frame work (properly painted/ fire retardant paint) at the edges to protect these from damage.

4. PROJECT EXECUTION, MANAGEMENT & COORDINATION

All electrical work should be carried out by licensed electricians under the full time supervision of a graduate electrical engineer holding electrical supervisor and contractors licence.

4.1 The Contractor shall prepare large scale comprehensive coordinated CAD drawings in conjunction with all other specialty trades, indicating clearances with structural and architectural construction. All other Contractors shall overlay their work on these CAD drawings utilizing individual CAD layers to produce final coordinated CAD drawings clearing all interferences with all adjacent activities and structures. This includes backgrounds for all areas above and below raised floors as applicable.

4.2 All drawings and drawing layers shall be created in a format compatible with the Architect/Engineer’s CAD system.

4.3 The Contractor shall coordinate with all trade drawings and specifications.

4.4 The Contractor will be responsible for providing its services as defined in the drawing sequence below and shall attend all coordination meetings as scheduled by the Construction Manager.

4.5 In preparing the Shop Drawings, the Contractor will utilize a CAD document sheet of the same size as the Owner’s Contract Drawings. The format should be similar and the lettering shall be at least one-eighth inch high.
4.6 Upon completion of the sheet metal drawings, the Contractor shall forward the CAD documents to the next Contractor who shall super-impose its equipment and piping utilizing a different CAD layer. The Contractor shall prepare CAD backgrounds in all areas for coordination regardless of the need for sheet metal in that area. In rotation, the HVAC, Plumbing, Fire Protection, Electrical (to include lighting), Telecommunications (as required), Fire Alarm (as required), Elevator (as required) and Security Contractor (as required) shall super-impose their work on the CAD document using individual layers. Each trade shall have a distinctive CAD layer and color. (Note: All distribution and routing of coordination documents is to be accomplished via electronic file transfer or by the messenger (at contractor’s expense) of the disks containing the appropriate files provided by the Contractor who is distributing the files. Messenger costs are included in the Contract. At each transmission of drawings, the Construction Manager shall be forwarded a copy of the corresponding transmittal.) After the last contractor has completed superimposing its work on the CAD document, a meeting will be held at which time all interferences between the various trades and the sequence of installation will be resolved. The electrical Contractor will bring to this meeting a color reproducible mylar of the composite drawings. The resulting changes will be noted on the drawings and all participants will sign the marked up coordinated drawing. Any and all overtime necessary for drafting, coordination, meetings, etc., to maintain the project schedule, is included.

4.7 The Contractor will then make the required amount of prints, reproducibles and CAD files for distribution to the Construction Manager, the Owner, Architect, Engineer, Commissioning Authority and associated Contractors print each.

4.8 After submission and approval of the coordination drawings, the Contractors will transfer to their Shop Drawings any changes made during coordination meetings which affect their work. Prior to submission for Approval, the Shop Drawings will indicate that they reflect the result of coordination between all trades and the date of coordination completion. Copies of the coordinated drawings must be distributed to all parties involved.

4.9 Should contractor install its work without coordination, and this work interferes with either this or another trade, it will be solely responsible for all changes (ie. costs to other trades should they be required to relocate) resulting from installing without coordination. Should there be interference in the field after coordination; the trades involved will be required to resolve the problem.

4.10 The Owner will not be responsible for costs incurred from the lack of coordination between the work of the trades.

5. PERFORMANCE GUARANTEE

The tenderer shall carry out the work in accordance with the Drawings, Specifications and other documents forming part of the Contract.

The tenderer shall be fully responsible for the performance of the selected equipment (installed by him) at the specified parameters and for the efficiency of the installation to deliver the required end result. The tenderer shall guarantee that the Electrical system as installed shall perform to complete satisfaction of Owner’s.

Complete set of architectural drawings is available in the Architect/Consultant’s office and reference may be made to same for any details or information. The tenderer shall also guarantee that the performance of various equipment individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

6. BYE-LAWS AND REGULATIONS
The work shall be carried out to the satisfaction of the Owner’s site representative and in accordance with the Specifications, Regulations of the Electric Supply Authority, Indian Electricity Rules and Regulations, latest Indian Standards.

7. FEES AND PERMITS

The Tenderer shall pay any and all fees and obtain permits required for the installation of this work. On completion of the work, the tenderer shall obtain and deliver to the Owner’s certificate of final inspection and approval by the local electricity authority (CFO/ Municipal, State/Central govt. whichever is applicable) at its own cost Owner’s not to pay for any clearances. The contractor is liable to take necessary permits and approvals for the entire electrical installation works pertaining to HVAC, Plumbing, Fire Fighting and other allied engineering services. However, all receipted amount shall be reimbursed on production of proof of payment.

8. DRAWINGS

The Electrical Drawings listed under Appendix-I, which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipment, electrical points & fixtures.

The tenderer shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.

Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the tenderer shall notify the Architect/Consultant/ Owner’s site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and tenderer shall rectify the same at his own cost.

The tenderer shall examine all architectural, structural, plumbing, HVAC and other services drawings and check the built works before starting the work, report to the Owner’s site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/ Owner’s site representative without additional cost to the Owner’s.

9. SPECIFICATIONS

The Specifications shall be considered as part of this contract. The Drawings indicate the extent and general arrangement of power distribution, location of lighting the fixtures, controlling switches, wiring system, cabling and earthing. These drawings are essentially diagrammatic. The Drawings indicate the point of termination of conduit runs and broadly suggest the routes to be followed. The work shall be installed as indicated on the Drawings. However, any change found essential to coordinate the installation of this work with other trades shall be made without any additional cost to the Owner’s. The data given herein and on the Drawings is as exact as could be secured, but its complete accuracy is not guaranteed. The drawings are for the guidance of the tenderer, exact locations, distances and levels shall be governed by the site conditions and the Architectural & Interior layouts.

10. ACCESSIBILITY

The Tenderer shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his ducting and piping. His failure to communicate insufficiency of any of the above, shall constitute his acceptance of sufficiency of the same. The Tenderer shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, requiring attendance, shall be finalized and communicated in sufficient time,
to be provided in the normal course of work. Failing this, the Tenderer shall make all the necessary repairs and changes at his own expense. Access panel shall be standardized for each piece of equipment / device / accessory and shall be clearly nomenclatured / marked.

11. MATERIALS AND EQUIPMENT

All materials and equipment shall conform to the relevant Indian Standards and shall be of the approved make and design. Makes shall be strictly in conformity with list of approved manufacturers as per Appendix - III.

The Tenderer shall be responsible for the safe custody of all materials and shall insure them against theft or damage in handling or storage etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Owner’s site representative within 15 days of the award of the contract. Any item which is proposed as a substitute, the tenderer shall state the credit, if any, due to the Owner’s. In the event the substitution is approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from the Owner’s site representative.

12. MANUFACTURERS INSTRUCTIONS

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

13. COMPLETION CERTIFICATE

On completion of the electrical installation a certificate shall be furnished by the Tenderer countersigned by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local, state/central govt./ municipal / fire authorities concerned.

14. INSPECTION AND TESTING

The Owner’s may carry out inspection and testing at manufacturer’s works for this contract. No equipment shall be delivered without prior written confirmation from Engineer. All expenses related to testing shall be to tenderer account. Tests on site of completed works shall demonstrate the following among other things.

That the equipment installed complies with specification in all respect and is of the correct rating for the duty and site conditions.

That all items operate efficiently and quietly to meet the specified requirements.

That all circuits are correctly protected and that protective devices are properly co-ordinated.

That all non-current carrying metal parts are properly and safely grounded in accordance with the specification and appropriate Codes of Practice.

The tenderers shall provide all necessary instruments and labor for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Owner’s and shall provide test certificate signed by a property authorized person. Such test shall be conducted on all materials and equipment and tests on completed work as called for by the Owner’s at tenderers expenses unless otherwise called for.

If it is proved that the installation or part thereof is not satisfactorily carried out then the tenderers shall be liable for the rectification and resetting of the same as called for by the Owner’s decision as to what constitutes a satisfactory test shall be final.
The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere. All tests shall be carried out by a test house approved by the Owner’s.

Tenderer / Contractor is responsible for satisfactory operation of entire electrical installation detailed in this tender although item may have been inspected at manufacturer’s works.

### 15. COMPLETION DRAWINGS

Upon the completion of the work and before issuance of certificate of virtual completion the tenderer shall submit to the Owner’s site representative four sets of layout drawings in progressive manner for individual systems drawn at approved scale indicating the complete wiring system as installed. Drawings shall be prepared on AUTO-CAD (latest version). Along with the hard copies, the tenderer shall submit copies of all drawings on floppies/CD. These drawings must provide:

a. Electrical substation layout & all panel layouts, as installed single line diagram & control wiring.

b. Cable Trays layout with number and size of cables installed.

c. Run and size of conduits, inspection, junction and pull boxes.

d. Raceways layout and Junction Boxes.

e. Number and size of conductors in each conduit with phase identification.

f. Location and rating of sockets and switches controlling the lighting and power outlets.

g. Location and details of distribution boards/panels, mains, switches along with phase balancing details.

h. A complete wiring diagram as installed and single line diagrams showing all connections in the complete electrical and security system.

j. Location of all earthing stations, route and size of all earthing conductors manhole.

k. Layout and particulars of all LT cables.

l. Instruction, maintenance and operation manuals including maintenance schedule for all equipment. Testing & commissioning reports of all electrical equipment.

### 16. OPERATING INSTRUCTION & MAINTENANCE MANUAL

#### 16.1 GENERAL

Upon completion and commissioning of part electrical system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer’s operating and maintenance manuals. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

The Contractor shall provide operating instructions and maintenance data books for all equipment and materials furnished under this Division as well as assist the CA in compiling and consolidating O&M information during the development of the site specific Commissioning Plan.

The Contractor shall deliver two (2) initial copies of the operation and maintenance manuals in accordance with the subcontractor Scheduling Procedures to the Owner and Engineer for review. The initial copies shall contain all the information available at the time of submission.
The Contractor shall thereafter Submit six (6) final copies of operation and maintenance manuals to the Owner and Engineer for review at least ten (10) weeks before Final Review of the Project. Assemble all data in a completely indexed volume or volumes in three ring binders and identify the size, model and features indicated for each item. The binders shall have the Project Name and Logo printed on the outside of the binders. Re-submittals of these final six (6) copies of the "Final Review" operation and maintenance books and two (2) electronic CD-RW recordable rewrite compact disc shall be delivered to the Owner upon Final Completion of the Project.

The vendor / manufacturer shall supply complete operations and maintenance manuals in accordance with the following requirements:

a. The operations and maintenance manual documentations shall be presented in an Avery 3" heavy duty white binder or equivalent at the time of original submission, and record manuals within four weeks of integrated delivery of equipment to the site.

b. The binder shall have a cover page depicting the system(s) covered by the manual, Owners name, site location, and date.

c. The binder shall contain a detailed table of contents page delineating all major sections of the manual. Each section of the manual shall have an Avery narrow tab type divider placed between sections (properly labeled) to ensure easy access. The major sections of the manual shall include:

Include the following information where applicable:

i. Manual index

ii. Specification Section reference number and index.

iii. Equipment and/or material model number and serial numbers.

iv. Identifying name, mark number, plan/drawings tagging, etc.

v. Locations of major equipment (where several similar items are used, provide a list).

vi. Manufacturer's catalogue literature including model, type, style, complete standard factory operations manual, brand name data, etc.

vii. Installation manual

viii. Operations manual

ix. Maintenance manual with lubrication charts, and recommended periodic maintenance and schedules

x. Detailed sequences of operation for all operating modes

xi. Supplier, dealer, distributor, vendor and service organizations including phone, fax and email addresses and name of contact person.

xii. "Final Review" or approved submittals.

xiii. Dimensional drawings with equipment weights

xiv. List of spare parts recommended for normal service requirements.
xv. List of Spare parts purchased as part of this project,

xvi. Performance curves and data including part load curves were applicable.

xvii. Wiring and interlock wiring diagrams in both system and ladder formats.

xviii. Motor ratings and actual loads.

xix. Assembly and disassembly instructions with exploded view Drawings where available.

xx. Manufacturer's recommended operation and maintenance instructions with all non-applicable information deleted.

xxi. Trouble shooting diagnostic instructions where available.

xxii. Sequences of operation.

xxiii. Copy of all warranties and guarantees.

xxiv. Copy of all factory and field test reports.

xxv. Completed Functional Test sheets.

xxvi. Completed Pre-functional check lists

xxvii. Copies of all “Data” Sheets

Items required for inclusion in the operations and maintenance manuals that cannot be provided four weeks after delivery of equipment to the site are expected to be submitted within two weeks of completion of the work in a format for insertion into the binder under a pre-fabricated tab that is identified in the table of contents (i.e. The site acceptance test may not be complete at the time this manual is required for submission, in this case the manufacturer shall submit the manual with this section empty, upon completion of the site acceptance testing the forms for this testing will be supplied (punched for the binder)). All documents shall be submitted electronically using CD in a dedicated sleeve within the binder.

16.2 SPECIAL CONTROL SYSTEM O&M MANUAL REQUIREMENTS

In addition to documentation that may be specified elsewhere, the controls contractor shall compile and organize at minimum the following data on the control system in labeled 3-ring binders with indexed tabs.

16.2.1 Three hard copies, as well as on disk in latest Word format, of the controls training manuals in a separate manual from the O&M manuals.

16.2.2 Operation and Maintenance Manuals in hard copy as well as on disk in latest Word format, containing:

a. Specific instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.

b. Full as-built set of control drawings (refer to submittal section above for details).
c. Full as-built sequence of operations for each piece of equipment.
d. Full print out of all schedules and set points after testing and acceptance of the system.
e. Full as-built print out of software program.
f. Electronic copy on disk of the entire program for this facility.
g. Marking of all system on the as-built floor plan and electrical drawings with their control system designations. (obtain a disk of as-built and coordination drawings from the electrical contractors)
h. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
i. Control equipment component submittals, parts lists, etc.
j. Warranty requirements.
k. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

16.2.3 The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:

a. Sequences of operation
b. Control drawings
c. GA drawings of panels
d. Lighting & Power details
e. Sensors and switches
f. Program setups (software program printouts)

16.2.4 Field checkout sheets and trend logs should be provided to the CA for inclusion in the Commissioning Record Book.

17. COMPOSITE CONTROL WIRING DIAGRAM REQUIREMENTS

As required by the construction schedule developed by the Construction Manager, this Contractor, along with all other Division Contractors, shall furnish to the BMS Contractor, the project specific wiring and interlock requirement diagrams from the equipment shop drawings for those items of equipment where there is joint wiring interface responsibility. These wiring and interlock diagrams will be furnished to allow the BMS Contractor to prepare project specific composite control wiring diagrams that will detail how equipment furnished by the multiple Contractors shall be interconnected to provide fully functioning interrelated systems, including the life safety system, for the overall project.

The items for which the wiring and interlock diagrams shall be furnished shall include but not be limited to lighting relays and/or contactors for the remote control of or by lighting systems, electronic meters, the Fire Detection, Alarm and Communication (Class E) System, the Security System, etc.

The wiring diagrams furnished to the BMS Contractor shall indicate those terminals and field devices which will be provided for the use of the BMS Contractor(s) to define the control interconnection to allow the interrelated systems to function as specified and as required by all applicable Codes. The BMS Contractor shall add to these drawings, those connections they will make for the control and/or monitoring of the lighting, electronic meters, and other items of equipment. The completed diagram shall include all line and low voltage wiring between control devices, control relays, sensors, controllers, switches, the Fire Command Station, the Security System, the Building Management System, etc.
One diagram shall be provided for each item or piece of equipment. Diagrams shall be suitable for insertion in a three-ring binder. The BMS Contractor shall complete the preparation of the composite control wiring diagrams and shall return them to the appropriate Contractors within six (6) weeks of receiving them. The Contractors shall verify that the wiring added to the drawings is correct and can be accommodated. If necessary, corrections shall be made by the BMS Contractor. This process shall be completed prior to commencement of work on the particular piece of equipment or in the area within which the equipment is located.

The intent of this requirement is that single composite drawings shall be available for each item of equipment indicating the wiring that shall be installed in its entirety including interlocks. Any omissions or errors noticed by the Contractors shall be brought to the attention of the Engineer immediately.

Each conductor termination on the composite wiring diagram shall be suitably identified by a termination number or symbol. In addition, each conductor termination shall be suitably indexed to identify the termination location of the other end of the wire. All internal wiring of panels (in detail) shall be included in the composite wiring diagram. For such items as motor starters, etc., all jumpers added or removed shall be clearly indicated as being "added" or "removed".

The composite wiring diagrams shall include description of the interlock sequence of operation. The description shall include complete identification of each item shown (relay, lighting controller, etc.), and each item's exact operation shall be related to the interlock sequence.

This Contractor and their Subcontractors shall coordinate the work of this Division with the requirements of the work of all other Division Contractors as to the need for terminal strips, etc., required by them to interface with and/or control equipment furnished under this Division.
18. **GUARANTEES, CERTIFICATIONS AND DEFECTS LIABILITY PERIOD**

Contractors and their Manufacturers shall provide a full parts and labor warranty during defects liability period. Subcontractor must maintain a local full time service company with 24-hour emergency service capable of responding to service needs within 4 hours. Contractor shall be aware that during the full warranty period as defined above, Manufacturers of pre-purchased equipment are to provide all required periodic and routine service and maintenance. The Manufacturer through the Contractor shall submit a service and maintenance plan for approval by the Owner. The Manufacturer must comply with the requirements of Owner’s Service Contract terms and conditions. When purchase agreements are made the responsibility of this Contractor, all service agreements made part of the initial purchase shall pass directly to the Owner. Full payment to the Manufacturer shall not be made without written authorization from the Owner. All other equipment, systems and related appurtenances shall be the responsibility of the Contractor for warranty. All warranty claims whether for pre-purchased or direct purchased equipment shall be the responsibility of the Contractor.During the defects liability period, the Contractor shall guarantee the following in a form satisfactory to the Owner:

a. All Work installed will be free from any and all defects in Workmanship and/or materials.

b. All apparatus will develop capacities and performance characteristics specified.

c. The systems shall operate without malfunction.

The Contractor shall, without cost to the Owner, remedy any defects within a reasonable time to be specified in notice from the Architect. In default thereof, the Owner may have such Work done and charge all costs to the Contractor. The start of the Contractor's defects liability period, as defined above, shall have no restrictions on start date and extend for the full period noted.

The Contractor shall confer with the Construction Manager prior to the bid date concerning the Schedule and determine if there is a need to operate any items of equipment or systems for temporary heating and/or cooling or other reasons prior to substantial completion. All required extended DLP costs for equipment, materials and systems shall be included in the Contractor's proposal and clearly designated with a breakout price.

19. **UPTIME GUARANTEE**

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all temperatures, pressures, humidity, power consumption, starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Construction manager/Consultant’s review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.
20. **OPERATING INSTRUCTIONS AND TRAINING**

This Contractor shall be responsible for the training of Owner personnel for both the equipment and systems this contractor installs as well as responsible to participate in the training of all systems that interface with the work of other Contractors and Vendors. The Contractor shall, in addition to start up services, provide factory trained specialists to supervise commissioning and instruct the Owner's operators during operating instruction periods.

In addition, the manufacturer of the pre-purchased equipment shall furnish the services of factory trained specialists to instruct the Owner's operators as set forth in the specifications and the pre-purchased documents. The operating instruction periods shall be as defined in pre-purchase documents. This contractor shall provide all labor and assistance required to properly execute all aspects of the requirements set forth for training.

Training shall consist of a minimum numbers of hours as listed below (minimum of 4 hours if not shown) of Owner instructions. Days shall not be defined as 8 hour periods, shall not be consecutive, and are separate and apart from start-up and commissioning. This shall consist of both classroom and in-the-field training. All training materials and a training curriculum unique to this project will be presented to the Owner 2 months in advance of the on-site training. Training will commence only after the approval of the curriculum and agenda by the Owner and the CA. The Owner may wish to videotape the on-site training. The Contractor and their vendors agree to allow videotaping of instruction periods. Include in addition to the periods of training listed:

a. periods at night for training of night shift personnel.
b. periods for use of the equipment for temporary lighting & power.
c. periods to be present during Owner instruction on the BMS
d. periods of training on major vendor furnished components such as transformer, HT Panel, lighting control, LT & distribution panel operation by the equipment manufacturer.

The Contractor shall commence no instruction period until all requirements of this section are met and the Owner has issued his written acceptance of the contractor's submitted agenda, starting time and Schedules.

The Construction Manager shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed.

The electrical contractor shall provide the CA with a training plan at least two months before the planned training according to the following outline:

a. Equipment (included in training)
b. Intended audience
c. Location of training
d. Objectives
e. Subjects covered (description, duration of discussion, special methods, etc.)
f. Duration of training on each subject
g. Instructor qualifications and experience for each subject
h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)

j. Instructor and qualifications

k. Training shall include:

i. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.

ii. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.

iii. Include a review of all systems using the simplified system schematics, riser, and one-line drawings.

iv. Include a review of all as-built drawings.

v. Basic engineering principals of operation for each piece of equipment

vi. Performance of equipment under different environmental and operating conditions.

vii. Equipment submittal data and performance curves.

viii. Equipment construction.

ix. Equipment safeties and alarms.

x. Equipment alarm and program settings

xi. Operation limitations/ restrictions

xii. Operation modes/ (response-action format)

xiii. Failure modes / (response-action format)

xiv. Maintenance modes /(response-action format)

xv. Control power and appurtenances

xvi. Include field walk-throughs to locate all concealed devices, review valve, duct and pipe tagging method, review equipment locations and tagging.

Discussion of relevant health and safety issues and concerns.

xvii. Discussion of warranties and service contracts.

xviii. Common troubleshooting problems and solutions.

xix. Location of all plans and manuals in the facility.
xx. Discussion of any peculiarities of equipment installation or operation.

xxi. Demonstration of all electronically transmitted data and graphics.

xxii. Sources for replacement parts/equipment and emergency service.

xxiii. Tenant interaction issues; and why certain features are environmentally responsive (i.e., save energy, lighting control, metering, improve indoor air quality (IAQ), reduce toxic materials, reduce waste).

This shall consist of a detailed, high quality training program in Power Point format to be reviewed and approved by the Commissioning Authority. The slides shall include graphs, detailed photographs, and one line diagrams for power, control, and flow to illustrate the above training requirements. Photographs shall include equipment with covers on and off, all appurtenances, and other related equipment.

During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.

The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment. The mechanical contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not controlled by the central building control system.

The electrical contractor shall provide training on each piece of equipment according to the following schedule:

<table>
<thead>
<tr>
<th>Hours</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Transformer &amp; UPS</td>
</tr>
<tr>
<td>12</td>
<td>HT &amp; LT Panels</td>
</tr>
<tr>
<td>8</td>
<td>Other Distribution Boards</td>
</tr>
<tr>
<td>8</td>
<td>Battery Chargers</td>
</tr>
<tr>
<td>4</td>
<td>Electronic Meters</td>
</tr>
<tr>
<td>8</td>
<td>Testing and Balancing</td>
</tr>
</tbody>
</table>

21. PARTIAL ORDERING

Owner through the Architect/Consultant/Construction manager reserves the right to order equipment and material from any and all alternates, and/or to order high side and/or low side equipment and materials or parts thereof from one or more tenderers.

22. TOOLS AND TACKLES
The Tenderer shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner’s site representative.

23. SITE CONDITION

Rating of all equipment shall be appropriate for the conditions of the location where the equipment will be installed and used. All the equipments shall be suitable for continuous operation under the most severe conditions of site and shall be rated for the following ambient condition in without any deration.

Location : JORHAT

Ambient Temperature :

<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>40.0 deg C</td>
<td>8.0 deg C</td>
</tr>
</tbody>
</table>
### APPENDIX–IV

**LIST OF INDIAN STANDARDS (IS)**

<table>
<thead>
<tr>
<th>Standard No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS : 374 - 1979</td>
<td>Ceiling fans and regulators (3rd revision)</td>
</tr>
<tr>
<td>IS : 694 - 1990</td>
<td>PVC insulated Electric cable for working voltage upto and including 1100 volts.</td>
</tr>
<tr>
<td>IS : 732 - 1989</td>
<td>Code of practice for electrical wiring and installation</td>
</tr>
<tr>
<td>IS : 1255 - 1983</td>
<td>Code of Practice for installation and maintenance of Power Cables upto and including 33 KV rating (Second Revision)</td>
</tr>
<tr>
<td>IS : 1258 - 1987</td>
<td>Bayonet lamp holders(Third revision)</td>
</tr>
<tr>
<td>IS : 1293 - 1988</td>
<td>Three pin plugs and sockets outlets rated voltage upto and including 250 volts and rated current upto and including 160 amps.</td>
</tr>
<tr>
<td>IS : 1554 - 1988(Part - I)</td>
<td>PVC insulated (Heavy Duty) electric cables for working voltages upto and including 1100 volts.</td>
</tr>
<tr>
<td>IS : 1885 - 1971</td>
<td>Glossary of items for electrical cables and conductors</td>
</tr>
<tr>
<td>IS : 1913 - 1978</td>
<td>General and safety requirements for fluorescent lamps luminaries Tubular.</td>
</tr>
<tr>
<td>IS : 2026 - 1977 to 81 (Part I to IV)</td>
<td>Power Transformers</td>
</tr>
<tr>
<td>IS : 2071 - 1974 - 76</td>
<td>Methods of high voltage testing</td>
</tr>
<tr>
<td>IS : 2309 - 1989</td>
<td>Protection of building and allied structures against lightning</td>
</tr>
<tr>
<td>IS : 2551-1982</td>
<td>Danger notice plate.</td>
</tr>
<tr>
<td>IS : 3837 - 1976</td>
<td>Accessories for rigid steel conduit for electrical wiring.</td>
</tr>
<tr>
<td>IS : 4146 - 1983</td>
<td>Application guide for voltage transformers</td>
</tr>
<tr>
<td>IS : 4615 - 1968</td>
<td>Switch socket outlets.</td>
</tr>
<tr>
<td>IS : 5133 - 1969(Part -I)</td>
<td>Boxes for the enclosure of electrical accessories.</td>
</tr>
<tr>
<td>IS : 5578 &amp;11353-1985</td>
<td>Marking and arrangement of bus bars</td>
</tr>
<tr>
<td>IS : 7098 – 1985(Part -)</td>
<td>Cross linked polyethylene insulated PVC sheathed cables. For working</td>
</tr>
</tbody>
</table>
II) voltages from 3.3 KV upto and including 33 KV

IS : 8130 - 1984 Conductors for insulated electric cables and flexible cords

IS : 8623 -1977 Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC.

(Part -I)

IS : 8623 – 1980(Part -II) Bus Bar trunking system

IS : 8828 - 1996 Miniature Circuit Breakers

IS : 9537 - 1981 Rigid Steel Conduits for electrical wiring (Second Revisions)


IS : 12640 - 1988 Earth Leakage Circuit Breakers

IS : 13947-1993 (Part-II) Air Circuit Breakers

IS : 13947-1989 Moulded Case Circuit Breakers

IS : 13947 - 1993 Degree of protection provided by enclosures for LV switchgear and control gear.

IS : 13947 - 1993 General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.

IS : 1651 & 1652 1991 Stationary cells and batteries lead acid type.

IS : 13779 Digital measuring instrument and testing accessories.

NBC – 2005 National Building Code of India
APPENDIX – V

ABBREVIATIONS

The following abbreviations have been used in the accompanying Specifications, drawings and Schedule of Quantities.

CU  Stands for copper.
GI  Stands for Galvanised Iron (Mild Steel)
V  Stands for Volts
KV  Stands for Kilo Volts
HV  Stands for High Voltage (3.3 KV and above)
MV  Stands for Medium Voltage (110 V, 230 V, 415 V, 600 V)
LV  Stands for Low Voltage (32 V & Below)
HT  Stands for High Tension
LT  Stands for Low Tension
VCB  Stands for Vacuum Circuit Breaker
PVC  Stands for Polyvinyl Chloride
AMP  Stands for Amperes
KWH  Stands for Kilowatt Hours
KW  Stands for Kilo Watts
BIS  Stands for Bureau of Indian Standards
IS  Stands for Indian Standards
IEE  Stands for Institution of Electrical Engineers - London
NEC  Stands for National Electrical Code
ACB  Stands for Air Circuit Breaker
ELCB  Stands for Earth Leakage Circuit Breaker
MCB  Stands for Miniature Circuit Breaker
MCCB  Stands for Moulded Case Circuit Breaker
SP  Stands for Single Pole
DP  Stands for Double Pole
TP  Stands for Triple Pole
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>TPN</td>
<td>Stands for Triple Pole and Neutral</td>
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<tr>
<td>MDB</td>
<td>Stands for Main Distribution Board</td>
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<tr>
<td>SDB</td>
<td>Stands for Sub Distribution Board</td>
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<tr>
<td>FDB</td>
<td>Stands for Final Distribution Board</td>
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<tr>
<td>MCC</td>
<td>Stands for Motor Control Centre</td>
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TECHNICAL SPECIFICATIONS

1. INTERNAL WIRING

1.1 SYSTEM OF WIRING

The system of wiring shall consist of PVC insulated copper conductor flexible FRLS wires in metallic/ non metallic conduits and shall be concealed as called for.

1.2 GENERAL

Prior to laying and fixing of conduits, the contractor shall carefully examine the working drawings prepared by him and approved by the Consultant indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, location of junction boxes, sizes and location of switch boxes and other relevant details. Any discrepancy found in the drawings shall be brought to the notice of the Owner's site representative. Any modifications suggested by the contractor shall be gotten approved before the actual laying of conduits is commenced.

In laying of conduits it is important that not more than two right angle bends are provided for each circuit and as far as possible. No junction box shall be provided in the entire length of conduit run for drawing of wires. Only switch outlets, lighting fixture outlets, equipment power outlets and socket outlets shall be considered for drawing of wires.

1.3 MATERIALS (METAL CONDUITS & ACCESSORIES)

1.3.1 Conduits

Conduits and Accessories shall conform to relevant Indian Standards. 16/14 (16 gauge upto 32 & 14 gauge above 32 mm) gauge screwed GI or MS conduits as specified on BOQ shall be used. Joints between conduits and accessories shall be securely made, to ensure earth continuity. All conduit accessories shall be threaded type only.

Only approved make of conduits and accessories shall be used.

Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

Note:
Whatever materials required to be billed by the Contractor should come on site with proper challan no. and quantity mention on it.

1.3.2 Joints

All jointing shall be subject to the approval of the Owner's site representative. The threads and sockets shall be free from grease and oil. Connections between screwed conduit and GI boxes shall be by means of hexagon brass check nut, fixed outside and brass bush from inside the box. The joints in conduits shall be free of burrs to avoid damage to insulation of conductors while pulling them through the conduits.

1.3.3 Recessed or Exposed Conduits

All conduits shall be as per Schedule of Quantities.

1.3.4 Flexible Conduits

Flexible conduits shall be made of heavy gauge MS strip galvanized after making the spiral. Both edges of the strip to have interlocking to avoid opening up.
1.4 PVC CONDUIT AND ACCESSORIES

PVC Conduit

Conduits and accessories shall conform to relevant Indian Standard and shall be heavy duty wall thickness of 2.0 mm rigid tubes which are unscrewed without coupling and with plain ends. All conduits used shall not be less than 20 mm diameter.

PVC conduit shall be used for all concealed installation.

PVC Conduit Accessories

Accessories used for conduit shall be of an approved type complying to relevant IS code.

All accessories used shall be of standard white or black colour, identical to conduit used.

Plain conduits shall be jointed by slip type of couplers with manufacturer’s standard sealing cement.

All conduit entries to outlet boxes, trunking and switchgear are to be made with adaptors female thread and screwed male bushes.

PVC-switch and socket boxes with round knockouts are to be used. The colours of these boxes and the conduits shall be the same.

Standard PVC circular junction boxes are to be used with conduits for intersection, Tee-junction, angle-junction and terminal. For the drawing-in of cables, standard circular through boxes shall be used.

Samples of accessories shall be submitted for approval prior to installation.

All jointing of PVC conduits shall be by means of adhesive jointing. Adequate expansion joints shall be allowed to take up the expansion of PVC conduits.

1.5 BENDS IN CONDUIT

Where necessary, bends or diversions may be achieved by means of bends and / or circular cast iron inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly secured and flush with the finished wall surface.

No bends shall have radius less than 7.5 cms or three times the outside diameter of the conduits.

1.6 FIXING OF CONDUITS

All conduits, shall be installed so as to avoid steam and hot water pipes. After the conduits, junction boxes, outlet boxes and switch boxes are installed in position, their outlets shall be properly plugged or covered so that water, mortar, insects or another foreign matter does not enter into the conduit system.

Surface conduits shall be fixed by means of heavy gauge GI saddles secured at intervals not more than 1000 mm, but on either side of couplers or bends or similar fitting saddles shall be fixed at a distance of 300 mm from centre of each fitting. For conduit fixing suitable PVC/Nylon fastners shall be used.

Recessed conduiting shall be done by making chase in the masonry by chase cutter, the conduit shall be fixed in the chase by means of GI hooks not more than 600 mm apart. After fixing of conduit the chase shall be filled with cement mortar after fixing of chicken mesh and brought to the original finish level of the surface.
1.7 Maximum permissible number of 1100 volt grade PVC insulated wires that may be drawn into rigid non-metallic or PVC Conduits are given below:

<table>
<thead>
<tr>
<th>Size of wires Nominal Cross section Area (Sq. mm.)</th>
<th>Maximum number of wires within conduit size(mm)</th>
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<tr>
<td></td>
<td>20</td>
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1.8 SWITCH OUTLETS AND JUNCTION BOXES

All outlet boxes for switches, sockets, and other receptacles shall be rust proof and shall be of 1.6 mm thick mild steel sheets with HOT dipped galvanizing (or as specified in BOQ), having smooth external and internal surfaces to true finish. All outlet boxes for receiving plug sockets and switches shall be fabricated to approved sizes. All boxes shall have adequate number of knock out holes of required diameter and earthing terminal screws. Outlet boxes shall be of a minimum depth as per manufacture standard.

1.9 INSPECTION BOXES

50 mm dia. inspection boxes of cast iron shall have smooth external and internal finish to facilitate removal and replacement of wires, where required.

1.10 FISH WIRE

To facilitate subsequent drawing of wires in the conduit, GI fish wires of 2.0 mm (14 SWG) shall be provided along with the laying of recessed conduit.

1.11 CONDUCTORS

All PVC insulated copper conductor flexible FRLS wires shall conform in all respects to Standards as listed under sub-head Regulations and Standards and shall be IS approved and ISI marked.

1.12 BUNCHING OF WIRES

Wires carrying current shall be so bunched that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not run in the same conduit. All wires shall have ferrules for identification. Lighting and power circuits shall be separate.

1.13 DRAWING CONDUCTORS

The drawing and jointing of PVC insulated copper conductor wires shall be executed with due regard to the following precautions. While drawing wires through conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends. Wire reel stands to be used for pulling of wires to avoid kinks.

Insulation shall be removed by insulation stripper only. Strands of wires shall not be cut for connecting terminals. The terminals shall have sufficient cross sectional area to take all strands and connecting brass screws shall have flats ends. All looped joints shall be connected through terminal block/connectors. The
pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. All light points shall be terminated through a connector.

All light points will terminated through a connector. Conductors having nominal cross sectional areas exceeding 10 sq.mm shall always be provided with cable sockets. At all bolted terminals brass flat washer of large area and approved steel spring washer shall be used. Brass nuts and bolts shall be used for all connections.

Only licensed wiremen (Before doing the work or before appointing him on site contractor has to submit his wiring licence to Owner) and cable jointers shall be employed to do jointing work. All wires and cables shall bear the manufacturer’s label and shall be brought to site in original packing. For all internal wiring. PVC insulated wires of 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in loop system and no joints shall be allowed in the length of the conductors. No wire shall be drawn into any conduit until all work of any nature that may cause injury to wire is completed. Care shall be taken while pulling out the wires so that no damage occurs to conduits/wire itself, the conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction. The minimum size of PVC insulated copper conductor wires for all sub-circuit wiring for light points shall be minimum 2.5 sq.mm copper Separate neutral to be pulled for each circuit.

1.14 JOINTS

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switches boxes only. No joints shall be made in conduits and in junction boxes. Conductors shall be continuous from outlet to inlet.

1.15 MAINS AND SUB-MAINS

Mains and sub-mains cable or wires where called for shall be of the rated capacity and approved make. Every main and sub main wires shall be drawn into an independent adequate size conduit. Earthing shall be in conformity with relevant IS codes and calculations shall be submitted for verification. An independent earth wire of the proper rating shall be provided for every single phase sub-main. For every 3-phase sub-main, 2 Nos. earth wires of proper rating shall be provided alongwith the sub-main. The earth wires shall be fixed to conduits by means of clips at not more than 1000 mm distance. Where mains and sub-mains cables are connected to switchgear, sufficient extra lengths of cable shall be provided to facilitate easy connections and maintenance.

1.16 LOAD BALANCING

Balancing of circuits in three phase installation shall be planned by the Consultants and shall be checked by the contractor before the commencement of wiring and shall be strictly adhered to.

1.17 COLOUR CODE OF CONDUCTORS

Colour code shall be maintained as indicated as per codal requirement for the entire wiring installations. Red, yellow, blue shall be for three phases, black for neutral and green with yellow band shall be for earthing.

2. SWITCHES, RECEPTACLES (MODULAR) AND LIGHTING FIXTURES

2.1 SWITCHES

All switches shall be enclosed type flush mounted suitable for 240 volts AC. All switches shall be fixed inside the switch boxes on adjustable flat M S strips/plates with tapped holes and brass machine screws, leaving ample space at the back and sides for accommodating wires. Switch controlling the light point shall be connected to the phase wire of the circuit and not more than ten lights shall be connected on one circuit and load shall be restricted to 800 watts. All wiring accessories shall be BIS approved. Perfect alignment shall be maintained while fixing of the back boxes.
2.2 **WALL SOCKET OUTLET**

Wall socket outlets shall be of the five pin. The switch controlling the socket outlet shall be on the phase wire of the circuit and not more than two socket outlets of 16 amps shall be connected on one circuit. An earth wire shall be provided along with the circuit wires and shall be connected to earthing screw inside the box. The earth terminal of the socket shall be connected to the earth terminal provided inside the box. All sockets shall be shuttered type.

a. Every socket outlet shall be controlled by an individual switch unless mentioned otherwise.

b. The switch controlling the socket outlet shall be on the ‘Live’ side of the line.

c. 6 amps and 16 amps socket outlet shall normally be fixed at any convenient height above the floor level as desired by the Architect. The switch for 6 and 16 amps, socket outlet shall be kept along with the socket outlet. However, in special case, if desired by the Architect the 6 amp. socket outlet can be placed at the normal switch level.

d. Where socket outlets are placed at lower level, they shall be enclosed in a suitable metallic box with the system of wiring adopted or shutter type sockets shall be provided as specified.

e. In an earthed system of supply, a socket outlet and plug shall be of three pin type, the third terminal shall be connected to earth.

f. Where use of shutter type of interlocking type of socket is required for any special installation, the items should be separately and specifically listed in the Schedule of Quantities of that particular work.

2.3 **LIGHTING FIXTURES & ACCESSORIES**

The light fixtures and fittings shall be assembled and installed in position complete and ready for service, in accordance with details, drawings, manufacturer’s instructions and to the satisfaction of the Project Manager.

2.3.1 **Scope**

Scope of work under this section shall include inspection at site, receiving at site, safe storage, transportation from point of storage to point of erection, erection and commissioning of light fittings, fixtures (to be supplied by Owner) and accessories including all necessary supports, brackets, down rods and painting etc as required.

2.3.2 **Standards:**

The lighting and their associated accessories such as lamps, reflectors, housings, ballasts etc., shall comply with the latest applicable standards, more specifically the following:

**General and safety requirements for Luminaries:**
- Part-1 Tubular fluorescent lamps - IS – 1913 (Part-1)
- Industrial lighting fittings with metal reflectors - IS – 1777
- Decorative lighting outfits - IS - 5077
- Bayonet lamp holders - IS - 1258
- Bi-pin lamp holders for tubular fluorescent lamps - IS - 3323
Electronic Ballasts for fluorescent lamps –
General & Safety requirement - IS – 13021 (Part-1)
Electronic Ballasts for fluorescent lamps –
Performance requirement - IS – 13021 (Part-2)
Ballast for HP MV lamps - IS - 6616
Tubular Fluorescent lamps - IS - 2418 (Part-1 to 4)
Luminaries – General requirement - IS – 10322 (Part-1)
Luminaries – Constructional requirement - IS – 10322 (Part-2)
Luminaries – Screw and Screwless termination - IS – 10322 (Part-3)
Luminaries – Methods of Tests - IS – 10322 (Part-4)
Particular requirement – General purpose Luminaries - IS – 10322 (Part-5/Sec-1)
Particular requirement – Recessed Luminarie - IS – 10322 (Part-5/Sec-2)
Particular requirement – Luminaries for Road and Street lighting - IS – 10322 (Part-5/Sec-3)
Particular requirement – Portable General purpose Luminaries - IS – 10322 (Part-5/Sec-4)
Particular requirement – Flood Lighting - IS – 10322 (Part-5/Sec-5)
High pressure mercury vapour lamps - IS – 9900 (Part-1)
Tungsten filament general electric lamps - IS - 418

2.3.3 Light Fittings-General Requirements:

a. Fittings shall be designed for continuous trouble free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Degree of protection of enclosure shall be IP-65 for outdoor fittings except bulkhead fitting. Bulkhead fitting shall be provided with IP-54 protection.

b. Fittings shall be so designed as to facilitate easy maintenance including cleaning, replacement of lamps/ ballasts.

c. All fittings shall be supplied complete with lamps. All mercury vapour and sodium vapour lamp fittings shall be complete with accessories like ballasts, power factor improvement capacitors, starters, etc. Out door type fittings shall be provided with weather proof junction boxes (IP-55) and IP-54 Control gear boxes.

d. Each fitting shall have a terminal block suitable for loop-out connection by 1100 V PVC insulated copper conductor wires upto 4 sq.mm. the internal wiring should be completed by the manufacturer by means of standard copper wire and terminated on the terminal block.

e. All hardwires used in the fitting shall be suitably plated or anodized and passivity.

f. Earthing :
Each lighting fitting shall be provided with an earthing terminal. All metal or metal enclosed parts of the housing shall be bonded and connected to the earthing terminal so as to ensure satisfactory earthing continuity throughout the fixture.

g. Painting/Finish:

All surfaces of the fittings shall be thoroughly cleaned and degreased and the fittings shall be free from scale, rust, sharp-edges, and burns.

h. The housing shall be powder coated/stove-enamelled or anodised as required. The surface shall be scratch resistant and shall show no sign of cracking or flaking when bent through 90 deg. over 12 mm dia mandrel.

j. Metal used in BODY of lighting fixtures shall be not less than 22 SWG or heavier if so required to comply with specification of standards. Sheet steel reflectors shall have a thickness of not less than 20 SWG. The metal parts of the fixtures shall be completely free from burns and tool marks. Solder shall not be used as mechanical fastening device on any part of the fixture.

2.3.4 Light Fittings – Special Requirements

Box Channel Type Industrial Fittings

Box type slim line channel must be in screw less construction manufactured from M.S. CRCA sheet steel powder coated with MS CRCA cover, powder coated white. Light reflection surface in Box/Channel type fittings shall be in a POLYESTER PRECOATED STEEL having a reflection factor of not less than 80%. SCREWLESS DESIGN & CONSTRUCTION Light fixtures shall be preferred due to their ease of maintenance, especially for box/channel for box/channel type fixtures.

Moisture Proof Industrial Fittings

Surface mounted totally enclosed moisture proof fixtures must be in polycarbonate body and diffuser with transparent prismatic interior and smooth exterior and frosted end. Fixture must be completely sealed with polyetherane double gasket to achieve IP 65 protection. Fixture is complete with CRCA steel white powder coated / enameled finish reflector.

18 W / 36 W Fluorescent and 36 W CFL Low Glare Light Fittings

Recessed mounted, modular fluorescent lighting fixture made of CRCA Sheet steel powder coated (white) housing, electro chemically brightened and anodised reflector, three dimensional cross louvers with concave contours, fresnel top at louver saddle to increase efficiency. The luminance of <200 cd/M² at 63 degree viewing angle in all directions so as to confirm Cat-2 classification of CIBSELG3

Highbay Industrial Fittings

Industrial Highbay luminaries shall be provided with pressure die cast housing along with all accessories, orthocyclically wound open construction ballast, capacitor & semi parallel ignitor connected to terminal block and mounted on the gear plate. The gear shall have side entry for ease in maintenance. The spun aluminium reflector is suitable for narrow as well as wide beam distribution. The luminaire will be suitable for metal halide lamp HPI BU + 250 W which has 25500 lumens and 2.5 min restrike time (when operate with son gear).

2.3.5 Accessories for Light Fittings Reflector

The reflectors shall be made of CRCA sheet steel/aluminium/Silvered glass/Chromium plated sheet copper as required. The thickness of reflectors shall be as per relevant standards. Reflectors made of steel shall
have stove enameled/ vitreous enameled/epoxy coating finish. Aluminium used for reflectors shall be anodized/epoxy stove enameled/mirror polished. The finish for the reflector shall be as specified. The reflectors shall be free from scratches / blisters and shall have a smooth and glossy surface having optimum light reflecting coefficient. Reflectors shall be readily removable from the housing for cleaning and maintenance without use of tools.

2.3.6 Lamps

a. **TLD**

Lamp shall be environment friendly low pressure mercury discharge lamp with mercury content less than or equal to 5 mg. The lamp shall have minimum lumen maintenance of 85 and CRI of 85. The lamp must comply to ROSH (Restriction of Hazardous substances) and covered by WEEE. Lamp should be fully re-cyclable. The lamp should be low on maintenance with life of 40 K hours in case of electromagnetic ballast and 65 K hours in case of HF ballast upto 10% failure. The discharge glass shall be lead free.

TLD Lamps shall be minimum tri-phosphor type and have bi-pin bases. Colou spectrum of light shall be equivalent to “PHILIPS color 84 or color 86 color 82 or “OSRAM color 21 or color 11 or color 41 (as required at site)”. The fluorescent Tubes (TLD) should have cool daylight colour designation. But Architects reserve the right to prescribe either Cool Daylight or Bright White or Incandescent Colour Designations for TLD. NO extra payment will be made over the quoted rate of bidder for this. The 36 W fluorescent tubes will have Nominal Luminous Flux of not less than 3350 lumens whether so mentioned in the Schedule of Quantities or not.

**T 5 – High Efficiency Eco-Friendly Lamps**

T-5 lamp shall be environment friendly low pressure mercury discharge lamp with mercury content less than or equal to 3 mg. lamp should have lowest CO2 emission compared to any other comparable light source (40% less than a TL-D standard lamp, 26% less than TL-D / 80). T-5 lamp shall be 100% lead free. T-5 lamp shall be designed for operation with electronic gear and well suited for dimming. Maximum lumen output to be reached at approx 35°C in free burning position. T-5 lamp can be ignited from -15°C to +50°C. Lamp should be fully recyclable and must comply to ROSH (Restriction of Hazardous substances) and shall be covered by WEEE. T-5 shall have 16 mm in diameter service life of TL-5 lamp should be 10% more than TL-D lamps. T-5 lamp shall have lumen efficacy of upto 104 Lux / W and shall have excellent colour rendering to En 12464 (Ra 80 to 89).

b. Compact fluorescent lamp shall have same luminous flux and power consumption as fluorescent tubes but less than half the length and more compact than U-shaped and circulator lamps. CFL shall be suitable for use with conventional control gear & standers and for HF electronic control gear. CFL lamp shall be non integral type of OSRAM / GE / PHILIPS/ Havells Sylvania only.

2.3.7 High Frequency Electronic Ballast

High frequency electronic ballast shall be used with fluorescent / Compact Fluorescent Lamps wherever specified in the schedule of quantities. High frequency electronic ballast shall comply to the following:

- IEC 927, IEC 928 for ≤10% total harmonic distortion.
- EMI / RFI – Confirming to FCC / VDE Class A/B.
- Line Transient as per IEEE C62.41.
- Ballast Crest Factor C1.7%.
- No Stroboscopic Effect
- Constant Wattage / Light output between 240 V ± 10%.
- Circuit protection for surge current and inrush current.

Short circuits, open lamp protection
- PF > 0.99 for fluorescent / T5 lamp and 70.95 for CFL.
- Deactivated lamp protection
- Suitable for use with single and twin lamps
- RFI < 30 MHz EN 55015
- Total Harmonic Distortion (THD) ≤10%
- Immunity to interference EN 61547
- Safety EN 60928 / IEC 928 / IS 13021 (Part I)
- Performance EN 60929 / IEC 929 / IS 13021 (Part II)
- Vibrations & Bump tests IEC 68-2-6 FCI EC 9001
- Quality Standard ISO 9001
- Environmental Standard ISO 14001
- DC Operation EN 60924
- Emergency Lighting Operation VDE 0108

Total System consumption (lamps + ballast) for
- 1 x 36 W TLD, shall not exceed 36 W
- 1 x 28 W T-5, shall not exceed 28 W
- 1 x 35 W T-5, shall not exceed 35 W
- 1 x 14 W T-5, shall not exceed 14 W
- 1 x 18 W CFL, shall not exceed 18 W
- 1 x 36 W CFL, shall not exceed 36 W
3. **MEDIUM VOLTAGE 1.1 KV GRADE XLPE / PVC CABLES**

3.1 **GENERAL**

The MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, Specifications, relevant Standard Specifications and cable manufacturer's instruction.

3.2 **MATERIAL**

The MV cables shall be cross linked polyethylene (XLPE) insulated PVC sheathed of 1100 volts grade as asked for in the schedule of quantities. All power cables (except for UPS distribution) shall be with aluminium conductor and control cables shall be with copper conductor as specified in the Bill of Quantities.

3.2.1 **Specifications of XLPE insulated aluminum / copper cable shall be as follows:**

- **Conductor**
  Stranded compacted circular conductor shall be of electrical grade high conductivity aluminium/ copper conductor shall be of armored / unarmored as specified in the BOQ as per IS 8130 / 84.

- **Insulation**
  The insulation shall be compounded PVC, application shall be by extrusion process insulation type C (85 °C) confirming to IS 5831-1984. The thickness of insulation will be as per the relevant codes.

- **Laying-up**
  Insulated conductors of multi core cables shall be with thermoplastic fillers in the interstices. The phase identification of cores shall be by colored strips.

- **Inner Sheath**
  Cores shall be surrounded either by a wrapped or an extruded PVC sheath. The thickness of the inner – sheath shall be as per relevant codes.

- **Armouring**
  The armouring shall be provided over the inner sheath.
  Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip armoring. Steel wires and strips for armouring confirm to IS:3975. The direction of lay of armouring shall be opposite to that of cores.

- **Outer Sheath**
  Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS:1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST1 of IS 5831. The colour of the outer sheath shall be black.

3.2.2 **Specifications for XLPE aluminium / copper cable shall be as follows:**

- **Conductor**
  Stranded compacted circular conductor shall be of electrical grade high conductivity aluminium / copper conductor per IS 8130/84.
b. Insulation

The insulation shall be of natural unfilled chemically cross linked polyethylene conforming to IS 7098. The thickness of insulation shall be as per the relevant codes.

c. Laying-up

Insulated conductors of multi core cables shall be with plastic fibre in the interstices. The phase identification of cores shall be by colored strips.

d. Inner Sheath

The cores shall be surrounded by either a wrapped or by an extruded PVC sheath. The thickness of the inner sheath shall be as indicated in the relevant codes.

e. Armouring

The armouring shall be provided over the inner sheath.

Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip. Steel wires and strips for armouring confirm to IS:3975. The direction of lay of armouring shall be opposite to that of cores.

f. Outer Sheath

Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS:1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST2 of IS 5831. The colour of the outer sheath shall be black.

3.3 INSPECTION

All cables shall be inspected by the contractor upon receipt at site and checked for any damage during transit.

3.4 JOINTS IN CABLES

The Contractor shall take care to see that all the cables received at site are apportioned to various locations in such a manner as to ensure maximum utilization and avoidance of cable jointing. This apportioning shall be got approved by the Owner’s site representative before the cables are cut to lengths. Where joints are unavoidable heat shrinkable type joints shall be made. The location of such joints shall be got approved from the Owner’s site representative and shall be identified through a marker.

3.5 JOINTING BOXES FOR CABLES

Cable joint boxes shall be installed with heat shrinkable sleeve and of appropriate size, suitable for XLPE armored cables of particular voltage rating.

3.6 JOINTING OF CABLES

All cable joints shall be made in suitable, approved cable joint boxes and the filling in of compound shall be done in accordance with manufactures’ instructions and in an approved manner. All straight joints shall be done in epoxy mould boxes with epoxy resin.

All cables shall be joined colour to colour and tested for continuity and insulation resistance before jointing commence. The seals of cables must not be removed until preparations for jointing are completed.
Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. The conductors shall be efficiently insulated with high voltage insulating tape and by using of spreaders of approved size and pattern. The joints shall be completely topped up with epoxy compound so as to ensure that the box is properly filled.

3.7 CABLE TERMINATIONS

Cable termination shall be done in cable terminal box using crimping sockets and proper size of glands of double compression type with earthing facility.

3.8 BONDING OF CABLES

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armour clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that no undue stress is passed on to the cable conductors.

3.9 LAYING OF CABLES ON CABLE TRAYS

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks. The relative position of the cables, laid on the cable tray shall be preserved and the cables shall not cross each other. At all changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius as recommended by the manufacturer’s. All cables shall be laid with minimum one diameter gap and shall be clamped at every metre to the cable tray and shall be tagged for identification with aluminum tag and clamped properly. Tags shall be provided at both ends and all changes in directions both sides of wall and floor crossings. All cable shall be identified by embossing on the tag the size of the cable, place of origin and termination.

All cables passing through holes in floor or walls shall be sealed with fire retardant Sealant and shall be painted with fire retardant paint upto one meter on all joints, terminations and both sides of the wall crossings by “VIPER CABLE RETARD”.

3.9.1 Laying of Cables In Ground

The minimum width of trench for laying single cable shall be minimum 350 mm. Where more than one cable is to be laid in horizontal formation, the width of the trench shall be workout by providing 200 mm gap between the cables, except where otherwise specified. There shall be clearance of 150 mm between the end cable and the side wall of the trench. The minimum dept of the cable trench shall not be less than 750 mm for single layer of cables. When the cables are laid in more than one tier the depth of the trench shall be increased by 300 mm for each additional tier.

Excavation of trenches:

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided. Where gradients and changes in depth are unavoidable, these shall be gradual. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. The bottom of the trench shall be level and free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 100 mm in depth. Prior to laying of cables, the cores shall be tested for continuity and insulation resistance. The cable drum shall be properly mounted on jacks, at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum and the spindle is horizontal. Cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains. The entire drum length shall be laid in one stretch. However, where this is not possible the remainder of the cable shall be removed by 'Flaking' i.e. by making one long loop in the reverse direction. After the cable has been uncoiled and laid into the trench over the rollers, the cable shall be lifted off the rollers beginning from one end by helpers standing about 10 meters apart and laid in a reasonably straight line.
Cable laid in trenches in a single tier formation shall have a cover of clean, dry sand of not less than 150 mm. above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid, a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. Finally the cables shall be protected by second class bricks before back filling the trench.

**Back Filling:**

The trenches shall be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 300 mm. Unless otherwise specified, a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence.

3.10 **CABLES INSIDE BUILDING**

Cables inside buildings shall be laid on the cable trays. All cables passing through walls shall run through GI Pipes of adequate diameter 50 mm apart maintaining the relative position over the entire length.

3.11 **ROUTE MARKER**

Route marker shall be provided along straight runs of the cables not exceeding 100 meters also for change in the direction of the cable route and underground joints.

Route marker shall be of cast iron painted with aluminum paint. The size of marker shall be 100 mm dia with "Cable" and voltage grade inscribed on it.

3.12 **CABLE TRAYS**

Cable Trays shall be Galvanized and factory fabricated out of MS channels, angle iron, tee, bends, sections, flats and perforated sheet for different loads and number and size of cables as given below:

Cable trays shall be galvanized as per Specification given elsewhere.

a. 1500 mm wide
   - Runners 25 x 100 x 25 x 3 mm
   - Rungs 20 x 40 x 20 x 3 mm
   - Suspenders 3 Nos. 40 x 40 x 5 mm angle (2 No. vertical & 1 No. horizontal)

b. 1200 mm wide
   - Runners 25 x 100 x 25 x 3 mm
   - Rungs 20 x 40 x 20 x 3 mm
   - Suspenders 3 Nos. 40 x 40 x 5 mm angle (2 No. horizontal & 1 No. vertical)

c. 1000 mm wide
   - Runners 25 x 100 x 25 x 3 mm
   - Rungs 20 x 40 x 20 x 3 mm
   - Suspenders 3 Nos. 40 x 40 x 5 mm angle (2 No. horizontal & 1 No. vertical)

d. 750 mm wide
   - Runners 20 x 75 x 20 x 2.5 mm
   - Rungs 20 x 30 x 20 x 2.5 mm
Suspenders 3 Nos. 32 x 32 x 4 mm angle (2 No. Horizontal & 2 No. Vertical)  
12 mm fully threaded rod.

e. 600 mm wide  
Runners 20 x 75 x 20 x 2.5 mm  
Rungs 20 x 30 x 20 x 2.5 mm  
Suspenders 1 No. 32 x 32 x 4 mm angle (2 No. Horizontal & 2 No. Vertical)  
10 mm fully threaded rod

f. 450 mm wide  
Runners 20 x 75 x 20 x 2.5 mm  
Rungs 20 x 30 x 20 x 2.5 mm  
Suspenders 3 Nos. 25 x 25 x 4 mm angle (2 No. Horizontal & 2 No. Vertical)  
8 mm fully threaded rod

g. Supply and fixing of perforated type cable trays of the following sizes of pre-galvanized iron.  
i. 300 x 40 x 40 x 2 mm thick  
ii. 150 x 40 x 40 x 2 mm thick

Note: Suitable length of 8 mm dia GI rod suspenders at 2000 mm intervals shall be included in the item for perforated type cable tray.

3.13 SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING, CABLE TRAYS OR JUNCTION BOXES FOR ELECTRICAL INSTALLATION.

General Requirements  
a. Quality of Zinc  
Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS:209-1992.

b. Coating Requirement  
Minimum weight of zinc coating for mild steel flats with thickness up to 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square metre shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches, black spots, pimples, lumpiness, runs, rust stains, bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing, pickling in acid, cold rinsing and then galvanizing.

3.14 TESTING OF CABLES  
Cables shall be tested at works for the following tests before being dispatched to site by the project team.

a. Insulation Resistance Test.

b. Continuity resistance test.

c. Sheathing continuity test.
d. Earth test.(in armored cables)

e. Hi Pot Test.

Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner’s site representative.

a. Insulation Resistance Test (Sectional and overall)

b. Continuity resistance test.

c. Sheathing continuity test.

d. Earth test.

All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labor for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Owner’s site representative.

4. LT PANELS/DISTRIBUTION PANELS/BOARDS

LT Panel, Main Distribution Panels, Sub-Distribution Panels and Final Distribution Panels/Boards shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system, neutral grounded at transformer. All Distribution panels shall be CPRI approved and manufactured by an approved manufacturer.

Distribution panels shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

4.1 CONSTRUCTION FEATURES

Distribution panels shall be 2 mm thick sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be form 3b construction. The Distribution panels shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement and bolted back. All removable/ hinged doors and covers shall be grounded by flexible standard connectors. Distribution panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of Distribution panels shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of Distribution panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum clearance of 275 mm shall be provided between the floor of Distribution panels and the lowest unit.

Distribution panels shall be of adequate size with a provision of spare switchgear as indicated on the Single Line Diagram. Switches shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Distribution panels in conformity with the location of cable/conduit
connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram engraved on PVC sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

4.2 BUS BAR CONNECTIONS

Bus bar and interconnections shall be of high conductivity electrolytic grade aluminum / copper as indicated in the bill of quantities complying with requirement of IS : 5082 – 1981 and of rectangular cross section suitable for carrying the rated full load current and short circuit current and shall be extendable on either side. Bus bars and interconnections shall be insulated with heat shrinkable sleeve of 1.1 KV grade and shall be colour coded. Bus bars shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bars shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area to be added to the bus bar to compensate for the holes. All connections between bus bars and breakers shall be through solid copper / aluminium strips of proper size to carry full rated current and insulated with insulating sleeves.

4.2.1 Temperature - Rise Limit

Unless otherwise specified, in the case of external surface of enclosures of bus bar trunking system which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metallic surface and of 15° C above ambient temperature for insulating surfaces as per IS 8623(Part-2) 1993.

All main distribution panels and sub distribution panels shall be provided with MCCB of appropriate capacity as per Single Line Diagram. All final Distribution boards shall be provided with Miniature Circuit Breakers. Final Single Phase Distribution boards shall be connected to the incoming supply through double pole MCB units & earth leakage circuit breakers. All wiring for final distribution boards shall be concealed behind 5 mm thick bakelite sheet or M S sheet cover. All Distribution boards shall be completely factory wired, ready for connection. All the terminals shall be of proper current rating and sized to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram.

Continuous earth bus sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points. Hinged doors/ frames shall be connected to earth through adequately sized flexible braids.

4.3 CABLE COMPARTMENTS

Cable compartment of adequate size shall be provided in the Distribution panels for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables.

4.3.1 Air Circuit Breakers (ACB)

The ACB shall confirm to the requirements of IEC 60947-2 / IS 13947-2 and shall be type tested & certified for compliance to standards from–CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 415 V \pm 10\%, 50 Hz supply system. Air Circuit Breakers shall be with molded housing flush front, draw out type and shall be provided with a trip freemanual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" “TRIP” indications.

The ACB shall be 3/ 4 pole with modular construction, draw out, manually or electrically operated version as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity.
(Ics) shall be as specified on the single line diagram and should be equal to the ultimate breaking capacity (Icu) and short circuit withstand values (Icw) for 1 sec.

Circuit breakers shall be designed to ‘close’ and ‘trip’ without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Inspection of main contacts should be possible without using any tools. The ACB shall be provided with a door interlock, i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breaker shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open.

Minimum 4 NO and 4 NC auxiliary contacts shall be provided on each breaker.

Rated insulation voltage shall be 1000 volts AC.
4.3.2 **Cradle**

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls/rollers and not on flat surfaces.

There shall be 4 distinct and separate position of the circuit breaker on the cradle.

**Racking Interlock in Connected/Test/Disconnected Position.**

**Service Position:** Main Isolating contacts and control contacts of the breaker are engaged.

**Test Position:** Main Isolating contacts are isolated but control contacts are still engaged.

**Isolated Position:** Both main isolating and control contacts are isolated.

There shall be provision for locking the breaker in any or all of the first three positions.

The following safety features shall be incorporated:

a. Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.

b. Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.

c. All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.

d. All Switchgear module front covers shall have provision for locking.

e. Switchgear operating handles shall be provided with arrangement for locking in ‘OFF’ position.

4.3.3 **Protections**

The breaker should be equipped with micro-controller based release to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones:

- Long time protection.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection.

The protection release shall have following features and settings:

a. **True RMS Sensing**

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current. It shall take into account the effect of harmonics also.

b. **Thermal Memory**

When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic
Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.
c. **Defined time-current characteristics**

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

d. **Trip Indication**

Individual fault indication for each type of fault should be provided by LEDs for faster fault diagnosis.

e. **Self Powered**

The release shall draw its power from the main breaker CTs and shall require no external power supply for its operation.

The release shall meet the EMI / EMC requirements.

f. The setting range of release shall be as follows:

<table>
<thead>
<tr>
<th>TYPE OF PROTECTION</th>
<th>SETTING RANGE OF RELEASE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICK-UP CURRENT</td>
</tr>
<tr>
<td>Long Time</td>
<td>0.4 to 1.0 times (I_n) ((I_x))</td>
</tr>
<tr>
<td></td>
<td>Steps : 0.04, 0.05, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00</td>
</tr>
<tr>
<td></td>
<td>Operating Limit : 1.05 to 1.2 times (I_n)</td>
</tr>
<tr>
<td>Short Time</td>
<td>2 to 10 times (I_x)</td>
</tr>
<tr>
<td></td>
<td>Steps : 2, 3, 4, 5, 6, 7, 8, 9 &amp; 10</td>
</tr>
<tr>
<td></td>
<td>Tolerance : ±10%</td>
</tr>
<tr>
<td>Instantaneous</td>
<td>2 to 12 times (I_n)</td>
</tr>
<tr>
<td></td>
<td>Steps : 2, 3, 4, 6, 8, 10, 12</td>
</tr>
<tr>
<td></td>
<td>Tolerance : ±10%</td>
</tr>
<tr>
<td>Ground Fault</td>
<td>0.2 to 0.6 time (I_n)</td>
</tr>
<tr>
<td></td>
<td>Steps : 0.2, 0.3, 0.4, 0.5, 0.6</td>
</tr>
<tr>
<td></td>
<td>Tolerance : ±10%</td>
</tr>
</tbody>
</table>
All **incomer** ACBs shall have following additional protections other than mentioned above.

- Under and over voltage
- Under and over frequency
- Trip Circuit supervision with PS class CT’s.
- Undercurrent, (DG set only)
- Reverse power (DG set only)
- Phase sequence reversal (DG set only)
- Load shedding and reconnection thru programmable contacts.
- Release should display the Contact wear indication.
- The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have graphical LCD for display of power parameters. The release should provide comprehensive metering with the following parameters
  - Phase currents (running, avg & max) – All parameters in single window.
  - Release should be able to capture short circuit current on which ACB has tripped. The last ten trips and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm. The sensing CT Should be Godowsky type with measurement precision of 1%.
  - Release should be self powered.
  - Release should have facility to select different type of IDMT protection (DT, SIT, VIT, EIT, HVF) for better co-ordination with Breaker.
  - Phase voltages (running, avg & max)
  - Energy & power parameters (active, reactive and apparent)
  - PF
  - Frequency
  - Maximum Demand (KVA& KW)

All **O/G** ACBs shall have following functions.

**Protection**

- The ACB control unit shall offer the following protection functions as standard:
  - Long-time (LT) protection with an adjustable current setting and time delay;
  - Short-time (ST) protection with an adjustable pick-up and time delay;
  - Instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
• Current and time delay setting shall be indicated in amperes and seconds respectively on a digital display.

• Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

**Measurements**

• An ammeter with a digital display shall indicate the true rms values of the currents for each phase. Release shall acknowledge the current & time delay settings done by user on the LCD display.

• A LED barograph shall simultaneously display the load level on the three phases.

• A maxi meter shall store in memory and display the maximum current value observed since the last reset. The data shall continue to be stored and displayed even after opening of the circuit breaker.

4.3.4 **Safety Features**

  a. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.

  b. It shall not be possible to interchange two circuit breakers of two different thermal ratings. For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle.

  c. There shall be provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB.

  d. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.

  e. It shall be possible to bolt the drawout frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.

  f. Drawout breakers should not close unless in distinct Service/Test/Isolated positions.

  g. The insulation material used shall conform to Glow wire test as per IEC60695.

  h. The ACB shall provide in built electrical and mechanical anti-pumping.

4.4 **MOULDED CASE CIRCUIT BREAKER (MCCB)**

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating molded case with high withstand capability against thermal and mechanical stresses.
The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

a. **Current Limiting & Coordination**
   - The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB.

**Protection Functions**

- MCCBs with ratings up to 200 A shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units.
- Microprocessor MCCBs with ratings 250A and above shall be equipped with microprocessor based trip units.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit lead seals to prevent unauthorized access to the settings.
- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.)
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C.

b. **Testing**

- Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

c. **Interlocking**

Molded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

i. Handle interlock to prevent unnecessary manipulations of the breaker.

ii. Door interlock to prevent the door being opened when the breaker is in ON position.

iii. Defeat-interlocking device to open the door even if the breaker is in ON position.

- The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable overload & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.

- All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
• The trip command shall override all other commands.

4.5 MOTOR PROTECTION CIRCUIT BREAKER (MPCB)

Motor circuit breakers shall conform to the general recommendations of standard IEC 947-1,2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°1. The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947-4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse with stand voltage of 6 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without derating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the "isolated" position.

The motor circuit breakers shall be equipped with a "PUSH TO TRIP" device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC. All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly co-ordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1. Type 2 co-ordination shall be guaranteed by tables tested and certified by an official laboratory: LOVAG (or other official laboratory). The motor circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without derating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available. Temperature compensation (-20°C to +60°C)

4.6 MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

4.7 RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)

a. System of Operation
Residual Current Circuit Breaker shall confirm to IEC 61008. RCCB shall work on the principle of core balance transformer. The incoming shall pass through the torroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer.

In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 100 mA at 240/415 volts AC and shall have a minimum of 10,000 electrical operations.

b. Mechanical Operation

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing / opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

c. Neutral Advance Feature

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact first before the phases; and at the time of opening, the neutral shall break last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

d. Testing Provision

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB and the operating handle shall move to the "OFF" position.

4.8 EARTHING

Earthing shall be provided as per IS:3043-1987.

4.9 PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per BOQ confirming to IS Code No.5.

4.10 LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

4.11 METERS

a. All voltmeters and indicating lamps shall be through MCB’s.

b. Meters and indicating instruments shall be flush type.

c. All CT’s connection for meters shall be through Test Terminal Block (TTB).

d. CT ratio and burdens shall be as specified on the Single line diagram.

4.12 CURRENT TRANSFORMERS
Current transformers shall be provided for Distribution panels carrying. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary’s for operation of associated metering.

The CTs shall confirm to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

4.13 POTENTIAL FREE CONTACTS

Potential free contacts shall be provided for connection to Building Automation System in panels indicated in Schedule of Quantities.

4.14 INDICATING PANEL

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per relevant fault level and toggle switch.

4.15 SELECTOR SWITCH

Where called for selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

4.16 CONTACTOR

Contactor shall be built into a high strength thermoplastic body and shall be provided with an are shield for quick are extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta Starters. The insulation for contactor coils shall be of Class “E”.

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 240 / 415 + 10% volts, 50 cyclAC supply.

4.17 THERMAL OVERLOAD RELAY

Thermal overload relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from −5deg C + 55 deg C.

All overload relays shall be of three element, positive acting ambient temperature compensated time logged thermal over load relays with adjustable setting. Relays shall be directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacity.

4.18 TIME DELAY RELAYS
Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

4.19 **TOGGLE SWITCH**

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS codes and shall be of 5 amps rating.

4.20 **PUSH BUTTON STATIONS**

Push button shall be provided for manual starting and stopping of motors / equipment “Green” and “Red” colour push buttons shall be provided for ‘Starting’ and ‘Stopping’ operations. ‘Start’ or ‘Stop’ indicating flaps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for ‘Stop’ push buttons. The push button contacts shall be suitable for 6 amps current capacity.

4.21 **WIRING**

In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per Consultants drawing.

4.22 **ANTI-CONDENSATION SPACE HEATERS**

1 No. 100 W, 240 volts, single phase, 50 Hz AC Anti Condensation space heaters controlled by thermostat and protected by 6 amps MCB’s or MPCB’s as per fault level at the panel shall be provided in each vertical section of main LT panel and 1 No. 60 watt Anti Condensation space heater shall be provided in each cable alley of main distribution boards and sub distribution boards. Supply and control equipment for the above shall be provided by the vendors.

4.23 **TESTING**

Testing of panels shall be as per following codes:

a. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages up to and including 1000 VAC.

b. IS: 13947: 1993 Degree of protection


5. **FINAL DISTRIBUTION BOARDS (FDB’s)**

Final Distribution Boards(FDBs) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum dielectric strength of 2.5 KV / Sec. All Distribution Boards shall manufactured by a manufacturer listed in Appendix-I.

FDB’s shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS-13947-1993.

5.1 **CONSTRUCTION FEATURES**

FDB’s shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of FDB shall be folded and braced as necessary to provide a rigid support for all component. FDB shall be suitable for indoor / outdoor installation, wall mounting free standing type, in double door construction. The Final Distribution Boards shall be totally
enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sqm tinned stranded copper connectors. Final Distribution Boards shall be suitable for the climatic conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of FDBs.

Knockout holes of appropriate size and number shall be provided in the FDB’s in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top/bottom to make holes for additional cable entry at site if required.

Final Distribution Boards shall comprises of the following:

5.1.1 A panel for mounting where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.

5.1.2 Installation accessories shall be part of the DB for fixing conductor and rails for mounting MCB’s and RCCB’s etc. neutral bus bars & earthing bus bars required in the circuit. All busbars in the FDB shall be insulated type.

5.1.2.1 Service cable /interconnection shall be part of the Distribution Boards.

5.1.2.2 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.

5.1.2.3 Degree of protection shall be IP-52 for indoor application, IP-54 for kitchen and IP-55 for outdoor application.

5.1.2.4 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB’s and RCCB’s unless noted otherwise.

5.1.2.5 Phase segregation to be maintained in all three phase distribution boards.

5.1.2.6 Earthing shall be provided in each FDB’s.

5.1.3 EARTHING

Earthing shall be provided as per IS: 3043-1987.

5.1.4 PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphate, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5.

5.1.5 LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

5.1.6 TESTING
Testing of panels shall be as per following codes:

a. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto 1000 VAC.

b. IS: 13947 : 1993 Degree of protection

5.1.7 WIRING
In wiring a distribution panel it shall be insured that total load of various distribution panel and/or consuming devices is divided evenly between the phases and number of ways as per code requirement.
6. **BUSDUCTS / RISING MAINS (SANDWICHED CONSTRUCTION)**

6.1 **SCOPE**

The specification covers design, manufacturing, supply, installation, testing and commissioning of Sandwich type busbar trunking for use as feeder bus bars for interconnection between separate electrical equipment / load centers, and for use as plug in busbar risers.

6.2 **SYSTEM DETAILS**

The bus bar shall be suitable for operation in a 600/1000V system, with frequency of 50 Hz having 100% neutral and internal earth.

6.3 **STANDARDS**

The bus bar shall be designed and manufactured in accordance with the following international standards for bus bar trunking:

- BS 5486 Part 2: Particular requirements of bus bar trunking systems
- IEC 60439 –2: Particular requirements of bus bar trunking systems
- IEC 60529: Degree of protection

The bus duct shall conform to IEE/NEMA/BUI/JIS for seismic protection certification.

6.4 **TESTING**

The bus bars shall be type tested at a reputed international test laboratory (ASTA or CPRI) for short circuit withstand. The test shall be for a minimum duration of 1 second. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer.

Degree of ingress protection (IP rating) shall also be tested at any reputed independent laboratory. This test shall be for IP54 for indoor application and IP65 for outdoor application for sandwiched bus bars.

6.5 **MANUFACTURER**

The manufacturer must have an established track record in design and manufacture of sandwich and cast resin busbar trunking, and must have supplied bus bar systems for at least 5-10 years.

The manufacturer must have ISO 9001 certification for design, manufacture and testing of bus bar systems.

6.6 **DESIGN & CONSTRUCTION REQUIREMENTS – SANDWICH BUSBARS**

**General:**

The bus bars shall be of sandwich construction, non-ventilated design. It shall be possible to mount the busbar system in any orientation, without affecting the current rating.

The bus duct shall consist of three phases and neutral bus bar permanently positioned dust and vermin proof and the degree of enclosure protection shall be IP 52 for indoor installation and shall be IP-65 for outdoor installation as per schedule of quantities.

**Bus bars:**

The bus bars shall of high conductivity Aluminum, as specified in the tender.
The maximum hotspot temperature rise at any point in the bus duct at continuous rated load shall not exceed 35 °C above a maximum ambient temperature of 39°C in any position.

Where an earth conductor is required, it shall be a separate, integral earth conductor, of the same high conductivity material as the phase conductors,

It shall be possible to provide a 200% Neutral where specified.

**Insulation:**

The bus bars shall be insulated throughout their length by epoxy coating / Mylar. The insulation material used shall be of minimum Class F/H (155 deg. C). The insulation must comply to UL 94 V-O. It shall be Halogen Free.

**Housing:**

The housing shall be made of extruded Aluminum case duly enameled/ electro-galvanized sheet steel, with an epoxy powder coated paint finish. The housing shall be profiled, to provide higher strength and efficient heat dissipation. The width of the housing shall preferably be the same for all ratings of bus bars, in order to provide interchangeability of tap off boxes.

**Joints:**

The joints between sections shall be made so as to provide flexibility during installation and expansion / contraction of busbar during operation. The joints shall be of the single bolt type.

The joint construction must have the following features.

- Heat expansion of at least 3mm per joint.
- The joint insulation must be of one piece molded design and not have any cut edges which can absorb moisture.
- The joint construction must allow a +/- 14mm adjustment at the time of installation, for ease of adjusting to site measurement variations.
- The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of molded one piece.
- The joint system must be designed in a way that the installer cannot insert the bus duct length too far and damage the bolt insulator.
- The busbar ends shall not have holes or slots at the joints – the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.
- It shall be possible to install and remove the joints without disturbing the busbar run.

**6.7 TAP OFF UNITS**

Where specified, tap off locations shall be provided for insertion of plug in tap off units. The tap off locations shall be covered by hinged plates.

Tap off unit’s safety features:

- When the door cover is open, it should not be possible to turn the MCCB on. This should be by means of mechanical safety locking system and not by the rotary handle of the MCCB.
The door shall be provided with a lock and keys.

When the lever is in ‘on’ position, even with the key unlocked, the operator should not be able to remove the box or open the tap off location cover.

During insertion, the earth conductor shall make contact first before the phase conductors. This should follow the sequence of first in last out concept.

The tap off unit handle shall be flexible in the sense that the ‘on/off’ handle can be attached in front, depending on the site situation.

When the box is open the live conductors shall be safeguarded by a transparent insulator plate which allows for visible inspection but does not allow touching of the live conductors.

In the event of a MCCB requiring maintenance or changing, the mechanical interlocking must allow easy access by removing only the front plate and not interrupting the adjacent linkages.

For IP65 bus-trunking, the tap off unit arrangement also must achieve IP65 without requiring any additional sealing at site. The complete arrangement with the tap off unit shall be tested for IP rating by an independent test authority.

The tap off boxes will be suitable for accommodating MCCBs or other accessories, as required. The tap off units should allow the flexibility of accommodating different, reputed MCCB makes, to be mutually agreed depending on the tender requirements.

Accessories: A full range of accessories like bends, end flanges, end feed units, and support brackets etc. shall be available

Installation

Bus ducts running along the wall shall be supported at intervals not exceeding 1.5 m. In case of branching, there shall be support on all branches at a distance of 300 mm from the point of branching. Support shall not be less than 40 x 40 x 6 mm MS angle secured in an approved manner. Supports may also be provided in the form of brackets fixed to walls where the duct runs along the wall. In case of ceiling suspended bus ducts, supports made out of 40x40x6 mm MS angle iron shall be provided. The horizontal distance between two such supports shall not be more than 1200 mm. The ducts supports shall be suspended from suitable approved suspension devices provided in the ceiling. Fire barrier shall be provided at each floor/wall crossing as per relevant IS code

Test at Site

The following tests shall be carried out at site and test results to be recorded:

a. Insulation resistance shall be tested with 1000 V megger and shall be not less than 100 mega ohms.

b. Earth continuity test

7. BATTERY CHARGER UNIT

a. General

The battery charger shall be Float cum Boost type Thyristor controlled. The charger shall have selector switch for Auto Float – Boost / Manual Float / Manual Boost Mode of operation. During Auto Float – Boost Mode, Automatic Changeover shall take place from Float Mode to Boost mode
and Vice-Versa. This means that when the Batteries are fully charged the charging shall automatically change from Boost charge to trickle charge.

b. **Construction Feature**

Float cum Boost charger and DC Distribution Board shall be housed in sheet steel cubicle with panels of 1.6 mm thickness, louvers for ventilation glands plate will be provided for cable entry from bottom. The cubicle shall be painted in Siemens grey shade RAL-7032. The battery charger is divided into two compartments. The upper compartment houses the battery charger with all the necessary controls. The lower compartment is suitable for housing the batteries.

c. **Performance**

The D.C output voltage of Float / Boost charger shall be stabilized within ± 2% for AC input variation of 230 V ± 10%, frequency variation of 50 Hz ± 5% and DC load variation of 0-100%. The voltage regulation shall be achieved by a constant voltage regulator having fast response SCR control. The ripple content will be within 3% of DC output nominal voltage.

There shall be provision to select Auto Float / Manual Float / Manual Boost modes. During Auto Float Mode the battery charging shall automatically changeover from Boost Mode to Float Mode and Vice Versa. During Manual Float / Boost modes it shall be possible to set the output volts by separate potentiometers.

The battery charger shall have automatic output current limiting feature.

d. **Components**

The battery charger shall essentially comprise of the following:

1. 1 No. double pole ON/OFF MCB at AC input.
2. 1 No. pilot lamp to indicate charger ON.
3. 1 No. Main Transformer: Double wound, naturally air cooled, having copper winding.
4. 1 set single phase full wave bridge rectifier consisting of 2 Nos. diodes and 2 Nos. SCRs, liberally rated, mounted on heat sinks and complete with resistor / condenser network for surge suppression.
5. 1 No. rotary switch to select auto float / manual float / manual boost. During auto float mode automatic changeover shall take place from float mode to boost mode and vice versa.
6. 1 set solid state constant potential controller to stabilize the DC output voltage of the float cum boost charger at ± 2% of time set value for AC input voltage variation of 230 V ± 10%, frequency variation of ± 5% from 50 Hz and simultaneous load variation of 0-100% and also complete with Current Limiting Circuit to drop the Float Charger output voltage upon overloads to enable the battery to take over.
7. 1 No. electronic controller to automatically changeover battery charging from boost to float and vice versa.
8. 1 No. DC ammeter and toggle switch to read charger output current and battery charge / discharge current.
9. 1 No. moving coil DC voltmeter to read the DC output voltage.
10. 2 set potentiometer to adjust the output voltage during manual /auto float and boost modes.
11. 1 No. double pole ON/OFF MCB for Charger Output (24 V DC Rating).
2 set DC output terminals. 1 set for the load and the other set for the battery.

Alarm Annunciation: Visual and audible alarm with manual accepts reset facility shall be provided for the following:

i. AC mains failure
ii. Charger Failure
iii. Load / Output over voltage

**Rating**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Input</td>
<td>230 V ± 10% AC 50 Hz single phase.</td>
</tr>
<tr>
<td>DC Output</td>
<td>To float / boost charge 24 V suitable rating batteries and also supply a continuous load.</td>
</tr>
<tr>
<td>Current Rating</td>
<td>As battery rating</td>
</tr>
<tr>
<td>Float Mode</td>
<td>27.0 V nominal (Adjustable) between 24-28.0 V.</td>
</tr>
<tr>
<td>Boost Mode</td>
<td>28.2 V nominal (Adjustable) between 24-29.0 V.</td>
</tr>
<tr>
<td>Voltage Regulation</td>
<td>± 2% for AC input variation of 230 V ± 10%. Frequency Variation of 50 Hz ± 5% and DC load variation 0-100%</td>
</tr>
<tr>
<td>Ripple</td>
<td>Less than 5%</td>
</tr>
</tbody>
</table>

e. DC Distribution Board

It shall be provided in the charging cubicle, it will comprise of the following:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>In</td>
<td>1 No. 63 A DP DC MCB</td>
</tr>
<tr>
<td>Out</td>
<td>6 Nos. 16 A DP DC MCB</td>
</tr>
</tbody>
</table>

### 7.1 SAFETY EQUIPMENT

#### 7.1.1 Danger Plate

Danger plate shall be provided on HV and MV equipment. MV danger notice plate shall be 200 mm x 150 mm made of mild steel atleast 2 mm thick with vitreous enamelled white on both side and with inscription in red colour on front side.

#### 7.1.2 Fire Extinguishers

Portable CO₂ conforming to IS:2878-1976, and dry chemical conforming to IS:2171-1967 shall be provided in the Sub-station.

#### 7.1.3 Insulating Mats for Electrical Purpose

**Materials** :

Insulating Mats shall be in compliance with IS-15652-2006 /IEC 61111-2002-06.
The insulating mats shall be made of Elastomer (a generic term that includes rubber, latex and elastomer compounds that may be natural or synthetic or a mixture of both) for use as floor covering for the protection of workers on AC and DC installation with the system voltage upto 66 KV AC and 240 volts DC. Classes and max. use voltages of insulation mats shall be as follows:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Class</th>
<th>Thickness (mm)</th>
<th>AC (rms)</th>
<th>DC (volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>A</td>
<td>2.0</td>
<td>3.3</td>
<td>240</td>
</tr>
<tr>
<td>ii.</td>
<td>B</td>
<td>2.5</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>iii.</td>
<td>C</td>
<td>3.0</td>
<td>33</td>
<td>-</td>
</tr>
</tbody>
</table>

Mats shall be resistant to acid and oil and low temperatures and shall be identified by the respective class symbol.

Thickness of mats for different classes, physical properties, dielectric properties and all other specification shall be as per IS:15652-2006 be free from blisters, pin holes, cracks, embedded foreign matters and other defects.

7.2 DRAWINGS/DOCUMENTS REQUIRED FOR REVIEW/APPROVAL

Following drawings documents shall be submitted by the manufacturer for approval.

a. General arrangement (GA) of equipment layout.
b. Equipment list.
c. Relay and metering system schematics.
d. Supply and erection schedule.
e. Catalogue and specification sheets.

8. POWER FACTOR CORRECTION SYSTEM WITH DETUNED FILTER

8.1 SCOPE

Design, manufacture, supply, erection, testing and commissioning of Indoor type power correction capacitor banks for power factor improvement as per specification given below:

8.2 STANDARD

Unless otherwise stated below, the capacitor shall comply with the following standards (and their latest amendments): IS 13340-1993, IS 13341-1992, IEC 60831-1+2

8.3 RATING

50 KVAR (or less) capacitor units as specified in the BOQ shall be used to form a bank of capacitors of desired capacity.

8.4 ENCLOSURE

The panel shall be indoor type, free standing, and floor mounting with IP42 degree of protection. It shall be completely made of CRCA sheet steel. The enclosure shall have sturdy support structure with angle supports as necessary and shall be finished with powder coating in the approved colour shade/s to match the colour of the other panels. The thickness of powder coating should be minimum 60-80 microns.
Suitable provisions shall be made in the panel for proper heat dissipation. Air aspiration louvers for heat dissipation shall be provided as a necessary.

The front portion shall house the switchgear and the rear portion shall house capacitors and series reactors. The enclosure is to be suitably sized to accommodate all the components, providing necessary air clearance between live and non-live parts, providing necessary working clearance.

8.5 APFC RELAY / CONTROLLER

Microprocessor based APFC relay (Intelligent VAr controller) shall sense the PF in the system and automatically switch ON / OFF the capacitor unit or stage to achieve the preset target PF. The controller shall have the following features:

- Digital settings of parameters like PF, Switching time delay, Step limit etc.
- Indication of PF, preset parameters.
- Minimum threshold setting of 1% of CT current.
- No-volt release.
- Protective shut down in case of harmonic overload.
- Indication for Failure to achieve the target PF, Harmonic overloading, Step failure etc.

8.6 CONSTRUCTION

Each basic unit of mixed dielectric extra low loss MPP capacitor shall be built with a number of elements. These elements shall be combination of capacitor tissue paper and biaxially oriented polypropylene film impregnated with non PCB bio-degradable impregnant or Film Foil capacitor manufactured using Poly propylene film placed between 2 layers of metal foil and winding. The elements shall be connected to the external bus bars through these leads in a series parallel connection to form a three phase unit.

The capacitor units shall be floor mounting type using minimum floor space. The container of capacitors shall be made out of 2 mm thick M S sheet steel of polyster paint coated finish. Each standard unit shall be provided with internal fuses (operation co-ordinated with case-rupture characteristics to avoid rusting).

Total Harmonic Distortion (THD) of upto 5% on voltage and current waveforms shall not affect the life of capacitors. 660±10% variation in line voltage shall not affect the life of the capacitors.

8.7 CAPACITORS

- General specifications: 3 phase, delta connected, 50 Hz.
- Voltage: Must be designed to withstand system over voltage, increased voltage due to series reactor and harmonics.
- Capacitor type: Super heavy duty with double side metalized capacitor tissue paper. Oil impregnated and self-healing type with bi-axially oriented polypropylene film shall be fitted with pressure sensitive disconnect or in each individual capacitor cell.
- Overvoltage +10% (12h / 24h), + 15% (30m / 24h), + 20% (5m), +30% (1m) as per Clause 6.1 of IS 13340-1993.
- Over current : 2.5 x In
- Peak Inrush current withstand : 350 x In
- Total watt-losses including discharge resistors: <0.45 W / k V Ar.
- Temperature category: -25 deg.C to 70 deg.C.
- Capacitor shall be self-heating type and oil impregnated for longer life. The impregnant shall be non-PCB, biodegradable type, must be properly treated and de-gasified, so as not to have any degeneration properties and shall be non-oxidizing.
- The design shall be modular for simple mechanical assembly, no extra accessories / metal parts to be required. Unit must be free standing with an IP 41 protection level.

8.8 DISCHARGE RESISTANCE

Capacitors shall be provided with permanently connected discharge resistors so that residual voltage of capacitors is reduced to 50 volts or less within one minute after the capacitors are disconnected from the source of supply.

8.9 SERIES REACTOR

Application

LV Harmonic Filters shall be used with harmonic filter duty power capacitors to mitigate harmonics, improve power factor and avoid electrical resonance in LV electrical networks.

Construction, Testing & Protection

The low voltage filter reactor shall be series type having a three phase, iron core construction suitable for indoor use (IP 00). The reactor shall be air cooled and the layout shall be in accordance with IEC 60289/IS-5553.

The complete unit shall be impregnated under vacuum and over-pressure in impregnation resin and shall be suitable for temperature Class H (T60/H) operation.

The reactor shall be tested using a separate source voltage test of 3.0kV (coil to core) for 1 minute as per IEC / IS standards.

The permitted tolerance of inductance shall be ±5% of rated inductance value.

Reactor tuning factor shall be 5.67% and the current rating of the reactor shall include the effects of harmonics and other possible over-currents.

The limit of linearity of inductance of the filter reactor shall be as follows $2.08 \cdot \sum |I| \text{ with } L = 0.95 L_N$

The reactor shall be fitted with a temperature sensitive micro-switch in the centre coil (normally open) for connection to trip circuits in case of high operating temperatures

8.10 TERMINALS

Each capacitor bank shall be provided with a terminal chamber and cable glands suitable for PVC insulated aluminum conductor armoured cables as specified.

8.11 EARTHING

Two separate earthing terminals shall be provided for earth connection of each bank.

8.12 SWITCHGEAR & PROTECTION
Incomer switchgear shall be TP&N breaker appropriate rating. Suitable contactor for each step shall be used and must be capable of capacitor switching duty at each step for short circuit protection.

Bus bars shall be suitably color coded and must be mounted on appropriate insulator supports.

Power cables used shall have superior mechanical, electrical and thermal properties, and shall have the capability to continuously operate at very high temperatures up to 125 °C.

Internal wiring between main bus-bars, breaker, contactor and capacitors shall be made with 1100 V grade, PVC insulated, copper conductor cable of appropriate size, by using suitable copper crimping terminal ends etc.

Suitable bus links for input supply cable termination shall be provided.

8.13 CONTROL CIRCUIT & GENERAL PROTECTION

The control circuit shall be duly protected by using suitable rating MCB.

An emergency stop push button shall be provided to trip the entire system (22.5 mm dia, mushroom type, press to stop and turn to reset).

Wiring of the control circuit shall be done by using 1.5 sq.mm, 1100 V grade, PVC insulated, multi-stranded copper control wire.

Inspection terminal strip, number ferruling, labeling etc. shall be provided.

440 V caution board on the panel shall be provided.

8.14 LOW VOLTAGE FILTER REACTOR

Application

LV Harmonic Filters shall be used with harmonic filter duty power capacitors to mitigate harmonics, improve power factor and avoid electrical reasonance in LV electrical networks.

Construction, Testing & Protection

The low voltage filter reactor shall be series type having a three phase, iron core construction suitable for indoor use (IP 00). The reactor shall be air cooled and the layout shall be in accordance with IEC 60289/IS-5553.

The complete unit shall be impregnated under vacuum and over-pressure in impregnation resin. The insulation shall be Class F/ H with maximum temperature rise limited to equivalent of class B. The reactor coils shall be wound with high grade aluminum / copper and termination shall be provided with suitably designed copper bars.

The reactor shall be fitted with a temperature sensitive micro-switch in the centre coil (normally open) for connection to trip circuit in case of high winding temperature.

The permitted tolerance of inductance shall be ±5% of rated inductance value. Reactor tuning factor shall be 7 % (189 Hz) and the current rating of the reactor shall include the effects of harmonics and other possible over-currents.

Reactor losses shall not exceed 0.5% of corresponding step kVAR i.e. for a step of 50 kVAR losses shall not be more than 250W
The limit of linearity of inductance of the filter reactor shall be as follows:
\[ 1.73 \sum I_N \text{ with } L = 0.95 L_N \]

8.15 TESTING

The capacitor bank shall be subject to tests as specified in relevant Indian Standards at the factory and the test certificates shall be furnished in quadruplicate.

8.16 INSTALLATION

i. Capacitors banks shall be installed as per installation manual of supplier and shall conform to relevant Indian Standards.

ii. All interconnections in the control panel shall be checked before commissioning.

iii. Cable end boxes shall be sealed after cable connections to prevent absorption of moisture.

iv. Insulation matting as per IS-15652 of an approved make platform shall be provided in front of the full length of the capacitor bank and control panel.

8.17 TESTING AND COMMISSIONING

i. Insulation resistance shall be tested with a 1000 volts meagger between phases and phase to earth.

ii. Residual voltage shall be measured after switching of the capacitors and the same shall not be more than 50 volts after one minute.

iii. Each discharge resistor shall be tested for its working.

9. EARTHING

9.1 EARTHING

The system shall be TNS with four wire supply system (R,Y,B,N and 2 Nos. E) brought from the main L T Panel. All the non-current carrying metal parts of electrical installation and all metal conduits trunking, cable sheaths, switchgear, distribution panels, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All metal work such as pipe lines, ducts, cable trays, stair case railing etc. shall be bonded to earth.

All earthing shall be in conformity with IS:3043 1987, and the basic system of earthing shall be TNS.

9.2 EARTHING CONDUCTORS

Earthing conductors shall be of copper / GI as mentioned in schedule of quantities and shall be protected against mechanical injury and corrosion.

9.3 SIZING OF EARTHING CONDUCTORS

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits upto 15 amps shall be earthed with PVC insulated copper wire.
All 3 phase switches and distribution panels upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper / GI wires. All 3 phase switches and distribution panels upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper / GI wires. All switches, bus bar, ducts and distribution panels of rating 200 amps and above shall be earthed with minimum of 2 nos separate and independent 25 mm x 3 mm copper / GI tape.

9.4 CONNECTION OF EARTHING CONDUCTORS

Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI, wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

9.5 PROHIBITED CONNECTIONS

Neutral conductor, sprinkler pipes, or pipes conveying gas, water or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lightning protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance measured between earth connection at the main LT panel and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate or circuit breakers, and shall not exceed 1 ohm.

All switches carrying medium voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size. The overlapping in strips at joints where required shall be minimum 75 mm. The joints shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner. Sweated lugs of adequate capacity and size shall be used for termination of all conductor wires above 6 sq.mm size. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned. Equipotential bonding of all metallic structures shall be done.

9.6 EARTHING

The following must always be ensured in earthing system.

- All earths must be interconnected. This includes transformer neutrals, Transformer body, HT Panels, LT Panels, lightning protection system earths, UPS earths etc and provision for interconnection with other services earthing grid etc. shall be made.

- Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure.

9.7 The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.
9.8 **RESISTANCE TO EARTH**

The resistance of earthing system shall not exceed 1 ohm.

9.9 **SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING FOR ELECTRICAL INSTALLATION**

**General Requirements**

a. **Quality of Zinc**

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

b. **Coating Requirement**

Minimum weight of zinc coating for mild steel flats with thickness up to 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs, rust stains, bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminium paint.

10. **ADVANCE LIGHTENING PROTECTION SYSTEM**

10.1 **SCOPE OF WORK**

The work to be done under this section comprises the supply & installation necessary for the complete installation of the lightning protection system.

The design of the components shall be traceable to field research, laboratory testing, fundamental analysis, and statistical levels of the lightning event.

The design of the components shall be traceable to long term practical field studies laboratory testing, fundamental scientific principles and statistical levels of the lightning event as documented in international standard.

The lightning protection system should comply in accordance with NFC 17-102 standard and shall be installed strictly to the manufacturer’s instructions.

The advanced lightning protection system shall include components as follows:

ESE Air terminal
Mechanical supports
Down-conductors
Performance Recording Equipment
A low impedance Grounding system.

10.2 **STANDARDS**
Complete installation shall be engineering and constructed in accordance with the latest revision of the following:

- NFC-17-102
- IEC 61204

The details of the lightning protection system shall also confirm to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this specification and drawings, whichever is more stringent and acceptable to the engineer.

10.3 AIR TERMINAL

The air termination shall be of the type that responds dynamically to the appearance of a lightning down lecturer by creating free electrons between outer surfaces and an earthed central finial rod.

The Air terminal should work under **Early Streamer Emission (ESE) Technology** and the attractive radius of the air termination shall be traceable to known and acceptable lightning research and statistics.

The Lightning conductor should deliver a unique gain time in efficiency, anticipating the natural formation of an upward leader. The Air terminal generates a leader that propagates rapidly to capture the Lighting stroke and conduct it towards the ground.

Arcing is not to be continuous and shall only occur during the progress of the lightning leader.

The air termination shall not cause high frequency radio interference except during the millisecond intervals associated with the progress of the lightning leader and during the main return strike of lightning events in the region.

The materials of the air termination shall be non-corroding in normal atmosphere.

The air termination shall not be dependent upon batteries or external power supplies for any part of its operation.

The Height of the air terminal support mast should be minimum 2mts and the height will be increased as per the coverage design.

The support shall be securely installed and guy wires shall be used where necessary to enable the air termination and mast system to withstand maximum locally recorded wind velocities.

10.4 DOWNCONDUCTOR

The down conductor should be used 25 x 3 mm copper/GI strip. Two down conductors shall be used in case of the structure height is above 28mts and both should be connected with maintenance-free Grounding system.

The main copper conductor shall be connected directly to the air termination.

The down conductor shall be installed in accordance with the manufacturer’s instructions and should not be subject to sharper bends.

The down conductor must be kept in constant physical contact with the structure via conductive mounting clamps.

10.5 LIGHTNING FLASH COUNTER

Each protection system shall be supplied with Lightning strike counter. The counter shall have a register that activates one count for every discharge where the peak current exceeds 400A at the 8/20us standard.
The lightning flash counter shall be robust and easy to install. The counter shall operate from the energy of the lightning discharge and should not work on external or battery power to operate.

The lightning flash counter shall be installed to the manufacturer's instructions in a readily accessible manner (always 2 mts above the Ground) so that reading can be taken at regular intervals. It shall be positioned such that its operating temperature is within the range -20°C to +60°C.

10.6 GROUNDING SYSTEM

The Lightning arrester grounding system reading shall not exceed 10 ohms static impedance except with prior approval by the specifying engineer or manufacturer of the lightning protection system.

Grounding will be done by copper bonded steel core ground rods especially designed for electrical grounding.

Bonding of the grounding system to metallic parts of the building, the structural reinforcing steel of the building to arriving services is recommended.

Electrically conductive, non soluble TEREC Powder should be used to achieve low ground resistance. Provided the materials are mixed and installed strictly in accordance with the manufacturer's instructions.

11. CABLELING FOR MATV SYSTEM

11.1 The Co-axial cable shall be of wideband type with operation capability up to 500 MHz.

11.2 The ageing resistance of the co-axial cable shall comply with DIN 47252, Part 2, i.e. max. 5% increases in attenuation at 200 MHz. measured by artificial ageing (14 days at 80 deg. C)

11.3 Cables shall meet or exceed the following specifications.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Construction</th>
<th>RG-6 MATV Type</th>
<th>RG-11 MATV Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Center Conductor</td>
<td>18 AWG tinned copper</td>
<td>14 AWG tinned copper</td>
</tr>
<tr>
<td>b</td>
<td>Dielectric</td>
<td>Foam Polyethylene Nom. dia 0.180</td>
<td>Foam Polyethylene Nom. dia 0.280</td>
</tr>
<tr>
<td>c</td>
<td>Shield</td>
<td>Foil - 0.003 Al. Tape Braid - 34 AWG 4 end AL. 60% coverage dia 0.212</td>
<td>Foil - 0.003 Al. Tape Braid - 34 AWG 6 end AL. 60% coverage dia 0.31</td>
</tr>
<tr>
<td>d</td>
<td>Jacket</td>
<td>Black PVC flame retardant dia over jacket 0.272 ± 0.008 Min. spot 0.023</td>
<td>Black PVC flame retardant dia over jacket 0.405 ± 0.010 Min. spot 0.032</td>
</tr>
</tbody>
</table>

**Electrical Properties**

<table>
<thead>
<tr>
<th></th>
<th>RG-6 MATV Type</th>
<th>RG-11 MATV Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Dielectric Strength</td>
<td>Conductor to shield 2000 VDC</td>
<td>Conductor to shield 1500 VDC</td>
</tr>
<tr>
<td>b. Capacitance</td>
<td>16.2 PF / FT, Nom</td>
<td>16.2 PF / FT. Nom</td>
</tr>
<tr>
<td>c. Impedance</td>
<td>75.0 ± 3.0 ohms</td>
<td>75.0 ± 3.0 ohms.</td>
</tr>
<tr>
<td>d. Attenuation</td>
<td>DB/100 ft.</td>
<td>DB/100 ft.</td>
</tr>
</tbody>
</table>
Section 6 - Employer's Requirements

11.4 DIRECTIONAL COUPLERS

These shall be of Ultra Wideband type and of hybrid circuit design.

These shall have a near flat frequency response over the entire operating range.

These shall have aluminium cast housing for high frequency radiation resistance.

These shall have ‘F’ sockets for all input, output and branch ports.

The Tipoff shall be available in one way, two way and four way configurations.

The splitters shall be available in two way, three way and four way configurations.

The Tapoffs shall be available in different tap values ranging from 11 dB, 15 dB, 20 dB, 25 dB and 30 dB.

These shall meet or exceed the following specifications:

<table>
<thead>
<tr>
<th>Tap off</th>
<th>Splitters</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Tap Loss</td>
<td>11-30 dB</td>
</tr>
<tr>
<td>b. Through Loss</td>
<td>0.5-4 dB</td>
</tr>
<tr>
<td>c. Isolation</td>
<td>&gt; 22 dB</td>
</tr>
<tr>
<td>d. Screening factor</td>
<td>&gt; 50 dB</td>
</tr>
</tbody>
</table>

12. HT CABLE

33 KV GRADE XLPE

12.1 GENERAL

Cables shall be aluminium conductor, cross linked polyurethane construction and shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, specifications, relevant Standard Specifications and cable manufacturers instructions.

12.2 MATERIAL
a. Conductor

The Conductor shall be made from electrical purity aluminum stranded wires compacted together.

b. Insulation

High quality TROPOTHEN - X (XLPE) unfilled insulating compound of natural colour shall be used for insulation. Insulation shall be applied by extrusion process and shall be chemically cross linked in continuous vulcanization process.

c. Shielding

Cables shall be provided with conductor shielding as well as insulation shielding and shall consist of extruded semi-conducting compound, additionally insulation shield shall be provided with semi-conducting and metallic tape shield over the extruded insulation shield. XLPE insulation and outer core shielding shall be extruded in one operation.

d. Armouring

Armouring shall be applied over the inner sheath and shall comprise of flat steel wires (strips).

e. Outer Sheath

Tough outer sheath of heat resisting PVC compound shall be extruded over the armouring in case of armoured cables or over extruded over the armouring in case of armoured cables or over inner sheath in the case of unarmoured cables.

12.3 TESTS

Cables shall be type tested and routine tested in accordance with IS:7098 (Part II).

a. Conductor resistance test.
b. Partial discharge test.
c. High Voltage test.

The following tests shall be carried out at site for insulation between phases and between phase and earth before and after cable laying.

a. Insulation Resistance Test.
b. Continuity resistance test.
c. Sheathing continuity test.
d. Earth test.
e. High Voltage test.

Cables shall be laid with a clearance of at least 75 mm between two cables.

12.4 END TERMINATION OF HT CABLE

Pre-moulded cable terminations for XLPE cable shall be used as per manufacturer’s instructions. The steel cone of M-seal Push-On shall consist of highly track resistant insulating section vulcanised to a semi-conducting section. The pad material shall have cold-flow properties and shall be flame retardant.

Each end terminal shall undergo Hi Pot Test.

12.5 LAYING OF HT CABLES
Direct In Ground

The work shall involve excavation of trench and laying of cable(s) as indicated in drawing and Schedule of Quantities.

The depth of the excavation shall not be less than 1200 mm for 33 KV plus radius of cable, from the upper surface of ground. Where more than one multicore cable is laid in the same trench, a horizontal inter spacing of 250 mm shall be left in order to reduce mutual heating and also to ensure that fault occurring on one cable will not damage the adjacent cable.

Cable shall be laid in cement pipes encased in concrete or hume pipes at all road crossing. Cables shall be laid in trenches over rollers placed inside the trenches. After the cable has been properly laid and straightened, it shall be covered with 80 mm thick layer of sand. Cable shall then be lifted and placed over this sand cushion. Again, the cable shall be covered with a 80 mm layer of sand. Over the sand a layer of cable protection tiles shall be placed by overlapping 50 mm on either side. Trenches shall then be back-filled with earth and shall be consolidated. Suitable cable markers made of cast iron with aluminium paint indicating the voltage grade and direction of run of the cables shall be installed at regular intervals.

12.6 RCC/MASONRY TRENCH

For laying of HT cable in RCC/Masonry trench refer detail on sub-station layout drawing and IS-1255-1983.
13. **EXTERNAL / STREET LIGHTING POLES**

13.1 **M.S. TUBULAR POLES**

13.1.1 **7 Meter High Pole with Ladder Bars**

7 meter high (5.75 meters above and 1.25 meters below ground) shall be M.S. step tubular pole in 3 steps (bottom part shall be 4 meters high, 11.3 mm outer dia and 3.65 mm wall thickness, middle part shall be 1.5 meter high, 88.9 mm outer dia and 3.25 mm wall thickness, top part shall be 1.5 meters high, 76.1 mm outer dia and 3.25 mm wall thickness) with 300 mm x 300 mm x 6 mm thick base plate. Foundation for the pole shall be of cement concrete in 1:2:4 ratio. (1 part cement, 2 parts coarse sand and 4 parts stone aggregate) IP-55 weather proof junction box shall also be provided to accommodate 1 No. 3 phase and neutral terminal block and 1 No. 6 amps SP MCB including 2.5 sq.mm PVC insulated copper conductor wire from the terminals block to the fixture and 2 Nos. 32 mm dia GI sleeves of suitable length shall be provided to the junction box.

13.1.2 **4.5 Meter High Pole**

4.5 meter high (3.6 meter above and 0.9 meter below ground) shall be 75 mm dia, 3.25 mm wall thickness MS tubular straight pole with a cast aluminium adaptor for post top mounting. Pole shall be provided with 300 mm x 300 mm x 6 mm thick MS base plate. Foundation for the pole shall be of cement concrete in 1:2:4 rates (1 part cement, 2 parts coarse sand and 4 parts stone aggregate) IP-55 weather proof junction box shall also be provided to accommodate 1 No. 3 phase and neutral terminal block and 1 No. 6 amps SP MCB including 2.5 sq.mm PVC insulated copper conductor wires from the terminal block to the fixture and 2 Nos. 32 mm dia GI sleeves of suitable length shall be provided to the junction box.

13.2 **CAST ALUMINIUM POLES**

**Design & Construction**

Ornamental cast aluminum pole shall be made out of cast aluminum as per requirements of IS:202 (1993). Casting of all pole Sections shall be accurately done from permanent moulds and cores of the design submitted to Achieve uniformity in all design aspects in internal and external shape of the unit. All sections shall be free from defects like blow holes, porosity, hard spots, cracks, Hot tears, cold shuts, distortion, sand and slag inclusion and other harmful defects. All the casted sections used in the pole shall be free from welding of any kind used to repair it. The casted sections shall be machined from all the locations used to insert the pieces into one another using either threading or socket method. Accuracy of all machined parts shall be maintained through out a lot for random replacements of sections if and when required. All the threaded joints shall be mechanically tightened and sealed using industrial tools to make the entire unit vandal resistant.

**Aesthetic appearance**

All the grooves and carvings of the pole unit shall be free from any kind of distortion for a pleasing aesthetic appearance.

**Material**

Cast aluminum material used for casting pole unit shall be Grade FG-220 type, as described in IS:202 and shall have minimum tensile strength of the order of 200 N/mmsq.

**Pre-treatment**

Each and every casted piece shall be subject to Sand blasting at a pressure of 10-15 kgf to remove all its external dirt and sand remains etc.
Painting and Finishing

Entire unit shall be given an extensive three stage treatment with PU based two pack Zn-Ph primer and paint prescribed for CI surfaces to make it absolutely rust and corrosion proof, as well as giving it a pleasing appearance. PU based paint shall be MRF make or equivalent.

Thickness of the coating

A minimum of 80 microns of coating thickness shall be achieved on the final piece.

Mounting arrangement

Pole unit shall be grouted using 4 nos. anchor bolts of size M-16x450 mm confirming to 6.8 Gr. as per IS 2062. Pole unit shall be grouted in a foundation made out of 1:3:6 concrete cement after excavating the earth with proper cable sleeves etc. laid in the foundation itself.

Dimensions of the unit

Total height = 3000 mm  
Dia of base plate = 380 mm  
Pitch Circle Dia = 335 mm

Description of top bracket / arms

Single double decorative arm shall be provided on the pole (as asked for in B.O.Q.), secured with the help of two nos. bolts outreach not less than 400 mm.

Service window

A service window of the size 150 mm x 100 mm shall be provided in the base of the pole to allow access to electrical connections and terminations. It shall be covered with MS plate and proper rubber gaskets shall be provided to prevent any ingress of water etc..

Electrical connections

Four way connectors shall be provided along with Slide lock and 1 no. 6 amps Sp MCB including 2.5 sqmm PVC insulated copper conductor wires from the terminal block to the fixture and 2 nos. 32 mm dia GI sleeves of suitable length shall be provided upto the service window. An earth boss is provided on the control plate along with connectors and interrupters.

13.3 GALVANIZED OCTAGONAL POLES

Design

The Octagonal poles shall be designed to withstand the maximum wind speed of 169 KM / Hr. as per IS 875. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS : 5649 Part VI 1982.

Pole Shaft

The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding. The welding of pole shaft shall be done by submerged Arc Welding (SAW) process.

All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing 4 foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from
inside and outside. The welding shall be done as per qualified MMAW process approved by Third Party Inspection agency.

**Door opening**

The octagonal poles shall have door of approximate 500 mm length at the elevation of 500 mm from the Base plate. The door shall be vandal resistance and shall be weather proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. There shall also be suitable arrangement for the purpose of earthing.

The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.

**Material**

<table>
<thead>
<tr>
<th>Octagonal Poles</th>
<th>HT Steel Conforming to grade S355JO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Plate</td>
<td>Fe 410 conforming to IS 226 / IS 2062</td>
</tr>
<tr>
<td>Foundation Bolts</td>
<td>EN.8 grade</td>
</tr>
</tbody>
</table>

**Welding**

The welding shall be carried out confirming to approved procedures duly qualified by third party inspection agency. The welders shall also be qualified for welding the octagonal shafts.

**Pole sections**

The Octagonal Poles shall be in single section (upto 11 mtr). There shall not be any circumferential weld joint.

**Galvanization**

The poles shall be hot dip galvanized as per IS 2629 / IS 2633 / IS 4759 standards with average coating thickness of 70 micron. The galvanizing shall be done in single dipping.

**Xing type**

The Octagonal Poles shall be bolted on a pre-cast foundation with a set of four foundation bolts for greater rigidity.

**Top Mountings**

The galvanized mounting bracket shall be supplied along with the Octagonal Poles for Installation of the luminaries.

**Manufacturing**

The pole manufacturing & galvanizing unit shall be ISO 9001 : 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.

**Service window**

A service window of the size 150 mm x 100 mm shall be provided in the base of the pole to allow access to electrical connections and terminations. It shall be covered with MS plate and proper rubber gaskets shall be provided to prevent any ingress of water etc.

**Electrical connections**
Four way connectors shall be provided along with Slide lock and 1 no. 6 amps Sp MCB including 2.5 sqmm PVC insulated copper conductor wires from the terminal block to the fixture and 2 nos. 32 mm dia GI sleeves of suitable length shall be provided upto the service window. An earth boss is provided on the control plate along with connectors and interrupters.

**Galvanized Octagonal Poles Dimensions**

<table>
<thead>
<tr>
<th>HEIGHT (mtr)</th>
<th>TOP DIA (A/F)</th>
<th>BOTTO M DIA (A/F)</th>
<th>SHEET THICKNESS</th>
<th>BASE PLATE DIMENSIONS (LxBxT)</th>
<th>FOUNDATION BOLT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(mm)</td>
<td>(mm)</td>
<td>(mm)</td>
<td>(mm)</td>
<td>BOLT SIZE (NO. x DIA)</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>130</td>
<td>3</td>
<td>200 x 200 x 12</td>
<td>4 x 16 Dia</td>
</tr>
<tr>
<td>4</td>
<td>70</td>
<td>130</td>
<td>3</td>
<td>200 x 200 x 12</td>
<td>4 x 16 Dia</td>
</tr>
<tr>
<td>5</td>
<td>70</td>
<td>130</td>
<td>3</td>
<td>200 x 200 x 12</td>
<td>4 x 16 Dia</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
<td>130</td>
<td>3</td>
<td>220 x 220 x 12</td>
<td>4 x 20 Dia</td>
</tr>
<tr>
<td>7</td>
<td>70</td>
<td>130</td>
<td>3</td>
<td>220 x 220 x 12</td>
<td>4 x 20 Dia</td>
</tr>
<tr>
<td>8</td>
<td>70</td>
<td>135</td>
<td>3</td>
<td>225 x 225 x 16</td>
<td>4 x 20 Dia</td>
</tr>
<tr>
<td>9</td>
<td>70</td>
<td>155</td>
<td>3</td>
<td>260 x 260 x 16</td>
<td>4 x 24 Dia</td>
</tr>
<tr>
<td>10</td>
<td>70</td>
<td>175</td>
<td>3</td>
<td>275 x 275 x 16</td>
<td>4 x 24 Dia</td>
</tr>
<tr>
<td>11</td>
<td>90</td>
<td>210</td>
<td>3</td>
<td>300 x 300 x 20</td>
<td>4 x 24 Dia</td>
</tr>
</tbody>
</table>
14. **UPS**

IGBT technology base UPS shall be provided. UPS shall be on line type with sufficient backup as shifted in BOQ.

15. **TESTING**

15.1 **GENERAL**

At the completion of the work, the entire installation shall be subject to the following tests in the presence of the Owner’s site representative.

- Wiring continuity test.
- Insulation resistance test.
- Earth continuity test.
- Earth resistivity test.

Test as per Appendix `E` of IS:732 -1989

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the Contractor at his own cost.

15.2 **TESTING OF WIRING**

All wiring systems shall be tested for continuity of circuits, and earthing after wiring is completed and before installation is energized.

15.3 **INSULATION RESISTANCE TEST**

The insulation resistance shall be measured between earth and the whole system of conductors, or any section thereof, with all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 divided by the number of points provided on the circuit, the whole installation shall have an insulation resistance greater than one megaohms. The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant standard specification or where there is no such specification, shall not be less than one a megaohms. All equipments, cables shall be inspected at works by the Architect as per relevant IS and testing commissioning of installation as per Appendix `E` of IS:732-1989 shall be done and all record to be maintained.

15.4 **TESTING OF EARTH CONTINUITY PATH**

The earth continuity conductor metallic envelopes of cables shall be tested for electric continuity and the electrical resistance of the same, along with the earthing lead but excluding any added resistance or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation, shall not exceed one ohm.

15.5 **TESTING OF POLARITY OF NON-LINKED SINGLE POLE SWITCH**
In a two wire installation a test shall be made to verify that all non-lined single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three or four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Owner’s site representative as well as the local authorities.
1. All Audio & Video work should be carried out by authorized system integrator of the OEM.

2. Before the procurement of material and starting of any execution, the OEM shall make a control and schematic drawing and get the same approved by the consultant. All drawings and drawing layers shall be created in a format compatible with the Architect/Engineer’s CAD system.

3. In preparing the Shop Drawings, the Contractor will utilize a CAD document sheet of the same size as the Owner’s Contract Drawings. The format should be similar, and the lettering shall be at least one-eighth inch high.

4. Upon completion of the sheet metal drawings, the Contractor shall forward the CAD documents to the next Contractor who shall super-impose its equipment and piping utilizing a different CAD layer. The Contractor shall prepare CAD backgrounds in all areas for coordination regardless of the need for sheet metal in that area.

AUDITORIUM
Area Dimension:

Scope of the work:
Scope of work consists SITC of DIGITAL CONFERENCE & SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT
2. Boundary Layer Microphone Setup with DSPs for DIGITAL CONFERENCE SYSTEM

Sound Reinforcement System
The Main FOH System (L & R) should be Two-Way Line Array Column Loudspeakers with expansion unit, which support Constant Beam width Technology with Asymmetrical Vertical Coverage to provides uniform sound distribution to every part of the audience area. The Loudspeaker System to provide an average continuous sound pressure level of 128 dB – 130 dB (+/- 3dB variation) or better

SITC of Two + Two Sets of Multi driver full range, IP55 or better rated loudspeaker system. The loudspeaker should support Eight (8) x 5” LF Driver & Sixteen (16) x 1” HF Driver, speech sensitivity shall be at least 98dB, Frequency Range of 46 Hz - 20 kHz. The coverage shall be of 148 deg. -150 Deg, (H) and 25 deg. – 45 deg. (V). The power handling capacity of the loudspeaker shall be at least 695 Watts continuous; Max speech SPL shall be 131dB peak
or better with a nominal impedance of 4 Ohms / 8 Ohms or higher. Enclosure Fiberglass-reinforced ABS cabinet, painted aluminum grille

SITC of Two Numbers of Dual 15" Installation friendly subwoofer with a Frequency Range of 39 Hz - 1kHz or better, Calculated SPL 138dB Peak or better. The loudspeaker should have a nominal impedance of 4 Ohms / 2 x 8 Ohms or better. Power Handling of 1350 Watt continuous / 5400 W Peak or more. At least 16 suspension / rigging points shall be available for flexible installs. The Subwoofer shall be enclosed in birch plywood with powder coated steel grille.

SITC of Two Numbers of 12" Two Way Portable Active Loudspeaker for stage monitor with frequency Range of 48Hz - 20 kHz or better & Peak Power Handling of 1000W or above with Built-in Class D amplification. Built in DSP features and should support Bluetooth connectivity. The Loudspeaker shall have a Max. SPL (Peak) of 126 dB or better. Coverage pattern 100 Deg X 60 Deg

SITC of Four Numbers of Compact Indoor type wall mount Music Loudspeaker for green room with 3" LF Driver; Power rating 50W-40W continuous; Coverage Angle: 100° x 100° or more; support various power tapping 15W or higher @ 70V/100V, Brackets with adjustment included

SITC of Four Numbers of stackable Wall Mount multi driver (8 or better) full range Line Array Column loudspeaker with free field frequency range (-10dB) of 80Hz to 20kHz; RMS power handling of 150 W better; The Nominal dispersion coverage shall be of 148 deg. -150 Deg, (H) and 20 deg. – 22 deg. (V); full range Speech Sensitivity of 93 dB SPL; Max SPL 121dB peak or better; Nominal Impedance of 8 ohms. And should support various power tapping 60W (Max.) at 70/100V; Enclosure Fiberglass reinforced ABS cabinet, painted aluminum grille or better.

SITC of One LOT of Multichannel Digital Network based Power Amplifier with Minimum Power Output (Total) 4800W or more; Should Support 2 Ohms / 4 Ohms / 8 Ohms, 70V/100V for offered Loudspeaker & Subwoofer System

SITC of One Number of Single Channel Mixer Power Amplifier with Minimum Power Output 250W or more; Should Support 4 Ohms / 8 Ohms, 70V/100V for offered Loudspeaker System
SITC of One LOT of Networked Based Digital Signal Processor with each unit should support 12 Mic/Line inputs & 8 Analog outputs with AEC; THD <0.01%; Channel Separation / Crosstalk not more than -75 dB; Frequency Response 20 Hz - 20 kHz or better; Dynamic Range 108 dB or more; 12 Control Inputs and 6 Logic Outputs for GPIO Controls; Ethernet Port for third party Control and Monitoring; Should support features like Input Equalizers, Router, Band Pass filter, Output Equalizer, Delay, Limiters, gates, Source selectors etc. for signal processing.

SITC of Fourteen Numbers of Boundary Layer Wired Microphone Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of Two Numbers of 18 inches / 50cm Gooseneck Microphone with On/Off Switch, flush mounted for Podium with sock mount as standard specification

SITC of Two Numbers of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of Two Numbers of Wireless Lavalier / Collar (Condenser) Microphone as standard specification, should consist of diversity RF Antenna Receiver System; condenser lavalier & ear worn microphone(s); should support 1200 frequencies and minimum 48 channels for operations

SITC of Four Numbers of Dynamic Wired Vocal Handheld Microphone with on off switch as standard specification with on off switch; polar pattern supercardioid; sensitivity 2.6mV/Pa; Max. SPL 147/156 dB or more; Equivalent noise level 18 dB-A or better; Impedence: 600 ohms; Recommended load impedance 2000 ohms; Connector: 3-Pin XLR or better.

SITC of Four Numbers of Dynamic Wired Instrument Microphone as standard specification with Polar pattern cardiod or better; sensitivity 2.5 mV/Pa; Max . SPL 147/156 dB or more; Equivalent noise level 18 dB-A or better; Impedence: 600 ohms; Recommended load impedance 2000 ohms; Connector: 3-pin XLR or better
SITC of One Set of Wired Drum Set Microphone kit as standard specification including microphone pack minimum five dynamic (incl. bass drum mic) and two condenser overhead microphones.

SITC of Eighty-Eight Numbers of Boundary Layer Wired Microphone Delegate Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of One LOT of Networked Chassis Based Digital Signal Processor; Should Support 16 I/O for Analog Mic / Line Level Connectivity; Should support AEC feature for all Microphone Inputs. Also provides sufficient line level (Pre-amp) output for further connectivity

SITC of One Number of 32 Channel Mixer - it will be digital mixing console with 32 in / 32 out USB interface with iPAD Control with minimum 32 mono inputs for microphones and eight numbers of line level inputs; minimum 31 output busses; minimum 26 motorised faders etc as per site.

SITC of One number of Professional Studio Headphone, 17Hz - 27,500Hz, Sensitivity >104dB, Rated Impedance 54 ohms or above; to be supplied with detachable cable 3m or more

Cafeteria, Reception & Passage – BGM

Scope of the work:

Scope of work consists SITC of BACK GROUND MUSIC SYSTEM as per details given below:

1. Audio System consist of CEILING MOUNT Loudspeakers for BGM
2. Single Zone Amplification for BGM Loudspeakers

BGM System

SITC of Twenty Numbers of Ceiling Flush Music/PA Loudspeaker: Frequency range of 69Hz to 16.5kHz or better; Power handling not less than 38 Watt Continuous Program Power; Minimum 129 deg Wide Coverage; Normal Sensitivity of 84 dB SPL @ 1 mtr; Nominal Impedance 8 Ohms; support various power tapping 15W (max.) at 70V/100V with grille; Shall include necessary standard hardware for ceiling install

SITC of One Number of Four Mic / Line Level Input Mixer Cum Amplifier with Power Output 1 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, independent bass & treble control for each output channel
First Floor - 47 Seater Conference

Scope of the work:

Scope of work consists SITC of DIGITAL CONFERENCE & SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT
2. Boundary Layer Microphone Setup with DSPs for DIGITAL CONFERENCE SYSTEM

Sound Reinforcement System

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

SITC of Forty-Five Numbers of Boundary Layer Wired Microphone Delegate Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of One Number of Boundary Layer Wired Microphone Chairman Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of One LOT of Networked Chassis Based Digital Signal Processor; Should Support 16 I/O for Analog Mic / Line Level Connectivity; Should support AEC feature for all Microphone Inputs. Should provide over-ride feature for Chairman Unit to control the conference any point of time during the conversation. Also provides sufficient line level (Pre-amp) output for further connectivity

SITC of Four Numbers of IP 55 rated wall mount loudspeaker with 5.25" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V

SITC of One Number of Networkable Digital Amplifier with total 600W output power or better across Minimum Two outputs channel @ 4 / 8ohms, 70V/100V; Frequency Response 20Hz - 20kHz for LZ mode ; THD 0.35%, Built in DSP for Matrix routing, Speaker EQs, delays, Network Control, GPIO Port etc.
SITC of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

**First Floor - 90 Seater Conference**

**Scope of the work:**

Scope of work consists SITC of DIGITAL CONFERENCE & SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT
2. Boundary Layer Microphone Setup with DSPs for DIGITAL CONFERENCE SYSTEM

**Sound Reinforcement System**

SITC of Ninety Numbers of Boundary Layer Wired Microphone Delegate Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of One Number of Boundary Layer Wired Microphone Chairman Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better

SITC of One LOT of Networked Chassis Based Digital Signal Processor; Should Support 16 I/O for Analog Mic / Line Level Connectivity; Should support AEC feature for all Microphone Inputs. Should provide over-ride feature for Chairman Unit to control the conference any point of time during the conversation. Also provides sufficient line level (Pre-amp) output for further connectivity

SITC of Six Numbers of IP 55 rated wall mount loudspeaker with 5.25" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V

SITC of Two Numbers of stackable Wall Mount multi driver (8 or better) full range Line Array Column loudspeaker with free field frequency range (-10dB) of 80Hz to 20kHz; RMS power handling of 150 W better; The Nominal
dispersion coverage shall be of 148 deg. -150 Deg, (H) and 20 deg. – 22 deg. (V); full range Speech Sensitivity of 93 dB SPL; Max SPL 121dB peak or better; Nominal Impedance of 8 ohms. And should support various power tapping 60W (Max.) at 70/100V; Enclosure Fiberglass reinforced ABS cabinet, painted aluminum grille or better

SITC of One Number of Networkable Digital Amplifier with total 2400W output power or better across Minimum Four output channels @ 4 / 8ohms, 70V/100V; Frequency Response 20Hz - 20kHz for LZ mode ; THD 0.35%, Built in DSP for Matrix routing, Speaker EQs, delays, Network Control, GPIO Port etc.

SITC of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

Second Floor – Large Meeting Room

Scope of the work:

Scope of work consists SITC of SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT

Sound Reinforcement System

SITC of One Number of 18 inches Gooseneck Microphone with On/Off Switch, flush mounted for Podium with sock mount as standard specification

SITC of Three Numbers of Dynamic Wired Vocal Handheld Microphone with on off switch as standard specification with on off switch; polar pattern supercardioid; sensitivity 2.6mV/Pa; Max. SPL 147/156 dB or more; Equivalent noise level 18 dB-A or better; Impedence: 600 ohms; Recommended load impedance 2000 ohms; Connector: 3-Pin XLR or better.

SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of Six Numbers of Boundary Layer Wired Microphone Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better
SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

SITC of Six Numbers of IP 55 rated wall mount loudspeaker with Minimum 8" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 350W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 60W (Max.) @ 70V/100V

SITC of One Number of Networkable Digital Amplifier with total 600W output power or better across Minimum Two output channels @ 4 / 8ohms, 70V/100V; Frequency Response 20Hz - 20kHz for LZ mode ; THD 0.35%, Built in DSP for Matrix routing, Speaker EQs, delays, Network Control, GPIO Port etc.

SITC of One Number of 18 inches Gooseneck Microphone with On/Off Switch, flush mounted for Podium with sock mount as standard specification

SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of One Number of Wireless Lavalier / Collar (Condenser) Microphone as standard specification, should consist of diversity RF Antenna Receiver System; condenser lavalier & ear worn microphone(s); should support 1200 frequencies and minimum 48 channels for operations

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

SITC of Four Numbers of IP 55 rated wall mount loudspeaker with Minimum 8" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 350W Peak or better; nominal impedance 8 ohms;

Second Floor – Small Meeting Room

Scope of the work:
Scope of work consists SITC of SOUND REINFORCEMENT SYSTEMS as per details given below:
1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT

Sound Reinforcement System
SITC of One Number of 18 inches Gooseneck Microphone with On/Off Switch, flush mounted for Podium with sock mount as standard specification

SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of One Number of Wireless Lavalier / Collar (Condenser) Microphone as standard specification, should consist of diversity RF Antenna Receiver System; condenser lavalier & ear worn microphone(s); should support 1200 frequencies and minimum 48 channels for operations

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

SITC of Four Numbers of IP 55 rated wall mount loudspeaker with Minimum 8" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 350W Peak or better; nominal impedance 8 ohms;
Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 60W (Max.) @ 70V/100V

SITC of One Number of Networkable Digital Amplifier with total 600W output power or better across Minimum Two output channels @ 4 / 8ohms, 70V/100V; Frequency Response 20Hz - 20kHz for LZ mode; THD 0.35%, Built in DSP for Matrix routing, Speaker EQs, delays, Network Control, GPIO Port etc.

SITC of One Number of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

Second Floor - Dining Area – BGM

Scope of the work:
Scope of work consists SITC of BACK GROUND MUSIC SYSTEM as per details given below:
1. Audio System consist of CEILING MOUNT Loudspeakers for BGM
2. Single Zone Amplification for BGM Loudspeakers

BGM System

SITC of Six Numbers of Ceiling Flush Music/PA Loudspeaker: Frequency range of 69Hz to 16.5kHz or better; Power handling not less than 38 Watt Continuous Program Power; Minimum 129 deg Wide Coverage; Normal Sensitivity of 84 dB SPL @ 1 mtr; Nominal Impedance 8 Ohms; support various power tapping 15W (max.) at 70V/100V with grille; Shall include necessary standard hardware for ceiling install

SITC of One Number of Four Mic / Line Level Input Mixer Cum Amplifier with Power Output 1 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, independt bass & treble control for each output channel

Second Floor – Exhibition Hall

Scope of the work:
Scope of work consists SITC of SOUND REINFORCEMENT SYSTEMS as per details given below:
1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT

Sound Reinforcement System
SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of Six Numbers of IP 55 rated wall mount loudspeaker with 5.25” LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V

SITC of One Number of Eight Mic / Line Level Input Mixer Cum Amplifier with Power Output 2 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, indepent bass & treble control for each output channel

SITC of One Number of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

Third Floor – Training Room, Large

Scope of the work:

Scope of work consists SITC of SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT

Sound Reinforcement System

SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of One Number of Wireless Lavalier / Collar (Condenser) Microphone as standard specification, should consist of diversity RF Antenna Receiver System; condenser lavalier & ear worn microphone(s); should support 1200 frequencies and minimum 48 channels for operations

SITC of Six Numbers of IP 55 rated wall mount loudspeaker with 5.25” LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V
Section 6 - Employer's Requirements

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre

SITC of One Number of Eight Mic / Line Level Input Mixer Cum Amplifier with Power Output 2 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, independent bass & treble control for each output channel

SITC of One Number of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

Third Floor – Training Room, Small

Scope of the work:

Scope of work consists SITC of SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT

Sound Reinforcement System
SITC of One Number of Wireless Handheld (Dynamic) Microphone as standard specification, should consist of RF Antenna Receiver System; Dynamic Vocal Handheld microphone with supercardioid polar pattern; should support minimum 1200 frequencies and minimum 48 channels for operations.

SITC of One Number of Wireless Lavalier / Collar (Condenser) Microphone as standard specification, should consist of diversity RF Antenna Receiver System; condenser lavalier & ear worn microphone(s); should support 1200 frequencies and minimum 48 channels for operations

SITC of Four Numbers of IP 55 rated wall mount loudspeaker with 5.25” LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V

Fifth Floor - 48 Seater Conference

SITC of One Number of Eight Mic / Line Level Input Mixer Cum Amplifier with Power Output 2 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, independent bass & treble control for each output channel

SITC of One Number of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre
Scope of the work:

Scope of work consists SITC of DIGITAL CONFERENCE & SOUND REINFORCEMENT SYSTEMS as per details given below:

1. Audio System consist of Two-Way Line Array Column Loudspeakers for SOUND REINFORCEMENT
2. Boundary Layer Microphone Setup with DSPs for DIGITAL CONFERENCE SYSTEM

Sound Reinforcement System

SITC of One Set of Active Digital Interface Box for Laptop Audio Connectivity
SITC of Forty-Six Numbers of Boundary Layer Wired Microphone Delegate Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better
SITC of One Number of Boundary Layer Wired Microphone Chairman Unit with On / Off Mute button; Support Phase Coherent Cardioid Technology; Should support supercardioid polar pattern, having bass tilt switch, Programmable membrane switch, RFI suppression, XLR Connector, Audio Frequency 50 - 20000 Hz or better, Sensitivity 22 mV/Pa, Signal to Noise Ratio 72 dB or better
SITC of One LOT of Networked Chassis Based Digital Signal Processor; Should Support 16 I/O for Analog Mic / Line Level Connectivity; Should support AEC feature for all Microphone Inputs. Should provide over-ride feature for Chairman Unit to control the conference any point of time during the conversation. Also provides sufficient line level (Pre-amp) output for further connectivity
SITC of Four Numbers of IP 55 rated wall mount loudspeaker with 5.25" LF Driver; should be compatible with optional weatherized grille as and PC Cover; Power rating 295W Peak or better; nominal impedance 8 ohms; Coverage Angle: 100° x 100° or better; internal multi-tap transformer which support various power tapping 30W (Max.) @ 70V/100V
SITC of One Number of Eight Mic / Line Level Input Mixer Cum Amplifier with Power Output 2 x 120W @ 4 Ohms / 8 Ohms, 70V/100V, Priority Muting, Euro Block Connectors, Sensitivity of 1.4 Vrms, indepent bass & treble control for each output channel
SITC of 10 Ch Mixer with minimum 6-8 mic inputs with 3 stereo line inputs as per site
Technical Specification – Extra Low Voltage Service (ELV)

This Specification brings out the qualitative and quantitative requirements of ELV Systems.

The objective of this RFP in terms of architecture is unification of the voice, video and data communication infrastructures, to build-up a converge platform that is standards based.

The proposed solution would be based on Hybrid technology which supports Analog, Digital and IP end points.

1.1 Technical Specification for Ip-Pbx

The proposed Media Gateway Unit is a pre-configured server which allows small and medium businesses to enjoy enterprise-class business telephony.

- An integrated, modular, state-of-the-art communication server that supports advanced TDM, SIP and IP business-class telephony and it support 300 ports per gateway including TDM and IP.
- Complete, user-friendly voice communications including embedded voicemail, personal assistant, automated attendant and integrated CTI server
- Supports analog, digital, IP and mobile phones and PC soft phones, ipDect, Dect and WLAN Phones in same platform.
- Proposed ip-pbx should have valid TEC approval certificate
- Pre-announcement: on-hold music and messages
- Automated attendant: voice-activated management of incoming calls
- Basic PC telephony
- Call-forwarding: automatic transfer of incoming calls
- Automatic call distribution: call-routing software

Proposed solution infrastructure should deliver
- Secured, Scalable and high reliable (99.999%) communications
- Feature rich telephony over all end points
- Directory services

IP Communications system

a) The client / server based architecture will be based on the use of a communication server to provide support for:
- One or more media gateways to allow for TDM connectivity – analog phones, Digital phones, Trunks, TDM to IP conversion and resources like conferencing, voice prompts
- IP communication devices (IP/SIP phones, IP desktop clients (future))
- Local or remote network management systems
Section 6 - Employer’s Requirements

b) To ensure, complete ownership and smooth delivery of all the functional and reliability requirements of the solution proposed, all the hardware and software must be from the same OEM. No third party products or integrated solutions are allowed.

c) **Standards:** The equipment must be compliant with **European and US standards** such as electrical security standards:
   - EN – 60950 (IEC950)
   - EN – 50082-x
   - EN – 55024
   - UL/CSA
   - FCC/IC PART 68 AND CS-03

   The vendor should furnish the certificate from the manufacturer to justify the above requirement.

d) **System configuration and future Scalability**
   - The requirement is to provide IP Telephony to:
   - The proposed system shall be equipped to handle the capacity indicated above, but should be scalable to minimum 800 extensions (Analog, digital and IP) from day 1.
   - System should evolve in the future into supporting multiple site, to ensure centralized architecture in a multi site environment, the system should support remote site architectures with gateways and IP phones. It should be able to support up to 200 gateways with the same server architecture.

e) The system must be able to interoperate with other telephone systems and endpoints using the following standards:
   - QSIG GF
   - QSIG BC
   - DPNSS
   - DSS1
   - H323
   - SIP

f) Proposed Communication server should be capable of handling peak hour traffic of up to 15000 Busy Hour Call Completion (BHCC) per server.

g) The system must support gateways for following external telephony interfaces and signaling protocols:
   - E1 CCS PRI (VN3-4-6-7 /ETSI) DASS2
   - E1 CAS (R2, Q421, MFC, Q23, Decadic)
   - T1 CCS generic
   - T1 CAS
   - T0 ISDN BRI (VN3-4-6-7 / ETSI)
   - 2 wire and 4 wire E&M
   - Analog Loop Start and Ground Start (with CLIP)

**IP network features**

a) The proposed system supports native IP communications in direct or "peer-to-peer" with only the telephone signaling transiting back toward the controlling communications server. The speech will be switched over the IP
network and exchanged directly from client to client. The voice and signaling frames should be marked [tagged] in order to be recognized and should be classified by the network. The standards of marking supported will be:
- Level 2: IEEE 802.1p/Q
- Level 3: TOS / DiffServ

b) In the case of a PC connected to an IP terminal, (IP telephone or IP application telephone), the IP terminal must treat the frames transmitted by the PC, tagged or untagged, in a transparent manner. It should be possible to turn the port off if the PC port is not used.

c) The client IP Media Gateway (the IP terminals) will support either a static IP address or a dynamic address (manageable from the terminal) by the Buyer’s compatible DHCP within their server. The Tenderer will document in the bid the elements used in the server to support client IP terminals.

d) Communication servers should support the following services for the IP phones, if these features are not supported natively, then the vendor has to provide the needed hardware and software to deliver these services in the network:
- Embedded DHCP server for Dynamic IP address allocation to IP Phones.
- TFTP server for firmware updates
- NTP protocols
- SNMP v3 standard

**SIP compatibility**

a) The proposed system should be natively SIP at the core. It shall support SIP based applications, SIP trunks and/or terminals. The SIP software should conform to the normalized architecture and be integrated in real-time communications management to benefit from the duplicated services. The SIP modules are:
- SIP Proxy
- SIP Registrar
- SIP Gateway
- SIP for applications

b) These modules will run natively within the communication Server. The redundant Communication server must support the redundancy for SIP modules as well.

c) If the SIP modules are not natively run on communication server, to ensure high availability for SIP communications, the SIP server must be deployed in hot standby redundancy.

d) The SIP applications and terminals will use either UDP or TCP to communicate. The supported standards must conform to the following RFCs:

e) The proposed system should include SIP trunks to be able to be connected securely and seamlessly to service providers infrastructures thorough session borders controllers and carrier grade SIP call session controllers.

f) Proposed IP Phones must be SIP standard compatible. It should be capable of running with H323 and SIP protocols.

**H323 compatibility**

a) The proposed IP PBX system must support H.323 and SIP technology and should permit the following functions:
- Management of communications between H.323 and SIP terminals
- Interoperability between the H.323 or SIP terminal and the traditional telephony devices (IP terminals, IP, analog, private or public lines)

b) The proposed system should integrate an H.323 gatekeeper server that offers the following services:
- Automatic registration of the H.323 terminal and assignment of a call number by the RAS protocol (Registration Admission Status)
- Resolution of the address, the terminal H.323 can be identified by its call number or by its IP address that can be assigned dynamically by a DHCP server
- Establishment of communications in direct mode

c) The main H.323 gateway features required are:
- Support of the H.225 and H.245 protocols
- "Fast-connect" setting
- H.245 tunneling
- Automatic registration and call number assignment with the RAS protocol
- Direct mode and routing mode
- Connection to an external gatekeeper
- H.323 attachment D for T38 fax
- Direct RTP

**Media Gateways:**

a) The system should support high density media gateway to support the TDM extensions and trunks.
b) It should support G723.1, G711, G729a Codecs
c) DC powered Media Gateways should have minimum 60 DSP resources, 25 universal slots, Voice prompt storage memory to accommodate 16 minutes of static prompts and 8 minutes of dynamic prompts, unlimited 3 party conference, 25 party meet me conference.
d) Media gateways at the remote site must be provided with Survivable server to ensure the local survivability of the local Analog, IP extensions and trunks in case of network isolation or complete breakdown of the Communication server complex.e) When the Media gateways are survived by survivable server, it should ensure all the telephony services are maintained transparently without any degradation. Vendor to explain how is this achieved.

**System features**

a) The IP PBX should support flexible numbering plan with upto 8 digits. System should allow mixed numbering scheme.
b) The system should provide distinctive ringing for internal calls, junction calls, auto call back, wake up service and emergency reporting service.
c) The proposed system should support automatic route selection (ARS) and least cost routing (LCR) features to route the calls based on priorities related to user profile, tariff, and network availability, along the most cost-effective path. This service will be transparent for users and irrespective of the physical carrier connection. It should be possible to inform the caller via voice prompt if the cheapest route is not available.
d) The proposed system should have both live and automated attendants features and either of the one or combination of both can be deployed to fulfill the requirement. Atleast 40 ports should be provided in the system.

e) The system should support voice prompts to guide the user in all communication positions by multilingual voice guides. Voice prompts must be broadcasted according to the language associated with the user. Minimum 32 context sensitive Voice prompts should be part of each system.

f) Multiline and multi directory feature: The system should support management of more than one line for IP and digital Phones. It should be possible to define as many as 10 lines with the same numbers for secretaries and other critical users. Also it should be possible to assign multiple directory numbers to a IP and digital Phone.

g) The system should have the following cost control features.
   - Class of service
   - Forced account code
   - Authorisation code
   - Least cost routing
   - Toll restriction
   - Automatic route selection
   - Call duration timer/warning

h) It should be possible for a user to make an external call from other sets via a PIN thus bypassing the external call barring category for that set.

i) Hunt groups – Sequential, Cyclical or “Parallel”. The telephone sets in the group could be analog phones, IP phones or a combination of both. In case of overall occupancy, the calls will stay on hold in a waiting queue, or be redirected towards another user, station group, attendant or an external correspondent. It should be possible to have upto 40 extensions in one group.

j) Boss / Secretary feature
   i. The system should support the Boss/Secretary feature between the IP phones. It should be possible to implement this feature with the software itself. Boss and secretary can call each other using single digit keys. System should support upto 5 secretary association with one boss and also one secretary for multiple bosses.

   ii. It should be possible to apply filter so that certain calls (based on number, CLIP) can land directly on boss’ sets bypassing the secretary set.

   iii. The boss should also benefit from the following additional services:
       - Direct secretaries call key
       - Notification of secretary absence station. In this case the filtering is automatically redirected to a predefined overflow secretary.
       - Notification of absence of the main and of the overflow secretaries. In this case, calls are automatically redirected to the boss set.

   iv. It should be possible to filter using predefined list of numbers including external, internal..

k) The system should support the following basic telephone features:
   i. Abbreviated dialing
   ii. Appointment reminder
   iii. Automatic call-back on busy trunk/bundle/network link
iv. Call forwarding unconditional on busy/no reply to extension, hunting group, Voice mail, operator, paging, etc.
v. Conditional external forwarding (busy or no reply)
v. External call forward to PSTN/cellular.
vi. Immediate forwarding
vii. Call pick-up
viii. Call parking
ix. Call tracing
x. Call waiting indication / voice prompt
xi. Calling line identification restriction for internal calls
xii. Calling party identification for internal users. (on analog phones also).
xiii. Camp on busy telephone/hunting group/voice mail
xiv. Controlled private call by Pin code and password
xv. Do not disturb
xvi. Dynamic call barring
xvii. General night service
xviii. Hunting group (fix head, cyclic, longest idle time, parallel)
xix. Internal/external music on hold
xx. Internal/external inquiry call
xxi. Individual hold
xxii. Instrument locking to prevent the outgoing calls.
xxiii. Last internal/external number redial
xxiv. Personal code modification
xxv. Store and redial external number
xxvi. Moving service: When a user moves between the offices, he/she can transfer his/her telephone station (number and class of service) to the visited telephone set.
xxvii. Three-party conference – minimum 50 simultaneous conferencing hardware and software to be included in the proposal.
xxviii. 6 party conference – 3 x 6 party conference should be supported in the system
xxix. 25 party meet me conference should be proposed for users to join audio conference call on a regular basis.
xxx. Multiple appointment reminders per extensions

I) The system should also support the following telephone features on the IP/Digital sets in addition to above basic features:

- Adjustable handset volume
- Call-by-name for sets with alphabetical keyboard: internal and external user
- Centralized phone book stored in communication server directory feature with spelling and syntax corrector with 100000 entries, accessible from the alphabetical keyboard of the phone. If the same is not supported vendor to provide a LDAP compliant Directory server for access from their IP/Digital phones.
- Caller name display
- Conditional/unconditional differentiated forwarding of multiple directory numbers
- Contextual voice prompts
- Distinctive ringing according to hierarchical level
- Fixed function keys
- Hands-free
- Headset capability
- Individual customization
- Interactive guidance with soft keys
- Last call and total calls pulse or costs charging display
- Loudspeaker announcement
- Multi-line: multi-appearance and multi-numbers
- Multi-line selective forwarding
- Message waiting indication
- Text messaging for mid range and high end digital and IP phones
- Calling line identification presentation/restriction (CLIP/CLIR)
- Digit by digit dialing mode
- End block dialing (digit correction possible)
- ISDN identification (CLIP) converted into name
- ISDN mini-text messages (carrier dependent)
- Malicious call identification
- Storage of unanswered calls with date, time, and callback
- Look ahead routing

**Network features**

a) If the solution is based on cluster of servers, the proposed solution shall support the following minimum set of features between all the users in the network:

- Associate number speed dial
- Camp on a busy set
- enquiry call
- Call by name
- Three party conference
- Meet me conferences
- Transfer to attendant
- Call back on no answer
- Intrusion
- Call pick-up
  a. Individual call pick-up
  b. Group pick-up
- Transfer of an internal or external call
- Transfer to a free or busy station
- Call a hunting group
- Loudspeaker announcement (IP station) - A free or busy IP set shall receive a message through its loudspeaker.
- Rerouting calls on ringing (IP station)
- Automatic call-back on busy set
- Call-back last internal caller
- Night forwarding
- Listening tones and voice guides
- Automatic off-hook call: Time-delayed
- Automatic off-hook call: Immediate
- Specialised incoming station
- Modifying the personal code
- Direct access to an external trunk
- Trunk allocation
- Automatic call-back on private busy trunks
- Open abbreviated number
- Business account code
- External call barring
- External call barring on transfer
- Direct Inward Dialling
- External number re-dial
- Number store (store/re-dial)
- Call park/call park retrieval
- On hold/retrieval from hold
- Over dialling
Bundle routing to a station or hunting group
Controlled private calls

**Voice Messaging application**

a) Voice messaging application has to be from the same OEM as that of the IP PBX and should be based on standard based technologies like SIP, IMAP and should support unified messaging features.

b) The offered Voice messaging application should be a single system delivering both standard voice messaging as well as unified messaging services.

c) Graphical user Interface (GUI ) must be supported on IP phones in addition to TUI (Telephone user interface) for message access and reviews.

d) Voice Mail features
   - Messaging facilities
     - Direct access to the mail box (by-pass the menu greeting) from business phone set (IP or analog) and from any phone set if the phone number is declared by the user in his personal settings.
     - Internal call routing (busy and no answer)
     - Maintain a specific number of minutes of messages per user
     - Guest mailboxes
     - Mailbox escape to predefined extension
     - Future delivery
     - Mailbox escape to operator
     - Automated attendant
     - The messaging application must have the ability to record live conversation through press of a button on the IP phone or through the softphone application.

   - Notification facilities
     - Message notification on phones, emails
     - Message waiting audible voice prompts
     - Integration with visual message waiting indicators on phones

   - Personal settings facilities
     - Password management
     - Call forwarding direct to mailbox
     - Password protected mailbox
     - Personalized voice greetings (busy, no answer)
     - Private messages
     - Announcement - only mailbox
     - Visual call management on display

   - Message Listening facilities
     - Playback control
     - Message header information
     - Message-rewind, pause and fast-forward
     - Reply to sender
     - Send a message copy
     - Skip messages
Attendant (Operator) positions

a) Tenderer should offer the Attendant console:
   - A professional Multimedia Attendant Console to efficiently manage calls and information on a
     Windows based PC.

b) The Multimedia Attendant Console option must run on Windows 8 operating system. The PC must not be
dedicated solely to this application and must be able to handle telephone applications and business
software simultaneously. The attendant console color screen must allow the operator to take advantage of
user interface based in, icons and buttons to activate the different functions.
   - The console should be associated with any digital / IP Phone for voice communication
   - In case of PC failure the attendant should still be able to handle calls through IP Phone

c) This attendant application must be LDAP compliant. To permits access to company directory servers or
databases, or ODBC databases (Oracle, Access, Excel, etc.), to allow call/dial by name.

d) the following services must be available:
   - Override - The attendant can bypass forwarding or do not disturb modes on a phone
   - Called Party Call Resources - When the called party is busy or does not answer, the following call
     resources should be available on attendant keys:
     - Callback request
     - Text message
     - Voice mail
     - Associate
     - Assistant
     - The attendant should be able to send mini text messages to a users with display:
     - Programmed message
     - Pre-programmed message completed by entering digit: date, hour
     - Pre-programmed message completed by any variable part (text and digits)
     - Fully programmable message (twenty characters maximum)
   - Transfer on no Answer
   - Transfer on Busy
   - Barge-in on Busy or Partially Busy
   - Three-party Conference
     - An attendant must be able to set up a three-party conference, and then transfer the
       conference to another user.
   - Trunk Assignment with/without Restriction (Transfer with Privilege)- This feature enables an
     attendant to transfer a trunk and public dial tone to an internal user. The user can then dial an
     external number with or without restriction. The attendant can request the call charges at the end of
     the call.
   - Call Transfer to other Attendant
   - Chained Call
   - Charging Recall
   - Phone Reservation - This feature allows the attendant to reserve a phone to, for example, transfer
     an important external call.
- Class of Service - The attendant console (in idle state) must be able to change the class of service for any phone.
- Public Trunk Access Restriction - The attendant console (in idle state) must be able to change the public trunk access and restriction for any phone.
- Input of Directory Name in Phone Book - The attendant console can create or modify directory names in its personal phone book.

**Digital Telephone terminals**

All phones should be from the same OEM as the PABX.

a) **Type 1: entry level Terminals**
- 1-line 20-character B&W display
- Hands-free and amplified listening modes with volume control
- Dual line
- Six programmable keys
- Personal directory of 12 numbers
- Mute
- Redial
- Message key with LED

b) **Type 2: Mid range Digital Phones**
- Adjustable B&W graphical backlit display with minimum 7 cm x 3.5cm
- 6 physical soft keys associated with LCD with key content display, should support atleast 30 programmable numbers with names
- 4 way Navigation key with exit and validation keys for use with the graphical interface
- 4 one touch programmable keys with LEDs
- Full Duplex Hands free and group listening modes
- Integrated alphabetic keyboard to access: dial by name, text mail, …
- Fixed keys
- Message key with LED
- Specific headset plug 3.5mm with presence detection for headset use

c) **Type 3: Advanced Digital phone**
- Adjustable Gray scale graphical backlit display with minimum 7.5 cm x 5cm
- 10 physical soft keys
- Adjustable display angle
- Contrast adjustment
- Navigation key with exit and validation keys for use with the graphical interface
- Context-sensitive and programmable keys for direct functions access
- Comfortable handset
- Full Duplex Hands free and group listening modes
- Integrated alphabetic keyboard to access: dial by name, text mail, …
- Direct access to text and voice mailboxes with message signaling led
- 5 fixed function keys
- Specific headset plug 3,5mm with presence detection for headset use

**IP Telephone terminals**

All phones should be from the same OEM as the PABX.

d) **Type 1: entry level Terminals**
- 1-line 20-character B&W display
- Hands-free and amplified listening modes with volume control
- Dual line
- Four programmable keys
- Personal index of 12 numbers
- Mute
- Redial
- Message key with LED
- 2xEthernet 10/100BT switched Port
- POE: Class 2
- LLDP/MED support

e) **Type 2: Medium end IP Phones**
- Adjustable B&W graphical backlit display with minimum 7 cm x 3.5cm
- 6 physical soft keys associated with LCD with key content display, should support at least 30 programmable numbers with names
- 4 way Navigation key with exit and validation keys for use with the graphical interface
- 4 one touch programmable keys with LEDs
- Full Duplex Hands free and group listening modes
- Integrated alphabetic keyboard to access: dial by name, text mail, …
- Fixed keys
- Message key with LED
- Specific headset plug 3,5mm with presence detection for headset use
- Ethernet 10/100/1000BT switched Port to connect the LAN and PC (external Giga bit adaptor must be offered if Gigabit Ethernet is not supported by the phone)
- POE support – please mention the POE class of the device
- XML compatible
- G711,G729,G723.1,G722.2 coding

f) **Type 3: Advanced Executive Touch Screen IP Phones for executives**
- Seven-inch screen graphical TFT-LCD color touch-screen display supporting 800 x 480 Wide video graphics array (WVGA)
- Capacitive touch screen with Haptic technology
- All features must be accessible through touch screen and therefore must have limited keys like home, volume up and down, quick access key for keyboard.
- Embedded Bluetooth® wireless with bluetooth handset and support wideband audio
- Should have external keyboard connector, 2 USB 2.0 ports
- Full Duplex Hands free and group listening modes
- Onscreen alphabetic keyboard to access: dial by name, text mail, …
- Adjustable foot stand
- Specific headset plug 3,5mm with presence detection for headset use
- 2x Ethernet 10/100/1000 BT switched Port (external Giga bit adaptor must be offered if Gigabit Ethernet is not supported by the phone)
- POE support – please mention the POE class of the device
- G711,G729,G722.2 coding
- 802.1x MD5 /TLS authentication, protection against DOS attacks,

**Security**

**a)** Security is currently one of the most important needs when a VoIP project should be deployed inside an enterprise. The Tenderer must only propose an offer that conforms with at minimum EAL1+ requirements of the Common Criteria (ISO-15408) standards. A certificate issued by the authority must be presented along with the answer.

**b) Communication server security**

i. Controlled access to management platform is imperative. The system must control the identity of the management terminals and the user accessing that terminal. During a connection, (local or remote) the system must check the consistency between the management platform name, management platform password, and user name before authorizing the connection.

ii. The System must support Syslog services for both internal and external command and configuration control accounting with a minimum of 5-day history.

iii. The System must support Network Time Protocol V4.1.2 (RFC 1305) to synchronize the system data/time of network devices

iv. The call server Operating System must be hardened Linux and it must not use or natively support network resource sharing services such as NFS, Samba or LPR

v. To avoid the introduction of virus, worm and Trojan type attacks; the use of internal e-mail servers is not acceptable.

vi. The Call Server must not employ the use of a 'default' password that is viable beyond the period of installation.

vii. The password & access control must include at least:
  - Shadow Passwords to prevent the possibility of an aggressor to easily read or deduce system or account access passwords.
  - Password Aging with configurable time periods
  - Usage of MD5 algorithm (or stronger) for password encryption
- Internal OS controls for remote point of access restriction and service availability. (i.e. TCP Wrappers & Trusted Hosts)

viii. Denial of Service

- Both the call server and the media gateways must provide self-protection mechanisms to counter this type of attack.

- Media Gateways should not host services such as proxy, FTP, Telnet or local dynamic routing to prevent exploitation in Distributed Denial of Service attacks.

- IP Phones should not support direct, external initiated, connections via HTTP, telnet, FTP, TFTP or any other protocol as means to prevent distributed Denial of Service attack exploitation.

ix. In addition to these basic rules, the system must be compatible with The 802.1X standard that is used in conjunction with Radius or LDAP servers to provide authentication, authorization and accounting for clients connecting to an Ethernet network.

x. All the offered IP Phone models must support 802.1x (EAP-MD5 or better i.e. EAP-TLS) for authentication and access control to the network, this mechanism must allow the user to be connected to the call server only after the authentication process.

xi. The system should have the capability to, based on standard mechanisms (such as 802.1Q and DHCP), assign automatically the corresponding voice VLAN number to the IP terminal clients during IP terminal initialization, allowing for the separation of voice and data.

c) Network Security

The IP station must have the ability to strip any VLAN tags assigned to traffic entering the network through the 'guest port' of the IP station, and further have the ability to switch that traffic into an identified data VLAN, further enhancing enforced voice and data traffic separation. The IP terminal must have the ability to disable its 'guest port.'

d) Management Security

i. Role Based Account Management to define different levels of administrator access depending on specific function responsibility.

ii. Administration users connecting directly to the Call Server (console) and management platform must be authenticated via a RADIUS server before gaining access to the call server.

System administration

a) The management platform must provide a client Graphical User Interface (GUI) as well as a web based interface to allow the administrator to manage the system from any PC with an Internet browser.

b) The management platform must use a client-server architecture allowing different administration clients to be connected to the system.

The management platform must allow the administrator to generate reports and graphics of the activity per period of time in terms of traffic, accounting and alarms and giving the possibility to generate statistics of all this analysis.

c) The management platform must allow the administrator to generate reports and graphics of the activity per period of time in terms of traffic, accounting and alarms and giving the possibility to generate statistics of all this analysis.

d) All IP PBX management applications (Fault & alarms, Configuration, Accounting) should belong to a single platform and a single image for data storage, minimizing operation expenses.

The IPPBX should be able to use standard protocol SNMP to integrate tasks with enterprise global network management platforms (like CA Unicenter TNG, HP Openview, or IBM Tivoli).
f) Management application should support tracking mechanisms for calls that overrun the set limits for external calls based on the duration or cost. It should send email alerts to draw the administrator’s attention.

g) Management tasks

The IP PBX system should provide a suite of applications and tools to permanently evaluate and report the operational health of the system. It should provide the following functions:

- Automatic recognition of plugged sets
- User moving
- Monitoring of all the events on the system
- Capture of performance and level of use of the resources
- Register and log all calls and give accounting information
- Monitor and register all users, attendants, trunks activity to generate traffic and level of use analysis

h) The management server must be able to be situated anywhere on the Buyer’s premises, and accessible to the communications system(s) via an IP network.

i) Management terminal

The system must include a dedicated management server/platform that will be based on the latest technologies, such as JAVA/JEE.

j) Management access security

- The access to the services offered by the management server should be protected in the following manner:
  - Authentication of the management server
  - Authentication of the client user

- The management server authenticates the user password in order to permit domain management.

k) Reports production

The management application should allow the automatic printing of all types of reports on a daily basis, in addition to being able to send them by email in different formats, including:

- Text format: .txt
- PDF format: .pdf
- HTML Format .htm
- Excel format: .xls
- Directory data (LDAP): .ldif

Call accounting

1. The call accounting application must be from the same OEM.

ii. The requirement in this RFP for call record storage on the system hard disk is for a minimum of 100,000 call records. Management and sorting of these tickets will be performed using the management and traffic analysis application residing on an external server. Call records will be automatically downloaded by the application at night; for security reasons, a sliding file of the most recent seven (7) days will be maintained continuously on the system hard disk.

iii. CDRs should be generated for outgoing and incoming calls with the following fields:

- Caller / called terminal name
- Name of the service
- Department name
- Number dialed (with masking of the last four digits) / caller number
- Date, hour, and minute that the call ended
- Length of the call
- Number of cost units
- Cost for the call
- Type of call
- Service features used

iv. The proposed service should offer the attendants a set of ready-to-use pre-defined reports, in addition to a management report utility to customize the existing reports or to create completely new ones. It will be possible to create graphs from these reports, in pie and histogram format.

**Alarm Management**
- Faults and Alarms management of all the incidents and fail reports generated by the system itself informing date, hour, severity level and action recommended to take. This module must be able to centralize the alarms and events of the system, and:
  - Notify an alarm depending to the severity level sending an e-mail or activating an script performing an specific action
  - Register and generate statistics for the alarms and events in the network in a daily scheme
- Generate reports and graphics about the statistics of the alarms and its correspondent resolution time.

**Environmental Conditions**

The equipment offered shall be capable of maintaining its guaranteed performance when operating continuously for 24 hours a day and 365 days a year under the following environmental conditions.

- Operational temperature: 0 to 45 Degree C.
- Storage: -20 degree C to +70 degree C
- Humidity: 20% to 80% without condensation.

1.2 **Technical Specification for CCTV**

Network Video Recorder Product Feature

- Support flip case, front slot type of hard disk installation, convenient installation and maintenance
- Support 16HDD, support HDD hot-swappable, support RAID0, RAID1, RAID5 etc.
- Support i8S plug and play protocol, IPC no need IP address
- Support ONVIF, RTSP IPC
- Support 4K network video preview, storage and playback
- Support H.264+ H.264 decode front-end adaptive access
- Support 2 HDMI and 2 VGA different source output, 4K output
- Brand new UI operation interface, support one key turn on record function
- Support IPC centralized management, including IPC parameters configuration, information import/export, voice intercom and upgrades, and other functions
- Support dual password verify playback, backup
- **Support IPC cross-border, into the area, leave the area, regional invasion, items abandoned/lost and other intelligent detecting access and linkage**
Section 6 - Employer's Requirements

• Support playback motion detecting data filtering, support video summary playback function
• Support different time periods playback, will be asynchronous time-sharing playback video distribution up to multiple window
• Support intelligent search, playback and back up function
• Support intelligent grouping channel
• Support instant playback under the preview, and does not affect other channel's preview
• Maximum support 16ch 1080P playback simultaneously and multiple channel backward simultaneously
• Support image multi-channel play

Operating System : Embedded LINUX operating system
Dual Stream : Each channel can set main stream and sub stream.
Video Compression: H.264+/H.264
Monitoring Image Quality : 4K/5MP/3MP/1080P/960P/720P
Image Motion Detection : Each screen can set multiple detection areas and set 6-level sensitivity (IPC Support)
Playback Quality : 1/4/9/16ch synchronous playback
Region Cover : can set 4 cover regions (IPC Support)
Recording Mode : Support manual, auto, motion detection, alarm trigger record mode
Backup Way : Support U disk, USB mobile HDD, network storage and backup(IPC Support)
Operation Way: Mouse, Keyboard control
Local Login : User name and password
Recording Storage: Local HDD, network
Mobile Surveillance: Support (iPhone, Windows Mobile, Android) smart phone
Power Supply: ATX110-220V 300W 50-60Hz
Power Consumption: ≤50W (without HDD)
Working Temperature: -10℃~+ 55℃
Working Temperature: 10%-90%
Dimension: 437mm×483mm×143mm
Weight(without HDD): 18.5Kg

IP Base Day & Night 2 MP IR VF Bullet Camera

Ⅰ Standard 2.8-12mm mega pixel lens, 5pcs Array LED infrared distance up to 60 meters.

Ⅱ Metal Housing
Ⅰ Standard ,H.265 video compression, high compression ratio, good view quality.
Ⅰ 2 MP clear images
Ⅰ Support standard Onvif, support multi-platform, terminal, and network.
Ⅰ Support cloud service
Ⅰ Support IE, Chrome, Firefox, Safari, Opera and other general browser.
Ⅰ Support Android, IPHONE, IPAD remote real-time monitoring, and mobile monitoring.
I Support motion detect, linkage photo, recording, trigger email alarm, FTP storage inform methods.
I Support POE. IEEE802.3af / at adaptive (optional)
I Support firmware remote upgrade.
I Support multiple user access and clients software

**IP Base Day & Night 2 MP IR Dome Camera**

I Standard 3.6mm mega pixel lens, 18pcs lights, infrared distance up to 30 meters.

**Metal Housing**
I Standard, H.265 video compression, high compression ratio, good view quality.
I 2 MP clear images
I Support standard Onvif, support multi-platform, terminal, and network.
I Support cloud service
I Support IE, Chrome, Firefox, Safari, Opera and other general browser.
I Support Android, IPHONE, IPAD remote real-time monitoring, and mobile monitoring.
I Support motion detect, linkage photo, recording, trigger email alarm, FTP storage inform methods.
I Support POE. IEEE802.3af / at adaptive (optional)
I Support firmware remote upgrade.
I Support multiple user access and clients software

### 1.3 Technical Specification for Data Switches and Networking

<table>
<thead>
<tr>
<th>L3 core switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>22x100/1000 Base-X SFP ports and 6x10/100/1000 BaseT ports.</td>
</tr>
<tr>
<td>4 SFP+ 1G/10G uplink ports</td>
</tr>
<tr>
<td>USB port for file transfer</td>
</tr>
<tr>
<td>Micro-USB Console Port</td>
</tr>
<tr>
<td>Dedicated Ethernet Management Port</td>
</tr>
<tr>
<td><strong>CAPACITY</strong></td>
</tr>
<tr>
<td>Switching Capacity 224Gbps</td>
</tr>
<tr>
<td>Throughput 160Mpps</td>
</tr>
<tr>
<td><strong>STACKING</strong></td>
</tr>
<tr>
<td>Stacking through dedicated stacking ports</td>
</tr>
<tr>
<td>84Gbps minimum stacking capacity</td>
</tr>
<tr>
<td>Minimum of 8 units in a stack</td>
</tr>
<tr>
<td>Must support split stack detection and protection</td>
</tr>
<tr>
<td>In-Service Software Upgrade in a stack</td>
</tr>
<tr>
<td><strong>POWER</strong></td>
</tr>
<tr>
<td>Redundant, hot-swappable power supplies</td>
</tr>
<tr>
<td>Must also support external backup power through power shelf providing backup power to the stack</td>
</tr>
</tbody>
</table>
| External backup power must support:
<table>
<thead>
<tr>
<th><strong>Section 6 - Employer's Requirements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procurement of Works-Small Contract</strong></td>
</tr>
<tr>
<td><strong>Bidding Document for Interior Work at Assam Water Centre</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PHYSICAL &amp; ENVIRONMENTAL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>N+1 redundancy to protect against failure of single power supply</td>
</tr>
<tr>
<td>N+N redundancy to protect against power feed failure</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>FRONT TO BACK AIRFLOW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Must fit in standard 19” chassis</td>
</tr>
<tr>
<td>1RU high</td>
</tr>
<tr>
<td>35cm deep or less</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>SCALABILITY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>4000 VLANs</td>
</tr>
<tr>
<td>48,000 MAC addresses</td>
</tr>
<tr>
<td>64,000 IPv4 routes</td>
</tr>
<tr>
<td>Jumbo frames up to 9216 bytes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>MANAGEMENT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CLI Console through:</td>
</tr>
<tr>
<td>Console Port</td>
</tr>
<tr>
<td>Bluetooth</td>
</tr>
<tr>
<td>Remote CLI over IPv4/IPv6 through</td>
</tr>
<tr>
<td>Telnet</td>
</tr>
<tr>
<td>SSH v2</td>
</tr>
<tr>
<td>RESTful API (XML and JSON)</td>
</tr>
<tr>
<td>Web Management (HTTP/HTTP) over IPv4/IPv6</td>
</tr>
<tr>
<td>File transfer over IPv4/IPv6</td>
</tr>
<tr>
<td>TFTP over IPv4/IPv6</td>
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<tr>
<td>FTP over IPv4/IPv6</td>
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<tr>
<td>SFTP over IPv4/IPv6</td>
</tr>
<tr>
<td>SCP over IPv4/IPv6</td>
</tr>
<tr>
<td>SNMP v1/v2/v3 over IPv4/IPv6</td>
</tr>
<tr>
<td>DHCP relay (IPv4/IPv6)</td>
</tr>
<tr>
<td>LLDP-MED</td>
</tr>
<tr>
<td>DHCPv4 and DHCPv6 server</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LAYER 2 FEATURES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE 802.1d Spanning Tree Protocol</td>
</tr>
<tr>
<td>IEEE 802.1w Rapid Spanning Tree Protocol</td>
</tr>
<tr>
<td>IEEE 802.1s Multiple Spanning Tree Protocol</td>
</tr>
<tr>
<td>ITU-T G.8032/Y.1344 Ethernet Ring Protection (ERP) v2</td>
</tr>
<tr>
<td>IEEE 802.3ad/802.1ax Link Aggregation Control Protocol and Static Link Aggregation</td>
</tr>
<tr>
<td>PVST+ Per-VLAN Spanning Tree Protocol</td>
</tr>
<tr>
<td>IEEE 802.1Q VLAN trunking</td>
</tr>
<tr>
<td>Feature</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IEEE 802.1ad Q-in-Q</td>
</tr>
<tr>
<td>Service &amp; Customer VLAN</td>
</tr>
<tr>
<td>NNI and UNI interfaces</td>
</tr>
<tr>
<td>High Availability VLAN for clustering</td>
</tr>
<tr>
<td>Multicast VLAN Registration Protocol</td>
</tr>
<tr>
<td>IEEE 802.1aq Shortest Path Bridging (SPB-M)</td>
</tr>
<tr>
<td>DHCP Option 82: Configurable Relay Agent Information</td>
</tr>
<tr>
<td>Port Mapping</td>
</tr>
<tr>
<td>Loopback Detection</td>
</tr>
<tr>
<td>BPDU Blocking</td>
</tr>
<tr>
<td>STP Root Guard</td>
</tr>
<tr>
<td>LAYER 3 FEATURES</td>
</tr>
<tr>
<td>64 Virtual Routing Forwarding instances or higher</td>
</tr>
<tr>
<td>IPv4 Routing</td>
</tr>
<tr>
<td>Static Routing</td>
</tr>
<tr>
<td>Routing Information Protocol (RIP) V1 and V2</td>
</tr>
<tr>
<td>OSPFv2 with Graceful Restart for IPv4</td>
</tr>
<tr>
<td>IS-IS with Graceful Restart</td>
</tr>
<tr>
<td>Border Gateway Protocol version 4 (BGPv4)</td>
</tr>
<tr>
<td>Virtual Router Redundancy Protocol v2</td>
</tr>
<tr>
<td>Policy Based Routing</td>
</tr>
<tr>
<td>Server Load Balancing</td>
</tr>
<tr>
<td>IPv6 Routing</td>
</tr>
<tr>
<td>Static Routing</td>
</tr>
<tr>
<td>Routing Information Protocol Next Generation (RIPng)</td>
</tr>
<tr>
<td>OSPFv3 with Graceful Restart for IPv6</td>
</tr>
<tr>
<td>IS-IS with Graceful Restart</td>
</tr>
<tr>
<td>Border Gateway Protocol version 4 with multiprotocol extensions for IPv6 (MP-BGP)</td>
</tr>
<tr>
<td>Virtual Router Redundancy Protocol v3</td>
</tr>
<tr>
<td>Neighbor Discovery Protocol</td>
</tr>
<tr>
<td>Policy Based Routing</td>
</tr>
<tr>
<td>Server Load Balancing</td>
</tr>
<tr>
<td>MULTICAST</td>
</tr>
<tr>
<td>Internet Group Management Protocol (IGMP) v1/v2/v3 snooping</td>
</tr>
<tr>
<td>Protocol Independent Multicast (PIM)</td>
</tr>
<tr>
<td>PIM Sparse Mode (PIM-SM)</td>
</tr>
<tr>
<td>PIM Source Specific Multicast (PIM-SSM)</td>
</tr>
<tr>
<td>PIM Dense Mode (PIM-DM)</td>
</tr>
<tr>
<td>PIM Bidirectional (PIM-BiDir)</td>
</tr>
<tr>
<td>Distance Vector Multicast Routing Protocol (DVMRP)</td>
</tr>
<tr>
<td>Multicast Listener Discovery (MLD) v1/v2 snooping</td>
</tr>
<tr>
<td>PIM to DVMRP gateway support</td>
</tr>
<tr>
<td>SECURITY</td>
</tr>
<tr>
<td>IEEE 802.1x with multi-client and multi-VLAN support</td>
</tr>
<tr>
<td>MAC-based authentication</td>
</tr>
<tr>
<td>Web-Based Authentication (Captive Portal)</td>
</tr>
<tr>
<td>Role-based access templates (VLAN, QoS, ACL) must be automatically applied to authenticated users</td>
</tr>
</tbody>
</table>

Access templates must be compatible with WLAN access templates and configurable in a single operation through the NMS.

| Learned Port Security                        |
| Access Control Lists (L1 to L4)              |
| DHCP Snooping                                |
| ARP Poisoning detection and IP Source Filtering |
| Radius with Change of Authorization (CoA) support for device authentication |
| Administrator Authentication                 |
| Remote Access Dial-in User Service (RADIUS)  |
| Lightweight Directory Access Protocol (LDAP) |
| Terminal Access Controller Access-Control System Plus (TACACS+) |
| QoS and ACLs                                 |
| Wire-rate L2/L3 performance                  |
| 8 queues per port                            |
| Flow-based QoS                               |
| Traffic Policing                             |
| Traffic Shaping                              |
| Class of Service                             |
| Differentiated Services                      |
| 802.3x Flow Control                          |
| 802.1Qbb Priority-based flow control         |
| End-2-End Head of Line (E2E-HOL) blocking prevention |
| Deep Packet Inspection (DPI) Application Monitoring and Policy Enforcement |
| Multimedia Capabilities                      |
| Detection, monitoring and tracking of Session Initiation Protocol (SIP) sessions |
| Real time SIP statistics including packet loss, latency, jitter, MOS and R-Factor |
| Multicast DNS Relay for Apple Bonjour and DLNA uPNP |
| Monitoring and Troubleshooting               |
| Local and remote Syslog logging              |
VRF support for management interfaces  
sFLOW v5  
Remote Monitoring (RMON)  
Dying Gasp through SNMP and Syslog  
Local and Remote Port Mirroring  
Port Monitoring (Packet Capture)  
Unidirectional Link Detection (UDLD)  
Digital Diagnostic Monitoring (DDM)  
Time Domain Reflectometry (TDR)  
Compliance and Certifications  
FCC Part 15:2012, Subpart B, Class A  
ICES–003:2012 Issue 5, Class A  
ANSI C63.4-2009  
FCC CRF Title 47 Subpart B (Class A)  
VCCI (Class A)  
Safety Agency Certification  
US UL 60950-1  
IEC 60950-1 Health and Safety  
EN 60825-1 Laser  
EN 60825-2 Laser  
CDRH Laser  
IEC 60950-1/EN 60950 with all country deviations  

L2 POE  

Gigabit Ethernet standalone chassis in a 1U form factor with 24 10/100/1000 BaseT PoE+ ports and 2 Gigabit SFP uplink ports.  

Minimum Switching capacity 56 Gb/s and Minimum throughput 41 Mpps  

Wire rate at layer 2  
Total number of MAC addresses: 16,000  
Total number of static IPv4 routes: 8  
Number of VLANs: 4,000  
Jumbo frame size: 9 216 bytes  
PoE power budget of 192W  

Resiliency and high availability  

Ring Rapid Spanning Tree (RRSTP) optimized for ring topology to provide less than 100 ms convergence time.  

Broadcast and multicast storm control to avoid degradation in overall system performance
<table>
<thead>
<tr>
<th><strong>Unidirectional Link Detection (UDLD)</strong> for detecting and disabling unidirectional links on fiber optic interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)</strong> encompasses IEEE 802.1D Spanning Tree Protocol (STP) and IEEE 802.1w Rapid Spanning Tree Protocol (RSTP), ITU-T G.8032 Ethernet Ring Protection</td>
</tr>
<tr>
<td><strong>Per-VLAN spanning tree (PVST+), Remote stacking upto 10KM</strong></td>
</tr>
<tr>
<td><strong>IEEE 802.3ad/802.1AX Link Aggregation Control Protocol (LACP) and static LAG groups across modules, Path MTU Discovery</strong></td>
</tr>
<tr>
<td><strong>Virtual Router Redundancy Protocol (VRRP) providing highly available routed environments</strong></td>
</tr>
<tr>
<td><strong>Layer-2 port loopback detection for preventing customer loops on Ethernet access ports</strong></td>
</tr>
</tbody>
</table>

### QoS and security

- **Priority queues:** Eight hardware-based queues per port for flexible QoS management
- **Flow-based QoS, Flow-based traffic policing and bandwidth management**
- **Egress traffic shaping and DiffServ architecture**
- **Support for end-to-end head-of-line (E2E-HOL) blocking prevention, Configurable scheduling algorithms, including Strict Priority Queuing (SPQ), Weighted Round Robin (WRR) and Deficit Round Robin (DRR)**
- **Autosensing IEEE 802.1X multi-client, multi-VLAN support, MAC-based authentication for non-IEEE 802.1X hosts, Web based authentication a customizable web portal residing on the switch**
- **Dynamically providing pre-defined policy configuration to authenticated clients — VLAN, ACL, BW**

### Manageability

- **Secure Shell (SSH) with public key infrastructure (PKI) support, Terminal Access Controller Access-Control System Plus (TACACS+) client, Centralized Remote Access Dial-In User Service (RADIUS) and Lightweight Directory Access Protocol (LDAP) administrator authentication, Centralized RADIUS for device authentication and network access control authorization**

### Manageability

- **CLI in a scriptable BASH environment via console, Telnet or Secure Shell (SSH) v2**
- **WebView Graphical Web Interface via HTTP and HTTPS**
- **Full configuration and reporting using SNMPv1/2/3 to facilitate third-party network management over IPv4/IPv6**
- **File upload using USB, TFTP, FTP, SFTP or SCP**
- **Multiple software image support with fallback recovery**
- **IEEE 802.1AB Link Layer Discover Protocol (LLDP)**
Policy- and port-based mirroring, Remote port mirroring, Flow v5 and Remote Monitoring (RMON), Digital Diagnostic Monitoring (DDM), and Time Domain Reflectometry (TDR)

Network Time Protocol (NTP)

Switch should support IEEE 802.3af or IEEE 802.3at-compliant end devices

Configurable per-port PoE priority and max power for power allocation

Dynamic PoE allocation: Delivering only the amount of power needed by the powered devices (PD) up to the total power budget for most efficient power consumption

<table>
<thead>
<tr>
<th>L2 None POE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gigabit Ethernet standalone chassis in a 1U form factor with 24 10/100/1000 BaseT ports and 2 Gigabit SFP uplink ports.</td>
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<tr>
<td>Total number of MAC addresses: 16,000</td>
</tr>
<tr>
<td>Total number of static IPv4 routes: 8</td>
</tr>
<tr>
<td>Number of VLANs: 4,000</td>
</tr>
<tr>
<td>Jumbo frame size: 9,216 bytes</td>
</tr>
<tr>
<td>PoE power budget of 380W</td>
</tr>
</tbody>
</table>

**Resiliency and high availability**

Ring Rapid Spanning Tree (RRSTP) optimized for ring topology to provide less than 100 ms convergence time.

Broadcast and multicast storm control to avoid degradation in overall system performance

Unidirectional Link Detection (UDLD) for detecting and disabling unidirectional links on fiber optic interfaces

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Per-VLAN spanning tree (PVST+), Remote stacking upto 10KM

IEEE 802.3ad/802.1AX Link Aggregation Control Protocol (LACP) and static LAG groups across modules, Path MTU Discovery

Virtual Router Redundancy Protocol (VRRP) providing highly available routed environments

Layer-2 port loopback detection for preventing customer loops on Ethernet access ports

Static Routing for IPV4 & IPV6
### Up to 8 IPV4 and IPV6 interfaces
- DHCP relay, Address Resolution Protocol (ARP)
- Internet Group Management Protocol (IGMP) v1/v2/v3 snooping
- Multicast Listener Discovery (MLD) v1/v2 snooping

### QoS and security
- Priority queues: Eight hardware-based queues per port for flexible QoS management
- Flow-based QoS, Flow-based traffic policing and bandwidth management
- Egress traffic shaping and DiffServ architecture
- Support for end-to-end head-of-line (E2E-HOL) blocking prevention, Configurable scheduling algorithms, including Strict Priority Queuing (SPQ), Weighted Round Robin (WRR) and Deficit Round Robin (DRR)

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### Network Time Protocol (NTP)

### Dual Band (2.4 & 5 GHz) Indoor Access Point:

#### General Parameters
Proposed solution should be able to manage all the Access Point centralized and up to 32 Access Point can be manage in single cluster.

Proposed Access Points must have dual radio 2.4 GHz and 5 GHz.

Must support 2x2 multiple-input multiple-output (MIMO).

Must supports up to 1.2Gb/s wireless data rate and up to 64 simultaneous clients association in single Access Point.

**Purposed Access Point must support below features**

<table>
<thead>
<tr>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed Radio Management</td>
</tr>
<tr>
<td>Manual RF Management</td>
</tr>
<tr>
<td>Background Scanning</td>
</tr>
<tr>
<td>Radio Dynamic Adjustment (RDA)</td>
</tr>
<tr>
<td>Dynamic frequency selection DFS</td>
</tr>
<tr>
<td>Transmit Power Control (TPC)</td>
</tr>
<tr>
<td>Activate / de activate indepently 2Ghz/5GHz Radio Chains</td>
</tr>
<tr>
<td>Set Transmit Power levels indepently for 2Ghz/5GHz Radio Chains - 1 dBm step-up</td>
</tr>
<tr>
<td>smooth L2 Roaming</td>
</tr>
<tr>
<td>Fast BSS Transition (802.11r Roaming)</td>
</tr>
<tr>
<td>Radio Resource Management (802.11k)</td>
</tr>
<tr>
<td>BSS Transition Management (802.11v)</td>
</tr>
<tr>
<td>802.1x/WPA2</td>
</tr>
<tr>
<td>Captive Portal(Internal Portal Server)</td>
</tr>
<tr>
<td>Local User Database</td>
</tr>
<tr>
<td>Rogue AP Detect - Indicate SSID for the detected AP, Indicates the MAC address of the detected AP.</td>
</tr>
<tr>
<td>EAP types supported: PEAP, EAP-TLS, EAP-TTLS,EAP-GTC</td>
</tr>
<tr>
<td>Configurable/Customizable Captive Portal (Look eand feel) - (logo, main image, terms of use)</td>
</tr>
<tr>
<td>Separate account for Guest Management - Guest Operator</td>
</tr>
<tr>
<td>Duration based guest acount</td>
</tr>
<tr>
<td>Auto expiration of Guest Account</td>
</tr>
<tr>
<td>Configuration Backup and Restore</td>
</tr>
<tr>
<td>Firmware Upgrade and Restore - Central upgrade</td>
</tr>
<tr>
<td>Syslog</td>
</tr>
<tr>
<td>Ping/Traceroute/TCPDUMP</td>
</tr>
<tr>
<td>Voice&amp;Video aware wireless</td>
</tr>
<tr>
<td>Qosmaping - WMM to 802.1p/DSCP</td>
</tr>
<tr>
<td>Single Point of Management via PVC - Central Configuration/Management</td>
</tr>
<tr>
<td>AP-Group redundancy - In case of PVC failure SVC takes overs. SVC - Secondary Virtual controller.</td>
</tr>
<tr>
<td>Operating temperature must be 0°C to 45°C (+32°F to +113°F)</td>
</tr>
<tr>
<td>Humidity must be 5% to 95% non-condensing.</td>
</tr>
<tr>
<td>CE &amp; RoHS, REACH, WEEE, CB Scheme Safety, NRTL</td>
</tr>
</tbody>
</table>
FCC and IC approval and certificates,

EN 60601-1-2 EMC requirements for the Medical Directive 93/42/EEC

Wi-Fi Alliance (WFA) certified 802.11a/b/g/n/ac

<table>
<thead>
<tr>
<th><strong>Out Door Access point</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed solution will be Controller less/HW Controller based/SW Controller based but all the Access Points managed centralized.</td>
</tr>
<tr>
<td>The WLAN solution shall propose an outdoor 802.11ac wave2 MU-MIMO indoor dual radio AP Access Point (2.4, 5G):</td>
</tr>
<tr>
<td>2X2:2 VHT40</td>
</tr>
<tr>
<td>Access Point shall offer up to 867Mbps throughput on the 5Ghz band (low and high bands) and up to 400Mbps throughput on the 2.4GHz band.</td>
</tr>
<tr>
<td>Integrated dual-band omni-directional antennas for 2x2 MIMO with maximum antenna gain of 8.46 dBi in 2.4 GHz and 6.62 dBi in 5 GHz.</td>
</tr>
<tr>
<td>Access Point shall have two 1Gbps Ethernet port; one port should support POE; one micro USB for console</td>
</tr>
<tr>
<td>Access Point shall propose Deep Packet Inspection (DPI) capabilities providing real-time classification of flows at the application level</td>
</tr>
<tr>
<td>Access Point shall propose a Factory reset button.</td>
</tr>
<tr>
<td>Access Point shall support up to 16 SSIDs (8 per radio).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RF Management</strong></th>
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<tbody>
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<tr>
<th><strong>Roaming Parameters</strong></th>
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<tr>
<td>L2 Roaming</td>
</tr>
<tr>
<td>Fast BSS Transition (802.11r Roaming)</td>
</tr>
<tr>
<td>Radio Resource Management (802.11k)</td>
</tr>
<tr>
<td>BSS Transition Management (802.11v)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Environment &amp; Certifications.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature must be -40°C to 65°C (-40°F to +149°F)</td>
</tr>
<tr>
<td>Chassis rating: IP67, Wind resistance:</td>
</tr>
<tr>
<td>¬ Up to 100 MPH sustained winds</td>
</tr>
<tr>
<td>¬ Up to 165 MPH wind gusts</td>
</tr>
</tbody>
</table>

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre
Humidity must be 10% to 90% non-condensing.

CE & RoHS, REACH, WEEE, CB Scheme Safety, NRTL

FCC and IC approval and certificates,

EN 60601-1-2 EMC requirements for the Medical Directive 93/42/EEC

Wi-Fi Alliance (WFA) certified 802.11a/b/g/n/ac

1.4 **Technical Specification for Video conferencing system**

**Smart meetings**: Powerful, integrated cameras deliver intelligent view capabilities, such as automatic framing and speaker tracking

- **Smart presentations**: Dual screens, dual content sources, wireless sharing, and 4K content make for great presentations
- **Smart integrations**: People count for usage metrics and resource allocation; tight integrations with screens for enhanced functionalities, features a unique direct, fast-switching approach for active speaker tracking with two pan-tilt-zoom cameras
- **Registration flexibility**: Built for both cloud and on-premises deployment, protecting your investment
- **Metrics**: Counts people in the room, enabling analytics for better resource planning Supports dual screens for video and content
  - Supports dual content sources for local meetings
- **4K content sharing** (local 30 fps; remote 5 fps)
- **Wired or wireless content sharing** (only two wires required – power and HDMI)
- **Automatic screen/display sharing** through HDMI CEC
- **Supports Wi-Fi** Optimal definition up to 1080p60
- **H.323/SIP** up to 10 Mbps point-to-point
- **Up to 10 Mbps total MultiSite bandwidth** and capable to connect 1+24 sites simultaneously.
- **Ability to connect up to four HD sources and 8 microphones** directly to the codec
- **Full duplex audio with high-quality stereo sound**
- **In-room control**: Control peripherals such as lights and blinds through the Touch 10, Eight microphones, 48V phantom powered, Euroblock connector, each with separate echo cancellers and noise reduction; all microphones can be set for balanced line level.
  - Four balanced line level inputs, Euro block connector
  - Three HDMI, digital: stereo PC/DVD input
### READYMADE FURNITURE

1. The readymade furniture must be manufactured by a manufacture who has been manufacturing quality furniture for at least 05 years.

2. The manufacturer must have the following certifications/memberships:
   - ISO 9001
   - OHSAS 18001
   - ISO 14001
   - Green Guard
   - BIFMA

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Item</th>
<th>Specification</th>
<th>Image</th>
</tr>
</thead>
</table>
| i     | Providing & fixing of Revolving Mid Back chair with Leatherette upholstery, Active Bio-Synchro, Die cast polished Aluminum Pedestal, Adj Arms, 5 Position Tilt Limiter, Back HtAdj, Seat Slide Mech as per detailed specification and model/shade approval of the consultant | a) Seat Assembly: The cushioned seat should be made up of moulded plastic outer & inner. Plastic inner is upholstered with leatherette and moulded High Resilience (HR) Polyurethane foam of density 45+/-2 Kg/m³ and hardness load 16+/- kgf as per IS:7888 for 25% compression. Seat size : 47.0 cm(W) x 48.0 cm (D)  
b) Back Assembly: The cushioned back is made of PU foam with insitu moulded MS ERW round tube of size 1.9+/-0.03cm x 0.16+/-0.0128cm. It is upholstered with leatherette. Mid Back size : 47.7 cm (W) x 60.1 cm (D)  
c) Armrests: The armrest top should be moulded from polyurethane (PU) and mounted on to a drop lift adjustable type tubular armrest support made of dia 3.81+/-0.03 cm x 0.2 +/-0.01 cm thick MS ERW tube having chrome plated finish. The armrest should be height adjustable up to 6.5 +/- 0.5 cm in 5 steps.  
d) Mechanism: It should have active bio synchro mechanism with adjustable tilting designed with the following features: 360 degree revolving type. Front-pivot for tilt with feet resting on ground and |
continuous lumbar support ensuring more comfort. Tilt tension adjustment should be able to operate on seating position with 5 position tilt limiter. The mechanism housing should be made up of HPDC Aluminium black powder coated.

e) Seat depth adjustment: The seat depth adjustment should be integrated in the seat through a sliding mechanism. Seat depth adjustment range is of 6.0 +/- 0.5 cm.

f) Adjustable Back support: Back frame should be connected to the Up/Dn mechanism housed in plastic T spine. It should be adjusted in the range of 7.42 +/- 0.5 cm for the comfortable back support to suit individual need.

g) Pneumatic ht. adjustment: The pneumatic ht. adjustment should have an adjustment stroke of 10.0 +/- 0.3 cm.

h) Pedestal Assembly: The pedestal should be of high pressure die cast polished aluminium and fitted with 5 nos. twin wheel castors. The pedestal should be 65.0 +/- 0.5 cm pitch centre dia (75.0 +/- 1.0 cm with castors).

i) Twin wheel Castors: 5 nos. twin wheel castors to be provided and are to be injection moulded in plastic having 6.0 +/- 0.1 cm wheel diameter and assembled to pedestal.

j) Overall Size:

<p>| Width (W) | 76.1 cm |
| Depth (D) | 76.1 cm |
| Height (H) | 112.7 cm - 130.2 cm |
| Seat height (SH) | 43.1 cm - 53.1 cm |</p>
<table>
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<tr>
<th>ii</th>
<th>Providing &amp; fixing of Revolving High Back chair in Pure Leather, Die-Cast Aluminium with buffed Pedestal, Knee Tilt Synchro Mech 5 Position locking, Soft Top Fixed Arms as per detailed specification and model/shade approval of the consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Seat / Back Assy: The seat and back should be made up of 1.2cm thick hot pressed plywood upholstered with leather and moulded Polyurethane foam. The back foam should be designed with Contoured lumber support for extra comfort. Back Size: 53.0cm. (W) X 80.0cm. (H) 2) Polyurethane Foam: The polyurethane foam should be moulded with density = 45 +/- 2kg/m3 and Hardness = 16 +/- 2 3) Seat-Back Connecting Spine: The seat and back should be arrested together spine made of 0.8cmthk. HR steel. The spine should be black powder-coated. 4) Armrest Assy: The armrest assy. should comprise of three parts viz. the armrest support tube and P.U. armrest and the armrest top. The armrest tube assy. is made of 2.54cm(1&quot;) x 0.16 +/-0.01 BG. M.S. E.R.W. support tubes and Chrome plated. The P.U. armrest is made of black integral skin polyurethane with 50-70 Shore ‘A’ Hardness and reinforced with M.S. Insert. The armrest top is made of ABS &amp; upholstered with foam &amp; leather. 5) Front Pivot Synchro Tilt Mech. features: • 360 degree Revolving type • 12 degree Seat tilt &amp; 19 degree Back tilt • Front pivot for tilt with feet resting on ground ensuring more comfort. • Tilt tension adjustment. • 5-position locking with anti-shock back mechanism, which prevents the backrest from impacting the user when the lock is released. • Static seat depth adjustment = 5.0cm with 5 position locking. 6) Pneumatic Height Adjustment: It has an adjustment stroke of 8.0cm. 7) Bellow: The bellow is 1-piece and blow moulded in black polypropylene. 8) Pedestal Assy: The pedestal is made of die-cast aluminium with...</td>
<td></td>
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<table>
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<th>Providing &amp; fixing of Revolving High Back chair with Leatherette upholstery, Active Bio-Synchro, Die cast polished Aluminum Pedestal, Adj Arms, 5 Position Tilt Limiter, Back HtAdj, Seat Slide Mech as per detailed specification and model/shade approval of the consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>buffing finished. It is fitted with 5nos. twin wheel castors. The pedestal is 67.0cm pitch-center dia. 9) Twin Wheel Castors: The twin wheel castors are injection moulded in 30% Glass filled black Nylon. Overall Size: 770mm W x 770mm D x 1135mm – 1225mm H x 499mm – 589mm SH</td>
</tr>
<tr>
<td>a) Seat Assembly :</td>
<td>The cushioned seat should be made up of moulded plastic outer &amp; inner. Plastic inner is upholstered with leatherette and moulded High Resilience (HR) Polyurethane foam of density 45+/−2 Kg/m3 and hardness load 16+/− kgf as per IS:7888 for 25% compression. Seat size : 47.0 cm(W) x 48.0 cm (D)</td>
</tr>
<tr>
<td>b) Back Assembly :</td>
<td>The cushioned back is made of PU foam with in situ moulded MS ERW round tube of size 1.9+/− 0.03cm x 0.16+/−0.0128cm. It is upholstered with leatherette. High Back size : 47.7 cm (W) x 76.4 cm (D)</td>
</tr>
<tr>
<td>c) Armrests :</td>
<td>The armrest top should be moulded from polyurethane (PU) and mounted on to a drop lift adjustable type tubular armrest support made of dia 3.81+/−0.03 cm x 0.2 +/- 0.01 cm thick MS ERW tube having chrome plated finish. The armrest should be height adjustable up to 6.5 +/- 0.5 cm in 5 steps.</td>
</tr>
<tr>
<td>d) Mechanism :</td>
<td>It should have active bio synchro mechanism with adjustable tilting designed with the following features: 360 degree revolving type. Front-pivot for tilt with feet resting on ground and continuous lumbar support ensuring more comfort. Tilt tension adjustment should be able to operate on seating position with 5 position tilt limiter. The mechanism housing should be made up of HPDC Aluminium black powder</td>
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<tr>
<td></td>
<td>e) Seat depth adjustment : The seat depth adjustment should be integrated in the seat through a sliding mechanism. Seat depth adjustment range is of 6.0 +/- 0.5 cm.</td>
</tr>
<tr>
<td></td>
<td>f) Adjustable Back support : Back frame should be connected to the Up/Dn mechanism housed in plastic T spine. It should be adjusted in the range of 7.42 +/- 0.5 cm for the comfortable back support to suit individual need.</td>
</tr>
<tr>
<td></td>
<td>g) Pneumatic ht. adjustment : The pneumatic ht. adjustment should have an adjustment stroke of 10.0 +/- 0.3 cm.</td>
</tr>
<tr>
<td></td>
<td>h) Pedestal Assembly : The pedestal should be of high pressure die cast polished aluminium and fitted with 5 nos. twin wheel castors. The pedestal should be 65.0 +/- 0.5 cm pitch centre dia (75.0 +/- 1.0 cm with castors).</td>
</tr>
<tr>
<td></td>
<td>i) Twin wheel Castors : 5 nos. twin wheel castors to be provided and are to be injection moulded in plastic having 6.0 +/- 0.1 cm wheel diameter and assembled to pedestal.</td>
</tr>
<tr>
<td></td>
<td>j) Overall Size : Width (W) : 76.1 cm Depth (D) : 76.1 cm Height (H) : 112.7 cm - 130.2 cm Seat height (SH) : 43.1 cm - 53.1 cm</td>
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<td>coated.</td>
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<td>Providing &amp; fixing of Visitor chair in leatherette with Aluminium Die cast understructure as per detailed specification and model/shade approval of the consultant</td>
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<tr>
<td>V</td>
<td>Providing &amp; fixing of Revolving Mid Back chair Knee Tilt Synchro Mechanism 4 Position Locking, Soft touch PU Arms, Chrome-Plated arms &amp; Pedestal, Adj Backrest as per detailed specification and model/shade approval of the consultant</td>
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<thead>
<tr>
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<tbody>
<tr>
<td><strong>a)</strong> Seat Assembly: The cushioned seat should be made up of moulded plastic outer &amp; inner. Plastic inner is upholstered with leatherette and moulded High Resilience (HR) Polyurethane foam of density 45+/−2 Kg/m3 and hardness load 16+/− kgf as per IS:7888 for 25% compression. Seat size: 47.0 cm (W) x 48.0 cm (D)</td>
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<td></td>
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<tr>
<td><strong>b)</strong> Back Assembly: The cushioned back is made of PU foam with insitu moulded MS ERW round tube of size 1.9+/−0.03cm x 0.16+/−0.0128cm. It is upholstered with leatherette.</td>
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<tr>
<td><strong>c)</strong> Visitor tubular frame: The tubular frame should be cantilever type &amp; made of dia 2.54+/−0.03 cm x 0.2+/−0.016 cm thick SS 202 tube. The back should be connected to frame through chrome plated high pressure die cast connector piece.</td>
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</tbody>
</table>
|   | The seat is made up of 1.2±0.1cm thick hot pressed plywood and upholstered with fabric or synthetic leather and moulded Polyurethane foam. The back is made up 1.2±0.1cm thick hot pressed plywood upholstered with replaceable fabric or synthetic leather upholstery covers and moulded Polyurethane foam. The back ply and foam is designed with contoured lumber support for comfortable seating posture. Back size: 64.5 cm (H), seat size: 51 cm (W) x 48 cm (D). The high resilience polyurethane foam for seat and back is moulded with density 45±2kg/m³ and hardness load 16±2 kgf as per IS:7888 for 25% compression. The armrest top is made of moulded polyurethane and mounted on to a drop lift height adjustable type M.S. Tubular armrest support chrome plated. The armrest height is adjustable upto 6.5±0.5cm. In 5 steps &
| vi | Providing & fixing of Cafeteria chair in SS understructure with body made of high impact strength Polypropylene compound with indoor grade UV resistance as per detailed specification and model/shade approval of the consultant | The seat and back should be made up of injection moulded high impact strength Polypropylene compound with indoor grade UV resistance. Seat size should be 52.5cm (W) x 53.2cm (D). Back size should be 51.6cm(W) x 40.5cm (H). The powder coated welded tubular frame should be made from 2.22cm dia x 0.16cm and 3.5cm x 1.5cm x 0.16cm stainless steel 202 Grade tube. The shoes should be made from high impact strength Polypropylene with indoor grade UV resistance and press-fitted to the frame. |
i) Seat Assembly: The cushioned seat is made of injection moulded plastic outer & inner. Plastic inner is upholstered with pure leather and moulded high resilience (HR) polyurethane foam of density 45+/-2 kg/m³, and hardness load 16+/- 2kgf as per IS:7888 for 25% compression. Seat Size: 47.6 cm (W) x 49.2 cm (D)

ii) Back Assembly: The cushioned back is made of PU foam with inset moulded MS ERW round tube of size 1.9+/- 0.03 cm x 0.16 +/-0.0128 cm. It is upholstered with Pure Leather. Mid Back Size: 46.5 cm (W) x 59.5 cm (D)

iii) Armrests (High Back and Mid Back): The armrest top is moulded from polyurethane (PU), upholstered in pure leather and mounted in the to a drop lift adjustable type tubular armrest support made of dia 3.81+/-0.03 cm x 0.2+/-0.01 cm thick MS ERW tube having chrome plated finish. The armrest height adjustable up to 6.5+/-0.5 cm in 5 steps.

iv) Active bio-synchro mechanism (HB & MB): The adjustable tilting mechanism is designed with the following features:

- 360 deg revolving type.
- Front-pivot for tilt with feet resting on ground and continuous lumbar support ensuring more comfort.
- Tilt tension adjustment can be operated in seating position.
- 5 position tilt limiter giving option of variable tile angle to the chair.
- Seat/Back tilting ratio 1:2.
- The mechanism housing is made up of HPDC Aluminium black powder coated.

v) Seat Depth adjustment (HB & MB): Seat Depth adjustment is integrated in the seat through a
sliding mechanism. Seat depth adjustment range is of 6.0 +/- 0.5 cm.

vi) Adjustable back support (HB & MB): Back frame is connected to the Up/Dn mechanism housed in Plastic T Spine. It can be adjusted in the range of 7.42 +/- 0.5 cm for the comfortable back support to suit individual need.

vii) Pneumatic ht. adjustment (HB & MB): The pneumatic height adjustment has an adjustment stroke of 10.0 +/- 0.3 cm.

viii) Pedestal Assembly: The pedestal is high pressure die cast polished Aluminium and fitted with 5 nos. twin wheel castors. The pedestal is 65.0 +/- 0.5 cm pitch-center dia (75.0 +/- 1.0 cm with castors).

ix) Twin Wheel Castor (HB & MB): 5 nos. twin wheel castors are injection moulded in plastic having 6.0 +/- 0.1 cm wheel diameter and assembled to pedestal.

x) Visitor tubular frame: The tubular frame is cantilever type & made of dia 2.54 +/- 0.03 cm x 0.2 +/- 0.016 cm thk S.S. 202 tube. The back connected to frame through chrome plated high pressure die cast connector piece.

Overall Dimension:
Mid Back Chair:
Width: 76.1 cm.
Depth: 76.1 cm
Height: 96.5 - 114.0 cm
Seat Height: 44.5 - 54.5 cm
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Providing & fixing of
Revolving High
Back chair in
Mesh Back,
Auto Balance
Mechanism,
Height
Adjustment,
Lumber
Support, Seat
Slide
Mechanism,
Nylon Pedestal,
4-Dimensional
Adjustable
Arms, 4
Position
Locking, 3-
Dimensional
Headrest

1. **SEAT ASSEMBLY:** The seat is made up of 1.4 ± 0.1 cm thick Hot-pressed/plywood molded polyurethane foam and upholstered with fabric.

   **SEAT SIZE:**
   50.0 cm (W) x 49.0 cm (D).

2. **BACK ASSEMBLY:** The two part assembly upholstered with Mesh fabric is made up of back outer injection moulded in glass filled Polyamide and back inner injection moulded in glass filled Polypropylene. The back consist of adjustable Lumbar support made of injection moulded Polyoxymethylene (POM) which is upholstered with foam and fabric having an adjustment of 5.5 ± 0.5 cm.

   **BACK SIZE:**
   48.0 cm (W) x 54.5 cm (H).

3. **POLYURETHANE FOAM:** The polyurethane foam for seat is of density = 55 ± 3 kg/m³.

4. **FOUR-WAY ADJUSTABLE ARMRESTS:** It is made of glass filled Polyamide arm structure with PU armtop and height adjustment of 9.0 ± 0.5 cm. The armtop has swivel, side-to-side and to-fro movements.

5. **MECHANISM:** The mechanism is designed with the following features:
   - 360° revolving type.
   - Auto-balance synchro-tilt
   - 4 position (including upright lock) giving option of variable tilt angle to the chair.

6. **SEAT DEPTH ADJUSTMENT:** Seat depth adjustment is integrated in the seat through a sliding mechanism. Seat depth adjustment range is of 4.5 ± 0.5 cm.

7. **HEADREST (FUZ102HDRESTXW01):** The Headrest is made up of injection moulded in glass filled Polyamide, foam and upholstered with fabric. Its has an adjustment of 5.0 ± 0.5 cm & it can be retrofit to AVID chair.
8. PNEUMATIC HEIGHT ADJUSTMENT: The CLASS-4 pneumatic height adjustment has stroke of 9.5 ± 0.5cm.

9. PEDESTAL ASSEMBLY: The pedestal is injection moulded in glasss filled Polyamide and fitted with 5 nos. twin wheel castors. The pedestal is 67.0 ± 0.5 cm P.C.D.

10. TWIN WHEEL CASTORS: The twin wheel castors are injection moulded in Polyamide having 6.0+ 0.1cm wheel Diameter.

1. SEAT ASSEMBLY: The seat is made up of 1.4 ± 0.1 cm thick hot - pressed plywood moulded polyurethane foam and upholstered with fabric

   SEAT SIZE: 48.0cm (W)x 49.0cm(D).

2. BACK ASSEMBLY: The two part assembly upholstered with Mesh fabric is made up of back outer injection moulded in glass filled Polyamide and back inner injection moulded in glass filled Polypropylene. The back consist of adjustable lumbar support having an adjustment of 4.0 ± 0.5cm. It is made of injection moulded polyoxymethylene (POM) which is upholstered with foam and fabric .

   BACK SIZE: 47.0 cm(W) x 53.0 cm(H).

3. POLYURETHANE FOAM: The polyurethane foam for seat is of density = 55 ± 5 kg/m³.

4. TWO-WAY ADJUSTABLE ARMRESTS: It is made of glass filled Polyamide arm structure with PVC armtop having a height adjustment
5. SLED BASE FRAME: The Powder coated welded tubular frame is made of 3.55 ± 0.03 cm x 1.94 ± 0.02 cm x 0.15 ± 0.02 cm thk M.S. E.R.W oblong tube. The frame is fitted with plastic caps made of injection moulded glass filled Polypropylene.

<table>
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<tr>
<th>x</th>
<th>Providing &amp; fixing of Revolving chair in Pure Leather, Die-Cast Aluminium with buffed Pedestal, Knee Tilt Synchro Mech 5 Position locking, Soft Top Fixed Arms as per detailed specification and model/shade approval of the consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Seat / Back Assy: The seat and back should be made up of 1.2cm.thick hot pressed plywood upholstered with leather and moulded Polyurethane foam. The back foam should be designed with Contoured lumber support for extra comfort. Back Size: 53.0cm. (W) X 95.4cm. (H)</td>
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<tr>
<td>2) Polyurethane Foam: The polyurethane foam should be moulded with density = 45+/−2kg/m3 and Hardness = 16+/-2</td>
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</tr>
<tr>
<td>3) Seat-Back Connecting Spine: The seat and back should be arrested together spine made of 0.8cmthk. HR steel. The spine should be black powder-coated.</td>
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<tr>
<td>4) Armrest Assy: The armrest assy. should comprises of three parts viz. the armrest support tube and P.U. armrest and the armrest top. The armrest tube assy. is made of 2.54cm(1&quot;) x 0.16 +/-0.01 BG. M.S. E.R.W. support tubes and Chrome plated. The P.U. armrest is made of black integral skin polyurethane with 50-70 Shore 'A' Hardness and reinforced with M.S. Insert. The armrest top is made of ABS &amp; upholstered with foam &amp; leather.</td>
<td></td>
</tr>
<tr>
<td>5) Front Pivot Synchro Tilt Mech. features:</td>
<td>• 360 degree Revolving type • 12 degree Seat tilt &amp; 19 degree Back tilt • Front pivot for tilt with feet resting on ground ensuring more comfort. • Tilt</td>
</tr>
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### xi

Providing & fixing of Visitor chair in pure leather with Aluminium Die cast understructure as per detailed specification and model/shade approval of the consultant

1. **Seat / Back Assy:** The seat and back should be made up of 1.2cm thick hot pressed plywood upholstered with leather and moulded Polyurethane foam. The back foam should be designed with Contoured lumber support for extra comfort. Back Size: 53.0cm. (W) X 73.0cm. (H), Seat Size: 54.6cm. (W) X 49.0cm. (D)

2. **Polyurethane Foam:** The polyurethane foam should be moulded with density = 45+/-2kg/m3 and Hardness = 16+/-2 On

3. **Fixed Type Mechanism:** The fixed type mechanism is with 0.8cm thk. spine welded to it.

4. **Understructure:** The Understructure should be made of M.S.E.R.W. Elliptical tube of size 45mm x 19mmx2.5mm welded to M.S.E.R.W Tube of Dia. 16mm x 14BG. The understructure should be powder coated in Silver metallic gray.

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tension adjustment. • 5-position locking with anti-shock back mechanism, which prevents the backrest from impacting the user when the lock is released. • Static seat depth adjustment = 5.0cm with 5 position locking.

6. **Pneumatic Height Adjustment:** It has an adjustment stroke of 8.0cm.

7. **Bellow:** The bellow is 1-piece and blow moulded in black polypropylene.

8. **Pedestal Assy:** The pedestal is made of die-cast aluminium with buffing finished. It is fitted with 5nos. twin wheel castors. The pedestal is 67.0cm pitch-center dia.

9. **Twin Wheel Castors:** The twin wheel castors are injection moulded in 30% Glass filled black Nylon. Overall Size: 770mm W x 770mm D x 1325mm – 1405mm H x 499mm – 589mm SH
<table>
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<tr>
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<th>Providing &amp; fixing of Pure leather 3 seater sofa with solid wood frame as per detailed specification and model/shade approval of the consultant</th>
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<tr>
<td>xiii</td>
<td>Providing &amp; fixing of Sofa set Ergonomic Back Support in Rich Black Leatherette upholstery (3+1+1) seater combination as per detailed specification and model/shade approval of the consultant</td>
</tr>
</tbody>
</table>

| FRAME MATERIAL (TROPICAL WOOD / PINE WOOD/ RUBBER WOOD): Tropical Wood Meranti. Moisture Content (10 – 12 %): <12%. Thickness of Plywood used(mm): 12mm. |
| SEAT FOAM: (DENSITY, TYPE): |
| Thickness (mm): 125mm (25mm 28 Density + 100mm 32 Density Supersoft) |
| Density (Kg/m3): 28 density and 32 Density |
| Type of Foam: Slabstock |
| Leg material: Self tapping fixing of leg. Material should be teak-wood. |
| The upholstery should be pure leather. |
| Size: |
| 3 Seater: 1990 mm W x 935 mm D x 885m H x 485 mm SH |

| i) Seat foam: The seat is made of PU foam with density 32+/=2 kg/cu.mtr. having an additional top layer f PU foam with density 28+/=2 Kg/cu.cm. Seat is upholstered with leatherette. |
| ii) Back foam: The back foam in made of PU with density 28+/=2 kg/cu.mtr. with two additional top layer of supersoft foam of density 23+/=2 kg/cu.mtr, upholstered with leatherette. |
| iii) Understructure: Understructure is made up of 1.2+/=0.1 cm thick hot pressed plywood measured as per QA method. Dia 4 mm zigzag spring assembly is mounted in understructure for support and additional cushioning purpose. |
| iv) Leg Assembly: It is a welded assembly made in Stainless steel (Grade SS202) tube & plate. |
| v) Overall Dimension: |
| a) Single seater: |
| Width: 86.0 cm |
| Depth: 92.0 cm |
| Height: 82.0 cm |
| Seat Height: 45.0 cm |
| b) Three seater: |
| Width: 205.5 cm |
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<td>Providing &amp; fixing of Pure leather sofa set with solid wood frame, (3+1+1) seater combination as per detailed specification and model/shade approval of the consultant</td>
</tr>
<tr>
<td></td>
<td>FRAME MATERIAL (TROPICAL WOOD / PINE WOOD / RUBBER WOOD): Tropical Wood Meranti. Moisture Content (10 – 12 %): &lt;12%. Thickness of Plywood used (mm): 12mm. SEAT FOAM: (DENSITY, TYPE): Thickness (mm): 125mm (25mm 28 Density + 100mm 32 Density Supersoft) Density (Kg/m³): 28 density and 32 Density Type of Foam: Slabstock Leg material: Self tapping fixing of leg. Material should be teak-wood. The upholstery should be pure leather. Size: 1 Seater: 1060 mm W x 935 mm D x 885mm H x 485 mm SH 3 Seater: 1990 mm W x 935 mm D x 885mm H x 485 mm SH</td>
</tr>
<tr>
<td>xv</td>
<td>Providing &amp; fixing of Sofa 3 seater in Pure leather with solid wood frame as per detailed specification and model/shade approval of the consultant</td>
</tr>
<tr>
<td></td>
<td>Frame: • Material: Combination of plywood and Solid Wood • Plywood thickness: 12 mm (moisture resistance and treated) • Moisture content: 10-12 % Foam Seat: • Material: Slab stock foam • Density: Super soft 32 kg/m³ Back: • Recron (Denier: 15, Fiber hollowness: 100%) Webbing • Double webbing: S - spring and nylon belt Legs: PVC 3 seater: 1820mmW x 920mmD x 890mmH x 470mm seat height</td>
</tr>
</tbody>
</table>

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Providing & fixing of Sofa 2 seater in Pure leather with solid wood frame as per detailed specification and model/shade approval of the consultant

**Frame:**
- Material: Combination of plywood and Solid Wood
- Plywood thickness: 12 mm (moisture resistance and treated)
- Moisture content: 10 -12 %

**Foam**
- Seat:
  - Material: Slab stock foam
  - Density: Super soft 32 kg/m³

**Back:**
- Recron (Denier: 15, Fiber hollowness: 100%)

**Webbing**
- Double webbing: S - spring and nylon belt

**Legs:** PVC
- 2 seater: 1410mmW x 920mmD x 890mmH x 470mm seat height

Providing & fixing of Sofa set (3+1+1) in Pure leather with solid wood frame as per detailed specification and model/shade approval of the consultant

**Frame:**
- Material: Combination of plywood and Solid Wood
- Plywood thickness: 12 mm (moisture resistance and treated)
- Moisture content: 10 -12 %

**Foam**
- Seat:
  - Material: Slab stock foam
  - Density: Super soft 32 kg/m³

**Back:**
- Recron (Denier: 15, Fiber hollowness: 100%)

**Webbing**
- Double webbing: S - spring and nylon belt

**Legs:** PVC
- 3 seater: 1820mmW x 920mmD x 890mmH x 470mm seat height
- 1 seater: 920mmW x 920mmD x 890mmH x 470mm seat height
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<td>Providing and fixing of All wood Table made of Plain Particle Board with two post formed and two PVC Lipped edges of dimension 1800mmW x 900mmD x 740mmH with free standing pedestal with castors of size 646mmH x 390mmW x 440mmD as per detailed specification, layout and model/shade approval of the consultant. The Table set should have Main Table + Mobile Pedestal Unit. i) Main Table should be made of 25mm PLB with post-formed finish. The size should be 1800mm W x 900mm D x 740mm ii) The mobile pedestal should be made of CRCA Steel with epoxy poder coated. The pedestal should have three drawers. The dimensions of the pedestal should be 646mmH x 390mmW x 440mmD.</td>
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<tr>
<td>xix</td>
<td>Providing and fixing of All wood Table made of MDF one side pre-laminated board with PVC membrane finish of overall dimension 1800mmW x 2100mmD x 750mmH with Back Unit of dimension (1800mmW x 500mmD x 750mmH) as per detailed specification, layout and model/shade approval of the consultant. Primary Work surface (1800mmW x 900mmD x 750mmH) : Made of 25mm thick MDF one side pre-laminate board confirming to IS-14587:1998 with 0.4mm PVC membrane pressed on to top. Soft-closing access flap with in-build power box are provided on work surface for wire management. Secondary Work Surface (1200mmW x 500mmD x 750mmH): Made of 25mm thick MDF one side pre-laminate board confirming to IS14587:1998 with 0.4mm PVC membrane pressed on to top. Modesty Panel : Made of 25mm thick MDF one side pre-laminate board confirming to IS14587:1998 with 0.4mm PVC membrane pressed on to top. Understructure : Made of 25mm Thick Pre-laminated twin board of E1-P2 grade and approved shade confirming to IS-12823:1990, Edge banded with matching 2 mm thick PVC lipping. Integrated Pedestal : Made of 25mm Thick Pre-laminated twin board of E1-P2.</td>
</tr>
</tbody>
</table>
grade and approved shade confirming to IS-12823:1990, Edge banded with matching 2 mm thick PVC lipping. Drawer fronts made of 25mm thick MDF one side pre-laminate board confirming to IS-14587:1998 with 0.4mm PVC membrane pressed on to top. Pedestal construction is BOX-BOX-FILE type which Uses powder coated 400 MM long metal Panel Drawer Slides. Drawer extension is 325 MM. Drawers have a soft closing & anti slam mechanism. Handles are provided for ease of opening. Pedestals are provided with lock for security. Back Unit (1800mmW x 500mmD x 750mmH) Made of 25mm thick MDF one side pre-laminate board confirming to IS-14587:1998 with 0.4mm PVC membrane pressed on to top. Made of 25mm Thick Pre-laminated twin board of E1-P2 grade and approved shade confirming to IS-12823:1990, Edge banded with matching 2 mm thick PVC lipping for body panels like side, bottom, back and shelves. Shutters are made of 25mm thick MDF one side pre-laminate board confirming to IS-14587:1998 with 0.4mm PVC membrane pressed on to top. Shutters have a soft closing & anti slam mechanism. Handles are provided for ease of opening. Storage is provided with lock for security.
<table>
<thead>
<tr>
<th>xx</th>
<th>Providing &amp; Fixing of Chair cum Desk Model with foldable seat and desk and grouted unrestructured as per detailed specification, layout and model/shade approval of the consultant</th>
</tr>
</thead>
</table>
| | The arrangement should have 3 seater rows in each column with 1 front-type desk of size 2044mmx698.5mmx890mm, 1 rear-type desk of size 2044mmx751mmx890mm and rest all mid-type desk of size 2044mmx1080mmx890mm. The under-structure should be made with steel ERW tube section(IS:228) of size 80x40x2.5mm thick with powder coat finish. Under-structure consists of two welded leg assemblies connected by means of welded seat side tube assembly and welded desk side tube assembly on both sides. Sturdy anchoring by anchor bolts on to base of 10mm thick plate for proper resting of structure. Plastic clad & shoe main clad made of glass filled 30% nylon-6 for covering anchor bolts. Two side clad made of 35mm thick PLT with 2mm thick PVC liping. Desk side clad made of 18mm thick PLT & seat side clad & connecting clad made of 25mm thick PLT. Desk has opening & closing mechanism by means of desk slider and slider sleeve made of 30% glass filled nylon-6. Desk comprises of PLT desk with aluminium section anodized finish on sides and TPE rubber on to Aluminium section outer side for cushioning effect for desk opening closing. Desk made of 18mm thick PLT fixed with Aluminium extrusion on sides for desk opening closing. Seat has self closing mechanism which will operate by means of spring. Seat under-structure is a combination of welded fabricated structure made of Ø19X2mmthk ERW tube with powder-coat finish which is covered by 0.8mm thick sheet-metal cover and upholstered with moulded foam inside and leatherette cover. Seat back comprises of ply with moulded foam.
upholstered inside leatherette cover. Wire carrier made of 0.8mm thick sheet metal for holding wire passing. Switch box made of 1.2mm thick sheet metal for switch plate mounting suitable for Anchor Roma plates. Front clad mounting made of 18MM thick PLT with sheet metal cover and bracket for holding on to top and mounting box for holding of clad with seat side clad. The decorative laminate should be having veneer finish.

Providing & Fixing of cafeteria table with MS powder coated understructure and PU coated table top of dimension (1350mm W x 750mmD) as per detailed specification, layout and model/shade approval of the consultant understructure comprising of leg assemblies and cross connectors. Over the matrix of legs and cross connectors, the worksurfaces and wire carriers are to be fixed. The legs used in the entire system are fabricated by CO2 welded MS tube of section 50.8mm x 50.8mm x 1.2mm thick (as per IS:7138 ERW). Cross connectors are to be provided as supporting members which should span across the leg assemblies and form the under structure. The cross connectors to be fabricated by CO2 welded MS tube of section 50.8mm x 50.8mm x 1.2mm thick (as per IS:7138 ERW) with 2 100mm x 55mm x 5mm L-shaped connector brackets (IS: 2062 5mm HR) on either ends which have counter-sunk holes and oblong slots (2 nos. each). Worksurface shall be made of 25mm thick pre-laminated board conforming to IS: 12823. The top shall be PU coated. The undersurface of the worksurfaces should be screwed to cross connectors and leg assembly. Spacers which are plastic moulded with Nylon-6 are used to give the floating effect of worktop maintaining a gap of 20mm between the understructure and the worktop.
Providing & Fixing of cafeteria table with MS powder coated understructure and Prelaminated table top of dimension (1500mm W x 900mm D) as per detailed specification, layout and model/shade approval of the consultant.

<table>
<thead>
<tr>
<th>Xxii</th>
<th>Providing &amp; Fixing of cafeteria table with MS powder coated understructure and Prelaminated table top of dimension (1500mm W x 900mm D) as per detailed specification, layout and model/shade approval of the consultant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xxii</td>
<td>understructure comprising of leg assemblies and cross connectors. Over the matrix of legs and cross connectors, the worksurfaces and wire carriers are to be fixed. The legs used in the entire system are fabricated by CO2 welded MS tube of section 50.8mm x 50.8mm x 1.2mm thick (as per IS:7138 ERW). Cross connectors are to be provided as supporting members which should span across the leg assemblies and form the understructure of the workstation. The cross connectors to be fabricated by CO2 welded MS tube of section 50.8mm x 50.8mm x 1.2mm thick (as per IS:7138 ERW) with 2 100mm x 55mm x 5mm L-shaped connector brackets (IS: 2062 5mm HR) on either ends which have counter-sunk holes and oblong slots (2 nos. each). Worksurface shall be made of 25mm thick pre-laminated board conforming to IS: 12823. The top shall be laminated with 0.8 mm thick laminate conforming to IS: 2046 and glue of PVAC. Bottom should have backing laminate of 0.8mm thickness. All the edges of the work surface shall be provided with machine pressed 2 mm thick PVC liping glued with hot melt EVA glue. The undersurface of the worksurfaces should be screwed to cross connectors and leg assembly. Spacers which are plastic moulded with Nylon-6 are used to give the floating effect of worktop maintaining a gap of 20mm between the understructure and the worktop. Access flap made of Aluminium extrusion and ABS moulded ends are capped to both ends of extrusion. Wire carrier is to be made with a combination of Dia 3 mm and Dia 5mm MS Rod along with 5 mm thick MS plates.</td>
</tr>
</tbody>
</table>

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre
<table>
<thead>
<tr>
<th>xxiii</th>
<th>18 body 3 bay KD movable storage system with central locking facility as per detailed specification, layout and model/shade approval of the consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A 3 bay, 18 body drive type optimizer with main body has Knock Down construction made out of 0.8 thick. CRCA Steel conforming to IS: 513 Grade D. Each bay has 1 single static, 1 single last and 2 twin mobile unit &amp; Each unit has 5 loading levels formed by 4 nos. of adjustable shelves. Body units are bolted to undercarriage. The dimensions of body are 457mm(D)x915mm(W)x1980mm(H). The channel length is 12 feet. The bodies including shelves are given anti-rust surface treatment &amp; are powder coated with epoxy polyester powder. It involves an 8 step treatment consisting of Hot water rinse, Knock of degreasing, degreasing, cold water rinse, phosphating, cold water rinse, and passivation &amp; dry off oven treatment. Final finish consists of epoxy polyester powder coating of approved color &amp; shade with a Dry Film Thickness of minimum 40 microns. The testing of paint is done for various physical &amp; chemical properties as per IS: 101. The material is then oven baked with a controlled temperature of 180 deg.C to 200 deg.C. It is made of 0.8 mm thick CRCA steel conforming to IS: 513 Gr.D or DD. Its max load bearing capacity is 80 Kg uniformly distributed per shelf for single static and single last unit and 40 kgs for twin mobile units. Shelves are mounted on support brackets &amp; shelf level can be adjusted at approx. 25.4 pitches. Box Files of size is 275 mm Wide X 345 mm High X 90 mm Thick. The Undercarriage is a welded frame made of HR sheet 3.15 mm thick conforming to IS: 10748 suitably fabricated to take the loads based on configuration. Sizes of Undercarriage: Single Static / Last – 1830 (Width) X 457 (Depth) X 65 (Height) Twin</td>
</tr>
</tbody>
</table>
Mobile - 1830 (Width) X 915 (Depth) X 65 (Height) External Load carrying capacity per under-structure - 1200 Kg. Maximum. The undercarriage, after pre-treatment, is coated with final finish consisting of epoxy polyester powder coat of approved colour & shade with a Dry Film Thickness of minimum 40 microns. Movement of units is achieved mechanically through a PU Drive wheel and ‘Sprocket-Chain-Tension arrangement mounted rigidly onto body side. Each movable undercarriage is provided with 2 Rollers on the shaft for driving, 2 antifriction ball bearing for rolling and 4 antifriction ball bearing for guiding between rail.

| Xxiv | Providing and fixing of Tile-based Modular workstations having the following details: 1. Panel thickness - 50mm 2. Ht. - 1200 mm (approx.) 3. Tile Configurations for all panels: Any of Fabric Tackable/Fabric Magnetic/Metallic/Prelaminated/Glass/Whiteboard as per the approval of the consultant. 4. Raceway - For mounting of switches: 150mm Metal Raceway at skirting level for all panels and below worktop level. Modular Tile Based System with nominal thickness of 50 mm. The trim width is 56.5 mm and the thickness of panel after fitting the tiles on frame should be 52 mm. Panels: Panels should comprise of metal frames with cladding of tiles. Metal fascia for wire management is to be provided at the bottom skirting level. Metal fascia to be provided below worktop for additional wire management. Exposed vertical and top edges are to be covered by curved metal trims. Horizontal gaps fillers are to be fixed on frame to prevent light passing through horizontal gaaps between tiles. Overall thickness of panel at trim level should be 56.5mm. Main structure is a combination of frames of height 1200mm. The frame comprises of 2 vertical uprights, a top horizontal tube and a bottom C channel as a welded structure. Vertical upright made from 1.5mm thick CRCA M.S. Grade D formed into “C” channel of 28.4 X 40. The top horizontal is a 1.2 mm thick M.S. tube of 25.4 X 25.4 mm. The bottom horizontal is a
5. Keyboard Pull out tray and CPU trolley for each workstation

6. Worksurface: In prelaminated particle board and PVC lipping; Board Thk. - 25mm

1.5 mm thick M.S. ‘C’ channel of size 38.1mm x 25.4 mm. The frame is powder coated in standard black colour. The pitch for mounting the brackets on the upright is 25.4 mm. The rectangular slot for wires on the upright is 60mm (H) x 18 mm (W), 1 no. at the bottom and 2 nos. at the intermediate level wherein each slot can allow 9 power cables of Dia.10 or 32 data cables of Dia. 6. The bottom horizontal would also have 2 slots for carrying wires, which are of the size 100mm (L) X 20mm(W) for wire carrying. The frames are fitted with removable tiles.). Worktop shall be made of 25mm thick plain particle board as substrate. The top shall be laminated with laminate of 0.6 mm thickness of approved shade anglue of PVC. Bottom shall have a backing laminate of minimum 0.6mm thickness. The user side edges of the worktop are to be made in half round profile with the decorative laminate wrapped around the edge and the other cut edges shall be provided with machine pressed 2 mm thick PVC edge band glue with hot melt EVA glue. All metallic parts should be of make Tata Steel/JSW, Particle board and lipping of make Merino, Fabric of make-Response and fittings of Ebco/ Hettich.

Xxv Providing and fixing mobile pedestal FULL HT, MOBILE 3DR BOX + BOX + FILE METAL 646 H X 390 W X 585 D

Construction and materials:
Welded Assembled. 0.8mm thick CRCA for Body Shell, Drawer Front & tray, Front Side Stiffener, Rear Side Stiffener & Bottom. 1.2 thick CRCA Top Stiffener & Bottom stiffener.

Drawer Fronts: Metal Front Straight Edge

Drawer Specifications: All Drawers with Double extension precision ball slide. 390mm wide Pedestals File drawer - suitable for storing Full-scape Godrej Ezee & Visa files in Depth wise manner. A4 files in
### Construction and materials:
Welded Assembled. 0.8mm thick CRCA for Body Shell, Drawer Front & tray, Front Side Stiffener, Rear Side Stiffener & Bottom. 1.2 thick CRCA Top Stiffener & Bottom stiffener.

**Drawer Fronts:** Metal Front Straight Edge

**Drawer Specifications:** All Drawers with Double extension precision ball slide. 390mm wide Pedestals File drawer - suitable for storing Full-scape Godrej Ezee& Visa files in Depth wise manner. A4 files in width wise manner. For Drawer pulling, side wise tapered recess provided in shell behind Drawer Fronts.

**Locking:** 10 lever Cam Lock & Central RH locking with actuator & lock channel mechanism.

**Top Panel:** 8mm thick Metal Straight Edge Top.

**Castors:** Swivelling non-lockable Castors mounted below the body shell.

**Anti-tipping:** Fifth roller arrangement mounted below File drawer to avoid toppling of unit when file drawer is pulled out.

**Partition in Drawer:** 1 no. Partition in Box Drawers with lock mounted.

**Application / Mounting Environment:** Suitable for pushing below Grid work surface which has got a clear height of 725 mm from below.

**Finish:** Epoxy Polyester Powder coated to the thickness of 50 microns (+/-10).
### Section 6 - Employer's Requirements

#### Procurement of Works - Small Contract

**Bidding Document for Interior Work at Assam Water Centre**

<table>
<thead>
<tr>
<th>XXvii</th>
<th>Providing and fixing of Modular knock down hinged door storage with skirting having dimension 1200mmH x 460mmD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction should be knockdown construction of 25mm thick and 18mm thk pre laminated boards with metal cladding of 0.8mm thick CRCA from outside. Side metal cladding should be Epoxy polyester powder coated with 50+/−10 microns. Top should be 11mm thick bent metal tops made of 0.8mm thick CRCA (as per IS: 513) and coated with Epoxy polyester powder of 50+/−microns. Two door opening for doors should be provided and made of 18mm thk pre laminated boards with decorative laminate on one side and backing laminate on the other side. Shelving should be 1 number adjustable shelf and 1 number fixed shelf without vertical partition for 900mmW unit and 2 nos. adjustable shelves and 2 nos. fixed shelves with vertical partition in between for 1050mm width unit. UDL for each shelf should be 40 kg. Skirtings of 150mm height should be provided. Skirting should be made of 0.8mm thick CRCA and powder coated to a thickness of 50+/−10 microns. Screw type adjustable leveler with plastic base should be provided for</td>
</tr>
</tbody>
</table>

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**Anti-tipping:** Fifth roller arrangement mounted below File drawer to avoid toppling of unit when file drawer is pulled out.

**Partition in Drawer:** 1 no. Partition in Box Drawers with lock mounted.

**Application / Mounting Environment:** Suitable for pushing below Grid work surface which has got a clear height of 725 mm from below.

**Finish:** Epoxy Polyester Powder coated to the thickness of 50 microns (+/-10).
| Vertical adjustment for uneven floors and leveling of units. Back panels should be made of 18 mm thick PLB and have splits back top panel and split back bottom panel separated by aluminium extrusion. 3 way nickel plated wooden furniture lock should be provided for effective and positive locking of doors. Recessed Handles should be made of aluminium extrusion for easy opening and closing. All metallic parts should be of make Tata Steel/JSW, Particle board and lipping of make Woodhouse, fittings of Ebco/Hettich and powder coating of Nerolac make powder. |
## LIST OF APPROVED MAKES

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>ITEMS</th>
<th>MAKE LIST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>A. ELECTRICAL AND LOW VOLTAGE SERVICES</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>LT PANELS</td>
<td>Manufacturer having valid CPRI Certificate of required Fault Level &amp; IP Level protection of approved make</td>
</tr>
<tr>
<td>2</td>
<td>LIGHT FIXTURES</td>
<td>PHILLIPS/ BAJAJ/ WIPRO/ HAVELLS/ SYSKA/HYBEC or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>3</td>
<td>MCB, ISOLATORS</td>
<td>L &amp; T/ HAGER / SCHNEIDER / LEGRAND / Siemens/Havells or equivalent make as approved by Dept.</td>
</tr>
<tr>
<td>4</td>
<td>PVC CONDUIT</td>
<td>AKG/PRECISION /BERLIA/PRESTO PLAST or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>5</td>
<td>FLEXIBLE CONDUIT</td>
<td>PILCO/ LAPP or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>6</td>
<td>PVC INSULATED COPPER WIRE (ISI MARKED)</td>
<td>FINOLEX/ HAVELLS/POLY CAB/RR/KABEL/ANCHOR or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>7</td>
<td>CO-AXIAL CABLES</td>
<td>HAVELLS/ POLY CAB/ FINOLEX or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>8</td>
<td>SWITCH, TV &amp; TELEPHONE SOCKET &amp; BOXES (MODULAR TYPE)</td>
<td>ANCHOR PENTA (to match with existing installation) or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>9</td>
<td>LUX SENSORS FOR LIGHT CONTROL</td>
<td>SCHNEIDER / MK / SIEMENS/ Helvor/Osram/ LEGRAND or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>10</td>
<td>ACB</td>
<td>Schneider(Master Pact), L&amp;T(Upower omega), ABB (Emax), Siemens(3WL) or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>11</td>
<td>MCCB</td>
<td>Schneider(Compact NSX), L&amp;T(DSINE), ABB (T max), Siemens(3VL), Legrand or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>12</td>
<td>Starters, Timer &amp; Contactors</td>
<td>Siemens, L&amp;T, Schneider or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>13</td>
<td>Push Buttons</td>
<td>Schneider, Siemens, L&amp;T, BCH or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>14</td>
<td>Indicating lamps (LED Type)</td>
<td>Tecnic, Schneider, Siemens, L&amp;T, BCH or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>15</td>
<td>Numerical Relays</td>
<td>Siemens, L&amp;T, ABB, GE, Schneider, Alstom or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>16</td>
<td>Synchronization relays</td>
<td>Deif, Woodward or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>17</td>
<td>APFC relay</td>
<td>ABB, Beluk, Epcos or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>18</td>
<td>Indicating meters</td>
<td>AE, MECO, L&amp;T, Rishab or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>19</td>
<td>Digital meters</td>
<td>L&amp;T, ABB, Siemens, Schneider, Socomec, Secure or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>20</td>
<td>Current Transformer</td>
<td>AE, Intrans, Kappa, L&amp;T or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>21</td>
<td>UPS</td>
<td>Numeric, Schneider, APC or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>22</td>
<td>Battery Charger</td>
<td>Waves, HBL, Amararaja or equivalent make as approved by Deptt.</td>
</tr>
</tbody>
</table>

*For items where approved make is not mentioned, contractor to proposed suitable brand and get approval before execution. For all items sample to be presented for final approval before procurement and execution.*
<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Approved Make/Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>SMF/VRLA Batteries</td>
<td>Exide, Amara Raja, HBL or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>24</td>
<td>Sandwich Bus duct</td>
<td>Schneider, L&amp;T, Legrand or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>25</td>
<td>GI Cable tray</td>
<td>Indiana / OBO/ Profab or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>26</td>
<td>Metalclad plug/socket/Decontactor</td>
<td>Legrand, Mennekes or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>27</td>
<td>HT/LT Termination</td>
<td>Raychem, M-Seal, 3M or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>28</td>
<td>Lugs</td>
<td>Lapp Kabel, Gripwel, HMI, Denson, Multipressings, Yamuna Gasses, Dowels, Komet, Raychem or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>29</td>
<td>Cable glands, lugs, End termination kits</td>
<td>Lapp Kabel, Gripwel, HMI, Denson, Multipressings, Yamuna Gasses, Dowels, Komet, Raychem or equivalent make as approved by Deptt.</td>
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<tr>
<td>30</td>
<td>1.1 kV grade XLPE insulated PVC sheathed Al./ Cu. Cable</td>
<td>KEI, NICCO, Polycab, Havells, Gloster, Finolex, Torrent or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>31</td>
<td>11kV XLPE Al. Cable</td>
<td>KEI, NICCO, Polycab, Havells, Finolex or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>32</td>
<td>MCB Distribution Boards</td>
<td>Legrand, Siemens, Hager, Schneider or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>33</td>
<td>Floor trunking</td>
<td>OBO/ Profab/ Honeywell, Legrand or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>34</td>
<td>Ceiling fans/Wall fans</td>
<td>Usha, Crompton, Orient or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>35</td>
<td>Ventilating fans</td>
<td>Greenheck, Ostberg, Kruger or equivalent make as approved by Deptt.</td>
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<tr>
<td>36</td>
<td>Ceiling Rose</td>
<td>Anchor, GM or equivalent make as approved by Deptt.</td>
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<tr>
<td>37</td>
<td>LED Driver</td>
<td>BEG, Osram, Philips or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>38</td>
<td>Lightning Protection and accessories</td>
<td>OBO, Dehn or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>39</td>
<td>Synthetic Insulating Mats</td>
<td>CPRI certified for required voltage or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>40</td>
<td>Chemical earthing</td>
<td>OBO, Dehn or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>41</td>
<td>Transformer</td>
<td>Crompton, ABB, Voltamp or equivalent make as approved by Deptt.</td>
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**B CCTV**

<table>
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<th></th>
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<td>CCTV Camera</td>
<td>PELCO, BOSCH, NEOS or equivalent make as approved by Deptt.</td>
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<tr>
<td>2</td>
<td>NETWORK VIDEO RECORDER</td>
<td>PELCO, BOSCH, NEOS or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>3</td>
<td>HARD DISC DRIVE</td>
<td>W.D/SEAGATE/TOSHIBA or equivalent make as approved by Deptt.</td>
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**C NETWORKING**

<table>
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<tbody>
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<td>NETWORKING SWITCHES</td>
<td>JUNIPER/ALCATEL/RUCKUS or equivalent make as approved by Deptt.</td>
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<td>2</td>
<td>REDUNDANT POWER SUPPLY UNIT</td>
<td>JUNIPER/ALCATEL/RUCKUS or equivalent make as approved by Deptt.</td>
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<td>-------------------------------------------------</td>
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</tr>
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<td>GIGABIT ETHERNET TRANSCIEVERS</td>
<td>JUNIPER/ALCATEL/RUCKUS or equivalent make as approved by Deptt.</td>
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<td>WIFI ACCESS POINTS</td>
<td>JUNIPER/ALCATEL/RUCKUS or equivalent make as approved by Deptt.</td>
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<td>5</td>
<td>PATCHCORD/PIGTAIL/OPTICAL FIBRE CABLE/PATCH PANEL/SPICE TRAY/CAT 6 CABLE &amp; I/O OUTLET</td>
<td>MOLEX/AMP/TYCO or equivalent make as approved by Deptt.</td>
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<td>NETWORKING/SERVER RACK</td>
<td>NETTRACK/APW/PRESIDENT or equivalent make as approved by Deptt.</td>
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<td>7</td>
<td>UTM</td>
<td>SOPHOS/CHECK POINT/FORTINET or equivalent make as approved by Deptt.</td>
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**D** INTERCOM

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<tbody>
<tr>
<td>1</td>
<td>SIP PBX/ IP PHONE/ AUDIO CONFERENCING DEVICE</td>
<td>GRANDSTREAM/ PANASONIC/ ALCATEL or equivalent make as approved by Deptt.</td>
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**E** VIDEO CONFERENCING

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<td>POLYCOM/CISCO/SONY or equivalent make as approved by Deptt.</td>
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**F** AUDIO

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<td>SPEAKERS/ SUBWOOFERS</td>
<td>JBL/ D &amp; B/ L ACOUSTICS or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>2</td>
<td>AMPLIFIER</td>
<td>JBL/ CROWN/ LABGRUPPER/ POWERSOFT or equivalent make as approved by Deptt.</td>
</tr>
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<td>3</td>
<td>COMPUTER</td>
<td>DELL/ LENOVO/ HP or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>4</td>
<td>MICROPHONE/ HEADPHONE</td>
<td>AUDIO TECHNICA/ AKG/ SHURE or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>5</td>
<td>ACTIV DIGITAL INTERFACE BOX FOR LAPTOP</td>
<td>RADIAL/ DBX/ PALMER or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>6</td>
<td>CONFERENCE SYSTEM CONTROLLER</td>
<td>BSS/ AUDIO TECHNICA/ POLYCOM or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>7</td>
<td>MICROPHONE CABLES</td>
<td>SCP/ GOTHAM/ EURO or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>8</td>
<td>MIXER</td>
<td>SANDCRAFT/ ALLEN HEATH/ MACKIE or equivalent make as approved by Deptt.</td>
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**G** VIDEO

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<tr>
<td>1</td>
<td>LED TV/ DISPLAY/ VIDEO WALL/ TOUCH PANEL</td>
<td>LG/ BARCO/ CHRISTIE or equivalent make as approved by Deptt.</td>
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<td>2</td>
<td>HDMI CABLES</td>
<td>GOOBAY/ PRODIGOLD/ KOING or equivalent make as approved by Deptt.</td>
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<td>3</td>
<td>HDMI OVER CAT6 EXTENDER/ PRESENTATION SWITCH</td>
<td>CYR/ CREESTON/ AMX or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>4</td>
<td>MOTOROSED SCREEN</td>
<td>DALITE/ ELITE/ C LITE or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>5</td>
<td>PROJECTORS</td>
<td>BENQ/ VIEWSONIC/ BARCO or equivalent make as approved by Deptt.</td>
</tr>
</tbody>
</table>
### Section 6 - Employer’s Requirements

**Procurement of Works-Small Contract**

**Bidding Document for Interior Work at Assam Water Centre**

#### H ACCESS CONTROL

<p>| | | |</p>
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<td>1</td>
<td>ACCESS CONTROL SYSTEM</td>
<td>ROSAALARE/ BOSCH/ HONEYWELL or equivalent make as approved by Deptt.</td>
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<td>EM LOCK</td>
<td>ALGATEE/ SECUREYE/ NEOS or equivalent make as approved by Deptt.</td>
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#### I BLINDS

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#### J WALL PANELLING, GLASS PARTITION, WALL PAINT, CUSTOM FURNITURE

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<tr>
<td>1</td>
<td>PLYWOOD</td>
<td>CENTURY, ARCHIDPLY, GREENPLY, AUSTINPLY or equivalent make as approved by Deptt.</td>
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<td>2</td>
<td>VENEER</td>
<td>CENTURY, GREEN, DECOWOOD, NATURAL VENEERS or equivalent make as approved by Deptt.</td>
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<td>3</td>
<td>LAMINATES</td>
<td>CENTURY, GREENLAM, MERINO or equivalent make as approved by Deptt.</td>
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<td>4</td>
<td>GLASSWOOL</td>
<td>SAINT GOBAIN, KFLEX, TWIGA or equivalent make as approved by Deptt.</td>
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<td>5</td>
<td>DRYWALL PARTITION</td>
<td>SAINTGOBAIN, BORAL or equivalent make as approved by Deptt.</td>
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<td>6</td>
<td>GLASS</td>
<td>SAINT GOBAIN, ASAHI or equivalent make as approved by Deptt.</td>
</tr>
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<td>7</td>
<td>POLISH</td>
<td>ICA, ASIAN PAINTS, SIRCA or equivalent make as approved by Deptt.</td>
</tr>
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<td>8</td>
<td>EXTRUDED ALUMINIUM SECTION FOR GLASS DOORS/WINDOWS/LOUVERS</td>
<td>DOMAL, HINDALCO, JINDAL, ENOX or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>9</td>
<td>TOUGHENED GLASS HARDWARE FITTINGS</td>
<td>EBCO, DOMAL, HETTICH, DORMA, YALE or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>10</td>
<td>WALL PUTTY</td>
<td>ASIAN, JK, BERGER or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>11</td>
<td>PAINT</td>
<td>ASIAN, ICI, BERGER, NEROLAC or equivalent make as approved by Deptt.</td>
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<tr>
<td>12</td>
<td>EXTRUDED ALUMINIUM BOX CHANNEL FOR PARTITION FRAMING</td>
<td>JINDAL or equivalent make as approved by Deptt.</td>
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<td>13</td>
<td>FASTNUT</td>
<td>HILTI, FISCHER or equivalent make as approved by Deptt.</td>
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<td>14</td>
<td>FURNITURE HARDWARE FITTINGS</td>
<td>GODREJ, BLUM, HAFFLE, HETTICH, YALE or equivalent make as approved by Deptt.</td>
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<tr>
<td>15</td>
<td>ACRYLIC SOLID SURFACE</td>
<td>CORIAN, LG HAUSYS, MERINO HANEX or equivalent make as approved by Deptt.</td>
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</tbody>
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#### K FLOORING

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<tbody>
<tr>
<td>1</td>
<td>CARPET</td>
<td>FLOTEX/ FORBO/ EGE/ BOLON/ CARUS or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>2</td>
<td>LED LINER FOOT LIGHT</td>
<td>PROLITE OR APPROVED EQUAL or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>3</td>
<td>WOODED FLOORING</td>
<td>EGO/ PERGO/ SQUAREFOOT or equivalent make as approved by Deptt.</td>
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#### L READYMADE FURNITURE

Procurement of Works-Small Contract
Bidding Document for Interior Work at Assam Water Centre
<table>
<thead>
<tr>
<th></th>
<th>MODULAR WORKSTATIONS/ PARTITIONS/ TABLES</th>
<th>GODREJ/ HAWORTH/ HERMAN MILLER or equivalent make as approved by Deptt.</th>
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<tbody>
<tr>
<td>2</td>
<td>READYMADE CHAIR</td>
<td>GODREJ/ HAWORTH/ HERMAN MILLER or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>3</td>
<td>READYMADE SOFA</td>
<td>GODREJ/ STANLEY/ HERMAN MILLER or equivalent make as approved by Deptt.</td>
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**M AUDITORIUM ACOUSTIC**

<table>
<thead>
<tr>
<th></th>
<th>WOOD WOOL BOARD</th>
<th>ANUTONE/ HIMALAYAN/ AMF or equivalent make as approved by Deptt.</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>DOOR HANDWARE FITTINGS</td>
<td>YALE/ HETTICH/ HAFFLE/ GODREJ or equivalent make as approved by Deptt.</td>
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<tr>
<td>3</td>
<td>STAGE CURTAIN</td>
<td>ZOHER &amp; CO. OR APPROVED MAKE or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>4</td>
<td>STAGE LIGHTS</td>
<td>CANARA LIGHTING/ MARTIN OR APPROVED EQUAL or equivalent make as approved by Deptt.</td>
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**N FALSE CEILING**

<table>
<thead>
<tr>
<th></th>
<th>GYPSUM CEILING</th>
<th>LAFARGE/ SAINT GOBAIN/ BORAL or equivalent make as approved by Deptt.</th>
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<tbody>
<tr>
<td>2</td>
<td>GRID CEILING</td>
<td>ARMSTRONG/ SAINT GOBAIN/ ANUTONE or equivalent make as approved by Deptt.</td>
</tr>
<tr>
<td>3</td>
<td>FLOATING ACOUSTIC CEILING</td>
<td>ARMSTRONG OR APPROVED EQUAL or equivalent make as approved by Deptt.</td>
</tr>
</tbody>
</table>
Drawings

Soft copy of drawings is provided as Annexure I
## Personnel Requirements

Using Form PER - 1 and PER - 2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Total Work Experience [years]</th>
<th>Experience In Similar Work [years]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Manager 1 No, BE in Civil</td>
<td>7</td>
<td>5</td>
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<tr>
<td>2</td>
<td>Asstt. Engineer 1 No, BE in Civil</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Asstt. Engineer 1 No, BE in Electrical</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Junior Engineer 2 Nos, Diploma in Civil</td>
<td>3</td>
<td>2</td>
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Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment Type and Characteristics</th>
<th>Minimum Number Required</th>
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<tbody>
<tr>
<td>1</td>
<td>Industrial Wet &amp; Dry Vacuum Cleaner</td>
<td>2 Nos</td>
</tr>
<tr>
<td>2</td>
<td>Power Tools</td>
<td>As Required</td>
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<tr>
<td>3</td>
<td>Hand Tools</td>
<td>As Required</td>
</tr>
<tr>
<td>4</td>
<td>Measuring Tools</td>
<td>As Required</td>
</tr>
</tbody>
</table>
Quality Assurance & Control

1. The contractor will submit a quality control and assurance plan to the ISC/Engineer in charge for approval within 7 days of signing of contract.
2. All material will be procured based on sample approvals by the ISC/Engineer in Charge.
3. All material received at the site shall be approved before use in construction.
4. Manufacturers’ test certificates should be submitted and accepted by the ISC/Engineer in charge at the time of material inspection before use in construction.
5. All work process shall be approved by the ISC/Engineer in Charge.
6. Quality checks and controls will be carried by the ISC/Engineer in charge during the entire execution period.
7. All work will be finally approved for finishing and quality after the completion of the work by the ISC/Engineer in Charge.
Health, Safety & Environmental Management

1. The contractor shall follow all rules & regulations for health, safety & environmental management as prevalent during execution.
2. Construction safety shall be maintained as per guidelines of SP70, 2001 of BIS
3. In general, the contractor will maintain a neat and clean work site which is healthy, safe and eco-friendly and shall follow all instructions of the ISC/Engineer in charge.
<table>
<thead>
<tr>
<th>Sl no.</th>
<th>Drawing Title</th>
<th>Drawing No.</th>
<th>Released Date</th>
<th>Ver. No</th>
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<tr>
<td>2</td>
<td>GROUND FLOOR INTERIOR LAYOUT</td>
<td>AC/606/I-02</td>
<td>16-11-18</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>FIRST FLOOR INTERIOR LAYOUT</td>
<td>AC/606/I-03</td>
<td>16-11-18</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>SECOND FLOOR INTERIOR LAYOUT</td>
<td>AC/606/I-04A</td>
<td>16-11-18</td>
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<tr>
<td>5</td>
<td>THIRD FLOOR INTERIOR LAYOUT</td>
<td>AC/606/I-04</td>
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<td>6</td>
<td>FOURTH FLOOR INTERIOR LAYOUT</td>
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<td>7</td>
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<td>EXTERNAL VOICE LAYOUT</td>
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<td>GROUND FLOOR DATA LAYOUT</td>
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<td>FIRST FLOOR DATA LAYOUT</td>
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<tr>
<td>47</td>
<td>SECOND FLOOR DATA LAYOUT</td>
<td>AC/606/V-19</td>
<td>27-11-18</td>
<td>2</td>
</tr>
<tr>
<td>48</td>
<td>THIRD FLOOR DATA LAYOUT</td>
<td>AC/606/V-20</td>
<td>27-11-18</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>---</td>
<td>---------------------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td>LIST OF DRAWING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sl no.</td>
<td>Drawing Title</td>
<td>Drawing No.</td>
<td>Released Date</td>
</tr>
<tr>
<td>57</td>
<td>13</td>
<td>FOURTH FLOOR DATA LAYOUT</td>
<td>AC/606/V-21</td>
<td>27-11-18</td>
</tr>
<tr>
<td>58</td>
<td>14</td>
<td>FIFTH FLOOR DATA LAYOUT</td>
<td>AC/606/V-22</td>
<td>27-11-18</td>
</tr>
<tr>
<td>59</td>
<td>15</td>
<td>NETWORKING SLD</td>
<td>AC/606/V-39</td>
<td>27-11-18</td>
</tr>
</tbody>
</table>
FOURTH FLOOR PLAN

LEGEND

- BLINDS
- PELMETS

COURTYARD - 1
COURTYARD - 2

FIRE EXIT
LIFT
(1800X2000)
LIFT
(1800X2000)
WC WC

GENTS TOILET - 1
5150 X 4620

TOILET - 5
(1500X3000)

DUCT

AW4
UP
DN
3900

WC

LADIES TOILET - 2
4050X3150

DUCT
AC LEDGE
(2900x5000)

REFER DETAIL DRWG.

Wall upto 1350 lVL.
Janitors cupboard

TERRACE
BELOW
STEEL RAILING
AS PER SPECS

AC LEDGE

DUCT

ELECT
Toilet
5285x6595 mm
ELECTRICAL SL S OF FIFTH FLOOR -PDB 5F/2

---

**Electrical System**

- **Lighting Switches**: Light switches are marked with symbols and locations.
- **Circuit Wiring**: Wiring diagrams indicate connections and locations.
- **Distribution Board**: Positions and configurations are specified.

---

**Release Details**

- **Release Date**: 12-12-18
- **Release For Review & Estimation**: 16-11-18
- **Release For Review Only**: 16-09-18
- **Release Date**: 30-09-18

---

**Additional Notes**

- **Office Suite**: Extention unit located on the rear side.
- **Cubicle**: Locations and dimensions are provided.

---

**Client**

- **Theme**: Food and River Erosion Management Agency of Assam
- **Location**: Market, Nizamuddin, New Delhi, India
- **Email**: info@activindia.com

---

**Design Firm**

- **Engineers (India) Pvt. Ltd.**

---

**DRW No.**

- **AC-330/F-3-03**
Note:

1) All U Rack will come with internal power supply unit.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 Link made or approved equal.
4) The WiFi access points design selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected to management network.
8) All point wiring of lan/cctv will be done by electrical contractor.

17-11-18 RELEASE FOR REVIEW & ESTIMATION

-\[\text{RGB to BELTOLA CHARIALI}\]
-\[\text{NH-37}\]
-\[\text{LAWN}\]
-\[\text{EXTERNAL CCTV LAYOUT}\]
-\[\text{INTERIOR DESIGN CONSULTANT}\]
-\[\text{MAIN CONSULTANT}\]
-\[\text{CLIENT}\]
Note:
1) All U Rack will come with internal power supply unit.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-LINK make or approved equal.
4) The Wifi Access points devices selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected to the management network.
8) All point wiring of LAN/CCTV will be done by electrical contractor.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATA POINT</td>
<td></td>
</tr>
<tr>
<td>CEILING MOUNTED WIFI ACCESS POINT</td>
<td></td>
</tr>
<tr>
<td>WALL MOUNTED WIFI ACCESS POINT</td>
<td></td>
</tr>
<tr>
<td>DVSB DATA VOICE SWITCH BOARD</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>QTY</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nos</td>
<td>Nos</td>
</tr>
</tbody>
</table>

- Activ Consulting Engineers (India) Pvt. Ltd.
- FREMAA (Flood and River Erosion Management Agency of Assam)
- 4th Floor, Nayantara Super Market, Sixmile, Guwahati
- DHI (India) Water & Environmental Pvt Ltd
- 206, Ground Floor, Okhla Industrial Estate, Phase III, IN-110020, New Delhi, India
- House No-1, 1st Floor, Bishnu Rabha Path, Between Spanish Garden & Shradhanjali Park, Zoo Road, Guwahati-781005
- tel: 98640-28822
- email: info@activindia.com

- REV. DATE: 01/17/11-18
- RELEASE FOR REVIEW & ESTIMATION
- DRAWN: S.K.
- CHECKED: M.T.
- DWG NO: AC/606/V-09
- SCALE: NTS
- PROJECT: FREMA OFFICE
- TITLE: EXTERNAL DATA VOICE LAYOUT

- Note: All U Rack will come with internal power supply unit.
- The U Rack will draw power from nearest UPS power supply.
- All data cables will be Cat 6 of D-LINK make or approved equal.
- The Wifi Access points devices selection will be confirmed by consultant before procurement.
- All information outlets will be Cat 6 compatible.
- The Network will be divided between guest & management access for security using managed switches.
- All CCTV cameras will be connected to the management network.
- All point wiring of LAN/CCTV will be done by electrical contractor.

- RELEASE FOR REVIEW & ESTIMATION
- REV. DATE: 01/17/11-18
- RELEASE FOR REVIEW & ESTIMATION
- REV. DATE: 01/17/11-18
- RELEASE FOR REVIEW ONLY
- REV. DATE: 01/17/11-18
- REMARK

- Paper size - A2
- 02 27-11-18 RELEASE FOR REVIEW & ESTIMATION
1) The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.

2) Therefore only essential & minimum alteration to false ceiling is advised.
1) The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.

2) Therefore only essential & minimum alteration to false ceiling is advised.
1) The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.

2) Therefore only essential & minimum alteration to false ceiling is advised.
1) The False ceiling, lighting, HV/AC, Fire-fighting & alarm work executed before interior design work.
2) Therefore only essential & minimum alteration to false ceiling is advised.

<table>
<thead>
<tr>
<th>QTY OF REMOVAL EXISTING FALSE CEILING (IN SQ.M)</th>
<th>QTY OF NEW GYPSUM CEILING (IN SQ.M)</th>
<th>QTY OF NEW GRID CEILING (IN SQ.M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QTY (Interior Design)</td>
<td>NIL</td>
<td>362</td>
</tr>
<tr>
<td>QTY (New Wiring &amp; Cabling)</td>
<td>168</td>
<td>168</td>
</tr>
<tr>
<td>TOTAL QTY</td>
<td>168</td>
<td>530</td>
</tr>
</tbody>
</table>

NOTE:

- The False ceiling, lighting, HV/AC, Fire-fighting & alarm work executed before interior design work.
- Therefore only essential & minimum alteration to false ceiling is advised.

LEGEND:

- GRID CEILING EXISTING
- NEW PARTITION
- REMOVAL OF EXISTING CEILING
- NEW GYPSUM CEILING
- NEW GRID CEILING

PROJECT: FREMA OFFICE

DRAWN: S.K
CHECKED: M.T

DWG NO: AC/606/I-27

SCALE: NTS

TITLE: FALSE CEILING LAYOUT OF GROUND FLOOR

INTERIOR DESIGN CONSULTANT

MAIN CONSULTANT

CLIENT
SYMBOL DESCRIPTION
1) The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.
2) Therefore only essential & minimum alteration to false ceiling is advised.

QTY OF REMOVAL EXISTING FAKE CEILING (IN SQ.M) | QTY OF NEW GYPSUM CEILING IN SQ.M | QTY OF NEW GRID CEILING IN SQ.M
--- | --- | ---
QTY (Interior Design) | 124 | NIL
QTY (New Wiring & Cabling) | 221 | NIL
TOTAL QTY | 345 | NIL

NOTE:
1) Removable ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.
2) Therefore only essential & minimum alteration to false ceiling is advised.

CLIENT
MAIN CONSULTANT
INTERIOR DESIGN CONSULTANT

PROJECT: FREMA OFFICE
DRAWN
CHECKED
DRAW NO
SHEET
PAGE
TITLE: FALSE CEILING LAYOUT OF SECOND FLOOR

INTERIOR DESIGN CONSULTANT
MAIN CONSULTANT

Shradhanjali Park, Zoo Road

email: info@activindia.com

Between Spanish Garden & FEDMAA (Flood and River Erosion Management Agency of Assam)

4th Floor National Freight Market, Kolkata (Gariahat)

Guwahati-781005 tel: 98640-28822

ELECTRICAL UNINSTALL & RE INSTALL FOR DATA/VOICE/CCTV/COMPUTERS USB POINTS

REMOVAL OF EXISTING CEILING

SOIL-LEVEL +8550

SECOND FLOOR PLAN
EXISTING (OLD RCP)

SECOND FLOOR PLAN
CHANGES (NEW INTERIOR)

SECOND FLOOR PLAN
EXISTING (OLD RCP) WITH ADDITIONAL ROUTE OF WIRING FOR DATA/VOICE/CCTV/COMPUTERS USB POINTS

SECOND FLOOR PLAN
REMOVAL OF EXISTING CEILING
1) The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.

2) Therefore only essential & minimum alteration to false ceiling is advised.

### Table: QTY of New Grid Ceiling (in SQ. M)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>QTY of Removal (Existing False Ceiling in SQ. M)</th>
<th>QTY of New Gypsum Ceiling (in SQ. M)</th>
<th>QTY of New Grid Ceiling (in SQ. M)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>QTY (Interior Design)</td>
<td>QTY (New Wiring &amp; Cabeling)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>499</td>
<td>84</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td>374</td>
<td>84</td>
<td>NILL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>125</td>
<td>125</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>458</td>
<td>458</td>
<td></td>
</tr>
</tbody>
</table>

### Title: False Ceiling Layout of Third Floor

**NOTE:**

1. The False ceiling, lighting, HVAC, Fire fighting & alarm work executed before interior design work.

2. Therefore only essential & minimum alteration to false ceiling is advised.
**FIFTH FLOOR CCTV LAYOUT**

**SYMBOL**
- IR DOME CCTV
- IR DOME CCTV PROVISION
- WALL MOUNTED CCTV
- IR BULLET CCTV

**DESCRIPTION**
- IR DOME CCTV
- IR DOME CCTV PROVISION
- WALL MOUNTED CCTV
- IR BULLET CCTV

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IR DOME CCTV</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>IR DOME CCTV PROVISION</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>WALL MOUNTED CCTV</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>IR BULLET CCTV</td>
<td>-</td>
</tr>
</tbody>
</table>

**Note:**
1. All U Rack will come with internal power supply unit.
2. The U Rack will draw power from nearest UPS power supply.
3. All data cables will be Cat 6 D-Link makes or approved equal.
4. The Wi-Fi Access points device selection will be confirmed by consultant before procurement.
5. All information outlets will be Cat 6 compatible.
6. The Network will be divided between guest & management access for security using managed switches.
7. All CCTV cameras will be connected to the management network.
8. All point wiring of cameras will be done by electrical contractor.

**Scale:** 1:100

**Legend:**
- Blue: IR DOME CCTV
- Red: IR DOME CCTV PROVISION
- Green: WALL MOUNTED CCTV
- Black: IR BULLET CCTV

**Date:** 27-11-18

**Disclaimer:**
In-110020, New Delhi, India
DHI (India) Water & Environmental Pvt. Ltd.
Shradhanjali Park, Zoo Road, Guwahati-781005
tel: 98640-28822
email: info@activindia.com

**Title:** FIFTH FLOOR CCTV LAYOUT

**Client:**
Between Spanish Garden & House No-1, 1st Floor
Managment Agency of Assam
FREMAA (Flood and River Erosion Management Agency of Assam)
Activ Consulting Engineers (India) Pvt. Ltd.

**Checked:** S.K.

**Drawn:** A.S.

**Dwg No:** AC/606/V-08

**Printed by:** Activ Consulting Engineers (India) Pvt. Ltd.
From Third floor CCTV, DATA, VOICE DB-1F/1 (U RACK)

02 27-11-18 RELEASE FOR REVIEW & ESTIMATION

CCTV-7
I J K L
Video Wall
FG1
AC LEDGE
DOUBLE
HEIGHT
COURTYARD-2
FIRE EXIT
DOUBLE  HEIGHT
FIRST FLOOR PLAN
 LIFT
(1800X2000)

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
<th>QTY</th>
</tr>
</thead>
<tbody>
<tr>
<td>☻️</td>
<td>IR DOME CCTV</td>
<td>19</td>
</tr>
<tr>
<td>🌹</td>
<td>WALL MOUNTED CCTV</td>
<td>-</td>
</tr>
<tr>
<td>🎥</td>
<td>IR BULLET CCTV</td>
<td>-</td>
</tr>
</tbody>
</table>

Note:
1) U Rack will come with internal power supply unit.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-Link make or approved equal.
4) The Wi-Fi Access point devices selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected management network.
8) All point wiring of lan/cctv will be done by electrical contractor.

SCALE: 1:500

Paper size - A2

DHI (India) Water & Environmental Pvt Ltd
206, Icchavan Rd, Shradhanjali Park, Guwahati-781005
tel: 98640-28822
email: info@activindia.com

CLIENT:
FREMA OFFICE
Between Spanish Garden & Bishnu Rabha Path
House No-1, 1st Floor
Market, Sixmile, Guwahati
4th Floor, Nayantara Super

MAIN CONSULTANT:
Activ Consulting Engineers (India) Pvt. Ltd.

PROJECT:
FREMAA (Flood and River Erosion Management Agency of Assam)
12th Floor, Nagajyoti House
Majuli, Dibrugarh, Assam

SCALE: NTS

DRAWN BY:
S.K
M.T

CHECKED BY:
RWP

DWG NO:
AC/606/V-04

REV
DATE
REMARK

92 27-11-18
RELEASE FOR REVIEW & ESTIMATION
02 27-11-18
RELEASE FOR REVIEW & ESTIMATION
02 27-11-18
RELEASE FOR REVIEW ONLY
18-08-18
RELEASE FOR REVIEW ONLY
1) All U Rack will come with internal power supply unit.
2) The U Rack will draw power from nearest UPS.
3) All data cables will be Cat 6 of D-Link make or equivalent.
4) The Wi-Fi Access point devices selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected using management network.
8) All point wiring of cctv will be done by electrical contractor.

Note:
- All U Rack will come with internal power supply unit.
- The U Rack will draw power from nearest UPS.
- All data cables will be Cat 6 of D-Link make or equivalent.
- The Wi-Fi Access point devices selection will be confirmed by consultant before procurement.
- All information outlets will be Cat 6 compatible.
- The Network will be divided between guest & management access for security using managed switches.
- All CCTV cameras will be connected using management network.
- All point wiring of CCTV will be done by electrical contractor.
Note:
1) All U Rack will come with internal power supply unit.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-Link make or approved equal.
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Note:
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2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-Link make or approved equal.
4) The Wi-Fi Access point devices selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected to management network.
8) All point wiring of lan/cctv will be done by electrical contractor.

SYMBOL | DESCRIPTION | QTY
--- | --- | ---
IR DOME CCTV | - | 21
WALL MOUNTED CCTV | - | 3
IR BULLET CCTV | - | 21

SCALE: 0 5M 10M 15M
Note:
1) All U Rack will come with internal power supply only.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-Link make or approved equal.
4) The Wifi Access points device selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected management network.
8) All point wiring of fixtures will be done by electrical contractor.

1) All U Rack will come with internal power supply only.
2) The U Rack will draw power from nearest UPS power supply.
3) All data cables will be Cat 6 of D-Link make or approved equal.
4) The Wifi Access points device selection will be confirmed by consultant before procurement.
5) All information outlets will be Cat 6 compatible.
6) The Network will be divided between guest & management access for security using managed switches.
7) All CCTV cameras will be connected management network.
8) All point wiring of fixtures will be done by electrical contractor.
**Title:** Third Floor Interior Layout

**Product:** Frema Office

**Scale:** NTS

**Drawn:** Activ Consulting

**Drawn No.:** AC/606/I-04

**Design:** 4th Floor, Nayanta Super Market, Boro Road, Guwahati

**Client:** Management Agency of Assam

**Date:** 16/11/2018

**Remarks:** Released for Review and Estimation

---

**Furniture Legend: Third Floor**

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Code</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D1</td>
<td>Storage Cabinet</td>
<td>4</td>
<td>SQMTr</td>
</tr>
<tr>
<td>2</td>
<td>D2</td>
<td>Workstation Table</td>
<td>12</td>
<td>SDMTr</td>
</tr>
<tr>
<td>3</td>
<td>D4</td>
<td>Control Room Table</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>4</td>
<td>D6</td>
<td>Network Printer / Corner table</td>
<td>4.5</td>
<td>RMT</td>
</tr>
<tr>
<td>5</td>
<td>B7</td>
<td>Side table (soft seat)</td>
<td>4</td>
<td>NOS</td>
</tr>
<tr>
<td>6</td>
<td>B8</td>
<td>Centre table</td>
<td>3</td>
<td>NOS</td>
</tr>
<tr>
<td>7</td>
<td>B11</td>
<td>Reception table</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>8</td>
<td>A9</td>
<td>Cartoom round table</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td>Support staff Table</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>10</td>
<td>F2</td>
<td>Centre Head Table</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>11</td>
<td>J1</td>
<td>Workstation Table - GATA ANALYSIS</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>12</td>
<td>M1</td>
<td>Workstation Table MODELLING SPECIALIST</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>13</td>
<td>M1</td>
<td>Workstation Table VIRTUAL LAB &amp; GIS SPECIALISTS</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>14</td>
<td>N1</td>
<td>Workstation Table - WDR OFFICE</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>15</td>
<td>L1</td>
<td>WDR OFFICE-1/2 - Table</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>16</td>
<td>G1</td>
<td>Table for knowledge exchange cafe cum library</td>
<td>4</td>
<td>NOS</td>
</tr>
<tr>
<td>17</td>
<td>A14</td>
<td>Training room table</td>
<td>23</td>
<td>NOS</td>
</tr>
<tr>
<td>18</td>
<td>O1</td>
<td>Table for tennis</td>
<td>12</td>
<td>NOS</td>
</tr>
<tr>
<td>19</td>
<td>CH-9</td>
<td>Chair for terrace-2</td>
<td>52</td>
<td>NOS</td>
</tr>
<tr>
<td>20</td>
<td>CH-14</td>
<td>Chair for Support staff workstation</td>
<td>59</td>
<td>NOS</td>
</tr>
<tr>
<td>21</td>
<td>CH-16</td>
<td>Sofa for small head</td>
<td>1</td>
<td>NOS</td>
</tr>
<tr>
<td>22</td>
<td>CH-3</td>
<td>Chair for Reception</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>23</td>
<td>CH-11</td>
<td>Sofa for Waiting room</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>24</td>
<td>CH-7</td>
<td>Chair for Control Room / Training room</td>
<td>69</td>
<td>NOS</td>
</tr>
<tr>
<td>25</td>
<td>CH-15</td>
<td>Chair for Ward office - 1/3</td>
<td>14</td>
<td>NOS</td>
</tr>
<tr>
<td>26</td>
<td>AX-2</td>
<td>Workstation table mobile drawer unit</td>
<td>20</td>
<td>NOS</td>
</tr>
<tr>
<td>27</td>
<td>AX-1</td>
<td>Workstation table mobile drawer unit</td>
<td>4</td>
<td>NOS</td>
</tr>
<tr>
<td>28</td>
<td>BB2</td>
<td>Modular knock down hinged door storage</td>
<td>2</td>
<td>NOS</td>
</tr>
<tr>
<td>29</td>
<td>BB3</td>
<td>Modular knock down hinged door storage</td>
<td>2</td>
<td>NOS</td>
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<tr>
<td>30</td>
<td>BB4</td>
<td>Modular knock down hinged door storage</td>
<td>1</td>
<td>NOS</td>
</tr>
</tbody>
</table>
A2 - Main Reception Table
A4 - Buffet Table
A6 - Audio Video Control Desk
A7 - Canteen Counter
A10, A11 - Dias & Podium
A13 - Main Audi Delegate Table
B4 - Wardrobe With Luggage Rack
B3 - TV Console Integrated Wardrobe
B10 - Meeting Room Console Table
D4 - Circular Table for Floor Monit. Room
D8 - Network Printer Table
E1, E2 - Office Suite with Main Desk & Rear Extention Unit