

## **NOTICE INVITING TENDER (NIT)**

**TENDER NOTICE NO: CDFD/ENGG/ELECT & HVAC/WORKS/2025-26/05**

Sealed Tenders are invited on behalf of the Director, CDFD from the working contractors of CPWD, Railways, MES, State PWD, State R&B, GHMC in respect of the work as detailed below up to 15.00 Hours on 05.03.2025.

1. **Name of work:** “Retrofit Works for Relocation of LT Substation Switchgear including Cables Etc., SITC of Substation Panels and its Associated Material & Works At CDFD Campus, Site- ‘A’, UPPAL, Hyderabad”.

2. **Details of Tender:**

1.	Estimated cost	Rs 1,51,26,000
2.	Earnest Money Deposit	Rs 3,00,000
3.	Tender Document Fee	Rs.5,000
4.	Completion period	60 Working Days
5.	Pre-Bid Meeting Date	27-02-2025 @ 11:00 AM
6.	Tender Opening Date	06.03.2025 @ 11:00 AM

3. The Tender document can be downloaded from the website [www.cdfd.org.in](http://www.cdfd.org.in) and [www.eprocure.gov.in](http://www.eprocure.gov.in). The cost of tender document and EMD should be submitted along with requisite DDs drawn in favour of “DIRECTOR, CDFD” in the Office of Executive Engineer, Laboratory Building, Uppal Campus. Copy of Firm Registration Certificate, along with GST certificate should be enclosed. Cost of tender document and EMD to be submitted in the form of Demand Drafts separately. Amendments / Corrigendum, if any, would be hosted on the CDFD website only.
5. Tender Form is not transferable and the cost of tender form is not refundable.
6. The site of the work is located at Opposite to RTA Office, Uppal-Nagole Road, Uppal, Hyderabad.
7. The above Tender will be dealt with under “Two Bid System” i.e. the tenderers have to submit Technical Bid and Price Bid separately.

8. The Technical Bid shall contain the following:
  - (i) Tender Cost and EMD in the form of Demand Draft.
  - (ii) The Earnest Money Deposit mentioned against the above work shall be furnished in the form of Demand Draft in favour of “Director, CDFD, Hyderabad” from any nationalized Bank.
  - (iii) Work experience giving details of work done by the tenderer in the past Five years as per the Proforma – I and Proforma – II.
  - iii) Other Information / documents as indicated in Instructions to Tenderers.
  - iv) Any other information, tenderer may like to submit reflecting their credentials.
9. The Price Bid shall contain the following:
  - (i) Duly filled in Price Bid document.
10. Method of submission of Sealed tenders – Technical Bid envelope and Price Bid envelope both kept in one envelope super-scribed “Tender for “Retrofit Works for Relocation of LT Substation Switchgear including Cables Etc., SITC of Substation Panels and its Associated Material & Works” At CDFD Campus, Site- ‘A’, UPPAL, Hyderabad.
11. The tender has to be submitted in sealed cover with Tender Document comprising N.I.T, Letter of submitting the tender, General conditions of contract, Special conditions of contract and Price Bid Document.
12. Tenderer shall quote rates both in figures and words. He shall also work out the amount for each item of work and write in both figures and words. On check, if there is any difference between the rates quoted by the tenderers in the words and figures are in the amount worked out by them / him, the following procedure shall be followed.
  - (a) When there is a difference between the rates in figures and the words, the rates which correspond to the amounts worked out by the tenderer shall taken as correct.
  - (b) When the amount of an item is not worked out by the tenderer or it doesn't correspond with the rate written either in figure or in words, the rate quoted by tenderer shall be taken as correct.
  - (c) When the rates quoted by the tenderer in figures and in words tally but the amount are not worked out correctly. The rates quoted by the tenderer shall be taken as correct and not the amount.
  - (d) Except writing the rates and amount, the tenderer should not write any conditions or make any changes, additions, alterations and any modifications in the printed form of tender. Tenderers who are desirous to offer rebate, the same should be brought out separately in the covering letter and submit along with the tender.

13. Eligibility Criteria:

To be eligible for award of contract, bidders shall provide evidence satisfactory to the CDFD of their eligibility and of their capability and adequacy of resources to carry out the contract effectively as detailed below:

- i) Copies of original documents defining the constitution or legal status, place of registration and principal places of business of the company or firm or partnership.
- ii) Tenderer should submit the Copies of works executed previously with CPWD, Railways, Hospitals, Biotech Institutions, MES, State PWD, State R&B, Electricity Boards and any Private Limited Companies.
- iii) Certificate of Registration for Goods Services Tax (GST).

14. Earnest Money Deposit (EMD):

- i) The EMD mentioned against the above work shall be furnished in the form of Demand Draft in favour of “The Director, CDFD, Hyderabad” from any Nationalized Bank. The EMD of unsuccessful Tenderer shall be returned after evaluation of Tender.
- ii) Tenders received without EMD and Tender cost will not be considered. No request for exemption in payment of EMD will be considered.
- iii) The EMD amount will be forfeited if the successful tenderer fails to sign/execute the formal agreement within one week from the date of such intimation or fails to commence the work as per the work order.

15. CDFD does not bind itself to accept the lowest or any other tender and reserves the authority to reject any or all tenders without assigning any reason. All the tenders, in which any of the prescribed conditions are not fulfilled or incomplete, in any respect, are liable to be rejected.

16. This Notice Inviting Tender shall form the part of the Contract Document.

17. The Consultancy firm should visit the site (CDFD) before quoting their Bid document.

18. The Director, CDFD reserves the right to postpone the tender issue date, submission / opening date and to accept or reject any or all tenders without assigning any reasons.

19. Tender completed in all respects shall be submitted as per the instructions given in the “Notice Inviting Tender” forming part of the tender document.

20. The tenderer shall sign all the pages of the tender documents and other documents submitted by him along with the tender.

21. The tenderer should ensure that amounts quoted should appear only in the price schedule document and nowhere else, otherwise, the tender is liable to be rejected.
22. Director, CDFD reserves the right of accepting the whole or part of any tender and tenderer shall be bound to perform the same at the rate or amount quoted.
23. The General conditions of contract of CPWD (GCC 2014) with all amendments shall be applicable and form part of agreement.
24. All works shall be executed confirming to CPWD specifications 2009.
25. The rates shall be quoted inclusive of all taxes except GST and GST rate shall be quoted separately in the price bid for complete item work as such noting extra shall be payable. Necessary Income tax shall be deducted as per rules in force.
26. Time is essence of the contract. In order to complete the work within the schedule time the tenderer is required to submit a detailed programme chart for various activities.
27. The tenderer must visit various electrical equipment's / line / site and get acquainted with the scope of work before quoting in the bid. The tenderer should submit the Site Visit Certificate which was issued by Executive Engineer. Without submission of the signed copy of the Executive Engineer, the tender will be summarily rejected.



**CENTRE FOR DNA FINGERPRINTING AND DIAGNOSTICS,  
UPPAL, HYDERABAD**

**TENDER DOCUMENT**

**NIT NO: CDFD/ENGG/ELECT & HVAC/WORKS/2025-26/05**

**DATED: 12<sup>th</sup> February 2025**

**FOR**

**SITE 'A', CDFD CAMPUS**

**INNER RING ROAD, UPPAL, HYDERABAD -500039,**

**INDIA.**

**PROJECT:-**

**“RETROFIT WORKS FOR RELOCATION OF LT SUBSTATION SWITCHGEAR  
INCLUDING CABLES ETC, SITC OF SUBSTATION PANELS AND ITS  
ASSOCIATED MATERIAL & WORKS AT CDFD CAMPUS, SITE 'A' UPPAL,  
HYDERABAD”.**

**CLIENT:-**



**“CENTRE FOR DNA FINGERPRINTING  
AND DIAGNOSTICS.**

**MEP CONSULTANT:-**



**HYDERABAD CONSULTING ENGINEERS**

**CONTENTS**

<b>Sl. No.</b>	<b>Description</b>
	<b><u>TECHNICAL BID</u></b>
1	Annexure I - Notice Inviting Tender
2	Annexure II- Instructions To Bidders (ITB)
3	Annexure III - Forwarding Letter
4	Annexure IV - Articles of Agreement
5	Annexure V - Compliance to Labour Laws
6	Annexure VI - Special Conditions of Contract
7	Annexure VII - Concept & Description
8	Annexure VIII - Technical Specifications
	A. ELECTRICAL
	1. CHAPTER-1
	2. CHAPTER-2
	3. CHAPTER-3
	4. CHAPTER-4
	5. CHAPTER-5
	6. CHAPTER-6
	7. CIVIL DBR

8	Annexure IX - List of Approved Makes / Vendors
9	Annexure X - Drawings
10	Annexure XI - General Check List
	<u>PRICE BID</u>
11	Annexure XII - Bill of Quantities

**ANNEXURE I****NOTICE INVITING TENDER (NIT)****TENDER NOTICE NO: CDFD/ENGG/ELECT & HVAC/WORKS/2025-25/05**

Sealed Tenders are invited on behalf of the Director, CDFD from the working contractors of CPWD, Railways, MES, State PWD, State R&B, GHMC in respect of the work as detailed below up to 15.00 Hours on 05.03.2025.

1. **Name of work:** “Retrofit Works for Relocation of LT Substation Switchgear Including Cables Etc,SITC of Substation Panels and Its Associated Material &Works At CDFD Campus ,Site ‘A’UPPAL, Hyderabad”.

2. **Details of Tender:**

1.	Estimated cost	Rs 1,51,26,000
2.	Earnest Money Deposit	Rs 3,00,000
3.	Completion period	60 Working Days
4.	Cost of tender documents	Rs 5,000/- (Rupees Five Thousand only)

3. The Tender document can be downloaded from the website [www.cdfd.org.in](http://www.cdfd.org.in) and [www.eprocure.gov.in](http://www.eprocure.gov.in). The cost of tender document and EMD to be submitted in the form of Demand Draft drawn from any nationalized bank favoring “THE DIRECTOR, CDFD, Hyderabad”.
4. Tender Form is not transferable, and the cost of tender form is not refundable.
5. The site of the work is located at Opposite to Uppal RTA Office, Inner Ring Road, Uppal, Hyderabad - 500039.



**ANNEXURE II****INSTRUCTIONS TO BIDDERS (ITB)**

- 1.** The Technical Bid shall contain the following:
  - (i) Duly signed Technical Tender Document Comprising NIT, ITB, and Letter of submitting the tender, special conditions of contract, Drawings and Approved make's list.
  - (ii) Tender Cost and EMD in the form of demand draft.
  - (iii) Documentary evidence for Eligibility as per eligibility criteria.
  - (iv) Other Information / documents as indicated in NIT.
  - (v) Any other information, tenderer may like to submit reflecting their credentials.
  
- 2.** The price schedule shall contain the duly filled in price schedule.

Tenderer shall quote rates both in figures and words. He shall also work out the amount for each item of work and write in both figures and words. On check, if there is any difference between the rates quoted by the tenderers in the words and figures are in the amount worked out by them / him, the following procedure shall be followed.

- (a) When there is a difference between the rates in figures and the words, the rates which correspond to the amounts worked out by the tenderer shall take as correct.
- (b) When the amount of an item is not worked out by the tenderer or it doesn't correspond with the rate written either in figure or in words, the rate quoted by tenderer shall be taken as correct.
- (c) When the rates quoted by the tenders in figures and in words tally but the amount are not worked out correctly. The rates quoted by the tenderer shall be taken as correct and not the amount.
- (d) Except writing the rates and amount, the tenderer should not write any conditions or make any changes, additions, alterations and any modifications to the printed form of tender. Tenderers who are desirous to offer a rebate, the same should be brought out separately in the covering letter and submit along with the tender.

**3. Method of submission of Tender:**

The tender must be submitted in three cover system as follows:

- a) First Sealed cover shall contain the Technical Bid and EMD amount and duly Superscripted “Technical Bid for Providing “Retrofit Works for Relocation of LT Substation Switchgear Including Cables Etc, SITC of Substation Panels and Its Associated Material & Works At CDFD Campus ,Site ‘A’UPPAL, Hyderabad”.
- b) Second sealed cover shall contain the duly filled and signed Price bid duly superscripted Providing “Retrofit Works for Relocation of LT Substation Switchgear Including Cables Etc, SITC of Substation Panels and Its Associated Material & Works At CDFD Campus ,Site ‘A’UPPAL, Hyderabad”.
- c) The third sealed cover shall contain both the two covers indicated at (a) and (b) above and duly superscripted “Tender for Providing “Retrofit Works for Relocation of LT Substation Switchgear Including Cables Etc, SITC of Substation Panels and Its Associated Material & Works At CDFD Campus ,Site ‘A’UPPAL, Hyderabad”.
- d) Sealed tenders are to be deposited in the Box kept for this purpose in the Executive Engineer Office, Inner Ring Road, Uppal, Hyderabad-500 039.

**4. Eligibility Criteria:**

The bidder shall meet the following eligibility criteria and submit the documentary evidence in the Technical Bid. The bid received without documentary evidence shall summarily be rejected.

- 4.1 Tenderer should have valid registration with CPWD/Railways/MES/State PWD/State R&B/ Central & State Government Autonomous Bodies / Hospitals / Biotech Labs/ TGSPDCL (in business as Contractor for similar works for a minimum period of five years at the time of bid opening) and submit the copies of the same.
- 4.2 Project completion timelines are the essence for the project so the tenderer should provide satisfactory evidence to the CDFD to assess their eligibility, capability and adequacy of resources to execute the contract works effectively as per timelines.
- 4.3 The contractor should have experience of Government: State / Central R&D Laboratories and should have the experience in retrofit works at operational R&D Laboratories.
- 4.4 The tenderer should have experience in DG sets in parallel operation, 33kV substation and Transformers capacity not less than 2.0 MVA.

- 4.5 The tenderer should have a minimum of 75 workers in their attendance register. The firm should have Registered in Provident Fund (PF) / ESI Office.
- 4.6 Copies of original documents defining the constitution or legal status, place of registration and principal places of business of the company or firm or partnership. The firm should have registered office in Hyderabad.
- 4.7 The Tenderer should possess a valid 'A' Grade license to operate and maintain 33kV and above installations in the state of Telangana. The Tenders of Bidders not having the said license will be rejected.
- 4.8 Actual Proof of Annual Turnover: The bidder should have achieved a minimum annual financial turnover of Rs.1000.00 Lakhs in any one of the last five years and solvency certificate from any nationalized bank for minimum Rs.20.00 Lakhs. The proof of annual turnover shall be duly certified by chartered Accountant / Income Tax Authorities.
- 4.9 The tenderer should submit the details of such completed works. In support of having completed these works, the tenderer should submit copies of the completion certificates from the owner companies indicating the name of work, the description of work done by the tenderer, value of contract executed by the bidder, date of start, date of completion (contractual and actual), value of the material supplied by the client.
- 4.10 Tenders containing two packets namely technical bid and Price bid shall be submitted within the due date.
- 4.11 The Financial / Price Bid of bidders who qualify Technical Bid only shall be opened later which shall be intimated to all eligible bidders participating in the Technical Bid.
- 4.12 The tenderer must visit various electrical equipment's / line / site and get acquainted with the scope of work before quoting in the bid. The tenderer should submit the Site Visit Certificate which was issued by Executive Engineer. Without submission of the signed copy of the Executive Engineer, the tender will be summarily rejected.
- 4.13 The successful bidder shall submit a detailed micro-level plan of carrying out the job within a period of 5 days after award of work.
- 4.14 Copies of attested IT returns submission for the last five financial years.

- 4.15 **Work Experience:** The tenderer should have satisfactorily completed in the last five years in his own / firm name at least one similar nature of work cost not less than of **₹120.00 Lakhs** (Excluding GST) or two similar works of each cost not less than **₹90.00 Lakhs** (Excluding GST) or three similar works costing not less than **₹60.00 lakhs** (Excluding GST) during the last 5 (Five) years prior to the date of submission of the bid in any Central / State Government or Central / State Government autonomous bodies / Electricity Boards. Hospitals / Biotech Labs, Similar nature of work means the work of carrying out Electrical Retrofit project or related works.
- 4.16 The tenderer should have his own panel manufacturing/fabrication unit in his own firm's name and should be CPRI approved vendor.
- 4.17 As the project works should be carried out in plant shutdown, time is most essence of the project, Tenderer should be acquainted to site conditions and should submit following inputs invariably to the Consultant/Executive Engineer-CDFD, same to be discussed with Consultant/ Executive Engineer to build confidence on works execution prior to submit his tender for works.
- a) Detailed execution plan i.e., PERT/ CPM schedule and discussion on each activity.
  - b) List of equipment used to do the work i.e., Crane, Hydra, Tripod & any other scientific method of handling equipment during lifting, shifting and inter connection.
  - c) Equipment riggers, agency name & their field experience in handling heavy equipment.
  - d) List of skilled/ semi-skilled/ un-skilled manpower engaging for work for each shift.
  - e) Deployment of manpower in 3 shifts.
  - f) Number of Managers & Engineers should depute for shift work.
  - g) Site Manager or site-in charge name, his experience, CV/ Resume and he should have minimum 15 years' experience in handling similar kind of works All above details and MOMs shall be part of tender document. No deviation / No amendments shall be accepted after awarding project on them. If any deviation is found during works execution, the decision of consultant/Executive Engineer is final whether to impose penalty alone or penalty & blacklist the tenderer for future works.
- 4.18 Certificate of Registration for Goods and Services Tax (GST) and the firm should have registered MSME.

## **5. Earnest Money Deposit (EMD):**

- 5.1 The EMD mentioned against the above work shall be furnished in the form of Demand Draft in favor of "The Director, CDFD, Hyderabad" from any Nationalized Bank. The EMD of unsuccessful Tenderer shall be returned after evaluation of Technical Bid.

- 5.2 Tenders received without EMD amount will not be considered. No request for exemption in payment of EMD will be considered.
- 5.3 The firms registered with NSIC / MSME, if any, are exempted from payment of EMD and tender cost subject to submission of valid documentary proof.
- 5.4 The EMD amount will be forfeited if the successful tenderer fails to sign/execute the formal agreement within one week from the date of such intimation or fails to commence the work as per the work order.
- 5.5 The EMD of successful Tenderer shall be returned after receiving the Performance Guarantee.
- 6.** CDFD does not bind itself to accept the lowest or any other tender and reserves the authority to reject any or all tenders without assigning any reason. All the tenders, in which neither of the prescribed conditions are not fulfilled or incomplete, in any respect, are liable to be rejected.
- 7.** This Notice Inviting Tender (NIT) and instructions to Bidders (ITB) shall form part of the Contract Document.
- 8.** The Director, CDFD reserves the right to postpone the tender issue date, submission / opening date and to accept or reject any or all tenders without assigning any reasons.
- 9.** The successful tenderer on the acceptance of his tender by CDFD shall sign the formal contract within Seven days from the stipulated date of start of the work.
- 10.** The tenderer shall sign all the pages of the tender documents and other documents submitted by him along with the tender.
- 11.** The tenderer should ensure that amounts quoted should appear only in the price schedule document and nowhere else, otherwise, the tender is liable to be rejected.
- 12.** Director, CDFD reserves the right to accept the whole or part of any tender and the tenderer shall be bound to perform the same at the rate or amount quoted.
- 13.** The successful tenderer shall be required to execute an agreement with CDFD for carrying out the work as per the agreed conditions. The cost of stamp paper for the agreement shall be borne by the contractor as per the state stamp act.
- 14.** Diagrams shown in the document are indicative.

- 15.** The General conditions of the contract of CPWD (GCC 2020) with all amendments shall be applicable and form part of agreement.
- 16.** All works shall be executed conforming to CPWD specifications 2019 and tender specifications.
- 17.** The rates shall be quoted inclusive of all taxes and Cess except GST and GST rate shall be quoted separately in the price bid for complete item work as such nothing extra shall be payable. Necessary Income tax and Labour Cess shall be deducted as per rules in force.
- 18.** Time is the essence of the contract. To complete the work within the scheduled time the tenderer is required to submit a detailed programming chart for various activities.
- 19.** Tenderers shall visit the site before quoting for better appreciation on work. For a site visit please take prior appointment (Thursday at 15:00 PM only) from Executive Engineer, (Mobile No: 9441490598) CDFD, Inner Ring Road, Uppal, Hyderabad - 500 039, without Visit Certificate (issued by Executive Engineer), the tender will be summarily rejected.

**20. Conditions of Contract:**

24.1 **PRICE:** The contract amount appearing in the priced schedule shall remain frozen during the entire tenure of the contract and no escalation in prices will be admissible on any account. However, whenever, the Minimum Wages, EPF or ESI rates are revised by Government of India, payment will be made accordingly as per the revised rates.

24.2 **RISK OF LOSS:** Contractor shall guarantee the due safeguard and return of all owner's property including documents / materials issued to him and will be responsible for the full value thereof to be assumed by the owner for all loss thereof or damage thereto from whatever cause happening while in possession or control of the contractor, his servant's workman or agents

**21. Payment Terms:-**

<b>PAYMENT TERMS</b>		
Sl No	Details	Description
1	Payment terms	<p>i. 60% on the value of supplied items (This is limited to cost of LT Panels, Cables, MS Structure in MT, Light Fixtures, and DB's only and on invoice amount or 60% of quoted price whichever is low).</p> <p>ii. 15 % after Installation.</p> <p>iii. 15 % after Testing and Commissioning of the equipment.</p> <p>iv. 05 % after completion and handing over of the work.</p> <p>v. 05 % after completion of defects liability period including warranty period.</p> <p>Note: The <b>minimum interim bill</b> amount should be more than <b>Rs 5.00 lacs.</b></p> <p><b>INR LC will be opened for 100%.</b></p> <p>(85% will be released against the material delivery at Site-CDFD).</p> <p>Remaining 15% will be released after Installation, Testing and Commissioning of the complete scope of the works. (In Operational Mode).</p>
2	Minimum Billing Period	10 (ten) working days from the date of certification from the project consultants subject to its correctness.
3	Performance guarantee (ISD)	2% of the total quoted amount which is inclusive of EMD amount. (Initial Security Deposit -ISD)
4	Total Security Deposit in shape of DD/ BC/ Bank guarantee	5% of the total executed amount in favour of CDFD, Uppal,
5	Defects liability period	3 months from the date of handing over the completed works.
6	Liquidated Damages	At the rate of 0.5% per day delay beyond the agreed completion period subject to a maximum of 5% of the total contract value.
7	Validity of the Bid	120 (One hundred and twenty) days from the last date of submission of the bid.

**ANNEXURE III**  
**FORWARDING LETTER**

To

The Director,

CDFD Laboratory Complex, Inner Ring Road, Uppal,

Hyderabad – 500039

(Hereinafter referred to as the entre)

Dear Sir,

I/We have read and examined the following documents relating.....to the work“ ..... ”.

- (a) Notice Inviting Tender
- (b) Instructions to Bidders (ITB)
- (c) Special Conditions of Contract
- (d) Technical Specifications
- (e) Drawings
- (f) List of Approved Makes
- (g) Bill of Quantities

Upon reading the terms and conditions contained or referred to therein and in accordance in all respect with the specifications design, drawings and other relevant details at the rates, I/We hereby tender for the execution of the works referred to in the aforesaid documents.

A sum of ₹ \_\_\_\_\_/- is hereby forwarded in crossed Bank Draft No: \_\_\_\_\_ dated \_\_\_\_\_ drawn on \_\_\_\_\_ Bank favoring \_\_\_\_\_ The Director, CDFD,

Hyderabad as Earnest Money Deposit. If I/We fail to keep the tender open for a period of 90 days, validity after opening the tender(s) or make any modifications in the terms and conditions of the tender, which are not acceptable to the Centre, I/We agree that the Centre shall, without prejudice to any other right or remedy, be at liberty to forfeit the said Earnest Money absolutely. Should this tender be accepted, I/We hereby agree to abide by and fulfil all the terms, conditions and provisions of the aforesaid documents.

If, after the tender is accepted, I/We fail to commence the execution of the works as provided in the conditions, I/We agree that the Centre shall without prejudice to any of their right or remedy, be at liberty to forfeit the said earnest money absolutely.

In the event of this Tender being accepted I/We agree to enter into an agreement as and when required and execute the contract according to your form of Agreement, within a month of receipt of work order, in default thereof, I/We do hereby bind my- self/ourselves to forfeit the aforesaid initial security deposit



I/We further agree to complete the work covered in the said schedule of quantities within 45 (Forty-Five) days reckoned from the tenth day of issue of letter of intent.

I/We agree to pay the Government, General Sales Tax (State and Central), Excise and Octroi duties, if any, Insurance, Seigniorage charges and all other taxes etc., at the rates prevailing from time to time as per the Act, as amended and rates quoted by me/us are inclusive of the same.

I/We agree to pay Income tax, to be deducted at source on the Gross value of the work done, and the rates quoted by me/we are inclusive of same.

I/We agree to get the work & workers to be engaged on the work at site and all materials and machinery collected and kept/operated at site for execution of the work. In case part work is taken over by the Employer before final completion of the whole work, such part may not be covered by the insurance from the date of taking over that part of work by the Employer. All the rates quoted by me/ us are inclusive of the same in full and nothing extra shall be claimed at any time on account of any of these.

Yours faithfully,

Contractor's Signature

Address:

Date:

.....  
.....  
.....  
.....  
.....



3. Tender documents containing Notice to the Contractor, Conditions of Contract, Appendix thereto, Special Conditions of Contract, Specifications and Schedule of Quantities with the rates entered therein, shall be read and studied as forming part of this agreement and the parties hereto shall respectively abide by and submit themselves to the conditions and stipulations and perform the agreement on their part respectively in such conditions contained.
4. The contract is neither a fixed lumpsum contract or a piece work contract, but is a contract to carry out work in respect of the entire works to be paid for according to actual measured quantities, including variations from BOQ at the rates contained in the Schedule of rates and Probable bill of quantities or as provided in the said conditions
5. The Employer reserves for himself the right to alter the drawings and natures of the work, of adding/substitution to or omitting any items of work or having portions of the same carried out through alternate agencies without prejudice to this contract.
6. Time shall be considered as the essence of this agreement and the contractor hereby agrees to commence the work within 10 days reckoned from the date of issue of Letter of Intent to execute the work, as provided for in the said conditions and complete the entire work in subject to nevertheless to the provisions for extension of time.
7. This agreement and contract shall be deemed to have been made in Hyderabad and any questions or dispute rising out of or in any way connected with this Agreement and Contract shall be deemed to have arisen in Hyderabad and only the courts in Hyderabad shall have jurisdiction to determine the same.

AS WITNESS our hand this ..... day of ..... 20.....

Signed by the said in the presence of:

EMPLOYER

WITNESS :

NAME :

ADDRESS :

CONTRACTOR

WITNESS :

NAME :

ADDRESS :

**ANNEXURE V**

**COMPLIANCE TO LABOUR LAWS & APPRENTICE ACT**

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, Contract Labour (Regulation and Abolition) Act, 1970, and rules and orders framed there under and other labour laws affecting contract labour and Apprentice Act, 1961 and the rules and orders framed there under that may be in force or brought into force from time to time. Contractor shall obtain a valid license under Contract Labour (R&A) Act 1970 and Contract Labour (R&A) Central Rules 1971 before commencing work and which should be valid till the completion.

## ANNEXURE VI

### SPECIAL CONDITIONS OF CONTRACT

1. Before filling in the tender, the tenderer will have to check up all the tender documents and will have to get immediate clarifications from the CDFD on any point that he feels is vague or uncertain. No claim/damages or compensation will be entertained on this account.

2. **TENDERER TO VISIT SITE:**

Each tenderer must, before submitting his tender, visit the site of work, to ascertain the physical site conditions prices and availability and quality of materials according to specifications before submitting the quotations. No excuse regarding the non-availability of any materials or changes in the price will be entertained or extra allowed on that account.

Certificate of Site visit shall be taken from Executive Engineer CDFD and the signed copy should be submitted along with tender document, without signed copy the tender will be summarily rejected.

The existing adjacent buildings belonging to Govt./private are in proximity of the proposed construction, hence the contractor shall cater for all arrangements to carry out the work without causing any disturbance to the occupants by providing screens with bamboo matting or other suitable material approved by CDFD. The contractor shall ensure that no dust or construction material falls near/around the existing buildings.

3. **EXECUTION OF WORK (PRICES TO INCLUDE):**

The whole of the work as described in the Contract (including the Bill of Quantities, the specifications and all drawings pertaining thereto) and as advised by the CDFD from time to time is to be carried out and completed in all its parts to the entire satisfaction of the CDFD. Any minor details of construction, which may not have been referred to in this contract, but which are usual in sound engineering & prevailing market standards and all construction practice and essential to the work, are deemed to be included in this contract. Rates quoted in the Price bid document shall be inclusive of all freights, taxes, such as octroi, Sales tax, Royalties, duties, excise, cess and seignories charges, turnover tax, sales tax on works contract, etc., as well as transportation, so as to execute the contract as per the rules and regulations of Local Bodies, State Government and Government of India. Any increase in these

taxes and ~~as~~ during the pendency of contract, shall be borne by the contractor and no extra claim on this account will be entertained **except GST**.

The rates quoted in the tender should also include all charges for:

- a)
  1. Carrying
  2. Hauling
  3. Labour
  4. Fixing
  5. Watering
  6. Cleaning
  7. Making good.
  
- b) The contractor should arrange timely at his cost for all required.
  - i) Plant, machinery, scaffolding, formwork, ladders, ropes, nails, spikes, shuttering, temporary supports, platforms, tools, all materials etc., required for executing the work, and protecting them from weather and other normal/natural causes.
  - ii) Covering/protecting for the walling and other works, during inclement weather, strikes etc., as and when necessary and as directed.
  - iii) All temporary canvas covers/covering, lights, tarpaulin, barricades, water shoots etc.
  - iv) All stairs and steps, thresholds and any other requisite protection for the works.
  - v) All required temporary weather-proof sheds at such places and in a manner approved by the CDFD/for the storage and protection of materials, against the effects of sun and rain.
  - vi) All required temporary fences, lighting/signboards etc., guards, approaches and roads as may be necessary for execution of the contract works and for safe guarding the public.
  - vii) The whole of necessary plant and machinery like bull dozers, graders, road rollers, bitumen heating plants, blowers, pumps, concrete mixers, hoists, vibrators, scaffolding, formwork, tackle, cartage, labour etc., and removal of the same at the completion of works.
  
- c) The CDFD will be the sole judge in deciding as to the suitability or otherwise of the tools/formwork/machinery or plant that may be brought to the work site by the contractor for the proper execution of the work.
  
- d) The rates quoted by the tenderer in the Bill of Quantities items of work will be deemed to be for the finished work.

#### **4. BILL OF QUANTITIES (PRICE BID DOCUMENT):**

The Bill of Quantities forms part of the contract, but the Employer reserves the right to modify the same or any part thereof. The contractor shall not be allowed any

compensation or damages for the work which is so omitted or cancelled or added or substituted by CDFD.

**5. ACCESS OF INSPECTION:**

The contractor is to always provide, during the progress of the works means of access with ladders, gangways etc., and the necessary attendants to move and adopt the same as directed for the inspection or measurement of the work by the Consultant/CDFD or any other agency employed by the Employer.

**6. DIMENSIONS:**

In all cases figured dimensions are to be accepted in preference to scaled sizes. Large scale details shall take precedence over small scale details/drawings. In case of any discrepancy, the contractor shall ask for clarification before proceeding with the work. Accordingly, if any work is executed without prior clarification, it is liable to be rejected and shall not be paid for,

**7. PROGRAMME OF WORKS:**

The contractor on starting the work shall furnish to the CDFD a PERT/CPM programmer, for carrying out the work stage by stage in the stipulated time, for the approval of CDFD and Employer, and follow strictly the approved time schedule by incorporating changes, if any, so authorized by the Consultant/CDFD and Employer, to ensure the completion of construction work in stipulated time. A graph or chart on individual items/group of items/trades of work shall be maintained, showing progress both in terms of quantities and value, week by week. The contractor shall submit to the CDFD a weekly progress report stating the number of skilled and unskilled labourers employed on the work, working hours done, quantity of cement, steel and other major items of materials (quantity and value wise) used and corresponding place, type and quantity of work done during the period.

The contractor must inform the CDFD 3 days in advance of the requirement of respective drawings and details by him, from time to time. The contractor shall strictly adhere to the approved programme and arrange for the materials and labour etc., accordingly.

Despite repeated instructions, if the contractor fails to show satisfactory progress of the work, the CDFD/may take suitable action as deemed fit, including levying of liquidated damages as per relevant clause of GCC of CPWD.

## **8. OFFICES, STORES, SHEDS ETC., ON THE SITE:**

- a. The contractor shall erect and maintain entirely at his own expense properly lighted, ventilated waterproof and lockable offices for his own staff on such parts as the CDFD shall indicate. Necessary permission from various authorities will be obtained by the contractor and necessary fees shall be paid by the contractor prior to constructing such offices, and as well for stores, huts for labourers or any other temporary structures required for the due execution of work. Any penalty levied by local authorities, for not following their bye-laws/regulations etc., in the matter, will be borne by the contractor. The contractor shall pay for the Electricity and Water charges consumed. All these offices shall be demolished, and the materials shall be taken away from site and ground left in good and proper order on completion of work, as required and directed.
- b. The contractor shall provide for all necessary storage on the site, in a specified area for all materials, in such a manner that all such materials, tools etc., shall be duly protected from damage by weather or any other cause. Stores for storage of cement shall all have weatherproof floors, walls and roofs and have proper locking arrangements and must be secure. All these must be maintained till the work is completed and so certified by the Consultant/ Executive engineer. Necessary and adequate watch and ward for all such accommodations and stores shall be provided for by the contractor at his cost and same included in the rates/amounts quoted by him. All such stores shall be cleared away and the ground left in good and proper order on completion of this contract unless otherwise expressly mentioned herein.
- c. All materials which are stored on the site such as cement, brick, metals and etc., shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials and prevent deterioration in quality due to water etc.

## **9 PROCUREMENT OF MATERIALS:**

The contractor shall procure all the materials including cement and steel required for the work from the open market. Time is the essence of the contract. Acceptance of the completion date by the contractor shall mean that he has taken into consideration the availability of all materials of approved make and quality in sufficient quantities at respective markets/sources, to enable him to complete the entire work in the stipulated period.

Contractors will get samples of all materials approved by the CDFD, before placing order/purchase/procurement. They shall conform to relevant SI /B.I.S. codes and or tender specifications as applicable.

For all materials, the contractor shall quote for the best quality of the materials of best make/source or supply, and they should be got approved by the Consultant/ Executive engineer, before procurement.



In case sufficient quantities of approved quality materials from approved sources are not available in time, the contractor may have to procure the same from neighboring areas even with longer leads, as required and directed, at no extra cost. In case approved good quality sand is not available consistently throughout the duration of the contract period, best quality of sand locally available may have to be screened and washed, as directed by the CDFD depending upon the use of sand in different items of work, at no extra cost. The materials will be, however, as per relevant B.I.S. specifications as and wherever applicable.

#### **10. TESTING:**

The contractor shall, as and when directed by the CDFD, arrange to test materials and/or portions of the work at site in any approved laboratory at his own cost in accordance with the relevant specifications and BIS code of practice. The Consultant and Executive Engineer will visit the Manufacturing Site to test physically the material / Equipment before dispatching the material / equipment to CDFD Site. The contractor shall transport all the materials from site to the approved laboratory at his own cost. The contractor shall carry out all the mandatory tests as per SI/ BIS relevant codes at the frequencies stated therein. Even after such tests, any materials brought to site or incorporated in the works are found to be defective or unsound or not as per approved samples, the contractor shall remove the same and re-erect at his own cost and without any additional time/period for the same, with reference to the date fixed for completing the work. In case these tests are not carried out at the frequencies stated, then proportionate costs of materials not so tested, including cost of testing and quantities of items of work executed with such materials, if otherwise accepted for retention in the work, will be deducted from the dues to the contractor. The deductions will be worked out by the Consultant / CDFD and shall be final and binding on him.

Tolerance on various material and items of work shall be allowed laid down in the documents below and the order of precedence shall be:

- a) Relevant SI / BIS Specifications.
- b) CPWD norms.
- c) Manufacturer's Specifications.

In the absence of the above CDFD decision based on the general practice being following shall be final.

#### **11. SITE MEETINGS:**

A senior representative of the contractor shall attend weekly meetings at works site and in additions, meetings as and when arranged by CDFD to discuss the progress

of the work and sort out problems, if any, and ensure that the work is completed in the stipulated time.

## **12. CUSTODY AND SECURITY OF MATERIALS:**

The contractor shall be responsible for the custody and security of all materials and equipment at site, and he will provide full time watchman/watchmen to look after his materials, stores, equipment's etc., including cement and steel at site and ensure that at no time unauthorized persons gains any access at works site.

## **13. CEMENT:**

The Contractor shall procure cement from the authorized dealers only, after getting the make and quality approved by the CDFD. The brands shall be ACC/ Ultra Tech/ Birla Corp. Ltd. (Cement Division)/ JK Cement / Ramco or any other manufacturer as approved by CDFD. The contractor should purchase the cement in adequate quantity, sufficiently in advance, to have sufficient stock (not less than the requirement of the next fortnight) at site all the time. He will construct a cement storage shed of adequate capacity with watertight walls, floor, roof and secure locking arrangements and locking as required and directed. Empty bags will be contractor's property. Contractor's representative shall maintain cement account at site, showing cement received with details of invoices, etc., quantity used daily (with brief details of items/location of works on which used), and progressive consumption and balance at site. CDFD representatives will check this register periodically. Actual cement consumption will be periodically checked with theoretical cement consumption. Damaged cement will not be allowed to be used in work. The contractor will carry out transportation of cement, within the site, as and when required, at no extra cost.

## **14. STEEL:**

The contractor shall procure steel from SAIL/TISCO/VSP/ JINDAL or any other manufacturer as approved by CDFD. The contractor shall produce the necessary vouchers in support of the purchases and the manufacturer's test certificates, to confirm the quality. All wastages, rolling margins, site to site transportation shall be borne by the contractor. Contractor shall maintain at site, steel account showing – steel received at site (consignment wise and section wise) and steel used (section wise) for work corresponding to each of the bills, etc., which shall be subject to checking by CDFD. All scrap steel at site and unused steel at site to the extent not required on the work shall be contractor's property and contractor will be allowed to take it away after measurements/weight, and after getting necessary permission in writing from the CDFD. In case of any discrepancy between the actual quantity of steel lying at site

and the balance quantity as per record, the decision of the CDFD shall be final and binding.

**15. MEASUREMENT TO BE RECORDED BEFORE WORK IS COVERED UP:**

The contractor shall take joint measurements with the consultant and CDFD before covering up hidden measurement or otherwise placing beyond the reach of measurement any item of work. Should the contractor neglect to do so, the same shall be uncovered at the contractor's expense or in default thereof, no payment or allowance shall be made for such work or the materials with which the same was executed.

**16. ACTION WHERE THERE IS NO SPECIFICATION:**

In case of any item/class of work, for which there is no specification mentioned (either in part or full), the same will be carried out in accordance with the relevant CPWD specifications (only for the specifications missing in the contract) and if not available even there (either in part or full) in, relevant standards of BIS/ SI shall be followed (only for the portions of specifications missing in the contract specifications and CPWD specifications). Bureau of Indian standard specifications, subject to the approval of the CDFD.

**17. CLEARING THE SITE ON COMPLETION/DETERMINATION OF WORKS:**

The contractor shall clear the site of the works as per the instructions of CDFD Executive Engineer. The site of works shall be cleared of all men, materials, sheds, huts etc., belonging to the contractor. The site shall be delivered in a clean and neat condition, as required by CDFD/within a period one week after the job is completed. In case of failure by the contractor, the CDFD, under advice to the CDFD/have the right to get the site cleared to his satisfaction at the risk and cost of the contractor.

**18. POSSESSION OF BUILDINGS/WORK COMPLETED:**

The contractor shall hand over to the CDFD possession of the completed works in stages, as and when required, and as directed by the CDFD.

The CDFD will take over the possession of completed works in stages and defects liability period will commence only from the date of handing over of all the completed works as stipulated in the price bid document.

**19. TYPOGRAPHIC, CLERICAL AND OTHER ERRORS:**

The CDFD clarification regarding partially omitted particulars or typographical, clerical and other errors shall be final and binding on the contractors.

**20. BENCHMARKS:**

The contractor shall construct and maintain proper benchmarks at different places on site as required and directed by the CDFD so that levels can be always checked accurately during the progress of work. In case benchmarks are disturbed for any reason whatsoever, necessary rectification shall be carried out by the contractor at his cost as directed by the CDFD

**21. FORCE MAJEURE:**

Neither CDFD nor contractor shall be considered in default in performance of the obligations under this order if such performance is prevented or delayed by events such as but not limited to war hostilities, revolution, riots, civil commotion, strike, lock outs, conflagration, epidemics, accidents, fire, wind, floods, droughts, earth quakes or ordinances or any act of God, or for any other cause beyond the reasonable control of the party affected or prevented or delayed, is given within 30 (Thirty) days from the happening of the event and in case it is not possible to serve the notice within the shortest possible period without delay.

As soon as the cause of force majeure has been removed the party whose ability to perform its obligations has been affected shall notify the other of such cessation, the actual delay incurred in such affected activity adducing necessary evidence in support thereof. From the date of occurrence of a case of Force Majeure, obligations of the party affected shall be suspended during the continuance of any inability so caused with the cause itself and the inability resulting there from have been removed and the agreed time of completion of the respective obligations under this agreement shall stand extended by a period agreed to the period of delay occasioned by such events. Should one or both parties be prevented from fulfilling the contractual obligations by a state of Force majeure lasting for a period of six months or more, the two parties shall consult each other and decide regarding the future execution of this agreement.

**22. COMPLETION OF WORK:**

The work shall be completed in **60 working days** and the start date of the work shall commence in 10 days from the date of issue of Letter of Acceptance of tender.

**23. BILLS OF PAYMENTS:**

The minimum value of work for interim payments shall be 3.0 lakhs. The contractor shall submit interim bills once in 10 days based on joint measurements recorded at site by the contractor's and consultant. All such interim payments shall not be considered as an admission of the due performance of the contract or any part thereof in any respect and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or re- erected at contractor's cost, all as per CDFD instructions, and directions. However, the Executive Engineer-In charge may accept bills of lesser value at his discretion.

**24. WORKMANSHIP**

Quality of materials and workmanship shall conform strictly to specifications given/stipulated in the tender/contract, and contractor will ensure that the best quality of work will be done to the satisfaction of the CDFD, with strict control on the materials, workmanship and supervision.

**25. QUANTITIES:**

The quantities mentioned in the Bill of Quantities, included in the contract, are approximate and are subjected to variations as per actual site conditions & requirements and as directed by the CDFD. The work shall be executed and completed accordingly.

**26. SITE SUPERVISION:**

The contractor shall appoint at his own cost competent and adequate number of qualified Engineers at site, for

- (a) Joint measurements and preparations of bills.
- (b) For testing materials at site and in outside laboratory.
- (c) For concreting and reinforcement work.
- (d) For other general supervision. Their appointment shall be approved by the CDFD. The site engineers shall not be removed from the site without the written consent of the CDFD.

**27. TAX DEDUCTION AT SOURCE:**

Income tax, GST and Labour Cess shall be deducted at source as applicable, by CDFD from contractor's interim and final bill payments as required by law

**28. EXTRA / SUBSTITUTED ITEM RATES:**

Such items shall be executed as per directions/instructions of the Consultant/CDFD.

The work on extra/substituted items shall be started only after the receipt of a written order from CDFD. However, rates for additional/extra or substituted (altered) items of work, which are not covered in the contract shall be derived based on the relevant clauses of GCC, the finalization of which shall not holdup the execution of such additional/extra items in any manner.

**29. SERVICES DRAWINGS**

The contractor shall furnish completion drawings of all services in triplicate, showing the work as actually executed, along with levels. The costs of all these are deemed to have been included in the respective item rates quoted by the contractor and nothing extra shall be paid on account of any of these requirements/acts.

**30. AGREEMENT:**

The successful contractor shall be required to enter into an agreement within 7 days (Seven) from the date of issue of letter of acceptance. The contractor shall pay for all stamps and legal expenses incidental thereto. However, the written acceptance of the tender by CDFD will constitute a binding contract between CDFD and the contractor whose tender has been accepted, whether such formal agreement is or is not subsequently executed. The standard GCC of CPWD shall be part of the agreement.

**31. INSURANCE:**

The contractor shall provide insurance in respect of damage to persons and property and firm insurance as per relevant clause of General conditions of contract. In addition, he will also insure against riots and civil commotion. The insurance shall also cover third parties and all the people working on the site and visitors including contractors, workers, CDFD personnel, other contractors' workers etc. The contractor shall indemnify CDFD against any claim or compensation or mishaps of whatsoever nature at site during the progress of work.

The contractor shall prove to the CDFD from time to time that he/they have taken out all the insurance policies as required and directed and has paid the necessary premium for keeping the policies valid as per relevant clause of the General Conditions of Contract.

In case of failure by the Contractor or sub-contractor to effect and keep in force the insurance policies, then the client, without being bound to, may pay such premiums as may be necessary and deduct the same from any money due or which may become due to the contractor or recover the same as a debt due from the contractor.

- a) The contractor shall provide workmen compensation policy, obtained in his name.

The below mentioned points should be covered in the Insurance Policy:

- Bodily injury caused by accident during the course and scope of employment.
- Bodily injury caused by disease or aggravated by the conditions of employment.
- Death or temporary disablement.
- Permanent total or partial disablement.
- Legal costs and expenses incurred with the company's consent.

- b) Policies and certificates for insurance shall be delivered by the Contractor to the Owner for the Owner approval before the Date of Start of work i.e., date of execution of the contract. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

- c) If the Contractor does not provide any of the policies and certificates required, the Owner may incur the insurance which the Contractor should have provided and recover the premiums the Owner has paid, from the contractor bills. Otherwise, due to the Contractor or if no payment is due, the payment of the premiums shall be a debt due. The cost of premium will be deducted from the contractor's bill, if at any time the work remains uninsured, irrespective of whether the policy is obtained by the owner.

- d) Alterations to the terms of the insurance shall not be made without the approval of the Owner or Consultants.

- e) Both parties shall comply with the conditions in the insurance policy.

- f) All policies in original shall be submitted to the owner before the release of the 1 st RA Bill. Particular attention is drawn to the following In case of accident, the Owner shall be informed in writing forthwith and First Aid, Hospitalization shall be provided by the Contractor. The contractor shall strictly follow regulations laid down by Govt. and State authorities in this regard and all cases are to be defended By the Contractor. The Owner shall not entertain any insurance claims. Compliance with all electricity regulations should be ensured.

**32. EPF & ESIC:**

The contractor shall be required to maintain employment records as covered in relevant Acts and produce documentary evidence to the effect that he has discharged his obligations under the Employees Provident Fund Act 1952, and ESI Act, 1948, if applicable, Group Insurance and other Acts for the workmen working at site towards safety, statutory regulations and insurance aspects applicable as per latest government (central & state) acts.

CDFD reserves the right of imposition of penalty for non-performance or damage during emergency / routine work instructed to your mechanic / Engineers.

**33. STATUTORY OBLIGATIONS:**

The contractor shall obtain a valid license under the Contract Labour (R&A) Act, 1970 and rules framed there under before the commencement of the work and continue to hold it till the completion of the contract.

The contractor shall maintain the following statutory registers as per the Contract Labour (Regulation and Abolition) Act 1970 and rules.

- a) Register of workmen.
- b) Employment cards of workmen.
- c) Master Roll Register.
- d) Register of Wages.
- e) Any other documents as required under the laws of the country.



**34. LABOUR LAWS AND RULES:**

The Site Engineer shall ensure that the contractor maintains relevant records and fulfils all conditions and requirements in accordance with

- a. The Payment of Minimum Wages Act
- b. Employer's Liability Act
- c. Workmen's Compensation Act
- d. Contract Labour (Regulations & Abolition) Act 1970 and Central Rules 1971.
- e. Apprentices Act 1961.
- f. Any other Act or enactment relating thereto and rules framed thereunder from time to time. The Site Engineer shall refrain from involving himself and the supervisors under him by comments/advice/attempts at mediation in any kind of labour dispute at site. His job is to report to his superiors any happenings of the sort in an objective manner.

**35. GOODS AND SERVICES TAX:**

Present GST is @ 18% on contract value and as applicable from time to time of GoI.

**36. WORKING AND SAFETY REGULATIONS:**

- a) The contractor shall observe all statutory, safety, and legal requirements / regulations issued by Central and State Governments applicable to the work as well as any local regulations applicable to the site.
- b) The contractor must fulfill the safety obligations at site and ensure that all safety equipment required for the execution of the work is available and used by the workmen at site.
- c) Required safety signage and other requirements as per safety norms must be compiled as per the instructions of the Owner/Consultant.
- d) A qualified person (i.e. shift in charge supervisor) is charge of safety should be at the site by the contractor to take care of the safety related issues during the execution period regarding workmen and material.
- e) The contractor shall be responsible for the provision of all safety notices safety equipment's including the safety gadgets for his workmen required by both the relevant legislation and such as the Owner may deem necessary. While working at heights, safety belts, nets, and safety helmets shall necessarily be used.

**37. EMPLOYER CONTRACTOR:**

- 37.1 The contractor shall comply with the provisions of the payment of Wages Act, 1936, Minimum Wages Act 1948, Employment Liability Act 1938, Workmen's compensation Act 1923, Industrial Disputes Act 1947, Maternity Benefits 1961 and Contract Labour (Regulation and Abolition) Act, 1970 or the modifications thereof and other laws relating thereto and the rules made there under from time to time.
- 37.2 The contractor when required to employ more than twenty workmen on the works under this contract, shall be bound by the Contract Labour (Regulation and Abolition) Act 1970 and rules framed there under. No Contractor can undertake or execute his work without a license issued by a licensing officer.
- 37.3 Notice showing rate of wages, hours of work etc. shall be submitted to the Office of Labour enforcement officer and the same be displayed on the notice board in the establishment/laboratory.
- 37.4 The tenderer shall at all times comply with such rules and regulations as stipulated in relevant Factory Acts, Latest Indian Electricity Rules, Telangana State Electricity Rules, Indian Petroleum Acts, Indian Explosives Act, Fire Adviser, etc. the tenderer shall obtain the necessary clearance for operation and maintenance of the plant and equipment from the above statutory bodies wherever applicable.
- 37.5 The Director, CDFD, shall not be responsible for any injury or loss of any workers of the contractor / sub-contractor / vendor that may take place while on executing work defined under our scope of work as per this contract. Any compensation or expenditure towards treatment for such injury or loss of life shall be the sole responsibility of the contractor. The contractor is solely responsible for any damage Injury or accident that may occur to any of his personnel working under this contract. He will not claim any compensation from the Director, CDFD.

**38. FIRE PROTECTION / HIGH TENSION (ELECTRICAL)/ ELECTRICAL SHOCK:**

- 38.1 The contractor, his agents, representatives, workmen etc. shall strictly observe the orders pertaining to fire, HT / LT (ELECTRICAL) precautions prevailing within the restricted areas /electrical sub stations, etc.
- 38.2 The contractor, his agents, representatives, workmen etc. shall be strictly adhering to the fire/electric shock precautionary measures while working near the explosive areas/HT/LT./ ELECT.SUB STATION areas. During such times

the workmen should be headed by their Engineer-in charge as a precautionary measure.

38.3 Contractor must abide by latest Contract Labour act, of Govt. of India/Telangana state as 1976 contract labour act is applicable.

38.4 The Contractor shall provide all safety appliances to his personnel at site like gloves, safety belt, gum boots, hard hats etc.

38.5 Any accident caused due to non – competence of safety rules, regulations and will entirely be the responsibility of the contractor.

38.6 Negligence/ malfunction of operator is noted which reflected in a monetary loss / material etc. should be recovered from the contractor RA bills & encashment of security B.G will be taken by depending by the nature of fault and how depth the operated/ supervisor is neglect/is responsible/ careless. The recoverable amount is decided by the Director, CDFD, which will be final and no correspondence or communication will be entertained from the contractor.

37.6 Specials tools and tackles, which are involved in the job to be brought by contractor only.

**39. INSPECTION BY THE CHIEF TECHNICAL EXAMINERS (VIGILANCE):**

The proposed work covered under this tender, during the progress and or after completion, can also be inspected by the Chief Technical Examiner/ Technical Examiner or Officers of the Central Vigilance Commission, Government of India, on behalf of CDFD to ascertain that the execution of the work has been done with materials and workmanship all as stipulated in the contract and as directed.

Contractor shall afford all reasonable facilities to the above vigilance staff and provide them with ladders, tapes, plumb bob, level etc., as required and directed and also necessary labourers skilled/unskilled to enable them to complete their inspection/study/technical scrutiny and no extra shall be admissible to the contractor on this account.

**40. DEFECTS LIABILITY PERIOD:**

The Defects Liability period shall be six months from the date of handing over all the work completed in all respects.

**41. FINAL MEASUREMENTS:**

The period of final measurements shall be 15 days from the date of all works completed in all respects.

**42. WATER AND POWER SUPPLY:**

One water point and electrical point power will be made available by CDFD to the contractor for the work. The contractor should make his own arrangement for extending up to the work area.

**43. PRIORITY OF CONSTRUCTION:**

The Contractor must execute such items/works on a priority basis, as may be decided by the client. The work program is to be approved in writing before execution. Client reserves the right to alter the priority as the case may be.

**44. JURISDICTION OF COURT IN CASE OF DISPUTES:**

**This contract is under the jurisdiction of the court at Hyderabad.**

**45. QUALITY OF TENDERER'S SUPPLY ITEMS:**

All materials, fittings, fixtures shall be of heavy and high quality within the scope of specifications. Samples of materials like fittings of doors, windows, etc., should be approved within a week from the award of tender by the contractor from Consultant/CDFD.

**46. MODE OF MEASUREMENT:**

The mode of measurement will be as per CPWD standard specifications for all items. There shall be no disputes in this regard

**47. GENERAL**

These Special Conditions of Contract shall be read in conjunction with the CPWD General Conditions of Contract, CPWD Technical Specifications, and CPWD

Technical Specifications for Electrical and air-conditioning works. Drawings and any other documents forming part of this contract wherever the context so requires.

The Notice Inviting Tender, ITB, Drawings & the bidding documents comprising of Special Conditions of Contract, Price Bid Document & Letter of Intent shall form part and parcel of the Agreement.

Notwithstanding, the sub-division of the documents into these separate sections and volumes, every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.

Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, then, unless a different intention appears, the provisions of the Special Conditions of Contract shall be deemed to override the provisions of the General Conditions of Contract and shall to the extent of such repugnancy or variations prevail.

#### **48. OBSERVANCE OF LABOUR LAWS & PRINCIPAL EMPLOYER**

Observance of labour laws shall be as per clause No.19 of General Conditions of Contract. Principal Employer's certificate will be issued by CDFD.

#### **49. RATES ARE FIRM AND NO ESCALLATION IS ALLOWED**

The Rates quoted by Contractor are firm and no escalation will be allowed on account of price increase of materials, fuel, labour etc. Clause 10C and clause 10CC of General Conditions of Contract are not applicable to this contract.

#### **50. MINIMUM REQUIRED T&P FOR WORK EXECUTION**

- a) Excavator cum loader LJC30 model or equivalent.
- b) Truck/Tipper/Dumpers/Load Tractors
- c) Water Tanker

**51. COMPLETION CERTIFICATE**

On completion of the installation a certificate shall be furnished by the contractor countersigned by the Consultant & Executive Engineer, under whose direct supervision the installation was carried out.

**52. TESTS AT SITE**

**GENERAL:**

The Contractor must perform all inspection and tests of the system as a whole and of components individually as required, under the supervision of the Experienced Engineer, in accordance with the provisions of the applicable ISI / BS / 'ASHRAE' standards or approved equal and as per site requirements. All tests shall be recorded in the format approved by the Department.

**ELECTRICAL EQUIPMENT:**

All electrical equipment shall be cleaned and adjusted at site before connection of power. The contractor, as per relevant IS/IE rules shall carry out the following minimum tests.

1. Wire and Cable continuity tests:

Insulation resistance test, phase to phase and phase to earth and phase to neutral on all circuits and equipment, using a 1000Volt Megger. The earth resistance between conduit system and earth must not exceed half (0.5) OHM.

2. The phase rotation tests.

Operating tests on all protective relays to prove their correct operation before energizing the main equipment including secondary injection test at site. Operating tests on all starters, circuit breakers, etc.

**ANNEXURE - VII**  
**CONCEPT & DESCRIPTION**

**1. INTRODUCTION:**

The Director, CDFD desires to “Retrofit Works for Relocation of LT Substation Switchgear Including Cables Etc,SITC of Substation Panels and Its Associated Material &Works At CDFD Campus ,Site ‘A’UPPAL, Hyderabad”..

In recent past heavy rainstorms / floods, the rain water was stagnated in HVAC Plant Room and LT panels Room up to 3 to 3 ½ feet level. Electrical MCC panels and HVAC equipment partly submerged in water and due to which total CDFD campus was power failure and HVAC system was in halt for more than 15 Days.

To overcome these unforeseen eventualities and considering site constraints, planning to elevate the LT panels & HVAC related equipment minimum of 3 feet height from existing location by providing civil masonry structure / MS super structure in designated locations and those shall be specified in enclosed schematic layout.

**2. PURPOSE OF PROVIDING INFRASTRUCTURE:**

- a. To protect the electrical panels, circuit breakers and live cables from electrical hazards.
- b. To protect HVAC related equipment from stagnated flood water and ensure HVAC system uninterrupted operation.
- c. Reliability of the system.
- d. Provide aesthetically good, maintenance and operation friendly layout.

Retrofit works comprise of

Electrical:

1. Decommissioning of LT Electrical panels at Cellar Substation in Main Lab Building.
2. Laying temporary power supply cables from sub-station/ DG set to one of LT panel to operate HVAC system partially to take care of critical areas/ labs air-conditioning.
3. Removing cables terminations and cables from the existing LT Substation LT electrical panels and shifting panels from existing location for providing MS structure at proposed new LT Substation.
4. Providing suitable MS super structure of 4 feet height in existing panels location.
5. Shifting and Lifting of electrical panels over MS structure.

6. Pulling cables into inside panels and re-termination of cables.
7. Providing MS structure and chequered plate platform in front of panels for operation & maintenance purpose.
8. Commissioning and testing of LT panels.

HVAC:

1. Providing of suitable MS super structure of 3 feet height in existing panels location for installing Electrical starter panels.
9. Shifting and Lifting of electrical panels over MS structure.
10. Shifting and lifting of electrical panels over RCC/ MS structure.
11. Pulling cables into inside panels and re-termination of cables.
12. Providing MS structure and chequered plate platform in front of panels for operation & maintenance purpose.
13. Commissioning and testing of Electrical starter panels.

**3. DESCRIPTION:**

To fulfil this requirement, the following civil masonry structure, MS super structure and retrofit works shall be envisaged:

- a. Civil masonry structure with RCC proposed for Main Electrical Panel Room . Civil masonry structure shall be made by digging pits of suitable size depth not less than 5 feet, excavating the soil, making footings with suitable size, cement concrete shall be reinforced with adequate dia. & quantity TMT steel rods, cement, sand and gravel mortar to bear heavy equipment static & dynamic loads.
- b. MS super structure proposed for all stationary electrical panels and associated stationary equipment installation. MS structure with chequered plate platform proposed for accessing equipment by service personnel. MS structure shall be made with adequate size MS 'C' channels, 'L' Angles, flat base plates, Chequered plates, MS pipes for railing and Anchor fasteners.
- c. Lifting and shifting of heavy equipment, Electrical panels and associated ancillary equipment shall be carried out in safe manner by crane, hydra, tripod and other suitable and approved method along with competitive riggers. The electrical panels should not be damaged during the shifts, if any damaged, the Contractor will be held responsible and has to replace such damaged parts without claiming any additional cost.



**TECHNICAL SPECIFICATION –ELECTRICAL  
SERVICES WORKS.**

## CHAPTER-1

### SCOPE OF WORK AND TECHNICAL SPECIFICATION – GENERAL SPECIFICATION OF ELECTRICAL SERVICES WORKS.

#### 1.1 SCOPE OF WORK

##### 1.1.1 SCOPE

- a) Scope of the contractor (Single Vendor/ Contract (Construction Contractor ) means construction contractor shall include but not limited to design, manufacture, assembly, testing at manufacturer's works, supply & delivery, properly packed for transport F.O.R.(Freight on Road) site, of all equipment, system and accessories, steel structures, air-conditioning and ventilation, complete and efficient erection, site testing, commissioning, putting into successful commercial operation and handing over the **“FOR “RETROFIT WORKS FOR RELOCATION OF LT SUBSTATION SWITCHGEAR INCLUDING CABLES ETC, SITC OF SUBSTATION PANELS AND ITS ASSOCIATED MATERIAL & WORKS AT CDFD CAMPUS ,SITE ‘A’UPPAL, HYDERABAD”**.
- b) **Electrical Panels in Chiller Room. (EXISTING)**
- i) **Emergency Panel-(5.5 X 1.2) Meters.**
  - ii) **AHU-3 Panel for Basement Wing C -(2.1 X 0.4) Meters.**
  - iii) **Power Saver-(1 X 0.3) Meters.**
  - iv) **Main AC Panel for Plant Room-(4.3 X 1.2 ) Meters.**

Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of all the above Existing **Electrical Panels in Chiller Room** indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 5 mtr radius and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on New MS Platform of 1 Meter Height as per Site requirement to the location shown by the user in the Chiller Room Area as per the safety Guidelines and as per the Direction of the client.

- c) **LT Substation in Cellar Main Building (13.8 X 7.9) Meter. (EXISTING)**
- i) **Main PCC Panel-(10.8 X 1.3) Meters**
  - ii) **450KVAR APFC Panel-1-(2.8 X 0.8) Meters**
  - iii) **450KVAR APFC Panel-2- (2.8 X 0.8) Meters**
  - iv) **APFC Panel-3No's-(1.2 X 0.8) Meters**
  - v) **HVAC Panel for Animal House-(0.65 X 0.65) Meters**
  - vi) **Change Over Panel-(1.8 X 0.8)**
  - vii) **Animal House & Lift Panel-(1.9 X 0.6) Meters**

Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the All the above Existing Panels located in **LT Substation in Cellar Main Building** indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on New MS Platform of 1 Meter Height in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user & as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.

- d) Scope of Electrical Installation (Supply, Installation, Testing and commissioning).
- (i) Temporary Construction Power Supply LT Panel has to be designed as per the IEC 60439 Standards only.
  - (ii) Routing of LT cables from Existing Substation 33KV/433V, Transformer and DG Synch Panel to New Temporary Construction Power Supply LT Panel located near CDFD LAB Area Building.
  - (iii) For Existing Directly Buried Cable Trenches ((20 X 1.2) Meters from LT Electrical Panel Room Located in Cellar area of Main Building (13.8 X 7.9) Meters to Pavement Area - Already existing road has to be dug up, excavated and existing cable to be removed which are underground laid .The existing underground cable trench is of (20 X 1.2) meter below Road. After removal of all cables the back filling of soil in the Trench and leveling it to the pre- existing road level has to be done and Road has to be complete remade as it is as it was earlier.
  - (iv) For Existing Directly Buried Cable Trenches (85 X 1.2) Meters from Pavement area located after the road next to LT Electrical Panel Room Located in Cellar area of Main Building (13.8 X 7.9) to the substation area- Total 85 meter length next to pavement area complete excavation removal of the existing cables, back filling of soil in the Trench and leveling it to the pre- existing pavement level and making sure that it is being remade as it is was earlier will be planned and same will be incorporated in the scope of work.
  - (v) For Existing Directly Buried Cable Trenches (65 X 1.2) Meters from Gravel filled area located around the Substation Area to the substation office area crossing Transformer Yard - Total 65 meter length complete excavation removal of the existing cables, back filling of soil in the Trench and leveling it to the pre- existing pavement level and making sure that it is being remade as it is was earlier will be planned and same will be incorporated in the scope of work.
  - (vi) LT substation in cellar main building (13.8 X 7.9) meters existing rolling shutter and wall height of more than the 2 feet has to be dismantled in order to remove all panels from existing electrical room which are being shifted in the New Electrical Panel room proposed near Visitors Parking next to the Security office.
  - (vii) Directly Buried Cable Trench The Cable laying inside the cable Trench, Digging, Excavation, refilling including sand laying, Brick laying for complete length/Width of Trench of (Width= 1200mm, Depth =750mm) 1.1KV LT Cable Trench for 180Meters.Wherever there is a road crossing while laying the cable, proper concrete Slab formation should be done on top of the Road Crossing as per the site condition for the vehicle movement by the Electrical contractor. (Refer Tentative Layout enclosed for your information.)

- e) **The Bidder's scope shall include the equipment, structures, buildings, facilities, and services listed (but not limited to) below:**
- (i) Indoor and outdoor Illumination System including lighting poles, panels, fixtures, cables, wires, conduits, junction boxes and all other accessories.
  - (ii) Power & control cables including all accessories, cable trays and hardware required for laying and termination.
  - (iii) Supporting steel structures for Substation equipment etc.
  - (iv) Special maintenance tools and tackles.
- f) Any other items not specifically mentioned in the specification, but which are required for completeness of Supply, Erection, Testing and Commissioning and Satisfactory Operation are deemed to be included in the Scope of the Specification for both Electrical and Civil Works.
- g) The complete design and detailed engineering shall be done by the Bidder based on the specification. Scope includes submission of general arrangement drawings, detailed design technical particulars, wiring and termination schedules, civil design inputs and other relevant drawings & documents required for engineering of all facilities to be provided under this contract. Complete details of the design & engineering requirements are spelt out in section.
- h) Bidders are advised to visit the sites and acquaint themselves with the topography infrastructure of the Project. Bidders should make themselves aware of the Site condition and they should understand 100% complete scope of work and extent of planning which has to be done from their end.

### 1.1.2 EXCLUSIONS

- a) NIL.

### 1.1.3 BASIC REFERENCE DRAWINGS

- a) The drawings and details provided in Annexure A Chapter enclosed with the bid documents are for reference only and shall be considered as basic inputs.

### 1.1.4 GENERAL REQUIREMENTS

- a) Project site data is indicated in enclosed with this specification.
- b) All the equipment and accessories covered under this specification shall be designed, manufactured, and tested in accordance with the latest revision of the standards mentioned under respective sections.
- c) The work shall be carried out in the best workman like manner in conformity with relevant specifications / code of practices of the Bureau of Indian Standards. In addition, work shall also confirm to the requirements of latest editions / amendments of the following:-
  - (i) Indian Electricity Act and Rules framed there under.
  - (ii) Fire Insurance Regulations.

- (iii) Regulations laid by the office of the Chief Electrical Inspector to Government.
  - (iv) Any other regulations laid down by the local authorities.
- d) Makes of all electrical equipment and accessories are subject to prior approval by the Consultant/Employer.
  - e) Similar equipment and components shall be of same make. Equipment's of same type and rating shall be interchangeable.
  - f) Bidder shall supply and install electrical equipment as per regulations of the local electrical inspectorate / statutory body for electrical installation. Bidder shall be responsible for getting all the necessary clearances from electrical inspector.
  - g) The Bidder shall be responsible for safety of personnel and equipment during the working. It will be the responsibility of the Bidder to co-ordinate and obtain Electrical Inspector's clearance before commissioning. Any additional items, modification due to observation of such statutory authorities shall be provided by the Bidder at no extra cost to the Consultant/Employer.
  - h) The equipment shall be suitable for outdoor application and shall be suitable for the application. Electrical Equipment selection shall be based on ambient temperature of 50 deg. C.
  - i) All the equipment offered shall be type tested & proven on prototype of same specifications. All routine tests & acceptance tests shall be carried out as per relevant IS in the presence of Consultant/Employer.
  - j) Bidder to furnish Field Quality plan for execution of works.
  - k) Bidder to note that power supply requirement for execution of works will be provided at one point only. Further distribution, conversion etc. as required shall be the responsibility of the Bidder.
  - l) Completion of works within / before stipulated time is the essence of the Project. Strict adherence to time schedule to be maintained for completion of Job.

## 1.2 CODES AND STANDARDS

**1.2.1** The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant Indian Standards as Specified in the Individual Section.

**1.2.2 Standards for Electrical Works:-**Design of electrical installation shall be carried out based on national electrical code (NEC) relevant IS: codes and as per rules and regulation of Indian Electricity rules requirement of the local electricity supply Authority and conforming to MES specifications. All equipment and material shall comply with appropriate Indian Standards (latest) or National Standards of the country of origin provided the later are equivalent to do better than the former. For items for which Indian Standards are not published, National standards shall be acceptable. Items for which Indian standards or National standards are not available the best and established Industry practices shall be acceptable, however, in all such cases prior approval of the Engineer shall be obtained. Works shall be carried out in the best workmanship manner in conformity with these specification/codes of practices of the Indian standards institution. In case of any contradictions, stipulations under these specifications shall govern. The various standards to be referred are as appended below:-

(a)	IS 2516	AC circuit breaker requirements voltage not exceeding 1000 V.
(b)	IS 2147	Degree of protection provided by enclosures for low voltage switchgear and control gear.
(c)	IS 4237	General requirements for switchgear and control gear for voltages not exceeding 1000 V.
(d)	IS 4017	Heavy duty air-break switches and fuses for voltages not exceeding 1000 V.
(e)	IS 2208	HRC Cartridge fuse links upto 650 V.
(f)	IS 2705	Current Transformers
(g)	IS 3156	Voltage Transformers.
(h)	IS 1248	Electrical indicating instrument.
(j)	IS 375	Marking & arrangement of switchgear Busbars.
(k)	IS 6875	Control switches & push buttons
(l)	IS 5082	Material data for Aluminum Bus Bars.
(m)	IS 3618	Pre-treatment of MS sheets for phosphating.
(n)	IS 13947 (ALL)	Specification for low voltage switchgear & control gear
(p)	IS 8623	Specification for low voltage switchgear & control gear assemblies
(q)	IS 3231	Relays
(r)	IS 4064	Switches, dis-connectors, switch dis-connectors, fuse combination units
(s)	IEC 60947 (All)	Specifications for low-voltage switchgear and control gear
(t)	-	Indian Electricity Act and Indian Electricity Rules
(u)	-	Fire Insurance Authority Regulations

### 1.2.3 Climatic Particulars/Service Conditions

- |    |  |             |
|----|--|-------------|
| a) | Maximum ambient air temperature (in shade)     | 45° C       |
| b) | Maximum ambient air temperature (under sun)    | 50° C       |
| c) | Minimum ambient air temperature                | 16° C       |
| d) | Maximum daily average ambient air temperature  | 35° C       |
| e) | Maximum yearly average ambient air temperature | 30° C       |
| f) | Altitude above M.S.L.                          | Up to 542M. |

### 1.2.4 SWITCHYARD LAYOUT REQUIREMENTS

- The switchyard shall be provided access ways for all electrical equipment.
- The cable trenches for the equipment shall be run as close to their foundations as possible even preferably touching.
- Fencing shall be earthed as required by relevant rules.

### 1.2.5 The switchyard shall be generally designed on the basis of following standards and codes:

- Symmetrical Short circuit rating:-The three phase symmetrical short circuit ratings of the switchgear at different voltage levels shall be as indicated in the Table below:

SL.No.	Voltage level	Symmetrical Breaking Capacity	Making Capacity
i)	415 V	50 kA	125 kA
ii)	220 V DC	Min.20 kA	--

- b) The rated short circuit withstand duration for 220kV and 415V shall be 1 sec.  
c) Degree of Protection

SL No	Equipment	Degree of Protection
i)	Marshalling Boxes, Panels, motors located Outdoor	IP 55
ii)	LT Switchgear	IP 52
iii)	Motors located indoor	IP 54

- d) All the electrical equipment shall be designed for 50 deg. C reference ambient temperature.

### 1.3 Loading criterion:-

**1.3.1** For the layout proposed by the Bidder the adequacy of the cantilever strength specified shall be checked considering the following factors of safety:

- Sum of all permanent normal loads (wind load on tubular bus + wind load on stack + dead weight of the tubes) = 2.5.
- Combination of all normal loads plus either short circuit or earthquake load whichever is higher.
- The switchyard shall be designed for the seismic coefficient and wind pressures as indicated elsewhere in the specification.

### 1.4 Grounding and Lightning Protection:-

**1.4.1** The requirements for the Grounding and Lightning Protection system are given below:-

- Non - current carrying metal parts of all electrical equipments like motors, transformers, circuit breakers, isolators, CTs, PTs, lightning arrestors etc. switchgears shall have duplicate ground connections.
- All exposed conductive parts of plant and equipment; control cubicles, valve actuators, cable glands & armour etc. shall be effectively earthed. All extraneous conductive parts such as structural steelwork, cable support steelwork, steel tanks and pipe work, compound and station perimeter, fences, gates etc. shall be effectively bonded to the earthing system.
- All non-current carrying structural shall be grounded at one point and all the electrical devices / equipment shall be grounded at two distinct points. A separate instrument earth network shall be provided, single point connected to the main earth system, to which all alarm, control, computer, instrument etc, earth connection shall be made. Instrumentation cable screens shall be single point bonded to the instrument earth network to minimise the effects of electrical interference.
- The lightning protection of the switchyard and control building, shall be done as per IS guidelines and codes of practice for lightning protection and connected directly to the main ground grid.
- Earthing system shall be designed as per IEEE-80 / IS – 3043.

- f) Lightning protection system shall be designed as per IS – 2309.

## 1.5 TESTING AND COMMISSIONING

**1.5.1** The consultant shall witness all the below mentioned Tests and provide a certificate for the same. The consultant shall also list the value obtained during the test and checking the acceptability of Test Result.

- a) Shop Testing:-All equipment and accessories shall be subjected to routine and acceptance tests as laid down in relevant standards and elsewhere in this specification.
- b) Test Witness:-Tests shall be performed in presence of Consultant/Executive Engineer, if so desired by the Consultant/Employer. The Consultant/Executive Engineer representatives shall be given full access to all tests. The Bidder shall give at least 2 weeks advance notice. Prior to giving test notice, the Bidder should have taken full approval of drawings / Technical data etc. and have furnished the particulars of proposed tests and procedures for conducting the tests and obtained Consultant/Employer approval.
- c) Type test certificates for all tests as required by relevant standards, carried out on identical equipment shall be furnished by Bidder immediately after placement of order. In the event, valid type test report viz. test reports for tests conducted within 5 years from date of order and conducted at reputed national / international test houses is not produced, type test shall be carried out by the Bidder without any implications on PLL.
- d) If identical equipment as offered has not been type tested, the same shall be performed. There shall be no extra cost / claim on this account at a later date for conducting the test.
- e) Test report in required number of copies shall be submitted for Consultant/Employer approval, prior to dispatch. No dispatch shall be made unless written approval of the report is issued and clearance for dispatch is given.
- f) The testing of all electrical equipment as well as the system as a whole shall be carried out at site to ensure that the equipment and its components are in satisfactory condition and will successfully perform its functional operation. The inspection of the equipment shall be carried out to ensure that all materials, workmanship and installation conform to the accepted design, engineering and construction standards as well as accepted codes of practice.
- g) All tests shall be carried out by the Bidder using his own instruments, testing equipment as well as qualified testing personnel.
- h) The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalization of the contract.
- i) At site all equipment shall be energized only after certification by the personnel performing the test that the equipment is ready for energizing and with concurrence of the Consultant/Employer.
- j) The various commissioning checks / tests to be carried out on the various equipment shall be in accordance with details indicated in respective sections.
- k) The following tests shall be carried out at site during commissioning.
  - (i) Check for physical damage.
  - (ii) Visual examination of zinc coating / plating.
  - (iii) Check from name plate that all items are as per order / specification.
  - (iv) Check tightness of all bolts, clamps and connecting terminals using torque wrenches.
  - (v) For oil filled equipment, check for oil leakage, if any. Also check oil level and top up wherever necessary.
  - (vi) Check cleanliness of insulator and bushings.



- (vii) All checks and tests specified by the manufacturers in their drawings and manuals as well as all tests specified in the relevant code of erection shall be performed.

**1.6 PAINTING:-**Painting shall be carried out by seven-tank process. After preparation of the under surface the switchgear shall be powder coated with epoxy based paint of shade 631 of IS-5.

### **1.7 QUALITY ASSURANCE TESTING AND INSPECTION**

- 1.7.1** Equipment offered shall be of type tested and proven type. All the routine tests shall be conducted as per relevant IS standards and shall be performed in the presence of Consultant/ Employer/ User representative, if so desired by the Consultant/Employer. The Vendor shall give atleast 1 month advance notice of the date when the tests are to be carried out.
- 1.7.2** Test reports of the various tests conducted at the time of inspection shall be furnished by the contractor and submitted to the consultant, The consultant shall certify the Test Reports as per the laid down standards.
- 1.7.3** Type test certificate of any equipment shall be furnished if so desired by the Consultant/Employer otherwise, the equipment shall have to be type tested, free of charge, to prove the design.
- 1.7.4** Type Test report shall be verified and certified by the Consultant.
- 1.7.5** In absence of such type tests certificates or in case such certificates are not found to be meeting the relevant standard requirements, vendors shall conduct all such tests according to relevant standards free of cost to Employer and reports shall be submitted to Consultant/ Employer for approval.
- 1.7.6** Various sub-vendor items shall be only from approved sub-vendors. All the sub-vendor items shall be type tested design.
- 1.7.7** For the various brought out items routine and type test certificates from equipment manufacturers shall be furnished.
- 1.7.8** List of the Equipment for which the test report shall be submitted are as follows:-
- a) Indoor and outdoor Illumination System including lighting poles, panels, fixtures, cables, wires, conduits, junction boxes and all other accessories.
  - b) Power & control cables.
  - c) Cable trays.

### **1.8 PACKING & DELIVERY**

- 1.8.1** The vendor shall arrange transportation of all equipment from the point of manufacture to the site. The arrangements shall include, but not be limited to determination of routes, required permits payments of required taxes & duties & notification to the Consultant/Employer.

### **1.9 PERFORMANCE GUARANTEE**

- 1.9.1** Bidders shall guarantee that equipment offered shall meet the requirement as stipulated in this specification and as confirmed by them in technical data sheet. In case, the performance of equipment offered at site is not as per the performance guarantee the Bidder will have to replace the equipment at site free of cost and without impacting the complete schedule.

### **1.10 O & M MANUAL**

- 1.10.1** O & M manual for installation, operation and maintenance of the equipment shall be furnished before dispatch of equipment.

### **1.11 DOCUMENTATION-(DRAWINGS FOR APPROVAL)**

- 1.11.1** The Complete list of documentation requirements are given below:-
- a) The complete design and detailed engineering shall be done by the Bidder based on conceptual tender drawings. Design of Switchyard includes preparation of single line diagrams and electrical layouts, erection key diagrams, electrical and physical clearance

diagrams, design calculations for Earth mat, Lightning Protection. Control and protection schematics, wiring and termination schedules, Cable trench / tray layout, Drawings and design of Structures, and other relevant drawings & documents required for engineering of all facilities to be provided under this contract, are covered under the scope of the Bidder. The Bidder shall furnish drawings as indicated in technical specification for each item for approval of the Consultant/Employer according to agreed time schedule. The Consultant shall verify and certify each drawings/documentation and calculations supplied by the contractor

- b) Bidder shall furnish, if requested, additional drawings, calculations, information to the Consultant / Consultant/Employer to enable him to examine / study the drawings for approval.
- c) If incomplete drawings / documents not meeting the Consultant's requirements are sent, the responsibility for any delay in approval shall be that of Bidder.
- d) Handing over of all the documents in editable format in the compact disc along with a set of hard copies as specified elsewhere.
- e) Drawings & document listed are minimum requirement only. All other necessary write-up, control schemes shall be submitted.
- f) Bidder may note that nothing in this specification shall be construed to relieve their responsibility for design, manufacture, testing & performance of switchyard equipment.
- g) Where drawings are returned to the Bidder with comments, the Bidder shall re-submit the revised drawings for approval.
- h) If any subsequent alterations are found necessary and approved by the Consultant / Consultant/Employer, all drawings and data affected by such alterations shall be duly revised and re-submitted for the approval as said above without any cost implication.
- i) Bidder shall be responsible for correctly incorporating all the points conveyed to him and re-submit the drawings to the Consultant/Employer for final approval.
- j) If the Bidder is unable to incorporate some of the comments, such non-compliance shall be clearly stated in a forwarding letter with reasons without delay. However, it shall be Consultant/Employer/ his Consultant's discretion to accept or reject the non-compliance.
- k) Work shall be carried out exactly as indicated on the approved drawings and data and no alterations shall be made without the written approval of the Consultant / Consultant/Employer.
- l) Approval of drawings by Consultant/Employer shall not relieve the Bidder of his contractual obligations and responsibility for engineering, design, workmanship, materials and performance of the equipment.

**1.11.2 The Detailed design shall include, but not limited to.**

- a) Single Line Diagram.
- b) Electrical Control Room layout & section drawings.
- c) Complete Guaranteed Technical Particulars.
- d) Cable trench / tray layout in switchyard area & switchyard control room with        sections.
- e) Cable tray arrangement outside switchyard.
- f) Design calculations & GA drawings for steel structures.
- g) Underground earth mat layout & design calculation.
- h) Lighting layout drawing (indoor & outdoor) with calculations.
- i) Power & control cable sizing calculations and schedule.
- j) Switchyard control room panel / equipment layout.
- k) GA drawings of all equipment.
- l) Scheme wiring and terminal details of all equipment.
- m) Type test certificates of all equipment.
- n) Technical leaflet.
- o) Generation of all data from soil investigation and topographical survey, Evaluation of foundation parameters preparation and submission of design basis with criteria and information required for approval, for the completion of the switch yard and control room work.

- p) Design and analysis of towers and their foundations, equipment supporting structures and their foundations, cable trenches, buildings etc, submission of design report with calculations for approval with all necessary documents, catalogues etc.
- q) Preparation and submission of all civil assignment drawings (Layout, Architectural and structural) required for the complete engineering of civil works, by others. Sufficient detailing shall be done in all drawings so that no difficulty is faced by site engineers during execution.
- r) Bill of material.
- s) Detailed erection & commissioning procedures.
- t) Write up on Control and Operation Philosophy.
- u) O&M manual.
- v) Routine test, type test, special test certificate.
- w) Quality assurance plan (QAP) indicating Employer's Review, Witness and Hold point.
- x) Any Other specific document / drawing required by Consultant/Employer / Government Agencies.

### **1.11.3 As Built Drawings: -**

- a) All the drawings / documents supplied by the Bidder for Consultant/Employer comments / approval, if required, shall be revised / modified, after Consultant/Employer approval, to incorporate all the modifications / changes necessitated at various stages of execution of contract viz.
- b) During inspection & testing at works and site.
- c) During erection, commissioning of individual equipment.
- d) During integrated commissioning of total system.
- e) Due to changes in associated connecting equipment not supplied by the Bidder (based on the information furnished by the Consultant/Employer / Consultant) Bidder shall furnish as-built drawings required for normal operation, maintenance, testing of all equipment in specified number of copies. All the approved drawings, manufacturer's drawings, installation drawings are included in as-built drawing.

## **1.12 Documents and Test Reports**

### **1.12.1** The Complete list of documents and Test requirements are given below:-

- a) Bidder shall furnish any relevant calculations asked for. It shall also contain the manufacturer's catalogues, operation and maintenance manuals etc.
- b) Bidder shall furnish bound volumes of copies of factory routine and type test certificates for all equipment.
- c) After completion of site testing of all the equipment, Bidder shall furnish the site test results of all equipment to the consultant. The Consultant shall also certify and verify the test results and recommend observations. This shall also clearly indicate the rectifications carried out during testing in case site test results vary very widely with factory test results. Commissioning engineer's and Consultant /Employer/TPA observations shall be clearly indicated against corresponding equipment, identified by manufacturer's serial numbers.
- d) Bidder shall furnish bound volume indicating list of spares supplied for each equipment. The volume shall contain manufacturer's catalogue number of components with description. It shall also indicate precautions to be taken for storing.
- e) All the Test Report Shall be from NABL Accredited Labs only.
- f) All the Test equipment's which would be used for conducting the test shall have valid calibration from NABL accredited Lab.

### **1.12.2 Operation, Instruction and Maintenance Manuals / Catalogues Instructionmanual shall give step by step procedure for**

- a) Erection, testing and commissioning

- b) Operation
- c) Maintenance and
- d) Repair

**1.12.3 Instruction manual shall also contain:**

- a) List of spare parts with ordering specification and manufacturer's catalogues
- b) List of consumables with specifications, brand names and annual consumption figures.
- c) Drawings relevant for erection, operation, maintenance and repair of the equipment.
- d) Procedure for ordering spares.

**1.12.4 Bidder shall submit the following drawings / data / documents in specified number of copies and reproducible prior to handing over the installation to the Consultant/Employer.**

- a) All drawings approved by Consultant/Employer.
- b) Equipment manufacturing drawings submitted for information to Consultant/Employer.
- c) Equipment drawings required for operation and maintenance.
- d) Inspection reports, factory and site test certificates in bounded volume.
- e) As built drawings incorporating all site modifications.
- f) Instruction manuals and catalogues.
- g) List of spares.

**1.12.5 Number of Copies:-**The Bidder shall submit drawings, documents AS BUILT drawings, instruction manuals etc. in following number of copies to the Consultant/Employer.

a)	For approval / re-submission for approval	8 copies
b)	After approval	8 copies
c)	As built drawing	8 copies + soft copy
d)	O & M manuals, equipment and system	2 sets to Consultants &
e)	Catalogues, factory & site test certificates	8 sets to Consultant/Employer
f)	volume and list of spares volumes	

**1.13 UTILITY CONSUMPTION LIST**

**1.13.1 Bidder shall furnish requirements for the following utilities:**

- a) Construction electrical power requirement - Power, Voltage, Current.
- b) LV AC power requirement for the switchboard - Power, Voltage, Current.

**CHAPTER-2****TECHNICAL SPECIFICATION FOR LT PANEL BOARDS****2.1 Scope:**

2.1.1 This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, Wooden packed for transportation complete in all respects with all components, fittings and accessories for efficient and trouble-free operation.

**2.2 General Information:**

2.2.1 The equipment's shall be designed, manufactured and equipped with accessories in accordance with this specification and the applicable codes standards indicated below. Materials and components not specifically stated in this specification, but which are necessary for satisfactory and trouble-free operation and maintenance of the equipment shall be supplied.

2.2.2 The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance and service life as specified herein.

2.2.3 Switchboards shall be suitable for an ambient temperature of 45 C.

**2.3 Codes and Standards:**

2.3.1 The equipment covered by this specification shall unless otherwise stated be designed, constructed and tested in accordance with the requirements of the Indian Electricity Act and Rules and latest revision of the following standards.

<b>Ref. Standard</b>	<b>Standard Title</b>
IEC 60439	Low voltage switchgear & control gear assemblies
IEC 60529	Degrees of protection provided by enclosures
IEC 60529 / IS 2147:1962	Degree of Protection of Enclosures for Low voltage switchgear
IEC 60044-1	Current transformers
IEC 60186	Voltage transformers
IEC 61140	Protection against electric shock
IS 1893-1	Criteria for Earthquake Resistant Design of Structures
IS 11353 1985	Guide for uniform system of marking Identification of Bus bar and Terminals
IEC 60085:2007	Distinguishes between thermal classes for electrical insulation systems and electrical insulating materials
IS 5082	Electrolytic Aluminium Bus bar, Trunking system, Rod tubes & sections for Electrical Purposes.

IS 694:1990	PVC insulated cables for voltages including 1100 V with Copper and Aluminium Conductor.
IS 13779 1999	AC Electric Meters / Static Meters
IS 13947 1993	General requirements of Switchgear and Control Gear for Voltage not exceeding 1000 / 1200V AC.
IEC 61921	Power capacitors – Low voltage power factor correction banks
IEC 60831-1 & 2	Shunt power capacitors of the self-healing type for A.C. systems having a rated voltage up to and including 1000 V.
IS 16636: 2017	Automatic Power Factor Correction (APFC) Panels for Voltage rating up to and including 1000V.
IEEE 693	Environmental testing/ Seismic Withstand Level
IEC 60664-1	Insulation coordination for equipment within low-voltage systems.

#### **2.4 Scope of supply under this specification / contract:**

2.4.1 As per Schedule of Quantities enclosed.

#### **2.5 Equipment/scope excluded from this specification / contract:**

2.5.1 All concrete foundations.

#### **2.6 Design requirement:**

- 2.6.1 The switchboards shall be designed for 415 V, 3 phase, 4 wire, 50 Hz AC supply.
- 2.6.2 Switchboards shall be rated for minimum fault level as mentioned in data sheets / Drawings.
- 2.6.3 The control power supply of the switchboards shall be 240 V, 1 Phase, 50 Hz AC supply tapped from the respective module itself.
- 2.6.4 The switchboards manufacturers shall apply all de rating factors necessary to all components of the switchboards to comply with the conditions detailed in this specification.
- 2.6.5 The ratings of motors, control-gears, Circuit Breakers etc. furnished in the drawings are for tender purposes only. Any changes in the above will be intimated at the time of placement of purchase order or before fabrication of panels.
- 2.6.6 The panels shall be fully bolted modular in construction for all incoming & outgoing compartments.

**2.7 Constructional features:**

- 2.7.1 The LV switchboards shall be as per the standards IEC 60439 CPRI tested. The switchboards and the associated equipment including switchgear, control gear, Busbar supports, Busbar orientation, Busbar links etc shall be identical in construction to the assembly which has undergone the type test. The drawings of the type-tested assemblies shall be made available for inspection.
- 2.7.2 The switchboard shall be of the totally metal enclosed, floor mounted, free standing, Indoor cubicle type of bolted design made of Galvanized iron (GI) Sheet steel, no welding frame to be considered. The load bearing members, doors and covers shall be made of 14SWG CRCA sheet not less than 2mm thickness.
- 2.7.3 This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker cassettes, molded case circuit breakers, main horizontal bus bars, vertical risers and other front mounted accessories.
- 2.7.4 The switchboard shall be fully compartmentalized as per form 3b construction with metallic shrouding only, FRP is not acceptable.
- 2.7.5 All the panels are dust and vermin proof protection, the degree of protection being not less than IP 54 for indoor and IP – 55 for outdoor application.
- 2.7.6 Readily extensible on both sides by the addition of vertical sections after removal of the end covers.
- 2.7.7 Provided front access to the feeders, bus bars and rear access to cable termination, cable alley etc.
- 2.7.8 The structure shall be mounted on a 75 x 40 x 5mm 'C' ISMC channel. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.
- 2.7.9 Each compartment shall be provided with a hinged door interlocked with switch/breaker housed inside the compartment so that door cannot be opened unless the switch/breaker is in 'OFF' position.
- 2.7.10 A cable chamber of minimum width 300 mm shall be provided for the cable end connections of power/control cables. The design shall ensure generous availability of space for ease of installation and maintenance of cables and adequate safety for working in one vertical section without having accidental contact with other live parts in adjacent section.
- 2.7.11 A cover plate at the top of the vertical section, provided with a ventilation hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.
- 2.7.12 Front and rear doors shall be fitted with tight gaskets with easy operating type fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The doors shall have concealed hinges. Removable screwed covers shall be provided on the rear of the cubicles.
- 2.7.13 A set of horizontal main bus bars shall be provided at the top or bottom as required. The



vertical bus bars shall be housed in separate fully enclosed chamber of min. width 300 mm and accessible from front and shall be tapped off from main horizontal bus bars.

- 2.7.14 All incoming/outgoing terminals of the individual feeders shall be provided with insulated shrouds to avoid accidental contact with live parts.
- 2.7.15 The height of the panel should not be more than 2275 mm. The working height shall be limited to a maximum height of 1800 mm and a min. height of 300mm from FFL. The total depth of the panel shall be adequate to cater for proper cabling space. Panels arranged side by side or in same room shall have same height and depth.
- 2.7.16 All switches, push buttons etc. shall be operatable from the front and shall be flush /semi-flush mounted. The apparatus and circuits shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary degree of safety.
- 2.7.17 Apparatus forming part of the switchboards shall have the minimum clearances as per relevant IS standards. Clearances shall be maintained during normal service conditions. Creepage distances shall comply to those specified in relevant standards.
- 2.7.18 All Bus bar insulating material shall be of DMC/SMC to withstand the effects of high humidity, high temperature, tropical ambient service conditions etc.
- 2.7.19 Foundation bolts and nuts for each panel shall be supplied along with the respective switchboard.
- 2.7.20 The lifting eyes for each shipping section and danger notice plates shall be provided for each switch boards.
- 2.7.21 Functional units such as circuit breakers and fuse switches
- 2.7.22 Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:
- 2.7.23 Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
- 2.7.24 Cable terminations of one functional unit, when working of those of adjacent unit/units.
- 2.7.25 All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
- 2.7.26 All the switchboards shall have permanent earthing strip provision for earthing panel frames and all metal parts of the switchgear by independent connection.

## **2.8 Metal treatment and finish:**

- 2.8.1 All surface to be painted including interior and exterior of panels, and other metal parts shall be chemically treated to remove all rust, scale, grease and other adhering foreign matters. All parts shall be Power coated. The finish shall be mat finish.
- 2.8.2 The complete treatment, painting, and drying with compressed air operations shall be done in dry and dust free atmosphere.
- 2.8.3 Should finished paint chip off or crinkle during transit/handling/installation, the contractor shall arrange for repainting the equipment at site at his own cost.

## **2.9 Bus bars:**

- 2.9.1 The bus bars shall be air insulated and made of high conductivity, Aluminum Conductor,



complying with the requirements of grade E91E of IS 5082 and suitable for 415 Volts, 4 wire 50 Hz system.

- 2.9.2 The bus bars and connections shall be suitably supported/ braced with non-hygroscopic DMC / SMC supports to provide a fault withstand capacity as specified.
- 2.9.3 High tensile bolts and spring washers shall be provided at all bus bar joints.
- 2.9.4 The bus bars shall be liberally sized and shall have uniform cross section throughout and shall be capable of carrying the rated current at 415 V continuously. The bus bars shall be designed to withstand a temperature rise of 45°C above the ambience. A current density of 0.8 Amps / Sq.mm. shall not be exceeded for sizing of Aluminum bus bars.
- 2.9.5 All bus connections, joints and taps shall be short and as straight as possible and applied with contact grease in the mating surface.
- 2.9.6 The main horizontal bus bars shall be run through the entire length of the panel and shall be accessible for maintenance from the front as well as rear. The bus bar chamber shall have separately screwed covers. All bus bars, links etc. shall be provided with an insulating cover to prevent accidental contact. The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars.
- 2.9.7 Bus bars shall be encased in color coded heat shrunk PVC sleeves (snug fit type). An aluminum earth bus of size not less than 40 x 10 mm shall run through the length of switch boards at top or bottom as required.

#### **2.10 Circuit breakers:**

- 2.10.1 Circuit breakers shall be Triple pole/Four Pole, Air Brake, Electrically/Manually operated horizontal draw-out type with suitable Protection release as specified in specification documents.
- 2.10.2 The breakers shall comply with the requirements of IEC 60947-1/2/4 & IS 13947 (Parts II & II/Sec. I) - 1977- Short Circuit Performance Category P-2, and shall have:
- 2.10.3 Rated operational / service voltage  $U_e$  415 - 690V, rated insulation voltage  $U_i$  1000V, impulse withstand voltage  $U_{imp}$  12KV, a short-time withstand current (KA rms)  $I_{cw}$  65 KA for 1 second.
- 2.10.4 Air Circuit breakers should have mechanical life of minimum 20,000 operations up to 3200A and minimum 12,000 operations above 3200A and up to 6300A with ordinary Maintenance prescribed by the OEM.
- 2.10.5 Air Circuit Breakers should have Electrical Life of 5000 operations up to 2500A and minimum of 4000 operations up to 4000A and 2000 operations up to 6300A @440VAC.
- 2.10.6 The dielectric test of 2.5 KV applied for one minute on main circuits.
- 2.10.7 Test evidence from a recognized independent Laboratory / Institution shall be furnished for compliance of the breakers with the above requirements.
- 2.10.8 The circuit breakers shall be fitted with detachable arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc. Interface barriers shall be provided to prevent flashover between phases.
- 2.10.9 The operating mechanism shall be of robust design, with a minimum number of linkages

to ensure maximum reliability. Manually operated circuit breakers shall be provided with spring operated closing mechanisms, which are independent of speed of manual operation. Electrically operated breakers shall have a motor wound spring charged closing mechanism. Breaker operation shall be independent of the motor, which shall be used solely for charging the closing spring.

2.10.10 Mechanical operation indicators shall be provided to show open and closed position of the breaker. Electrically operated breakers shall be additionally provided with mechanical indications to show charged and discharged conditions of the charging spring.

2.10.11 Provision shall be available for fitting a minimum of five trip devices- three over current, a shunt trip and an under-voltage release or two over current, and earth fault release, a shunt trip and one under voltage release. The breakers shall be of the shunt or series trip type as specified. For static trip device either a shunt trip or an under-voltage coil shall be provided.

2.10.12 Circuit breakers shall be individually housed in sheet metal cassettes provided with hinged doors. The breaker along with its operating mechanism shall be mounted on a robust carriage moving on guide rollers within the cassette. Isolating contacts for both power and control circuits shall be of robust design and fully self-aligning. The assembly shall be designed to allow smooth and easy movement of the breaker within its cassette.

2.10.13 The breaker shall have three distinct positions within the cassette as follows:

- |                        |  |
|------------------------|--|
| a) 'Service' position  | : with main and auxiliary contacts connected.                                    |
| b) 'Test' position     | : with power contacts fully disconnected and control circuit contacts connected. |
| c) 'Isolated' position | : with both power and control circuit contacts fully disconnected.               |

2.10.14 It shall be possible to achieve any of the above positions with the cassette door closed.

2.10.15 Mechanical position indicators shall be provided for the three positions of the breaker.

2.10.16 The moving portion of the circuit breaker shall be so interlocked that:

2.10.17 It shall not be possible to isolate it from the connected position, or to plug it in from the isolated position with the breaker closed. The circuit breaker can be closed only when it is in one of the three positions or when it is fully out of the cassette.

2.10.18 It shall not be possible to open the hinged door of the cassette unless the breaker is drawn to the isolated position.

2.10.19 Inadvertent withdrawal of the circuit breaker too far beyond its supports is prevented by suitable stops.

2.10.20 Moving portions of breakers of the same ratings shall be interchangeable.

2.10.21 Provision shall be available for the padlocking of the circuit access flaps in any of the three positions.

2.10.22 Automatically operated safety shutters shall be provided to screen the fixed isolating contacts when the breaker is drawn out from the cassette.

2.10.23 The moving portion of the circuit breaker shall be provided with a heavy duty self-aligning earth contact, which shall make before and break after the main isolating contacts during insertion into and withdrawal from the service position of the breaker. Even in the isolated position positive earthing contact should exist.

2.10.24 Auxiliary switches directly operated by the breaker operating mechanism and having 4 NO and 4 NC contacts, shall be provided on each breaker. The auxiliary switch contacts shall have a minimum rated thermal current of 10 Amps.

2.10.25 All the ACB shall have built-in Ready to close signaling contact – RTC over breaker body.

### **2.11 Air Circuit Breaker Protection Release:**

2.11.1 Trip unit should be capable of doing Zone Selective Interlocking so that the device that is closest to the fault will trip without any time delay therefore reducing the fault clearing time and reducing the damage to the equipment.

2.11.2 Trip Unit shall have closing on short-circuit (MCR): This function trips the ACB when a short- circuit current flows during ACB closing operation, and lock the ACB to keep it inoperative.

2.11.3 Trip unit should be able to setting display for LSIG protection parameter settings.

2.11.4 The microprocessor - based release shall have adjustable overload (70% to 100% of rated current of the breaker), short circuit protection (2 to 10 times overload setting and fixed time delay not exceeding 60m sec), and instantaneous setting of greater than 10 times rated current. It should be possible to store tripping history of last ten faults.

2.11.5 The protection release shall have adjustable neutral protection from 50% to 100% of rated current or long time setting of the protection release.

2.11.6 The overload setting of microprocessor release shall have a thermal memory feature lasting for not less than 20 minutes before and after tripping. The setting of the ACB should be possible with dip switches for settings of protection release.

### **2.12 Moulded Case Circuit Breakers:**

2.12.1 The MCCB shall be complying with IEC 60947-1/2/4 & IS: 13947 Part II.

2.12.2 MCCB's shall be triple pole (TP) / four pole (FP) Thermo-Magnetic / Micro Processor based releases with quick break and quick make type and shall be trip free.

2.12.3 Short circuit withstanding capacity shall be as indicated in the respective drawings.

2.12.4 The circuit breaker shall provide class II insulation between the front cover and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.

2.12.5 The insulating case of the MCCB's shall be made of high strength heat resistant, flame retardant and thermosetting material so as to provide the following important functions.

2.12.6 Safety of operating personnel

2.12.7 Very high dielectric strength

2.12.8 High withstanding capacity against thermal and mechanical stresses.

2.12.9 The contact system shall be maintenance free with arc extinguishing devices & Properties.

#### **2.12.10 Terminations: The following features shall be provided for terminals.**

- a) Interchanging capability for line & load ends, extended terminals to connect Aluminum cables of required runs & sizes.
- b) Copper cable termination without extended termination accessories.

- c) Visual indications: The following visual indications shall be provided for the MCCBs.  
“ON”  
“OFF”
- d) The MCCBs shall have adjustable/fixed thermal overload setting and adjustable/fixed magnetic setting as per the drawings or specifications.
- e) The MCCBs shall be of Manual type as per the requirements indicated in the drawings and specifications.
- f) Minimum one No. (1 No.) NO / NC / Change Over auxiliary contact shall be available for “ON” & “OFF” positions.
- g) For 4 pole MCCBs, the neutral contact shall make earlier than the phase but while tripping, the neutral contact shall break later than the phase for safety purposes.
- h) Positive indication of neutral shall be available.

**2.12.11 Accessories: The following accessories shall be a standard feature of the MCCB:**

- a) Rotary handle operating mechanism with locking arrangement as indicated in the drawing & specifications.

**2.13 MCCB Protection Release:**

- 2.13.1 The thermal magnetic release, where specified shall have adjustable overload setting from 70% to 100% of rated current and magnetic setting of at least 8 times rated current.
- 2.13.2 The microprocessor - based release shall have adjustable overload (70% to 100% of rated current of the breaker), short circuit protection (2 to 10 times overload setting and fixed time delay not exceeding 60m sec), and instantaneous setting of greater than 10 times rated current. It should be possible to store tripping history of last ten faults.
- 2.13.3 The protection release shall have adjustable neutral protection from 50% to 100% of rated current or long time setting of the protection release.
- 2.13.4 The overload setting of microprocessor release shall have a thermal memory feature lasting for not less than 20 minutes before and after tripping. The setting of the MCCB should be possible with dip switches for settings of protection release.

**2.14 Metering**

- 2.14.1 Incomers and outgoing feeders shall be provided with comprehensive power meters capable of four quadrant operation and equipped with graphical display for A, V, Pf, Hz, KW, KVA, KVAR, KWH, KVARH, demand values, THD on current and Voltages.
- 2.14.2 There shall be provision within the meter for set point driven alarms and at least 2 digital alarms with 1s time stamping, there shall be a historical data log of alarms with date and time stampings.
- 2.14.3 There shall be provision of at least one Modbus RTU RS485 port on the meters provided on Incomers of Sync Panel, Main LV Switchboard and the PCC Panels for communication.
- 2.14.4 The meter shall be preferable of standard front dimensions of 96 mm x 96 mm with graphical antiglare display and backlighting for superior viewing even in extreme lighting conditions and viewing angles.
- 2.14.5 The multi-function meter installed to monitor the mains incomer(s) of the installation shall comply to Power Quality measurement standard IEC 61000-4-30.
- 2.14.6 The current transformers for metering and for protection shall be mounted on solid copper

/ aluminum bus bars with proper supports.

- 2.14.7 On all the incomers of switch boards ON/OFF indicators lamps shall be provided suitable for operation on AC 230 volts supply. All lamps shall be protected by MCBs.

### **2.15 Indication Lamps (LED type)**

- 2.15.1 Filament type indicating lamps shall be provided wherever called for in the control schematic diagrams. The lamps assembly shall be complete with a cluster of LED's, holders and lenses.

### **2.16 Space heaters**

- 2.16.1 Each vertical section of the switch boards shall be provided with thermostat-controlled space heaters rated for 240 Volts + or - 10%, single phase, 50 Hz. The heaters shall have individual ON-OFF switch.
- 2.16.2 The wiring of space heaters in each switch board shall be grouped and brought out to easily accessible terminals for connection to power supply, through switch-fuse unit.
- 2.16.3 Each switchboard shall be provided with plug-socket with switch fuse for connection of hand lamp rated 240 V, 50 Hz. single phase.

### **2.17 Fuses**

- 2.17.1 All control and power fuses shall be link type HRC fuses and they shall be provided with visible indication to show that they have operated.

### **2.18 Current Transformers**

- 2.18.1 Current transformers shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracy as specified / required.
- 2.18.2 Current transformers wherever required and called for in the single line diagram and/or required shall be furnished.
- 2.18.3 The CTs shall be bar primary, in epoxy-encapsulated type, rated for 415 V. The CTs shall be designed to withstand the thermal and mechanical stresses resulting from the Maximum short circuit current.
- 2.18.4 The vendor shall ensure that the VA output of the CTs are adequate for the relays, Meters and loads connecting them.
- 2.18.5 The CTs shall be provided with Class A/Class B insulation and proper polarity markings in a suitable manner.

### **2.19 Indicating / Integrating Meters**

- 2.19.1 All indicating instruments shall be of flush mounting industrial pattern, conforming to the relevant standard.
- 2.19.2 The instruments shall have non-reflecting bezels, clearly divided and indelibly marked scales and shall be provided with respect to adjusting devices in the front.

- 2.19.3 Integrating instruments shall be of flush mounting switchboard pattern, conforming to the relevant standards.
- 2.19.4 Meters shall be provided with circular 90 scale with square casing of specified size.
- 2.19.5 MT instruments shall have + or - 1% accuracy on full scale. Each meter shall be magnetically screened.

## **2.20 Cable terminations**

- 2.20.1 Cable entries and terminals shall be provided in the switchboard to suit the number, type and size of Aluminium / Copper conductor power cables and copper conductor control cable specified in the detailed specifications.
- 2.20.2 Switchboard shall be designed either for top or bottom or combined entries and outgoing, Which Architects will confirm at the time of drawing approval. Generous size of cabling chambers shall be provided, with the position of cable gland and terminals such that cables can be easily and safely terminated. Removable un-drilled plates shall be furnished for fitting the cable glands.
- 2.20.3 Sufficient space shall be provided to avoid sharp bending and for easy connection. A minimum space of 300 mm from the gland plate to the nearest terminal block shall be provided.
- 2.20.4 Multi way terminal blocks complete with screws, nuts, washers and marking strips shall be furnished for terminating the internal wiring and outgoing cables.
- 2.20.5 Power and control terminals shall be washer head screw type or stud type complete with crimping type connectors. Screw type terminals with screws directly impinging on conductor are not acceptable.
- 2.20.6 Each control terminal shall be capable for connection of 2 Nos. 2.5 mm standard copper wires at each ends.
- 2.20.7 Not more than two wires shall be connected to any terminal. If necessary a number of terminals shall be jumpered together to provide wiring points.
- 2.20.8 Atleast 10% spare terminals shall be provided in each module.
- 2.20.9 Terminal blocks for current transformer secondary lead wires shall be provided with shorting and earthing facility.
- 2.20.10 Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.
- 2.20.11 Cable risers shall be adequately supported to withstand the effects of rated short circuit Currents without damage and without causing secondary faults.

## **2.21 Control wiring**

- 2.21.1 The wiring shall be complete in all respects so as to ensure proper functioning of control, protection and interlocking scheme.
- 2.21.2 All wiring shall be completed up to terminal blocks on the side of each unit-module.
- 2.21.3 All control wiring shall be carried out with 1100/660 V grade single core PVC cable having stranded copper conductors of minimum 2.5 Sqmm.

- 2.21.4 Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance. Wires shall not be spliced or tapped between terminal points.
- 2.21.5 Numbered ferrules at each end shall identify wires. The ferrules shall be of the ring and of non-deteriorating material. They shall be firmly located on each wire to prevent free movement and shall be interlocking type.
- 2.21.6 All control circuit fuses shall be mounted in front of the panel and shall be easily accessible.
- 2.21.7 All spare contacts of relays and switches shall be wired up to the terminal blocks.
- 2.21.8 Each of the DC circuit shall be provided with Double pole MCB for 2 wire DC underground system of specified voltage.
- 2.21.9 Note: DC Control wire and AC Control wire should be always sensible.

## **2.22 Ground bus**

- 2.22.1 An Aluminium ground bus rated to carry maximum fault current shall be furnished along the entire length of each switchboard. Each stationary unit shall be connected directly to this ground bus by two separate and distinct connections in accordance with Indian Electricity Rules.
- 2.22.2 Grounding terminals on the ground bus shall be provided. Connectors shall be provided at either end of switch board for connection to station ground mat.

## **2.23 Terminal Blocks**

- 2.23.1 Terminal blocks shall be of 660 Volts grade of stud type. Insulating barriers shall be provided between adjacent terminals.
- 2.23.2 Suitable provision shall be made to terminate control/power connections in the respective module.
- 2.23.3 Terminal blocks shall have a minimum current rating of 10 Amps and shall be shrouded. Provisions shall be made for label inscriptions. The wire terminations to the blocks shall be of screw type suitable for crimp type socket.

## **2.24 Name plate**

- 2.24.1 The panel as well as feeders' compartments shall be provided with name plate of anodized aluminium, with white engraving on black background. They shall be properly secured with self-tapping screws at the top of the cubicles. The panel/feeder descriptions shall be as indicated in the drawings/employers. The size of the nameplates shall be proportionate to the respective equipment's.
- 2.24.2 Also individual panel number and danger plate shall be furnished at back of panel.

## **2.25 Accessories**

- 2.25.1 The following accessories shall be furnished along with each switchboard.
- 2.25.2 One (1) no. fuse pulling handle for each switchboard.



- 2.25.3 One (1) no. winding handle for withdrawing breaker from the cubicle.
- 2.25.4 Other accessories as deemed necessary for trouble free and efficient operation of the equipment offered.

## **2.26 Drawings and Manuals**

The following drawings shall be supplied for each switchboard.

- 2.26.1 General arrangement drawing for each type of board showing constructional features and space required in the front for withdrawal of breaker, power and control cable entry points, location of various devices, terminal blocks, cross sectional details, bus bar supports, number of buses, etc. shall be submitted within 15 days from the date of letter of intent for approval.
- 2.26.2 Foundation plan and anchor hold details including dead load and impact load.
- 2.26.3 Drawing and data sheet for each component.
- 2.26.4 Electrical wiring diagram.
- 2.26.5 Terminal block arrangement drawing for outgoing feeders.
- 2.26.6 Complete relay technical particulars and recommended settings.
- 2.26.7 Operation, maintenance and installation manuals, (one set to consultants).
- 2.26.8 Technical Catalogues/Leaflets of CTs, meters, lamps, etc. shall be submitted along with Offer.
- 2.26.9 The approval of the drawing does not absolve the vendor from his obligation of ensuring proper and correctness of functioning/operation of the system.

## **2.27 Tests :-Routine and Test**

- 2.27.1 Type test certificates and results as per relevant Standards (Specification) for all the equipment offered under the scope of this specification shall be furnished.
- 2.27.2 All routine tests on all major components shall be made as per relevant specification.

## **2.28 Inspection**

- 2.28.1 Inspection of the Switchboards including inspection of wiring and electrical operational tests by the Owner/Architect before dispatch should be arranged by the tenderer. The cost of transport and incidental expenses to be borne by the tenderer. Two weeks clear notice to be given for carrying out the inspection.

## **2.29 Dielectric Tests**

- 2.29.1 Insulation of the main circuit that is the insulation resistance of each pole to the earth and that between the poles shall be measured.
- 2.29.2 Each switch board will be completely assembled, wired, adjusted and tested for operation under simulated conditions to ensure correctness of wiring and proper functioning of all equipment's.
- 2.29.3 All current carrying parts and wiring shall be subjected to a high potential test.



**2.30 High Voltage Test**

- 2.30.1 A high voltage test with 2.5 KV for one minute shall be applied between the pole and earth. Test shall be carried out on each pole in turn with the remaining poles earthed. All units racked in position and the breakers closed. Originals test certificate shall be submitted along with panel.

**2.31 Packing And Transport**

- 2.31.1 Road Transport packed in Wooden Crates shall send the switchboards to site. The packing should be of high quality to avoid any damage to the equipment's during transit. They shall be wrapped with polythene sheets before being placed in crates to prevent damage to the finish.

**2.32 Type test reports**

- 2.32.1 Switchboard configurations offered shall be CPRI /Independent international test house tested for all the tests as per IEC61439-1 and internal arc tests as per IEC 61641 for all three functional compartments. Copies of the test certificates shall be submitted with the tender.

**2.33 LV power factor correction Panels**

- 2.33.1 The specification covers the design, manufacture, assembly, routine testing of power factor correction equipment.
- 2.33.2 This equipment could either be stand alone or could be integrated with the LV Distribution Board through a dedicated feeder.
- 2.33.3 The equipment shall be routine tested at manufacturer's works at country of origin before dispatch.

**2.34 Capacitor Banks**

- 2.34.1 Capacitor banks shall have multiple stages, which shall be switched ON / OFF automatically with the use of electromagnetic / electronic contactors. The contactor should be suitable for the type of loads connected to the network.
- 2.34.2 The capacitor banks shall incorporate series de tuning reactors to prevent amplification of system harmonics and prevent resonance.

**2.35 Normal rating**

- 2.35.1 The normal rating of the capacitor bank shall be the maximum continuous rating under the worst temperature conditions as defined in the local utility regulations.

**2.36 Drawings and Information**

The vendor shall furnish the following drawings and documents along this submittal for approval:

- 2.36.1 Dimensioned drawing showing outline of the capacitor bank.
- 2.36.2 Single line diagram showing all the major electrical components.
- 2.36.3 Protection and control schematics of the capacitor bank.
- 2.36.4 Details of cable terminations and fittings.
- 2.36.5 Foundation plan, including foundation loading.
- 2.36.6 Original catalogues for various proposed components.
- 2.36.7 Technical Manual giving installation, operation and maintenance instructions.
- 2.36.8 Schedule of recommended spare parts.

### **2.37 Capacitor Units**

- 2.37.1 The capacitor units shall be Metallized Polypropylene Capacitor.
- 2.37.2 The capacitor units shall incorporate a 3-phase pressure switch disconnecter for protection against internal faults and the unit shall be suitable for a network voltage of 415-480 volts and shall be rated at 525 Volts or above. The de rating shall be due to factors like temperature, voltage rise due to the connection of detuned reactors.
  - a) The temperature category of the capacitor units shall be -5 / D.
  - b) The capacitor unit casings shall be metallic.
  - c) The capacitor unit shall be completely leakage proof without any filling of jelly, wax.
  - d) The film used in the capacitor shall be of the self-healing type utilizing low-loss metalized Poly propylene.
  - e) The built-in discharge resistors shall not be accessible (factory fitted) and tamper proof. The discharge resistors shall ensure reduction in capacitor voltage to less than 50 volts in 3 minute after switch off.
  - f) The total losses including discharge resistors to be less than 0.5 Watt/KVAR.

### **2.38 De tuning Reactors**

- 2.38.1 Capacitors with suitable de-tuning reactors shall be employed to correct power factor while avoiding the risk of resonance condition by introducing a reactor in series with the capacitors, such that the capacitor / reactor combination is inductive at the frequencies but capacitive at fundamental frequency.
- 2.38.2 The de-tuning reactors shall be connected in series with each capacitor stage and shall be of iron cored type.
- 2.38.3 The reactor insulation shall be Class "H" rated at 180oC. The maximum temperature of the reactor
- 2.38.4 at maximum continuous RMS amperage shall be no higher than 145oC at a 50oC ambient.
- 2.38.5 The capacitor and reactor combination represent a series resonant circuit. The circuit should be tuned such that the series resonant frequency should be below the lowest

harmonic order expected to be present in the electrical network If the lowest harmonic order expected to be present in the electrical network is likely to the 150Hz (3rd order harmonics) then the series de-tuning reactors should be of 135Hz (2.7 tuning order) with a relative impedance 14%.

### **2.39 Short Circuit and Overload Protection**

- 2.39.1 The capacitor bank shall be protected by a suitably rated MCCB at the incomer. It shall have a rotary front operating door mounted handle and should be interlocked with the door to ensure that the capacitor bank is de-energized when door is open.
- 2.39.2 The MCCB shall be a three pole and shall fully comply with the requirements of the IEC 60947-1 & 2.
- 2.39.3 The MCCB shall be rated for a minimum insulation voltage of 660 V and designed for an ambient temperature of 50 degrees C. The current rating shall be at least 1.5 times the full load current of the capacitor bank and shall have a mechanical endurance of a minimum 1000 operations.
- 2.39.4 Each stage of the capacitor bank shall also have a suitably rated MCCBs with an electronic overcurrent relay for overload protection. The electronic over-current relay shall be adjusted to trip if the RMS current of the stage exceeds the overload setting.

### **2.40 Switching Device**

- 2.40.1 The suitable capacitor duty contactors shall be selected based on the KVAR selection as per the SLD.
- 2.40.2 The contactor shall be rated for 690 Volts and shall be 3-pole.
- 2.40.3 The contactors shall isolate all three supply phases to the capacitor on switch off, the rated voltage of control coil shall be 415V (phase-to-phase). This voltage is subject to a variation of (+) 10% and (-) 15%.
- 2.40.4 The pick-up voltage of coil shall be 70% and drop out voltage shall not be more than 60% of rated voltage.
- 2.40.5 The mechanical endurance of the contactors shall not be less than 3 million operating cycles at no Load, the electrical endurance at normal utilization duty for capacitor shall not be less than 200,000 operations.

### **2.41 APFC Relay**

- 2.41.1 APFC Relay shall be microprocessor based to sense the reactive current requirement in the system shall switch ON / OFF the required stages of a capacitor bank.
- 2.41.2 The relays shall have programable settings to switch the capacitor banks ON/OFF Automatic.
- 2.41.3 The Relay shall be suitable for 1A or 5 A current input and shall have LCD Display.
- 2.41.4 The controller shall allow the following settings and readings.
  - a) Auto sensing & switching ON/OFF Capacitors.

- b) Identify Phase angle difference.
- c) Measurement of power factor at every stage.
- d) Leading & lag capacitor measurement.
- e) Active Power/Reactive Power/Apparent Power/THD Measurement.
- f) 4 Quadrant Display with RS485 communication port.

**2.42 APPROVED VENDOR LIST- FOR MAKES PLEASE REFER LIST OF APPROVED MAKES FOR ALL ELECTRICAL WORKS GIVEN IN - ANNEXURE-1**

**END OF SECTION**

**CHAPTER-3****TECHNICAL SPECIFICATION FOR 1.1KV FRLS WIRES AND 1.1KV FRLS LT CABLES****3.1 GENERAL****3.1.1 Work Description**

- a) The design, manufacturing, testing and supply of single core PVC insulated 1.1 KV grade stranded twisted wires shall comply with following standards with update amendments under the specifications.
  - (i) IS-3961: Current rating for cables.
  - (ii) IS-5831: PVC insulation and sheath of electric cables.
  - (iii) IS-694: PVC insulated cables for working voltage up to and including 1100 volts.
  - (iv) IEC-54 (I): PVC insulated cable.
- b) Copper / Aluminum stranded twisted conductor PVC insulated wires shall be used in conduit as per item of work. Aluminum wires for power cables and copper wires for control cables shall be used.
- c) The wires shall be color coded - (red, yellow, blue) for Phases, black for Neutral and green for Earth.
- d) Progressive automatic in line indelible, legible and sequential marking of grade, voltage, capacity and length in meters shall be embossed at every meter on the outer sheath of cable.
- e) The design, manufacture, testing and supply of the cable under these specifications shall comply with following standards latest edition of:
  - (i) IS: 8130: Conductors for insulated electric cables and flexible cords.
  - (ii) IS: 5831: HRPVC / HR PVC insulation and LSZH sheath of electric cables.
  - (iii) IS: 3975: Mild steel wires, strips and tapes for armoring cables.
  - (iv) IS: 3961: Current rating of cables.
- f) The routing and minimum rated current carrying capacity of the LV power cables shall be indicated on the Drawing. The Contractor shall consider the manufacturer data and engineering for cable sizing and to ensure that it meets the conditions of grouping, ambient temperature etc.
- g) All LT cables for normal power/control circuits within buildings shall be XLPE insulated and PVC sheathed Aluminum conductor and control cables shall be PVC insulated and PVC sheathed copper conductor respectively.
- h) All LT cables, for emergency power circuits serving emergency light, Building Management System (BMS), Fire Protection System, Security Systems, emergency communication systems, and sump pump system and fire lifts etc. with back-up from UPS systems or incoming and outgoing from the Emergency Main Switchboard, shall be fire resistant as required.
- i) Cables in service duct, open trench, direct-laid underground in soil shall be by means of armoured cables. Non-armoured cables shall only be laid in conduits, trunkings or tray/ladder for mechanical protection.

### 3.2 Standards

3.2.1 All cables shall be manufactured and constructed in accordance of the following standards with the latest revision:

Sr.No	Standards	Electrical Items
a)	IS: 694	HRPVC/XLPE insulated (heavy duty) electric cables for working voltage up to and including 1100 volts.
b)	IS: 424-1475(F-3)	Power cable-flammability test.
c)	IS: 7098(I)	Specification for cross-linked polyethylene insulated LSZHPVC sheathed cable for working voltage up to 1.1 KV.
d)	IS: 1554	Specification for PVC insulated (heavy duty) electric cables for working voltages up to and including 1100 volts.
e)	ASTM-D: 2863	Standard method for measuring the minimum oxygen concentration to support candle-like combustion of plastics (Oxygen Index).
f)	ASTM-D: 2843	Standard test method for measuring the density of smoke from the burning or decomposition.
g)	IEEE: 383	Standard for type of tests Class-IE, Electric cables, field splices and connections for power generation station.
h)	ASTME: 662/ IEC:754(x)	Standard test method for specific optical density of smoke generated by solid materials
i)	IS: 10418	Cable drums.
j)	IS-10810	Testing method of cable.
k)	IS-6121	Cable glands.
l)	IS-9537	Rigid steel conduit.

3.2.2 The manufacturing of the cable shall also conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in the approved Specification and Drawings of contractor. Only more stringent specification shall be followed.

### 3.3 Submission

3.3.1 All technical submissions shall be approved by the TPA/Consultant/Employer prior to the respective stages of construction with respect to the approved design and development documents. In case of major deviations, it shall be brought under the notice of Consultant/Employer for its review and approval.

3.3.2 As a minimum requirement, the submission shall include the following:

- a) Equipment submission with manufacturer's data
- b) Sample submission
- c) Shop Drawings of the cable route showing the coordinated routing of cables, arrangement on cable trays, methods of fixing of cable trays and cables, etc. All conduits including concealed conduit routing drawings shall also be included

- d) Cable test reports and IS Certification
- e) Cable schedule indicate the following data include:
  - (i) Cable code and type and installation method
  - (ii) Cable feed from and serve to
  - (iii) Cable route length and voltage drop
  - (iv) Cable capacity and
  - (v) Upstream protection breaker rating
- f) The cable schedule shall be prepared in accordance to the cable manufacturer's data.

### 3.4 PRODUCT

#### 3.4.1 LT Cables

- a) The cables shall be suitable for laying in racks, ducts, trenches conduits and underground buried installation with uncontrolled back fill and chances of flooding by water.
- b) They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating condition.
- c) The aluminum / copper wires used for manufacturing the cables shall be true circular / sector in shape before stranding and shall be of uniformly good quality, free from defects. The conductor used in manufacture of the cable shall be of H2 grade.
- d) The cable should withstand 2.5 kA for 1 Sec. with insulation armour insulated at one end. Bidder shall furnish calculation in support of capability to withstand the earth fault currents. The current carrying capacity of armour and screen (as applicable) shall not be less than the earth fault current values and duration.
- e) The fillers and inner sheath shall be of non-hygroscopic fire retardant materials and shall be suitable for the operating temperature of the cable. Filler and inner sheath shall not stick to insulation and outer sheath.
- f) Progressive automatic in line indelible, legible and sequential marking (grade, voltage, capacity, length - in meters) shall be embossed at every meter on the outer sheath of all cables and at every 5 meter LSZH marking in case of LSZH cables.
- g) IS: 3975 method (b) for strip / wire armouring shall only be acceptable. For single core cable aluminium wire armouring shall be used.
- h) Allowable tolerance on the overall diameter of the cables shall be + 2mm.
- i) The normal current rating of all HRPVC/XLPE insulated cables shall be as per IS: 3961.
- j) A distinct inner sheath shall be provided by pressure extrusion process for all multi cores armoured and unarmoured cables as per IS: 5831.
- k) Outer sheath shall be provided by extrusion process as per IS: 5831.
- l) The breaking load of armour joint shall not be less than 95% of that armour wire. Zinc rich paint shall be applied on armoured joint surface.
- m) In plant repairs to the cables shall not be accepted.
- n) All the cables shall be supplied in non-returnable drums as per IS: 10418.
- o) Fire Survival Cables
  - (i) Multi core Al / Cu Conductor XLPE/ Cross linkable Low Smoke Halogen Free

insulated with Fire rated Glass Mica Tape, LSZH inner and outer Sheathed, Armoured with GI Strip/ Wire Fire Survival Cable.

- (ii) Basic design shall be as per BS:7846-2009,
- (iii) Fire resistance of the cable shall be as per BS:8491-2008 & 8434-2:2003

### 3.4.2 Inspection

All cables shall be inspected on receipt of the same at site and checked for any damage during transit.

### 3.4.3 Joints in Cables

Cable drum length and sizes of cable lengths required may be checked carefully before cutting the cables from drum. The contractor shall take care that the cables received at site are distributed to various locations in single length as far as possible to ensure maximum utilization. Where the joints are unavoidable, the same is to be done with approval from the Consultant/Employer. The joints shall be done by qualified jointer strictly in accordance with manufacturer's instruction / drawings in presence of Consultant/Employer.

### 3.5 Joint Boxes for Cables

3.5.1 The cable joint boxes shall be of appropriate size suitable for type of cable of particular voltage rating.

### 3.5.2 Cable Joints

- a) All cable joints materials shall be of standard make and suitable to requirement. On jointing of cables in the joint box the cable compound shall be filled in accordance with manufacturer's instructions and in approved manner. All straight through joints shall be done in epoxy mould boxes with epoxy resins. Straight through joints shall not be permitted unless the length of run is in excess of cable drum.
- b) End terminations of cables more than 1.1 KV grade shall be done with epoxy mould boxed and epoxy resin. Cable glands shall be 1.1KV grade double compression type and made to tin plated heavy-duty brass casting and machine finished. Glands shall be of robust construction capable of clamping cable and cable armour, firmly without injury of cable.
- c) All washers and hardware shall be made of brass tinned. Rubber components used in the glands shall be made of neoprene of tested quality.
- d) Cable lugs shall be tinned copper / aluminium solder less crimping type conforming to IS: 8309 suitable for aluminium or copper conductor.
- e) Crimping of terminals shall be done by using Corrosion inhibitory compound, with crimping tool.
- f) Fire resistant paint has to be applied 1 Meter on either side of cable joint.
- g) The contractor shall liaise fully with all other contractors to achieve an efficient and properly coordinated installation where equipment has to be re-positioned due to lack of site liaison; no extra cost shall be incurred by the client.

### 3.6 Internal Wiring



- 3.6.1 All the wiring installation shall be as per IS: 732 with latest amendment. PVC insulated copper conductor cables as specified in bills of quantity shall be used for sub-circuit runs from the distribution boards to the points and pulled into conduits. They shall be twisted copper conductors with thermoplastic insulations of 1100 volts grade. Color Code for wiring shall be followed.
- 3.6.2 Looping system of wiring shall be used, wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors with prior permission of the Consultant/Employer. No reduction of strands is permitted at terminations. No wire smaller than 1.5 sq.mm shall be used.
- 3.6.3 Wherever wiring is run through trunkings or raceways, the wires emerging from individual distributions shall be bunched together with cable straps at required regular intervals. Identification ferrules indicating the circuit and DB number shall be used for sub main sub-circuit wiring. The ferrules shall be provided at both end of each sub main and sub-circuit.
- 3.6.4 Where single phase circuits are supplied from a three phase and a neutral distribution board, no conduit shall contain the wiring fed from more than one phase. In any one room in the premises where all or part of the electrical load consists of lights, fans and/or other single phase current consuming devices, all shall be connected to the same phase of the supply. Circuits fed from distinct sources of supply or from different distribution boards or through switches or MCBs shall not be bunched in one conduit. In large areas and other situations where the load is divided between two or three phase, no two single phase switches connected to different phase shall be mounted within two meters of each other.
- 3.6.5 All splicing shall be done by means of terminal blocks or connectors and no twisting connection between conductors shall be allowed.
- 3.6.6 Industrial sockets shall be of polycarbonate and deeply recessed contact tubes. Visible scraping type earth terminal shall be provided. Socket shall have self-adjustable spring loaded protective cap. Socket shall have MCB/ELCB/RCCB as specified in the schedule of work.

### 3.7 Fire Seal System

- a) The entire floor/wall opening provided for cable crossing shall be sealed by fire seal system.
- b) The fire proof sealing system shall fully comply with the requirements of relevant IS/BS: 476 Part-B. The fire proof seal system shall have minimum one hour fire resistance rating.
- c) The fire proof seal system shall be physically, chemically, thermally stable and shall be mechanically secured to the masonry concrete members. The system shall be completely gas and smoke tight, ant rodent and anti-termite.
- d) The material used in fire proof seal system shall be non-toxic and harmless to the working personnel.
- e) Type of fire proof seal system shall be foaming type or flame mastic type compound or approved equivalent.
- f) After laying and jointing work is completed, high voltage test should be applied to all cables to ensure that they have not been damaged during or after the laying operation and that there is not fault in the jointing.
- g) Cables for use on low and medium voltage system (1.1KV grade cables) should withstand for 15 minutes a pressure of 3000V, DC applied between conductors and also between each conductor and sheaths. In the absence of pressure testing facilities it is sufficient to test for one minute with a 1000V insulation tester In case the test results are

unsatisfactory the cost of repairs and replacements and extra work of removal & laying will be made good by the contractor.

- h) Cable shall be installed so that separations shown in the table below are observed.

Sr.No	Cable	Another Cable or Hot Pipe Work	Separations
1	HT Cable (11kV )	HV Cable (11kV )	50 mm
2	ELV & LT 230 V/433 V	ELV & LT cable 230 V/433 V	50 mm
3	HT cables (11kV )	ELV & LV cables 230 V/433 V	300mm
4	LT cables 433 V	Telephone/Instrument cable	350mm
5	All cables	All hot pipe work	200mm

### 3.8 Factory Tests

3.8.1 Each type of cable specified shall be fully type tested according to IEC 502 and the appropriate British Standards. The types and sizes of cables required are shown on the Drawings.

3.8.2 The Contractor shall submit reports issued by a national or international testing authority on type test that have been successfully performed on the cable for Consultant/Employer approval.

3.8.3 The type test shall include the following test:

- a) Partial discharge test;
- b) Bending test, plus partial discharge test;
- c) Tan  $\delta$  measurement as a function of the voltage and capacitance measurement;
- d) Tan  $\delta$  measurement as a function of the temperature;
- e) Heating cycle test plus partial discharge test ;
- f) Impulse withstand test, followed by a power frequency voltage test;
- g) Medium-voltage alternating current test;
- h) Type test (non-electrical) as stipulated in IEC 502, Table VI.

3.8.4 Cable routine test shall be conducted at factory in accordance with IEC 502 for the following tests:

- a) Measurement of the electrical resistance of conductors
- b) Partial discharge test .
- c) 4 hour HT test

### 3.9 Site Acceptance Test

3.9.1 The Contractor shall supply all necessary testing equipment's for site testing. When required, these testing equipment's shall be calibrated at the expense of the Contractor at a recognized national laboratory.

3.9.2 The Contractor shall engage an Authorized Medium Voltage Testing Engineer who is recognized by SEB to perform all site tests.

3.9.3 In addition to SEB's requirements and those recommended by the manufacturer, the following tests shall be carried out:

- a) Continuity test
- b) Earth test
- c) Polarity test
- d) Insulation resistance test
- e) DC high voltage test. The test voltage shall be in accordance with SEB's requirements and Consultants approval.

### 3.10 CABLES XLPE HT Cables (Up to 1.1kV)

- a) LT cables shall be laid in trenches unless otherwise specified. Generally, laying, jointing and commissioning shall be as per regulations of local authorities.
- b) The termination and jointing techniques for XLPE cables shall be by using heat shrinkable or push on cable jointing kits.
- c) While laying underground cables in ducts care should be taken so that any underground structures such as water pipes, sewerage lines etc. are not damaged. Any telephone or other cable coming in the way shall be properly protected as per instructions of the Consultant/Employer. The HT cable shall be laid at least 1200mm for cable up to 11kV (E) and 750mm for cable upto 1.1KV below the ground level in a trench 450mm wide or as per the layout and BOQ.
- d) After laying and jointing work is completed High Pot test shall be performed in presence of Consultant/Employer and test results submitted for approval in order to ensure that they have not been damaged during or after the laying of cables. In case, the test results are unsatisfactory, the cost of all repairs and replacement and all extra work of removal and relaying will be made good by the contractor without any extra cost.
- e) **Note:** All other procedure will be followed as per L.T. cables.

### 3.11 CABLE INSTALLATION/EXECUTION/ERECTION, LAYING AND INSTALLATION OF 1.1KV,LT XLPE CABLE .

On receipt of LT cables at site, cables shall be inspected to detect any damage. The ends of cable shall be in sealed condition. After inspection, cable shall be located in a proper place with battens of cable drums being replaced. The cable drums shall not be stored 'on flat' with flanges horizontal. Consultant/Employer will inspect the cables before storing. Contractor shall take out samples from the drums as per their instructions and send them to the manufacturer to conduct the approval tests. After the receipt of the test analysis, the cable will be accepted by the client.

#### 3.11.1 CABLES AND CABLE ENTRIES

Particular attention is drawn to the Contractor's responsibilities in safeguarding cables Stored / laid in outdoor locations and unfinished buildings. Such equipment is particularly vulnerable to damage from water and dust penetration. The Contractor shall ensure that cables are protected in this respect while installation work is proceeding. Covers temporarily removed from trenches/entries for purpose of

installation shall be reassembled on completion of the work and replaced when such Work is suspended or otherwise left incomplete. Similarly, all entries shall at times be effectively sealed against ingress of water and dust, eg., Duct entries shall be sealed by the insertion of proprietary stopper plugs or approved means.

### **3.11.2 HANDLING OF CABLES**

Storage & handling of cable before and during installation shall be executed with regard to manufacturer's recommendations. Cable drums shall be rotated only in the direction indicated on the drum, and open ends of cable shall be effectively sealed after cutting to prevent ingress of moisture, using heat shrink end caps.

### **3.11.3 CABLE PULLING**

- a) Armoured cables shall be installed with the aid of specifically manufactured rollers, in order to prevent damage to outer sheaths. Cables up to 38 mm diameter shall be installed by hand. However, larger cables, with the approval of the Company Site Representative, may be installed with the assistance of a winch. Any such winch shall be equipped with a suitable tensioning device and indicator, and operated by a competent operator.
- b) Cable shall never be installed directly from a drum mounted on a moving vehicle.
- c) Drum jacks, cable rollers, cable winch and other equipment shall be of the correct type for the cable being installed.
- d) Winching of cables through ducts / pipes shall only be carried out with the approval of the Consultant/Employer in which event a pulley eye shall be attached to the conductors. Cable shall be run in neat and orderly manner to allow space for future cabling and maintenance. Under any circumstances the cable shall not run diagonally across a room, cable basement, corridor, etc.
- e) A cable sheath stocking may be employed on cables where no undue stress in the sheath is likely to occur.
- f) Care shall be taken to ensure that the draw strain is applied to the armouring and protected during drawing against damage.

### **3.11.4 CABLE BENDING**

- a) At all times utmost care shall be exercised to prevent excessive bending or twisting of cable during installation.
- b) Changes in direction in cable trenches, racks or trays shall provide for a minimum cable bending radius of twelve times the overall cable diameter.

### **3.11.5 Erection of Cables**

- a) Notwithstanding the cable routes indicated on the Drawings the Contractor shall be entirely responsible for the supply of correct lengths of the cables to be installed and for all allowances for connecting and terminating the cables to the switchgears and transformers respectively. The Contractor shall submit proposed cable routes including details of supports for the cables for approval before installation. The cable shall not be run in places other than corridor, passageway, electrical riser or other designated areas subject to the Consultant /Employer approval. The cost of support shall be deemed to have included in the Contract.

### **3.11.6 Cable Laying**

- a) The cable drum shall be placed on jacks before unwinding the cable. Great care shall be exercised in laying cables to avoid forming links. At all changes in directions in

horizontal & vertical places, the cable shall be bent with a radius of bend not less than 8 times the diameter of cable.

- b) The cable of 1.1KV grade shall be laid not less than 750mm below ground level in a 375 mm wide trench (throughout). Where more than one cable is to be laid in the same trench, the width of the trench shall be increased such that the inter axial spacing between the cables except where otherwise specified is at least 150mm minimum or as per site requirements or as approved by the Consultant/Employer. Where single core cables are used in multiphase systems, the cables shall be installed in trefoil where possible.
- c) In case the cables are laid in vertical formation due to unavoidable circumstance the depth per tier shall be increased by 200 mm (minimum). Cable shall be laid in reasonably straight line, where a change in direction takes place a suitable curvature shall be i.e. either 20 times the diameter of the cable or the radius of the bend shall not be less than twice the diameter of the cable drum or whichever less is. Minimum 3 meter long loop shall be provided at both sides of every straight through joint & 3 meters at each end of cable or as directed at site.
- d) Greater care shall be exercised in handling the cable in order to avoid forming 'Kinks'. The cable drum shall in-verbally convey on wheels and the cable unrolled in right direction as indicated on the drum by the manufacturer. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks and strains.
- e) Cables laid in trenches in single tier formation, 10 cms all-around sand cushioning is provided below and above the cable before a protective cover is laid. For every additional vertical tier. The 30 cm of sand cushion is provided over the initial tier. The cable shall be protected by 2nd class brick of size not less than 230 x 115 x 75mm, stone tiles / RCC curved channel be placed on top of the sand breadth wise for the full length of the cable and where more than one cable is to be laid in the same trench the brick shall cover all cables and project at least 8 cms over the outer sides of the end cables.
- f) Filling of trenches shall be done after sand cushioning and tiles or bricks lying and inspection is carried out by the Consultant/Employer (Refer drawing). Back fill for trenches shall be filled in layer not exceeding 150 mm. Each layer shall be properly rammed & consolidated before laying the next layer.
- g) Hume pipe shall be provided on all road crossing. The size of the pipe shall be above the size of the cable. Minimum 100mm dia. pipes are to be provided. The pipe shall be laid in ground with special arrangement and shall be cement jointed and concreting of 1:5:10 shall be provided as per relevant IS with latest amendment. Nothing extra shall be paid on this account. Cable route markers at interval of 30 meters and at the point of direction change shall be provided to indicate cable path. Aluminum strip cable tag of 20mm wide with engraved tag no. shall be provided at both ends of cable.
- h) Where the cables are laid in ducts (pucca trenches) inside the building, they will be laid on MS rack/ cable trays grouted on trenches walls. Cables passing through floors shall be protected from mechanical damage by steel channel to a height of one meter above the floor. Sleeve shall be provided in the wall for crossing of cables.
- i) Where the cables are laid in open (in building) along walls, ceiling or above false-ceiling, cable rack (ladder type) or cable tray shall be provided. The size of the cable tray or rack shall depend on the number of cables to pass over that rack. Cable tray/rack shall be properly supported through wall/ceiling according to the site conditions. Cable laid on tray & riser shall be neatly dressed & clamped at an interval of 1000 mm & 750mm for horizontal & vertical cable run respectively either side at each bend of cable. All power cables shall be clamped individually & control cables shall be clamped in groups of three or four cables. Clamps for multi core cables shall

be fabricated of 25x3 GI flats. Single core power cable shall be laid in trefoil formation & clamped with trefoil clamps made of PVC/fiber glass.

- j) Cable openings in wall/floor shall be sealed by the contractor suitably by Hessian tape & Bitumen compound or by any other proven material to prevent ingress of water.
- k) After the cables are laid, shall be tested as per IS and the results submitted to Consultant /Employer and in case the results found unsatisfactory, all the repairing/ replacing of cables will be done by the contractor free of charge.

### **3.11.7 CABLE JOINTING**

- a) Cables shall be run in continuous unbroken lengths. Any requirement for cable jointing shall be executed only with the approval of the Consultant/Employer.
- b) Fully trained workmen who have passed an approved course of instruction in such work for the operating voltage level concerned shall execute all cable jointing. The Contractor shall furnish written confirmation in this respect to the Consultant/Employer.

### **3.11.8 PROTECTION FROM MOISTURE**

- a) Each cable system shall be installed either where it will not be exposed to rain, dripping water, steam, condensed water, etc., or be of a type designed to withstand such exposure.
- b) In damp situations and wherever they are exposed to weather, all metal sheaths and armour of cables, metal conduit, ducts, ducting trunking clips and their fixings, shall be of corrosion-resistant material or finish, and shall not be placed in contact with other metal with which they are liable to generate electrolytic action.
- c) For conductors insulated with impregnated paper, exposed conductor & insulation at termination's and cable joints shall be protected from ingress of moisture by being suitably sealed.

### **3.11.9 CABLE TERMINATION**

- a) Fully trained & competent workmen who have passed an approved course of instruction in such work for the operating voltage level concerned shall execute all work on the termination of cables. The Contractor shall furnish written confirmation in this respect to The Company Site Representative.
- b) Within terminal boxes, an adequate length of cable loop shall be provided to enable each cable core to be connected to any terminal, in accordance with the approved method of termination for each equipment.
- c) For multi core terminal /junction boxes, an adequate length of cable loop shall be left to allow for remaking and termination of each core, i.e. a 25mm diameter loop prior to entry of cable core into each terminal.
- d) All connections at a cable termination shall be mechanically & electrically perfect and shall be protected against mechanical damage or any vibration liable to occur. They shall not impose any appreciable mechanical strain on fixing of the connection and shall not cause any harmful mechanical damage to the cable conductor or equipment. Conductors of cables shall be terminated in a manner suitable for the terminal arrangement of the equipment concerned.
- e) Prior to final connection, all cable shall be checked for continuity and insulation resistance and correct installation.



- f) The appropriate check sheets shall be complete by the Contractor and accepted by The Company Site Representative, prior to final connection.

#### **3.11.10 GLANDS, SEALS AND SHROUDS**

- a) The entire body of a cable shall enter a gland, & the outer sheath of a cable shall not be removed before entering the weatherproof seal. Cable shall be on a straight axis from a point immediately before entering a gland.
- b) Cable glands shall securely retain the cable without damage to the outer sheath or armour.
- c) Glands shall be correctly sized and of a type suitable for installation in each respective type of enclosure.
- d) All glands shall be correctly sized and of a type which will maintain the integrity of the equipment within into which they are to be installed. Such factors as use of insulated plastic enclosure and explosion proof type protection shall be taken into account when selecting glands.
- e) All mechanical glands shall be of the hexagon double compression type, knurled type glands shall not be used.
- f) Earth continuity of brass glands & termination's shall be achieved by rigid clamping of armour within each gland and intimate contact between threaded components of glands and equipment.
- g) Brass glands terminating in unthreaded enclosures shall be provided with earth continuity by attachment of earth continuity bonds.
- h) Terminations of mineral insulated cable shall be provided with sleeves having a temperature rating equal to that of the seals.
- i) Cores of sheathed cables, from which the sheath has been removed, and non-sheathed cables at terminations of conduit, ducting or trunking, shall be enclosed according to the design specification.

#### **3.11.11 TERMINAL CONNECTING LUGS**

- a) Cable loops of conductors of 10Sq.mm and above shall be fitted with compression-type terminal connection lugs, using tools specially designed for use with such lugs.
- b) At all terminal connections, cable conductors shall be fitted with correctly sized cable sockets of the crimped compression type. Soldered connections shall be employed only where their use is unavoidable. Solder used shall have a melting point of not less than 185 Deg.C, and cable lugs or thimbles shall be the correct type and size for each conductor. Packing of oversized lugs shall not be permitted.
- c) Compression joints shall be made using proprietary sets of lugs and indent dies, correctly sized and shaped for each specified conductor concerned. Use of mixed lugs and dies of different manufacture or systems shall not be permitted.

#### **3.11.12 SEALING OF CABLE TRANSITS**

- a) Openings made or provided in or through building walls, floors, etc., shall be effectively sealed.

- b) Cable entries into trenches (in switch rooms, etc) shall be effectively sealed after cables have been laid. Unused cable entries and cable entries in equipment also shall be effectively sealed.
- c) Openings through roofs and external walls shall be made weatherproof, including installation of flashing and / or rain hoods to prevent the entry of driving rain, seepage of water, dust, etc.

### **3.11.13 CABLE SUPPORTS**

- a) Every cable and conductor used as fixed wiring shall be supported in such a way that it is not exposed to undue mechanical strain and so that there is no appreciable mechanical strain on the terminations of the conductor. Account shall be taken of the mechanical strain imposed by the supported mass of the cable or conductor.
- b) Conduit, ducting and trunking shall be properly supported and of a type that is either suitable for any risk of mechanical damage which may be met in normal conditions of service, or adequately protected against such damage.
- c) Installation shall take into account longitudinal expansion and contraction that may occur with variation of temperature under normal operating conditions.

## **3.12 UNDERGROUND CABLES**

### **3.12.1 GENERAL REQUIREMENTS**

- a) All excavation, cable protection, backfilling and surface restoration and installation of cable markers, protection tiles and warning tape shall be in accordance with the Electrical drawings.
- b) Construction of cable trenches, their bedding and backfilling shall be executed in accordance with Electrical Drawings.
- c) Where excavations are required near footings, foundations, concrete floors, etc. earthwork under and in the vicinity of these excavations shall not be disturbed and all backfill shall be well consolidated.
- d) Installation shall be so arranged that all trenches are excavated and backfilled in a minimum period of time, care shall be taken to ensure that all cable's. For a particular route are made available at site, before trenches are excavated.
- e) When planning the excavation sequence for cable trenches, the contractor shall take care to not obstruct access.
- f) Adequate safety precautions shall be observed at all excavations by the provision of safety barriers, warning notices, shoring, etc.
- g) Cables installed under roads shall be in accordance with the Electrical Drawings. An additional number of pipes, 3 to 5, depending on space, shall be installed at normal cable laying depth to accommodate future cables.
- h) Cables to be installed in underground ducts, conduits or pipes, shall be of a type that incorporates a sheath and/or armour, suitably resistant to any mechanical damage likely to be caused during drawing in.
- i) Physical separation between HV, LV, tele-communication and instrument cables laid within the same cable trench shall be in accordance with Electrical Drawings.



- j) Underground cable routes shall avoid close proximity to pipe crossings and parallel pipe runs. Physical separation between cables and pipes shall be not less than 300 mm and cables should cross underneath pipes.
- k) If a cable route is in close proximity to underground pipes carrying hot liquids or gases, or which are regularly steam cleaned, the pipe shall be insulated in order to limit its outside temperature to a maximum of 60 Deg.C. In these cases cables may be run above pipes.
- l) Buried cables shall be identified with their full cable numbers, as detailed on the cable schedule, at both termination points. Cable number shall be embossed on a metallic strip and installed on cables using proprietary cable ties. Sample of which shall be approved before use.
- m) Cable route and cable joint markers shall be installed visibly at ground surface level in accordance with the Electrical drawings.
- n) When cable routing is not definitely indicated on a design layout drawing, the Contractor shall submit full details of his proposed routing to The Company Site Representative for approval. Routing details shall be shown clearly on the Contractor's working drawings.

### **3.12.2 CABLE INSTALLATION**

- o) Installation of direct buried cables shall not be commenced until the entire route has been excavated and prepared ready to receive the cable.
- p) If cable is left exposed above ground, it shall be coiled and suitably protected against damage. Alternatively, such cable may be left on the drum, which shall be lowered from its jacks and firmly anchored.
- q) Laying patterns, as indicated on the layout drawings, shall be adhered to.
- r) Unavoidable crossings shall be made either in the cable cellar directly underneath the corresponding switchgear panel, or at the branching-off point of a particular cable from the main trench. Care shall be exercised to keep the whole installation tidy in these areas.
- s) Ends of hard-floored cable trenches, ducts or pipes shall slope down into surrounding soil, to avoid cable damage following possible settling of soil.

## **3.13 ABOVE GROUND**

### **3.13.1 GENERAL REQUIREMENTS**

- a) Cable shall be laid on racks or trays in accordance with laying patterns indicated on layout drawings.
- b) All cable outlets from a duct system, all joints in a duct system, and all joints between such a system and another type of ducting or conduit shall be formed so that joints are mechanically sound. During cable pulling cables shall not be damaged.
- c) Spacing between cable racks, trays, or cable ladders, and structures, wall or columns, shall be at least 50 mm.
- d) Metal parts of cable racks and trays shall be bonded between each section, and connected to the common earth grid.
- e) Cables shall be fixed to cable racks and trays by proprietary ties, straps and / or clamps where indicated on the layout drawings and as specified in the design specification. The cable ties, straps and clamps shall be capable of retaining the cables during short circuit stresses, and if nylon/plastic ties are used they shall be UV-resistant.

- f) Where cables, conduits, ducts or trucking pass through fire-resistant structural elements such as walls and floors designated as fire barriers, openings made shall be sealed according to the appropriate degree of fire resistance. In addition, where cables, conduits or conductors are installed in channels, ducts, trunking, or shafts that pass through such elements, suitable internal fire-resistant barriers shall be provided to prevent spread of fire.
- g) Enclosure for conductors and their joints / termination's which are subjected to dust conditions shall be protected to IP 54 (refer to IEC 79)
- h) Cables shall not be installed on exterior wall faces of buildings, ceilings or support structures without the specific approval of The Company Site Representative. Spacing between cable and structure or similar shall be at least 10 mm.
- i) For horizontal runs of cable on structures, cables shall be adequately cleaned such that no sags occur in cabling.
- j) All cables shall be supported by saddles, cleats or other supports as indicated on the layout drawings such that no mechanical forces are imposed on cable glands.
- k) Cable saddles shall be double-fixing. Half-section saddles shall not be used. Fixing of saddles by means of explosive tools shall not be permitted.
- l) Cleats shall firmly clamp cable without distorting or damaging cable.
- m) Cables sheathed with rubber, PVC or equal, may be supported by a catenary's wire, either continuously bound to supported cable or attached at intervals. For cables supported by a catenary's wire incorporated in accordance with minimum heights indicated on the layout drawings.
- n) For spans without intermediate supports, terminal supports, terminal supports shall be arranged so that undue strain is not placed on conductors or insulation of cable. Adequate precautions shall be taken against any risk of chafing of cable sheath. Minimum specified height above ground and length of spans shall be in accordance with the layout drawings.

### **3.14 TESTING :**

#### **3.14.1 Cables shall be tested at site as follows :**

- a) Before shifting of cables drums from the yard to the site, insulation resistance shall be carried out on the cable and readings recorded in the presence of the Site Representative.
- b) On cable being laid prior to sand bedding an I.R. shall conducted and recorded in the presence of the Site Representative.
- c) On the cable trench route being completed and compassion done an I.R shall be conducted and recorded in the presence to the Site Representative.
- d) No backfilling of trenches shall be done till the trench/sand padding/ cable's are inspected and tested.
- e) Before end termination's are made an I.R shall be conducted to ensure the cable is in order.
- f) On termination's being completed prior to connecting to the equipment. The following test shall be conducted.
- g) An I.R. done on the cable/Termination.
- h) Cable/term subject to a pressure test for 15 minutes. The voltage to be applied shall be as per manufacturers recommendations and in co-ordination with Consultant/Employer s.

- i) An I.R. Done on completion of the above Hi pot test
- j) All tests shall be done and recorded in the presence of the Site representative.

**3.15 APPROVED VENDOR LIST- FOR MAKES PLEASE REFER LIST OF APPROVED MAKES FOR ALL ELECTRICAL WORKS GIVEN IN - ANNEXURE-1.**

**END OF SECTION**

**CHAPTER-4****GENERAL ELECTRICAL TECHNICAL SPECIFICATION FOR LT SIDE  
AND INTERNAL ELECTRIFICATION WORKS****4.1 GENERAL****4.1.1 Work Description**

- a) The scope of works for all electrical works and system comprises of design, engineering, supply, delivery, installation, testing and commissioning, handover, training, maintenance and warranty all as described or reasonably implied in the Contract. The Contractor is obliged to provide fully functioning works and systems in conformance with the requirements of the Contract and approved design and development documents prepared by the contractor.
- b) In the event certain items are not fully described or indicated in the Contract, but deemed essential by the contractor for the performance of the works and systems then the provision of such items shall form part of the Contractors scope of works at no additional cost to the Owner.
- c) The drawings and documents from Consultant/Employer shall be used as guidance for the contractor in producing his detail design and shop drawings for carrying out works at site approved by GE.
- d) The Contractor shall be responsible to co-ordinate the equipment and services and shall produce properly co-ordinate shop drawings to demonstrate the installation comply with the performance requirement with shop drawings, calculations, and details. The Consultant/Employer shall monitor the process of shop drawings and document preparation.
- e) Shop drawings shall take into account actual measurement and setting out dimensions/levels obtained and determined by the Contractor on site, actual equipment / material used, actual routing of services, co-ordination with all installation, and site conditions/constraints.

**4.2 Scope of Work:**

The Electrical HT, LT and ELV installation shall generally include the following:

**4.2.1 Common Services:**

- a) Liaison with Client to obtain and coordinate provision of incoming electricity supply.
- b) Design, Supply, Installation, testing & commissioning of complete 11KV HT distribution system including 11KV incoming electricity supply feeder from Substation-1 intake point , 11KV HT Meter Room, 11KV main switchboard, 11KV cabling to 11KV HT switchboards, 11KV cabling to 11/0.433kV distribution transformer, LT main distribution system and associated accessories till final distribution. In conjunction with SEB acceptance upon completion.
- c) Complete Earthing systems for connection with component electrical systems as per latest applicable IS/IEC Norms.

**4.2.2 Internal Services:**

- a) Complete LT distribution system including main LT switchboard, automatic power factor correction devices, sub-boards and distribution boards, UPS and associated distribution main and sub-main cabling and associated accessories.

- b) Complete lighting and power installation including all final circuiting work and associated accessories.
- c) Normal and emergency lighting supply and installation and associated accessories.
- d) Complete earthing system.
- e) Complete lightning protection system and associated accessories.
- f) Complete telephone cabling system and associated accessories.
- g) Complete wiring work to external/landscape and public area architectural/special lighting and dimming systems as per lighting design and associated accessories.
- h) Complete internal cable system and outlets for Telephone and MATV system and associate works.
- i) Wiring for complete Security systems
- j) Miscellaneous works like providing and fixing of rubber mats, fire buckets, first aid box, fire extinguishers,etc.
- k) All associated interfacing power supply work to other mechanical installations.
- l) Voltage drop, transformer losses, power factor and other parameter shall be as per Indian Standard Requirement.
- m) All associated interfacing works with other M&E installations.
- n) Other works as shown on the Drawings and described elsewhere in the Contract documents.
- o) All equipment shall be of the class most suitable for working under the conditions specified and shall withstand the atmospheric conditions without deterioration.
- p) Contractor shall co-ordinate with all other agencies working at site for interconnection and safety aspects.
- q) Also, the Contractor shall furnish combined guarantee minimum for 1 year from the date of successful commissioning from the manufacturer. In case there is any defect, the free replacement of any part or in whole will be made immediately at no extra cost to Owner.

#### **4.3 Fee, Permits & Tests:**

- 4.3.1** The contractor shall obtain all sanctions and permits required for the above said works from all the relevant authorities. On completion of the work, the Contractor shall obtain N.O.C from concerned authorities including, Chief Electrical Inspectorate of State. The original of the same shall be delivered to the Owner through Consultant.
- 4.3.2** The Owner shall have full power regarding the equipment's/ materials get tested by authorized/ recognized independent agency at the contractor's expense in order to prove their soundness and adequacy. The contractor will rectify the defects/ suggestions pointed out by independent agency through Owner at contractor's expense.
- 4.3.3** The installation shall comply in all respects with the requirements of Indian Electricity Act 1910, Indian Electricity Rules (IER) 1956 and other related Laws and Regulations (for F.F. etc.) as amended up to date, there under and special requirements, if any, of the State Electricity Boards etc. The contractor shall be liable to furnish the list of authorized licensed persons/ employed/ deputed to carry out the works/ perform the assigned duties to fulfill the requirement of Rule No.3 of IER 1956 as amended up to date.

**4.4 Codes & Standards:**

**4.4.1** The design, manufacture, inspection, testing and performance shall comply with all the currently applicable statutes, safety codes, relevant Bureau of Indian Standards (BIS), British Standards (BS), International Electro Technical Commission (IEC) publication, NEMA & VDE Standards amended up to date.

**4.4.2** The design engineering, manufacturing and the installation shall be in accordance with established codes, sound engineering, practices, and specifications. Further, the same shall conform to the statutory regulations applicable in the country. Contractor shall obtain all approvals from statutory authorities, e.g, electrical inspector, SEB or any other agency as applicable before commissioning of electrical system if required.

**4.4.3** Some of the relevant Indian and British Standards are listed below.

- (i) Indian Electricity Rules.
- (ii) Factory Act.
- (iii) NBC 2023.
- (iv) NEC 2023.

**4.4.4** Any other standard may be followed provided it is equivalent or more stringent than the standards specified above.

**4.4.5** In case of any deviation/conflict with the codes & standards, the following order of precedence shall govern

- (i) Recommended Design guidelines of Consultant/Employer.
- (ii) International standards & requirements.
- (iii) Local codes of practice.
- (iv) Approved design development documents

**4.5 Design:**

**4.5.1** The Contractor shall be fully responsible for the complete design of all works for the Contract, including all temporary works.

**4.5.2** It is the responsibility of the Contractor to ensure that his design does not compromise the design intents of the Consultant/Employer's approved design development documents, all authorities compliances and approvals.

**4.5.3** The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipment offered by the contractor shall be complete in all respects.

**4.5.4** Any materials or accessories, which may not have been specifically mentioned, but which are usual and necessary for the completion of the system and satisfactory & trouble free operation and maintenance of the equipment shall be provided without any extra cost to the Owner. This shall also include spares for commissioning of the equipment.

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

**4.6 Contractor shall be responsible for:**

- 4.6.1 Detailed co-ordination with other services, shop drawings for various electrical layouts such as equipment layout, cabling layouts, earthing layouts, including equipment installation and cable termination details etc. prior to start of work.
- 4.6.2 Preparation of bill of materials for electrical works.
- 4.6.3 Protection co-ordination drawings/ tables for complete power system.
- 4.6.4 Shop inspection and testing procedures.
- 4.6.5 Field-testing and commissioning procedures.
- 4.6.6 Preparation of as built drawings.
- 4.6.7 Contractor shall also be responsible for:
- 4.6.8 Any other work/activity which is not listed above however is necessary for completeness of electrical system.

**4.7 Date of Commencement and Completion Period:**

- 4.7.1 The contractor shall be allowed admittance to the site on the date of commencement as described in the General Conditions and he shall thereupon and forthwith begin the works and shall regularly proceed with and complete the same on or before the date of completion subject, nevertheless to the provisions for the extension of time. The time being the essence of the contract, the Contractor will adhere to the time, progress chart and project schedule and will give proportional output/progress in proportional time.

**4.8 Schedule and Manner of Operations:**

- 4.8.1 Time being the essence of this Contract, the Contractor will be expected to furnish all labour and materials in sufficient quantities and at appropriate times, expedite and schedule the work as required and so manage the operation that the work will be completed within the time stated in the Contract.

**4.9 Design Conditions:**

- 4.9.1 Design ambient: temperature summer 45 Deg. C dry bulb temperature & 24 Deg. C wet bulb temperature, Winter 7 Deg. C dry bulb temperature & 5 Deg. C wet bulb temperature.
- 4.9.2 Relative Humidity: 65% maximum

**4.10 Coordination of Work**

- 4.10.1 Contract documents establish scope, materials and quality but are not detailed installation instruction.
- 4.10.2 Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- 4.10.3 The drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other divisions will permit. Provide off-sets, fittings, and accessories which may be required but not shown on the drawings. Investigate the site, and review drawings of other divisions to determine conditions affecting the work, and provide such work and accessories as may be required to accommodate such conditions.

- 4.10.4** The locations of thermostats, switches, panels and other equipment indicated on the drawings are approximately correct. Exercise particular caution with reference to the location of panels, thermostats, switches, etc., and have the precise and definite locations accepted by the Consultant /Employer before proceeding with the installation.
- 4.10.5** The drawings show only the general run of services and approximate location of equipment, outlets, panels, etc. Any significant changes in location of equipment, outlets, panels, etc., necessary in order to meet field conditions shall be brought to the determine attention of the Consultant/Employer for review before such alterations are made. Modifications shall be made at no additional cost to the Contract.
- 4.10.6** Carefully check space requirements with other division works to ensure that equipment can be installed in the space allotted.
- 4.10.7** Wherever work interconnects with work amongst different installation, coordinate with other trades to insure that they have the information necessary so that the Contractor may properly install the necessary connections and equipment. Identify items requiring access in order that the Ceiling Trade will know where to install access doors and panels.
- 4.10.8** Furnish and set sleeves for passage of risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each riser passing through building surfaces.
- 4.10.9** Provide fire stopping around all pipes, conduits, ducts, sleeves, etc., which pass through fire compartments.
- 4.10.10** Provide required supports and hangers for equipment suitably so as not to exceed allowable loading of structures.
- 4.10.11** Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the drawings as to the area to which it applies. Submit these drawings to the Consultant /Employer for review. At completion include a set of these drawings with each set of record drawings.
- 4.10.12** Coordinate with the local utility companies/authorities for their requirements for service connections and provide all necessary provisions, grounding, materials, equipment, labor, testing, and appurtenances.
- 4.10.13** Before commencing works, examine adjoining works on which this work is in any way affected and report conditions which prevent performance of the works. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- 4.10.14** The Contractor is responsible to any modifications required due to service not properly coordinated.

#### **4.11 Electrical Power Supply Interfaces**

- 4.11.1** The Contractor shall provide power supply points/isolators at certain designated locations within the development for all mechanical and electrical installations as indicated on the drawings. It is the responsibility of the Contractor to coordinate and make connections to these power supply points/isolators and to provide all the necessary 'down-stream' power supply distribution board/network to the mechanical system's control panels, equipment, sensors, field devices, etc.

#### **4.12 INTERFACING WITH ALL SERVICES AND SYSTEMS**

##### **4.12.1 General**



- a) The Contractor shall provide all necessary provisions for interfacing amongst installation, services, and equipment. All necessary sensors, current/voltage transformers, voltage-free contacts, relays, auxiliary contacts, terminals, transducers etc. for interfacing works shall be provided by the Contractor.
- b) All control/monitoring wiring from sensors, equipment, and components for the interfacing shall be terminated at a separate interfacing compartment located at the respective equipment/system's switchboard or control panel. The interfacing compartment shall be completed with all necessary connectors, terminals, and with proper identifications to allow interfacing works to be easily carried out. The compartment shall clearly indicate —Extra Low Voltage Cable Only. No Power Cable Connection. Where there is no equipment/system switchboard or control panel involved, the Contractor shall provide separate interfacing panels with provisions same as the interfacing compartment as described above. The locations of the switchboard/control panels and the interfacing panels shall be properly coordinated.
- c) Wiring and cables for interfacing with the fire alarm system and other fire protection and life safety systems shall be fire rated to comply with Local Fire Department.
- d) The Contractor shall provide and make all power cable connections from mechanical equipment, local control panels, and distribution boards to the electrical isolators or power points (including cable termination) provided under Division 16 works. Location of power supply isolators and power points shall be properly coordinated.
- e) In addition to the interfacing requirements shown on the Drawings, interfacing provisions as described below shall also be provided and included in the Contract.

#### **4.12.2 Electrical Installation**

- a) The Electrical Installation shall provide the following:
  - (i) Electrical installation shall include direct power cable connections from the source (Panel feeder) to final loads.
  - (ii) Earthing terminal should be adequate and complete in all respect.

#### **4.12.3 Examination of Site**

- a) Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- b) The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work, based on examination of the site or other information. Failure to examine the drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

#### **4.12.4 Excavation and Backfill**

- a) Where ever required provide trenches details, duly approved by the Consultant/Employer with all relevant section etc. as per IS codes, minimum before 1 month of laying the pipes, etc. Coordinate with during the excavation, and ensure that the excavation and backfilling is being properly done as per requirement.
- b) Where ever it is asked by the Consultant/Employer for providing trenches in Contractor's scope.

- c) The trench shall be of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Except where rock is encountered, do not excavate below the depths indicated. Where rock excavations are required, excavate rock to a minimum over depth of four inches below the trench depths indicated on the drawings or required. Backfill over depths in the rock excavation and unauthorized over depths with loose, granular, moist earth, thoroughly machine tamped to a compaction level of at least 95% to standard proctor density or 75% relative density or as specified by the Consultant. Wherever unstable soil that is incapable of properly supporting the work is encountered in the bottom of the trench, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
- d) Excavate trenches for utilities that will provide the following minimum depths of cover from existing grade or from indicated finished grade as required by local authorities.
- e) Trenches should not be placed within 3meters of foundation or soil surfaces which must be resist horizontal forces.
- f) Do not backfill until all required tests have been performed and installation observed by the Consultant /Employer. Comply with the requirements of other sections of the specifications. Backfill shall consist of non-expansive soil with limited porosity. Deposit in 15 cm layers and thoroughly and carefully tamp until the work has a cover of not less than 30 cm. Backfill and tamp remainder of trench at 30 cm intervals until complete. Uniformly grade the finished surface.

#### **4.12.5 Cutting and Patching**

- a) All kinds of cutting and repairing of brick Walls or Partitions, etc. for the proper routing of pipe, cutting and repairing of RCC wall, or ceiling shall be in the scope of the contractor.
- b) Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc., using skilled trade people of the trades required at no additional cost to the Contract.
- c) Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Contract.

#### **4.12.6 Sealing of Penetrations**

- a) Air Tight Seals
  - (i) All penetrations through the building fabric subject to suction or pressurization shall be sealed airtight.

#### **4.12.7 Holes in Roof**

- (i) Roof penetrations for passage of conduits or circular PVC and PVC Cables shall be sealed watertight using a flexible polypropylene conical sleeve manufacturer to seal the cable to the roof structure, regardless of the roof profile.
- (ii) All sharp metal edges, which may come in contact with the cable, shall be suitably bushed.

**4.12.8 Fire Rated Penetrations**

- (i) Where services penetrate any fire rated barrier, the Contractor shall seal the penetration with the use of an appropriate material to ensure the integrity of the fire barrier.
- (ii) The Contractor shall seal the cable enclosures through fire rated barriers to ensure the integrity and rating of the fire barrier.

**4.12.9 Acoustic Penetrations**

- (i) Where services penetrate acoustic barriers, sealant shall be supplied and installed to maintain the acoustic separation at least equal to the barrier penetration.

**4.13 Mounting Heights**

**4.13.1** Verify exact locations and mounting heights with the Consultant /Employer before installation.

**4.14 Supports**

**4.14.1** Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.

**4.14.2** Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and equipment room.

**4.14.3** Provide supporting frames or racks for equipment which is installed in a free standing position.

**4.14.4** Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workman like arrangement of all equipment mounted on them.

**4.14.5** Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on ducts, pipe, electric conduits, raceways, or cables for support.

**4.14.6** Equipment shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splinters, runners, bars and the like in the plane of the ceiling). Provide independent support of equipment. Do not attach to supports provided for ductwork, piping or work of other trades.

**4.14.7** Provide required supports and hangers for equipment so that loading will not exceed allowable loading of structure. Equipment and supports shall not come in contact with work of other trades.

**4.15 Fastenings**

**4.15.1** Fasten equipment to building in accordance with the best industry practice.

**4.15.2** Where weight applied to the attachment points is 45kg or less, conform to the following as a minimum:

Sr.No	Material	Description
i	Wood	Wood screws
ii	Concrete and solid masonry	Dash Fastener of appropriate ratings - HILTI/FISHER
iii	Solid metal	Machine screws in tapped holes or with welded studs

- a) Where weight applied to the building attachment point exceeds 45 kg, but is 135 kg or less, conform to the following as a minimum:
- (i) At concrete slabs provide 60cm x 60cm x 13cm steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top slabs screed line, where no fill is to be applied.
  - (ii) At steel decking or sub-floor for all fastenings, provide through bolts and threaded rods. The tops of bolts and rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with his decking or sub-floor such hangers shall be provided.
- b) Where weight applied to building attachment points exceeds 135 kg, coordinate with and obtain the approval of Consultant/Employer and conform to the following as a minimum:
- (i) Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall suitably weld or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
  - (ii) For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
  - (iii) Wall mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars.

#### **4.16 Identification**

**4.16.1** Identify equipment with permanently attached black phenolic nameplates with 13 mm high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with cadmium plated screws; peel and stick tape or glue on type nameplates is unacceptable.

**4.16.2** Services runs shall be properly identified as per the requirements in the Contract. See individual section for additional identification requirements.

#### **4.17 Prohibited Labels and Identifications**

**4.17.1** In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any surface any name, trademark,

or other insignia which is intended to identify the manufacturer, the vendor or other source(s) from which such object has been obtained is prohibited.

**4.17.2** Required test lab certification labels shall neither be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

#### **4.18 Equipment Pads and Anchor Bolts**

**4.18.1** Provide all details with proper sections for the equipment pads and anchor. The equipment pads casting and making provision for anchor fastening shall be as per the final UNALTERED drawing duly approved by the Consultant/Employer, shall be in the scope of contractor.

**4.18.2** All equipment pads for all vibrating equipments shall have cork vibration pads sandwiched between the finish surface and the bottom surface of required thickness suggested by the Contractor to ensure that the minimum vibration can travel below.

**4.18.3** Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.

**4.18.4** Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an attached to 15 cm square, galvanized metal back plates which are attached to the gypsum board with an approved non- flammable adhesive. Toggle bolts installed in gypsum board partitions are not acceptable.

#### **4.19 Miscellaneous:**

**4.19.1** A site order book will be maintained at site, which will be in the custody of the Consultant, or his representative and all instructions given to the Contractor will be recorded in the site order book and the same has to be signed by the contractor to comply with the instructions given therein. The site order book shall be put up to GE on a weekly basis by the Consultant.

**4.19.2** After completion of the work the whole installation shall be tested by the contractor. The tests shall comply the following I.E.E. Regulations and shall be submitted along with the final bill:

- a) The result of the insulation test shall comply with the I.E.E. Regulations 1101 to 1108A and 1008B as may be applicable.
- b) Test shall be carried out to ascertain that all the non-linked SP switches have been connected to the phase conductor.
- c) The continuity test of the earthing system shall comply with I.E.E. Regulations 1108 to 1109 to the latest addition.

**4.19.3** If the result of the above tests does not comply with the I.E.E. Regulations, the contractor shall be bound to rectify the faults so that the required results are obtained.

**4.19.4** The contractor shall be responsible to provide all the necessary test certificates of testing instruments, such as megger insulation tester, earth tester multi-meter, AVO meter etc. for carrying out the above tests.

**4.19.5** The work will not be considered as complete and taken over by the User till all the components of the work after being completed at site in all respects have been inspected/ tested by the Consultant/Employer to his entire satisfaction and a completion certificate issued by the Owner to this effect.

**4.19.6** Shop drawing for electrical work e.g. equipment, cable earthing and conduit layout for all systems shall be prepared by the contractor and got approved before starting of the work.

**4.19.7** At the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit 6 sets of drawing and two tracing of each drawing to Owner of each layout drawings drawn at approved.

#### **4.20 Contractors Superintendence:**

**4.20.1** The contractor shall provide all necessary superintendence during the execution of the works and as long as there is necessity. The contractor or his competent and authorized agent or representative approved of in writing by the owner (which approval may at any time be withdrawn) is to be constantly on the works and shall give his whole time to the superintendence of the same. Such authorized agent or representative shall receive on behalf of the contractor, directions and instructions from the Consultant/Employer or his representative.

**4.20.2** The contractor shall provide detailed organization of the execution team deployed for the works with names and CV's, of all key staff before the commencement of work and get it approved of in writing by the Consultant/Employer. Contact telephone or pager numbers for emergency and/or twenty-four (24) hour call shall also be included.

**4.20.3** If in any case of withdrawal of any worker/ technician/ Engineer from the execution team, the replacement of the same shall be done with equivalent qualification, and shall be approved in writing by the Consultant/Employer .

#### **4.21 Quality Assurance Programme:**

**4.21.1** To ensure that the equipment and services under the scope of this Contract whether manufactured or performed within the Contractor's works or at the Owner's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance program to control such activities at all points necessary. Such programme shall be outlined by the Contractor and shall be finally accepted by the Owner after discussions before the award of Contract. A quality assurance programme of the contractor shall generally cover the following:

- a) His organization structure for the management and implementation of the proposed quality assurance programme.
- b) Documentation control system.
- c) Qualification data for bidder's key personnel.
- d) The procedure for purchases of materials, parts components and selection of services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control.
- f) Control of non-conforming items and system for corrective actions.
- g) Inspection and test procedure both for manufacture and field activities.
- h) Control of calibration and testing of measuring instruments and field activities.
- i) System for indication and appraisal of inspection status.
- j) System for authorizing release of manufactured product to the Owner.
- k) System for maintenance of records.
- l) System for handling storage and delivery.



- m) The Owner or his duly authorized representative reserves the right to carry out quality audit and quality surveillance of the system and procedure of the Contractor / his Vendor's quality management and control activities.

#### **4.22 Quality Assurance Documents**

**4.22.1** The Contractor shall be required to submit the following Quality Assurance Documents within three weeks after dispatch of the equipment.

- a) All Non-Destructive Examination procedures, stress relief and weld repair procedure used during fabrication and reports including radiography interpretation reports.
- b) Welder and welding operator qualification certificates.
- c) Welder's identification list, listing welders and welding operator's qualification procedure and welding identification symbols.
- d) Raw material test reports on components as specified by the specification and / or agreed to in the quality plan.
- e) Stress relief time temperature charts/oil impregnation time temperature charts.
- f) Factory test results for testing required as per applicable codes/mutually agreed quality plan/standards referred in the technical specification.
- g) The quality plan with verification of various customer inspection points (CIP) as mutually and methods used to verify the inspection and testing points in the quality plan were performed satisfactory.

#### **4.22.2 Inspection, Testing and Inspection Certificates**

- a) The Consultant/Employer or duly authorized representative shall have at all reasonable times free access to the Contractor's premises or works and shall have the power at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection, if part of the works is being manufactured or assembled at other premises or works, the Contractor shall obtain permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works. Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Owner and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.
- b) All equipment being supplied shall conform to type tests and shall be subject to routine tests in accordance with requirements stipulated under respective sections. Bidder shall submit the type tests reports for approval. The Contractor shall intimate the Consultant/Employer the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies. If for any item type test were pending payment would be made on successful completion of type/routine test(s) actually carried out as per Consultant/Employer /Owner instructions.
- c) The Contractor shall give the Consultant/Employer thirty (30) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account. The Consultant/Employer unless witnessing of the tests is virtually waived will attend such tests within thirty (30) days of the date of which the equipment is notified as being ready for test/inspection, failing which the Contractor may proceed with the test which shall be deemed to have been made in the presence of Consultant/Employer and he shall forthwith forward to the Consultant/Employer duly certified copies of tests in triplicate.
- d) The Consultant/Employer within fifteen (15) days from the date of inspection as defined shall inform in writing to the Contractor of any objection to any drawings and all or any

equipment and workmanship which in his opinion is not in accordance with the Contract. The Contractor shall give due consideration to such objections and make the necessary modifications accordingly.

- e) When the factory tests have been completed at the Contractor's or Sub-contractor's works, the Consultant/Employer shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Consultant/Employer, the certificate shall be issued within fifteen (15) days of receipt of the Contractor's Test certificate by the Consultant/Employer. Failure of the issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificate shall not bind the Owner to accept the equipment should, it, on further tests after erection, is found not to comply with the Specification. The equipment shall be dispatched to site only after approval of test reports and issuance of material inspection clearance certificate by the Owner.
- f) For tests whether at the premises or at the works of the Contractor or of any Sub-Contractor, the Contractor except where otherwise specified shall provide free of charge such items as labor, materials, electricity, fuel, water, stores, apparatus and instruments as may be required by Consultant/Employer or this authorized representative to carry out effectively such tests of the equipment in accordance with the Specification.
- g) The inspection by Consultant/Employer and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed quality assurance programme forming a part of the Contract.
- h) The Consultant/Employer will have the right of having at his own expenses any other tests(s) of reasonable nature carried out at Contractor's premises or at site or in any other place in addition of aforesaid type and routine tests to satisfy that the material comply with the specifications.
- i) The Consultant/Employer reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment's for these tests shall be provided by the Contractor.

#### **4.23 Tests**

##### **4.23.1 Charging (Pre-commissioning tests):**

- a) On completion of erection of the equipment and before charging, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Consultant/Employer and the Contractor for correctness and completeness of installation and acceptability for charging, leading to initial pre-commissioning tests at Site. The pre-commissioning tests to be performed as per relevant I.S. / vendor/ bidder submittal and as included in the Contractor's quality assurance programme.

##### **4.23.2 Commissioning Tests:**

- a) The available instrumentation and control equipment will be used during such tests and the Contractor will calibrate all such measuring equipment and devices as far as practicable. However, immeasurable parameters shall be taken into account in a reasonable manner by the Contractor for the requirement of these tests. The tests will be conducted at the specified load points and as near the specified cycle condition as practicable. The Contractor will apply proper corrections in calculation, to take into account conditions which do not correspond to the specified conditions.



- b) All instruments, tools and tackles required for the successful completion of the Commissioning Tests shall be provided by the Contractor, free of cost.
- c) Pre-commissioning test shall be carried out as per relevant IS and/or as specified in the relevant clause.
- d) The Contractor shall be responsible for obtaining statutory clearances from the concerned authorities for commissioning of the equipment.

#### **4.24 Packaging**

**4.24.1** All the equipment's shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of availability of Railway wagon/truck/trailer sizes in India should be taken account of the Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Owner takes no responsibility of the availability of any special packaging/transporting arrangement.

#### **4.25 Protection**

**4.25.1** All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non- metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.

#### **4.26 Finishing Of Metal Surfaces**

##### **4.26.1 General:**

All metal surfaces shall be subjected to treatment for anti- corrosion protection. All ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts and bolts and spring washers shall be electro galvanize. All steel conductors used for earthing/grounding (above ground level) shall be galvanized according to IS: 2629.

##### **4.26.2 Painting:**

- a) All sheet steel work shall be degreased, pickled, and phosphate in accordance with the IS- 6005 —Code of practice for Phosphate iron and sheet. All surfaces, which will not be easily accessible after shop assembly, shall beforehand be treated and protected for the life of the equipment. The surfaces, which are to be finished painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer. Oil, grease, dirt and swab shall be thoroughly removed by emulsion cleaning. Rust and scale shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- b) After Phosphate process thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying. The phosphate coating shall be sealed with application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be —flashing dried while the second coat shall be stoved
- c) Powder coating/electrostatic painting of approved shade shall be applied.

- d) The exterior color of the paint shall be as per IS-5 or as approved by Consultant/Employer. A small quantity of finishing paint shall be supplied for minor touching up required at site after installation of the equipment's, if required.
- e) In case the Bidder proposes to follow his own standard surface finish and protection procedures or any other established painting procedures like electrostatic painting etc. the procedure shall be submitted along with the Bids for Consultant's review and approval.

#### **4.27 Handling, Storage and Installation**

- 4.27.1** In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the Consultant/ Owner or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level plumb, square and properly aligned and oriented.
- 4.27.2** Contractor shall follow the site procedure for transporting of materials, unloading, and safe storage. The equipment's after collection from store shall be erected, tested and commissioned as per contract specification, manufacturer guidelines and Consultant/Employer instruction.
- 4.27.3** In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the Consultant/Employer. Contractor shall be held responsible for any damage to the equipment consequent for not following manufacturer's drawings/instructions correctly.
- 4.27.4** Where assemblies are supplied in more than the one section, Contractor shall make all necessary connections between sections. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the Contractor at his own expense.
- 4.27.5** The Contractor shall submit to the Consultant every week, a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. The Consultant shall compile these reports and put up to EE on the 15<sup>th</sup> and last working day of every month.
- 4.27.6** The Contractor shall be fully responsible for the equipment/material until the same is handed over to the Owner in an operating condition after commissioning. Contractor shall be responsible for the maintenance of the equipment/material while in storage as well as after erection until taken over by Owner, as well as protection of the same against theft, element of nature, corrosion, damages etc.
- 4.27.7** The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment, which require indoor storage.
- 4.27.8** The words 'erection' and 'installation' used in the specification are synonymous.
- 4.27.9** Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.
- 4.27.10** The minimum phase to earth, phase to phase and section clearance along with other technical parameters for the various voltage levels shall be maintained as per relevant IS.

#### **4.28 Protective Guards**

- 4.28.1** Suitable guards shall be provided for protection of personnel on all exposed rotating and / or moving machine parts. All such guards with necessary spares and accessories shall be designed for easy installation and removal for maintenance purpose.

**4.28.2** The Contractor shall also conform to the general regulations governing personnel on the site and must keep to the working space allocated for their use.

**4.28.3** The contractor shall be responsible for any kind of mishap, etc. happened with personnel. The Owner shall not take the responsibility for any of such kind.

**4.29 Tools and Tackles**

**4.29.1** The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dismantling and maintenance of the equipment's.

**4.30 APPROVED VENDOR LIST- FOR MAKES PLEASE REFER LIST OF APPROVED MAKES FOR ALL ELECTRICAL WORKS GIVEN IN - ANNEXURE-1**

**CHAPTER-5**  
**TECHNICAL SPECIFICATION FOR INTERNAL ELECTRIFICATION**  
**(LIGHTING AND POWER) AND FOR CONDUIT SYSTEM, CABLE TRAY,**  
**CABLE LADDER INSTALLATION**

## **5.1 GENERAL**

### **5.1.1 Work Description**

- a) The drawings for the lighting and power points indicate approximate position of all lighting fittings, switches, power outlet points, isolating switch points etc. The actual position of all fittings, switches, the wiring details and cable routes shall be coordinated with other trades at site and submitted for the approval of the Consultant/Employer. All time and cost required for adjusting the layout or complete installation to suit site requirement is included.
- b) To determine the exact positioning of lighting and power points due consideration shall be given, for selection of the most accessible routes for wiring, convenience of switching and operational requirement of the installation.
- c) No extra cost will be paid should the final positions be relocated within the same room.
- d) For the purpose of specification and related drawing, each lighting & power point circuit shall be coded with a prefix to indicate the corresponding distribution board number.
- e) The electrical equipment/system may develop sudden changes due to low frequency or direct electric current components such as fluorescent lamps, contactors, etc. shall be fitted with radio and television interference suppression components suitable to meet the levels specified in BS: 800 —Limits of Radio Interferencel.

### **5.1.2 This section included the specification of the following:**

- a) Distribution boards
- b) Miniature circuit breakers
- c) Earth leakage circuit breakers
- d) 6A Switch Socket Outlet
- e) 16A Switch Socket Outlets
- f) Isolating Switches
- g) Conduit Boxes
- h) Contactors
- i) Dimmers Switch
- j) Time Switch
- k) Cooler Control Units
- l) Water Heater Switches
- m) Bell Push Switches

## **5.2 Standards**

- 5.2.1** The complete wiring installation shall be engineered according to manufacturer data and constructed in accordance with the latest revision of the IS and the appropriate BS/IEC

**5.2.2** In the adoption of standards and requirements, the Contractor shall take the following precedence:

- (i) Consultant/Employer decision
- (ii) Local codes of practice
- (iii) Drawings
- (iv) Specification
- (v) International standards and requirements

### **5.3 Submission**

**5.3.1** All technical submissions shall be approved by the Consultant/Employer prior to the respective stages of construction with respect to the approved design and development documents. In case of major deviations, it shall be brought under the notice of Consultant/Employer for its review and approval.

**5.3.2** The submission shall include the following as a minimum requirement,

- (i) Equipment catalogues submission with manufacturer's data
- (ii) Sample submission include all wiring accessories
- (iii) Shop Drawings of the lighting and power positions, circuit numbers, cable routings, switching arrangement, mounting height, etc. The positions and mounting heights shall be coordinated with other services. Fixing details of all wiring accessories shall also be included.
- (iv) Drawings showing the installation details
- (v) Labeling system
- (vi) Builder's works requirement.

### **5.4 Lighting Point Installation**

**5.4.1** The various types of light fittings to be supplied and installed are described in the Schedule of Lighting Fittings on Drawing

**5.4.2** Surface mounted light fitting shall terminate at junction box having entries appropriate to the run of conduit. This shall be complete with porcelain / PVC connector suitable for the size and number of connections and wiring points to be connected with the specified fitting. Wiring to the light fittings within the false ceiling space shall be by means of heat resistant (butyl or silicon rubber insulated to BS 6500) cables i.e. between the junction box and the lamp holder/terminal blocks, in flexible conduits.

**5.4.3** At every light fitting an approved type earth terminal shall be provided for connection of the circuit protective conductor of the final circuit.

**5.4.4** Ferrous metal work shall be of minimum of 1mm thickness and treated against corrosion by galvanizing after welding or lead primer or other approved process. Metal work shall be painted with one priming coat, one under-coat and two final coats with stove-enamelled matt white paint unless otherwise specified.

**5.4.5** Cables used for internal wiring of the lighting fittings shall be with appropriate type and size, number with conductor of size not less than 1.5 sq mm single core. The insulation of the cables shall withstand the maximum temperature throughout the life of the fitting. It will be subject to normal use without deterioration which could affect the safety of the fitting.

- 5.4.6** Cables within the lighting fittings shall be neatly bundled by nylon self-locking cable ties. Wiring shall be properly routed and secured away from control gear etc. wherever possible.
- 5.4.7** All cable terminations within the light fittings shall be suitably shrouded.
- 5.4.8** All light fittings shall be supported with appropriate fixing accessories such as clips, supporting brackets, suspension sets, nuts, washers, screws etc. for their proper installation on different types of ceiling panels. Suspension sets shall be of adjustable type suitable to carry the weight of the
- 5.4.9** Lighting fittings unless otherwise stated or indicated on drawings. The suspension sets shall be generally of 900mm length. Exact lengths required shall be provided to suit the site requirement.
- 5.4.10** All lamps in operational condition with proper control gear shall be provided together with the light fittings as required and specified.

## **5.5 Switches**

- 5.5.1** Lighting switches unless otherwise specified, shall be single pole, quick make and break, silent action type with solid silver alloy contacts and totally enclosed for flush or surface mounting as required.
- 5.5.2** Lighting switches shall be suitable for indoor or outdoor service according to location housed in standardized purpose manufactured galvanized steel boxes completed with conduit knockouts made up into single or multi-gang units employing a grid switch system of fully interchangeable components at standardized fixing centers of matching switches of different types and ratings but of identical dimensions, push buttons, neon indicator lamps, blanking units, grids, steel boxes and plates all capable of integration into standard composite assemblies in any combination as required.
- 5.5.3** Grids shall be adjustable for variation in depth of plaster and for squaring errors and of the same type for surface or flush mounting. Switches in mechanical plant rooms and electrical substations and switch rooms shall be of the metal clad type approved by the Consultant/Employer mounted in flush or surface conduit boxes as specified.
- 5.5.4** Switches located on brick or concrete walls shall be mounted in horizontal arrangement in plaster depth steel boxes or in galvanized steel boxes using box suspension straps and cover plates. Countersunk screws shall be provided for fixing to the conduit boxes.
- 5.5.5** Switches for external use shall be of weatherproof construction with IP-65 rating unless otherwise specified. Samples of all switches, conduit boxes and plaster depth boxes shall be submitted to the Consultant/Employer for approval prior to installation.
- 5.5.6** Switches shall be rated for 6Amps (minimum light switch rating 6Amps), 16Amps or 20Amps (as determined by circuit load). Inductive lighting circuit shall be assessed at twice the steady state connected load current. One or two ways switch as indicated on the drawings be fixed generally at a height of 1200mm from floor level in rooms. The switch shall possibly be located inside the room on the handle side of the door as close as practicable.
- 5.5.7** Earth continuity terminal shall be provided and connected to the circuit protective conductor at every lighting switch position. Single pole switches shall be connected to break the phase wire of the supply. The neutral wire shall not be routed through switch boxes.
- 5.5.8** Switches which are mounted in the same location shall be of multi-gang type, of the maximum number of gangs available. All switches used shall be of approved or prescribed items as required by local Authorities. Circuit from different phase and circuit from emergency power should have separate switch plate.

### 5.5.9 Isolation Switch

- a) Isolating switches shall be of the current ratings and number of poles (generally double pole for single phase and 4-pole three phases) as indicated on the Drawings.
- b) Isolating switches shall be of the totally enclosed pattern, metal-clad or polycarbonate with positive quick-make and quick-break action.
- c) Switches shall be capable of passing and interrupting their full rated current safely and without damage.
- d) Ferrous materials shall be galvanised, switch handles shall be interlocked to prevent opening the cover with the switch "ON".

### 5.5.10 6AMP Switch Socket Outlets

- a) Switch socket outlets shall be as per BS: 1363 single pole 6Amp 3round pin shuttered outlets, one or two gang for indoor service except otherwise specified and suitable for surface or flush mounting according to location.
- b) Switches shall be of the quick-make and break type silent action totally enclosed with solid silver alloy contacts. Switched socket outlets for indoor use shall be housed in suitable galvanized steel boxes as per BS: 4662 with conduit knockouts. Types and finishes of socket plates shall match those for the lighting switches.
- c) Generally switch socket outlets shall be positioned 300mm above floor level except in plant rooms, kitchen, etc. where they shall be positioned 1400mm above floor level or 150mm above counters or benches as per requirement.
- d) Switch socket outlet in all mechanical plant rooms, electrical switch rooms shall be of the metal clad type, with recessed or protected switch dolly, mounted in flush or surface conduit boxes as specified.
- e) All switch socket outlets used shall be of an approved quality.

### 5.5.11 16 AMP Switch Socket Outlets

- a) 16Amp switch socket outlets shall be 3pin round type to BS: 546 shuttered, of finished similar to 6Amp switch socket outlets and flush mounted in galvanised steel conduit boxes to BS: 4662 requirements.

## 5.6 Miniature Circuit Breaker

**5.6.1** The MCB shall be suitable for manual closing, opening and automatic tripping under overload and short circuit. The MCB shall also be trip free type.

**5.6.2** Single pole / three pole versions shall be furnished as required. The MCB shall be rated for 10KA fault level.

**5.6.3** The MCB shall be suitable for housing in the lighting boards and is suitable for connection at the outgoing side by tinned cable lugs and for bus-bars connection on the incoming side.

**5.6.4** The terminal of the MCB and their open and close conditions shall be clearly / indelibly marked. The MCB shall generally conform to IEC/ IS: 60898

## 5.7 Lighting/Small Power Distribution Boards



- 5.7.1** Distribution boards shall be of standard make with MCBs as per approved make given. Distribution boards shall be of steel sheet construction double door all welded enclosure of IP42 protection and powder coated painted.
- 5.7.2** Ample clearance between the conductors of opposite pole and sheet steel body shall be maintained in order to obviate any chance of short circuit. Removable conduits entry plates shall be provided at top and bottom to facilitate drilling holes at site to suit individual requirements.
- 5.7.3** Additional / separate adopter box of suitable size shall be provided to accommodate wires, cables and No. of conduits etc. at no extra cost.
- 5.7.4** The MCB shall be mounted on high grade rigid insulating support and connected by electrolytic copper bus bars.
- 5.7.5** Each incoming MCB isolator shall be provided with solder-less cable sockets for crimping.
- 5.7.6** Phase separation barriers made out of arc resistant materials shall be provided between the phases. Bus bars shall be colour coded for phase identification.
- 5.7.7** Distribution boards shall be recessed in wall or mounted on surface of wall with necessary mounting arrangement.
- 5.7.8** The mounting height shall not exceed 1200mm from finished floor level. Distribution board shall be provided with proper circuit identification name plate and danger sticker/plate as per requirement.
- 5.7.9** All the distribution boards shall be provided with engraved name plates with lighting, power or UPS with DB Nos., as the case may be.
- 5.7.10** Each DB shall be provided with circuit list giving details of each circuit. All the outgoing circuit wiring shall be provided with identification ferrules giving the circuit number & phase.
- 5.7.11** Each distribution board shall have separate neutral and earth connection bar mounted within the DB each having the same number of terminals as the total number of outgoing individual circuits from the distribution board. Conduit & cable armouring shall be bonded together & connected to the distribution board earth bar.
- 5.7.12** Where oversized cables are specified due to voltage drop problems, it shall be contractors responsibility to ensure that satisfactory terminal arrangements are provided without an extra cost.

## **5.8 Telephone Outlets**

- 5.8.1** Telephone outlets where called for shall be single or twin flush mounted type suitable to receive the plug- in telephone cable lead to the approval of the Telecom. The finish of the telephone outlet plates at various areas shall be as specified for lighting switches.

## **5.9 Power Supply for Lighting at Wet Condition**

- 5.9.1** Residual Current Circuit Breakers shall be provided individually for each circuits serving lighting subject to wet condition.

## **5.10 Conduits, Cable Trays, Cable Ladder Work Description**

- 5.10.1** This section describes the supply and installation of wiring facilities systems include conduits, cable trays, cable ladder and Trunking system, c/w associated fittings and accessories.



**5.10.2** All cables running above the suspended false ceiling, columns, or on surface shall be supported by proper clamps, on cable tray or cable ladder system. No free hanging of cable is allowed.

**5.10.3** The cable routes shown in the drawings shall be used as a guide only. The cable routes may be physically examined and coordinated with other services before undertaking the installation work in hand.

**5.10.4** Uncoordinated and inaccessible routes after other services are installed, shall be relocated at the expense of the Contractor.

**5.10.5** All conduits, trunking, cable trays and cable ladders shall be earthed in accordance to IS: 4043.

## 5.11 Standards

**5.11.1** The complete wiring facilities system shall be manufactured, supplied, installed and tested in accordance with the latest revision of the Indian standards and the appropriate BS / IEC include:

Sr.No	Material	Standards/Codes
i	Steel Conduit and Fitting Accessories	IS:9537 (Part-II)/ BS4568 & BS731
ii	PVC Conduit and Fitting Accessories	IS-9537/1983 (Part-III)/BS6099 & BS4607
iii	Cable Tray	BS729
iv	Cable Ladder	BS729
v	Cable Trunking	BS4678

**5.11.2** The complete wiring facility system shall conform to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in the approved specification and drawings.

## 5.12 Submissions

**5.12.1** All technical submissions shall be approved by the TPA/Consultant/Employer prior to the respective stages of construction with respect to the approved design and development documents. In case of major deviations, it shall be brought under the notice of Consultant/Employer for its review and approval.

**5.12.2** Routing of installation Sample of proprietary factory-made accessories, elbows, risers, reducers, tees, crosses, etc.

## 5.13 Steel Conduit and Accessories

### 5.13.1 Steel Conduit:

- All conduits shall be of heavy gauge solid drawn ERW welded manufactured out of 16 (1.6mm) gauge MS Sheet up to 32mm dia and 14 (2 mm) gauge for sizes above 32mm.
- Both inner and outer surfaces shall be smooth without burrs, dents and kinks.
- Conduits shall be black stove enameled inside and outside. The cross section of conduit shall be uniform throughout.
- The welding shall be uniform such that welded joints do not yield when subjected to flattening test. Welded joint shall not break when threaded or bent at an angle.

- e) Conduit shall conform to specifications of IS: 9537 (Part-II) and the capacity of conduits shall be in accordance with the standards
- f) The minimum size of the conduit shall be 19/20mm diameter.
- g) Care shall be taken to ensure that all conduits are adequately protected while stored at site prior to erection and no damaged conduit is used.

#### **5.13.2 Fittings.**

- a) Samples of conduit fittings shall be submitted for approval prior to use on work.
- b) Fittings shall be those intended for use with screwed conduits and shall comply with IS 9537. However, bends, elbows and tees shall not be installed.
- c) Boxes and cover plates installed outdoors shall have fixing lugs exterior to the box so that fixing screws do not enter the box interior.
- d) Adaptors used with flexible conduits shall conform to IS: 9537.

#### **5.13.3 Circular Boxes**

- a) Circular boxes shall be of malleable cast iron, galvanized and of standard pattern with spout(s). When used for connecting lengths of conduits, circular boxes shall be provided with cover plates of similar make that are complete with brass fixing screws.

#### **5.13.4 Rectangular Boxes**

- a) Rectangular boxes (adaptable boxes) shall be of mild steel not less than 2.4 mm gauge and galvanized. When used as junction boxes, lids of the same gauge with brass fixing screws shall be used.

#### **5.13.5 Boxes for Accessories**

- a) Boxes for accessories shall be suitable for surface mounting or recessed mounting according to the requirements. Surface mounted boxes and accessories shall be metal clad pattern. Recessed boxes and accessories shall be complete with insulated molded type cover plates conforming to IS: 5133 Part I-1969.

#### **5.13.6 Covers**

- a) All covers for boxes, etc shall be made of galvanized steel of 1.2mm thickness.

### **5.14 PVC Conduit and Accessories**

#### **5.14.1 PVC Conduit**

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

### 5.14.2 PVC Conduit Accessories

- a) Accessories used for conduit wiring shall be of an approved type conforming to IS: 3837- 1966.
- b) All accessories used shall be of standard white or black color, identical to conduit used.
- c) Plain conduits should be jointed by slip type of couplers with manufacturer's standard sealing cement.
- d) All conduit entries to outlet boxes, trunking and switchgear are to be made with adaptors female thread and male bushes screwed.
- e) PVC-switch and socket boxes with round knockouts are to be used. The colors of these boxes and the conduits shall be the same.
- f) 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.
- g) Samples of accessories shall be submitted for approval prior to installation.
- h) 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.

## 5.15 Conduit Installation

### 5.15.1 Layout

- a) The conduit layout and conduit routes shall be submitted for approval. Allowance for adjustments due to site conditions shall be made at no extra cost.
- b) Conduit routes shall be chosen for easy, straight runs with minimum bends and crossings. Generally they shall follow the structure of building, running at right angles or in parallel to floors and ceilings. Conduits shall be kept within 300 mm of floors and ceilings when running parallel to them.
- c) Outlet boxes for housing accessories shall be used as draw boxes. The total number of draw boxes shall be kept to a minimum and shall be provided so that conduit runs do not exceed 12 m or have more than two right angle bends.
- d) All conduits shall be kept clear of gas and water pipes. In particular, conduits shall be at least 150 mm away from gas pipes. Where proximity to these pipes is unavoidable, they shall be effectively segregated e.g. using rubber or other insulating material to prevent appreciable voltage differences at possible points of contact. Segregation from extra low voltage circuits and telecommunication circuits shall also apply unless these are wired to the same voltage requirements as lighting and power circuits.
- e) Conduits from different distribution boards shall not be connected to the same junction box. Each run of conduit shall be assembled complete with draw-in-wires.

### 5.15.2 Joints and Terminations

- a) Electrical and mechanical continuity shall be maintained throughout all conduit joints and terminations. Conduit threads shall be thoroughly cleaned and tightly screwed. The conduit system shall be watertight after installation.

- b) Conduits shall be connected using couples or via boxes. With a coupler, the ends of the conduit shall butt close together and the running coupler is screwed tightly on and tightened by a locknut.
- c) Conduits terminating into boxes provided with spouts shall be threaded so that there are no exposed threads. For boxes with no spouts, the termination shall be made using a brass bush and a coupler. The conduit is pushed through the knockout or drilled entry and the bush is screwed tightly onto its end. The coupler is screwed to butt firmly against the exterior wall of the box.
- d) Where conduits are not jointed or terminated in boxes, they shall be terminated in a screwed brass bush.
- e) In all joints and terminations, conduit threads shall not be exposed. Where this cannot be avoided as in a running coupler, the exposed threads shall be coated with red lead paint to seal against the ingress of water.

### 5.15.3 Bends

- a) Conduits shall only be bent cold with an approved type of bending block or bending machine, without altering the dimensions of their sections.
- b) All conduit bends shall be such as to permit compliance to the requirements for bends in cables to as stated in the BS7671.
- c) Bends shall be made with as large a radius as the position of the conduit within the building permits. Where the bend is more than 90 degree, circular or rectangular junction boxes are to be used for connecting conduits.

### 5.15.4 Cabling

- a) The conduit system must be installed free of obstructions and sharp corners before any cables are drawn in. Conduits shall be thoroughly swabbed to remove moisture and dirt immediately prior to the drawing in of cables.
- b) Cables shall be drawn without crossing each other and shall not be pulled against the walls of the draw boxes. Slack cables shall left in all draw boxes.
- c) Cables shall be continuous throughout conduit lengths and no joints are permitted. There shall be no kink in cables, neither any cut, abrasion or chink in the cable insulation.
- d) The same conduit shall carry the lead and return conductors bunched together. However, the same conduit shall not house cables from different distribution boards.
- e) Cables for power and lighting circuits and extra low voltage systems shall not be drawn into the same conduit. Lighting and power circuits shall run in separate conduits except, where an adopter box is employed as final distribution point, a number of final circuits are grouped together in larger conduits between the distribution board and the adopter box provided that all final circuits in one conduit are of the same phase. In the case of three phase circuits, all three phases including neutral, if any, shall be drawn into the same conduit.
- f) Conduits shall not constitute the earth continuity path for the electrical circuit. A separate circuit protective conductor shall be installed within the conduit. The whole conduit system shall be effectively earthed.
- g) Flexible conduits shall have a separate earthing conductor installed within the tubing and connected at conduit ends. Flexible conduits in general shall not be used for more than 3m length.

- h) Maximum number of PVC insulated 650/1100V grade/copper conductor cable conforming to IS:694-1990.

Nominal Cross-Sectional area of Conductor in Sq.mm	20mm		25mm		32mm		38mm		51mm		64mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13
1.5	5	4	10	8	18	12	-	-	-	-	-	-
2.5	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	5	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

#### 5.15.5 Notes:

- The above table shows the maximum capacity of drawing in of cables in conduits
- The columns Head 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight run by an angle of more than 15 degrees. The columns heads 'B' apply to runs of conduit which deflect from the straight by an angle of more than 15 degrees.
- Conduit sizes are the nominal external diameters.

#### 5.15.6 Access and Drainage

- The conduit system shall be rewirable, that is, draw boxes must be accessible for the purpose. Where boxes are concealed, their covers shall be flushed with the finished surface.
- The need for accessibility notwithstanding, the conduit system shall be protected against the ingress of water and impurities. When installed, conduits shall be kept dry and free of debris with approved pipe plugs or caps. Such plugging is especially essential prior to pouring concrete for concealed installation. As for boxes, they shall be covered by steel plates prior to concreting.
- When installed outdoor, and in situations liable to condensation of moisture, conduits shall be arranged to be self-draining, so that water may drain to low points which are fitted with a drain plug. Conduits laid under concrete floors shall have watertight floor-traps of approved detail for access of these drainage points.

- d) Conduits run on surfaces other than structural steel members shall be secured using galvanized space bar saddles and brass fixing screws. Spacing of saddles shall not exceed
- e) 1.2 m for conduit sizes up to and including 25 mm and 1.8 m for sizes 32 mm and above.
- f) Conduits run on structural steel shall be secured using girder clips or an approved clamp. These conduits and those run in the vicinity of structural steel shall be bonded to the steelwork using an efficient and permanent metallic connection. The conduits shall not in any way be under mechanical stress.
- g) All conduit boxes except loop-in patterns shall be fixed direct to the building structure in addition to the support provided by the conduits.
- h) Conduits terminating into surface boxes shall be secured by a minimum of 3 saddles at not less than 32 mm, 150 mm and 300 mm respectively from the box.
- i) Conduits shall be painted with an approved paint to blend with visual environment. A zinc rich undercoat shall be provided before painting the final coat.

### **5.16 Cable Tray/ Cable Ladder**

**5.16.1** Cable Tray and Cable Ladder systems are intended for the support and accommodation of cables and possibly other Electrical equipment in Electrical/Instrumentation/Communication systems.

**5.16.2** The cable trays / ladders shall be fabricated according to the design specified by IEC 61537 and should be tested for Safe Working Load (SWL).

**5.16.3** Fabrication of Tray / Ladder and accessories at site and welding is not permitted. In unavoidable circumstances, If any cut or holes are made in the trays/Ladder/accessories, zinc spray need to be applied over the surface. The metal edge has to be protected by edge protection sleeves to avoid cable damage. Edge of the supports has to be protected with plastic END caps. Screwed connections and internal fixing Devices should not create any damage to the cable when correctly fixed. Sudden or jerky motions shall not be used to tighten reusable screw connections.

#### **5.16.4 Cable Tray:-**

- a) The cable tray and all accessories shall be fabricated from sheet steel and has to be galvanized against corrosion confirming to EN10346 / ISO1461-1999 for installations in indoor and outdoor applications respectively. The cable trays shall be supplied in standard lengths of 3000 mm and the width of the tray shall be as follows.

Width: 100, 150, 200, 300, 450, 600.

- b) All the cable tray accessories like Bend's, TEES's, Cross over's etc should be designed in accordance with IEC 61537 and shall be factory fabricated. The accessories shall be from the same material as of the tray and modular type, it should be connected with the trays by using fasteners. Typical details of trays, fittings and accessories.etc are shown in the enclosed drawings.
- c) For Cable trays designed, tested and confirming to IEC 61537, thickness of cable tray should be according to the manufacturer's catalogue. For locally fabricated and non-tested tray, thickness should be 2 mm up to span length of 1.5 meter, 2.5 mm for span length between 2 to 3 meter and 3 to 4 mm for span length between 4 and 10 meter.

#### **5.16.5 Cable ladder:-**

- a) The cable Ladder and all accessories shall be fabricated from sheet steel and has to be galvanized against corrosion confirming to EN10346 / ISO 1461-1999 for installations in indoor and outdoor applications respectively. The cable ladders shall be supplied in standard lengths of 3000 mm and the width of the ladder shall be as follows.

Width: 200 to 600 mm in multiples of 100 mm

- b) Maximum rung spacing in the ladder shall be 300mm. The rung's should be made of C profiles suitable to fix cables by special metal clamps according to the drawing. The ladder shall be of riveted and foldable type for easy transportation and to avoid damage during transportation and storage. All the ladder accessories like Bend's , TEES's, Cross over's etc should be designed in accordance with IEC 61537 and shall be factory fabricated . The accessories shall be made from the same material as of the ladder and modular type, it should be connected with the ladder by using fasteners. The details of ladders, fittings and accessories..etc. are shown in the enclosed drawing.
- c) For Cable Ladders designed, tested and confirming to IEC 61537, thickness of cable Ladder should be according to the manufacturer's catalogue. For locally fabricated and non-tested Ladder, thickness should be 2.5 mm up to span length of 1.5 to 2 meter, 3 mm for span length between 2.5 to 4 meter and 3 to 4 mm for span length between 5 and 10 meter.

#### **5.16.6 Mounting Accessories (supports and Brackets):-**

- a) The mounting accessories shall be fabricated from steel and has to be hot dip galvanized against corrosion confirming to ISO 1461-1999 for installations in both indoor and outdoor applications and should be of completely modular type.
- b) All supports and Brackets should be factory made, hot dip galvanized after completing welding, cutting, drilling, other machining operations and tested according to IEC 61537 according to the arrangements in the enclosed drawing. The system shall be designed such that it allows easy assembly at site by using Bolts and Nuts. The main support and brackets shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hard ware etc to form various arrangements required to support the cable trays. Welding of the components at the site shall not be allowed.

#### **5.16.7 Corrosion Protection:-**

- a) The cable tray / ladder/accessories shall be Galvanized according to EN10346 / ISO 1461-1999 for installations indoor and corrosive outdoor applications respectively. Sample tray / ladder / accessories / mounting accessories and supports should be salt spray tested according to ISO 9227 for > 150 hours & 500 hours. (\*155 hours according to class 3 for pre-galvanized surface and 550 hours according to class 6 for Hot dip Galvanized surface as per ISO).

#### **5.16.8 Testing and Certification:-**

- a) Cable tray / Ladder bend, T Bend, cross, and all supports are to be tested for Safe Working Load (SWL), deflections, Impact resistance, Salt Spray & Electrical continuity test according to IEC 61537. The cable tray/ladder should not deflect more than 1/100th of the span length at SWL in Mid span and the transverse deflection of all mounting accessories at SWL shall not exceed 1/20th of the length. The cable tray / cable ladder should be tested up to 1.7 times SWL at minimum and maximum room temperature. The temperature classification of cable tray system should be – 5 to + 150°C.

### **5.16.9 Cable Trunking**

- a) Cable trunking shall be manufactured from 1.6 mm minimum electro-galvanized mild sheet steel to BS4678 finished in oven-baked electro statically coated epoxy powder coating with color.
- b) All trunking shall have removable lids extending over their entire lengths. Lids shall be fixed at interval not exceeding 1 meter by means of brass steel screws which and protected against corrosion by a finish of zinc coating or equivalent to zinc coating.
- c) Factory-made bends, joints, elbow, riser, tee, reducer and accessories with same material shall be provided throughout the installation for trunking.
- d) Trunking space factor shall be in compliance with latest IS standards. Copper earth link bar shall be fixed at every joint of the cable trunking run.

**Note:** All items mentioned in this section shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturer's Association (NEMA).

### **5.17 APPROVED VENDOR LIST- FOR MAKES PLEASE REFER LIST OF APPROVED MAKES FOR ALL ELECTRICAL WORKS GIVEN IN - ANNEXURE-1**

**END OF SECTION**



## CHAPTER-6

### TECHNICAL SPECIFICATION FOR EARTHING SYSTEM

#### 6.1 EARTHING SYSTEM

6.1.1 The Contractor shall provide all required material and carry out equipment grounding of all equipments.

6.1.2 The earthing system shall meet the requirements of IS 3043 & IEEE 80.

#### 6.2 DESIGN CRITERIA

a) The earthing system conductors and accessories shall be as follows:

(i)	Conductors above ground level and in trenches	Galvanised steel
(ii)	Lightning protection air termination and down conductors for buildings	Galvanised steel Flat

b) The size of the earthing leads shall be decided based on the type of equipment and structure to be earthed and shall be provided generally as per IS-3043 and also with a view to minimise the number of sizes.

c) The size of conductors for lightning protection system shall be decided based on mechanical strength.

#### 6.3 Standards

6.3.1 Complete earthing system shall be designed and executed in accordance with the latest revision of the following standards and the appropriate BS/IEC:

Sr.No	Standards/Codes	Earthing & LPS
1	IS: 3043	Code of practice for Safety Earthing
2	BS6651	Lightning Protection System
3	IEC 61024-1-2	Lightning Protection System
4	IEEE-80	Guide for safety in Alternating current sub-station grounding

6.3.2 The detail of the Earthing System shall also conform to the requirements of all relevant local codes as applicable together with the additional requirements referred to in the Specification and Drawings, whichever is the more stringent and acceptable to the Consultant /Employer.

## 6.4 EARTHING SYSTEM LAYOUT

- 6.4.1 The earthing system design and installation shall generally comply with the following standards.
- 6.4.2 The Bidder shall submit the earthing drawing / layouts to electrical Inspector (CEIG) for his approval. Necessary modification wherever required shall be carried out by the Bidder and got approved by the Inspector at no extra cost to the Consultant/Employer. After installation the resistance of the ground grid shall be tested in presence of Consultant/Employer as per the IE rules. After the test, report shall be submitted to Electrical Inspector for approval. The submission of Earthing layout, drawings and obtaining Electrical Inspectorates final clearances & approval shall be within the responsibility of the Bidder.
- 6.4.3 Metallic frames of all current carrying equipment, supporting structures adjacent to current carrying conductors, structures, lightning protection system conductors and neutral points of various systems shall be connected to a single earthing system. Two earthing leads shall be used if rated voltage of equipment is above 250V. If the rated voltage is 250V or below, one earth lead shall be provided. Metallic structures adjacent to electrical equipment shall be earthed by one earthing lead.
- 6.4.4 All cable trays in the plant buildings as well as inside the trenches shall be connected to earth grid at an interval of about 10 m.
- 6.4.5 Fence shall be earthed.
- 6.4.6 Cable trays, steel pipes / conduits, steel columns, etc. shall not be used as earth continuity conductors.
- 6.4.7 Instrumentation system and computer system shall be provided with a dedicated earthing system suitable for the equipment.

## 6.5 EARTHING SYSTEM and LIGHTNING PROTECTION INSTALLATION

- 6.5.1 Earthing conductor running exposed on column, walls, etc., shall be supported by suitable cleating, at intervals of 750 mm.
- 6.5.2 When earth conductor passes through floors, walls, etc., suitable pipe sleeves shall be provided and the same shall be sealed after installation.
- 6.5.3 The connection between earthing pads / terminal to the earth grid shall be made short and direct and shall be free from kinks & splices.
- 6.5.4 Metallic conduits and pipes shall not be used as earth continuity conductor.
- 6.5.5 Flood light poles & towers, their junction boxes shall be connected to the earthing conductor to be run along with supply cable. This earth conductor shall be in turn connected to earth grid at two extreme points.
- 6.5.6 Flexible earth conductors shall be provided at expansion joints for earthing the gates, operating handles, etc.
- 6.5.7 Equipment bolted connection after being checked and tested shall be painted with anti-corrosive paint / compound.
- 6.5.8 Connection between the equipment earth lead and the grid conductor shall be welded. For rust protection, the welds shall be treated with zinc chromate primer and coated with zinc rich paint.
- 6.5.9 The cable sheaths, screens armour shall be earthed at both ends for multi-core cables. For single core cables the same shall be done at one end (switchgear end) only.
- 6.5.10 All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- 6.5.11 Lightning protection system shall consist of vertical air termination rods, horizontal roof

conductors, down comers, and pipe electrodes.

- 6.5.12 The need for providing the lightning protection system shall be established by calculating risk index value for each building structure, etc., as per procedure given in IS-2309 and any building whose risk index is above the value specified in IS shall be provided with lightning protection.
- 6.5.13 The lightning systems design and installation shall generally comply with IS:2309 code of practice for the protection of building and allied structure against lightning.
- 6.5.14 Each down conductor shall be connected to a rod electrode (to be provided by others) through test links.
- 6.5.15 Conductors of lightning protection system shall not be connected with conductors of safety earthing system above ground level.
- 6.5.16 The down conductors shall be welded to steel structures at 1000 mm interval or cleated to wall at 750 mm interval. Wherever welded, the weld locations shall be treated to provide rust protection.
- 6.5.17 Each down conductor shall be provided with a test link at a height of about 1000mm above ground level.
- 6.5.18 All the metallic structures within a vicinity of 2000 mm shall be connected to the lightning protection conductors.
- 6.5.19 Installation of earth connection leads to equipment and risers on steel structures / walls shall include laying the conductors, welding / cleating at specified intervals, welding / brazing to the main earth grids, risers, bolting at equipment terminals and coating welded / brazed joints by bitumastic paint. Galvanised conductors shall be touched up with zinc rich paint where holes are drilled at site for bolting to equipment / structure.
- 6.5.20 Installation of lightning conductors on the roofs of buildings shall include construction of upstands, laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods wherever necessary, laying, fastening / cleating / welding of the downcomers on the walls / columns of the building and connection to the test links to be provided above ground level.
- 6.5.21 Make of all items used shall be of reputed and reliable make. These makes shall be subject to Consultant/Employer /TPA approval.

## 6.6 Work Description

- 6.6.1 This section covers design, and setting of the complete earthing network for individual earthing systems, circuit protective conductors and bonding conductors and, supply, installation, testing, commissioning of earthing system.
- 6.6.2 A complete earthing network comprising cables, copper tapes, electrodes and earth bonding of all relevant necessary non-current carrying metal parts of equipments/ apparatus shall be connected as required.
- 6.6.3 The system shall have a common earthing system as described in the specification and as shown on the drawings. Individual earthing systems as per drawing shall be provided for following:
- (i) HT Electrical Earthing
  - (ii) LT Electrical Earthing
  - (iii) DG Generator Earthing
  - (iv) ELV Earthing
  - (v) Data Communication Earthing

- 6.6.4 Main HT / LT / Generator Electrical Earthing shall have two earth connections to the earthing system.
- 6.6.5 Sufficient numbers of electrodes interconnected by Cooper / GI (as per requirement) to form earthing mat so that the overall earth resistance is less than 1 ohm for each individual earthing mat.
- 6.6.6 The number of earth electrodes of the earthing mat is indicated on the drawings as minimum. The Contractor shall test the resistivity of soil at site and determine the exact number of earth electrodes to achieve the required earth resistance value with approval of Consultant/Employer. Earth plate, earth mat detail to achieve the earth resistance value shall be included in the Contract for complete earthing installation.
- 6.6.7 The Contractor shall have approval of materials from Consultant/Employer before use on work. Execution of earthing shall be carried out only in the presence of the Consultant /Employer.

#### **6.6.8 General**

- a) The resistance between earthing system and the general mass of earth shall not be greater than 1 ohm.
- b) The earth loop resistance to any point in the electrical system shall not be in excess of 0.5 ohms in order to ensure satisfactory operation of protective devices. The resistance to earth shall be measured at the following:-
  - (i) At each electrical system ground or system neutral ground.
  - (ii) At one point each grounding system used to ground electrical equipment enclosures.
  - (iii) At one point each grounding system used to ground wiring system enclosures such as metal conduits and cable sheaths or armored.
- c) All earthing conductors shall be of high conductivity copper/ G.I. and able to protect against mechanical damage as per requirement. The cross-sectional area of earth conductor shall not be smaller than half that of the largest current carrying conductor. However, the contractor shall use the sizes specified in the bill of quantities of the Tender. Common earth mats of resistivity of less than one (1) ohm shall be constructed below the lowest floor structure prior to any ground work construction. The earth mats shall comprise the complete earth electrodes, earth strips/grids, earth inspection chambers, earth leads, main earth terminals, earth test link boxes at ground level, etc. Each individual earthing system shall have earth leads connecting its main earth terminal directly to an earth electrode underground as specified.
- d) All earthing products/accessories shall be in accordance to IS standards.
- e) The mating surface of all tapes at joints etc shall be cleaned before clamping and riveted with proper connector or exothermic welded. All connections to electrical apparatus shall be made by bolted connection in a visible and accessible position.

#### **6.6.9 Pipe Earth Electrode:**

- a) G.I. pipe shall be of medium class 100mm dia and 3m in length. G.I. Pipe electrode shall be cut tapered at bottom and provided with holes of 12mm dia drilled not less than 7.5cm from each other up to 2m of length from bottom.
- b) The electrode shall be buried in the ground vertically with its top being 20cm minimum below ground level.
- c) Clamping of the earth leads to the earth rod shall be made by earth clamp. The clamps shall be capable of providing high pressure contact between the earth rod and the earth leads to achieve low contact resistance.

- d) When two or more electrodes are driven to form a group, the heads of the electrodes in the group shall be bonded to each other by means of a 25 mm x 3mm GI / Copper strip, laid at a depth of at least 600 mm in soil.
- e) Recommended water seal insert sleeve approved by Consultant/Employer shall be provided with all earth electrode penetrations through basement water proofing membranes and the installation shall be done under strict supervision.

#### **6.6.10 Plate Earth Electrode:**

- a) The plate earth electrode shall consist of copper plate or G.I. plate as per item of work. The plate electrode shall be buried in ground with its faces vertical and top not less than 4.5m below Ground level. The plate shall be filled with charcoal dust and common salt filling, extending 15cm around it's on all sides.
- b) A watering pipe of 50mm dia of medium class G.I pipe shall be provided. The top of the pipe shall be provided with a funnel and a G.I. mesh screen for watering the earth. In the case of pipe electrode a removable plug shall be provided.
- c) The earthing lead from electrode onwards shall be suitably protected from mechanical injury by suitable dia medium class G.I. pipe in case of wire and size according to strip size.
- d) The overlapping of strips at joints shall done in approved manner
  - (i) GI strips shall be riveted with rivets/ bolted and welded.
  - (ii) Copper strips shall be riveted with rivets/ bolted brass nuts, bolts and washers and brazed.
- e) The protection pipe within ground shall be buried at least 30 cm deep (to be increased to 60cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth.
- f) In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts, check nuts and washers.
- g) In case of pipe electrode it shall be connected by means of a through bolt, nuts and washers and cable socket.
- h) Main earthing conductor is taken from the earth electrode with which the connection is to be made.
- i) No earth pit shall be fixed within 1.5 M of a wall of foundation. The location of the earth electrode will be such where the soil has reasonable chance of remaining moist. Effort shall be made to locate them in grass lawns or near flower beds or water taps.

#### **6.6.11 Earth Inspection Chamber**

- a) Earth electrode shall be fitted with a heavy- duty pre-cast concrete inspection chamber / pit complete with heavy-duty cover as specified on drawings.
- b) For earth electrodes located outside or on the apron of the building, earth inspection chambers shall extend to a depth of not less than 300 mm below finished ground level and kept free of soil. For earth electrodes located inside building, earth electrodes shall be buried not less than 100 mm below the floor slab structure. Each earth electrode shall be clearly marked 'Safety Electrical Earth Connection – Do Not Remove'.
- c) The chamber and cover shall be heavy duty detail to consider the traffic load at the location of installation. The cover shall be recessed cover to receive the Architectural floor finish at the location of installation.

#### **6.6.12 Earth Strip**

- a) Earth strips/grids shall be of bare GI/ Copper strips of 25 mm x 3 mm as specified.
- b) Earth strips shall be riveted or joint with proper connector to earth electrodes underground below the floor slab structure, and shall be buried not less than 300 mm below the floor slab structure.
- c) In order to minimize the mutual inductance between strips, earth strips shall be positioned at a distance not less than 6m apart unless otherwise specified.

### **6.7 Submission**

- a) All drawings shall be approved by the TPA. All other technical submissions shall be approved by the Consultant. All technical submissions are to be submitted prior to the respective stages of construction with respect to the approved design and development documents. In case of major deviations, it shall be brought under the notice of Consultant/Employer for its review and approval.
- b) As minimum requirement the submission shall include the following:
  - (i) Shop Drawings and Sample Submission.
  - (ii) Builder's work requirement.
  - (iii) Testing procedures and report format for testing of the earth electrodes and/or earth strips.
  - (iv) Soil resisting test report with calculation report for the details of the earthing system detail including quantity and layout of earth electrodes and/or earth strips to achieve the required earth resistance. The report shall be endorsed by the Contractor's Installation Engineer who supervise and endorse the installation upon completion.
  - (v) Proposed details of earthing system including quantity and layout of the earth electrodes and/or earth strips according to the calculation result.

### **6.8 APPROVED VENDOR LIST- FOR MAKES PLEASE REFER LIST OF APPROVED MAKES FOR ALL ELECTRICAL WORKS GIVEN IN - ANNEXURE-1**

**END OF SECTION**

**STRUCTURAL DESIGN BASIS REPORT**  
**FOR**  
**THE CONSTRUCTION OF PROPOSED ELECTRICAL PANEL ROOM.**

## Index

### CONTENTS

1. Introduction
2. Structural Engineering Information
3. Structural Concepts
4. Loads
  - 4.1. Dead Load
  - 4.2. Live Load
  - 4.3. Wind Load
  - 4.4. Earthquake load
5. Foundations
6. Materials
  - 6.1. Concrete
  - 6.2. Reinforcement
7. Fire Resistance
8. Exposure Condition
9. Concrete Covers



## 1. INTRODUCTION

The objective of this report is to lay down the design basis for the structural design of the proposed Construction ----- at Hyderabad. This report covers minimum design specifications, which will form the overall design philosophy to be adopted in the structural design of the project.

Client :

Structural Consultants:

## 2. STRUCTURAL ENGINEERING INFORMATION

The Structural Design Basis Report is prepared in reference to the relevant IS Codes and drawings provided by the client.

## 3. STRUCTURAL CONCEPTS

The building is designed as a Regular RCC Framed structure (Beams and Columns).

- 3.1 All structural elements shall be designed as per limit state method as given in IS 456-2000, IS: 1893 (Part-1):2016 and IS: 13920:2016
- 3.2 All structural elements shall be checked for limit state of serviceability such as deflection and cracking.
- 3.3 The structure is analyzed for specific loads like dead load, live load, wind, and seismic loads and for the load combinations as given in the relevant codes.
- 3.4 Forces and moments from the 3D analysis output for the worst combinations are used for the design of the structure.
- 3.5 Deflection limits and cracking limits shall be followed as per the relevant Indian standards.

## 4. LOADS

### 4.1 Dead Load:

Dead load shall include weight of all structural and Architectural components. Self-weight of the materials shall be calculated based on unit weights given in IS: 875 (Part-1)

Floor finish (75mm thick screed) - 1.5 kN/m<sup>2</sup>

Self-Weight of Structural Members:

Materials	Unit Weight in kN/m <sup>3</sup>
Steel	78.50
Plain Concrete	24.00
Reinforced Concrete	25.00
Soil	18.00
Water	10.00
Bricks	19.20

#### 4.2 Live loads:

The superimposed loads shall be calculated in accordance with IS: 875 (Part-2) based on Occupancy Classification. For multiple occupancies of use in the building shall be referred with the other appropriate comparable occupancy classification as per Table.1 of IS 875 (Part-2).

#### 4.3 Wind Loads:

The Wind pressure shall be calculated in accordance with IS: 875 (Part-3).

Project is located at Hyderabad, Telangana

Basic Wind Speed,  $V_b$  - 44 m/sec

Risk Coefficient,  $k_1$  - 1.00

( $k_1$  corresponds to 50 years Mean Probable Design Life of Structure)

Terrain, height, structure size factor,  $k_2$  - Varies to suit the height of the structure

Topography factor,  $k_3$  - 1.00

Importance factor for cyclonic region,  $k_4$  - 1.00

Design wind speed,  $V_z$  -  $V_b \times k_1 \times k_2 \times k_3 \times k_4$

Wind pressure at z,  $p_z$  -  $0.6 \times V_z^2$

Design wind pressure  $P_d$  -  $k_d \times k_a \times k_c \times p_z$

#### 4.4 Earthquake Loads

The loading due to earthquake is assessed based on the provisions of IS: 1893 (Part-1)

Project location - Hyderabad

Seismic Zone - II

Zone factor (Z) - 0.1

Importance Factor (I) - 1.0

Response Reduction Factor (R) - 3.0 (OMRF)

## 5. FOUNDATIONS

Foundations shall be designed as open foundations with allowable safe bearing pressure of 300 KN/m<sup>2</sup> at a depth of 1.5m from existing ground level, as recommended in Soil report.

## **6. MATERIALS**

The following materials are used for structural work:

### **6.1 Concrete**

Grade of concrete shall be M25

### **6.2 Reinforcement**

All reinforcement shall conform to IS: 1786 having minimum yield strength of 500 N/mm<sup>2</sup>

## **7. FIRE RESISTANCE**

Structural Elements are designed for Two hours of fire resistance.

## **8. EXPOSURE CONDITION**

The project is located at Hyderabad. Hence the structural elements are designed for Mild exposure conditions as per IS 456.

## **9. CONCRETE COVERS**

The Nominal cover to main reinforcement in various structural elements shall be based on exposure condition and fire resistance, as listed below.

Foundation - 50mm

Columns - 40mm

Beams - 30mm

Slabs/Balcony - 25mm

**END OF SECTION**

**LIST OF APPROVED MAKES FOR EXTERNAL AND INTERNAL ELECTRICAL WORKS**

**ANNEXURE-1**

<b>Sr.No</b>	<b>Details of Equipment/ Material</b>	<b>Approved Makes</b>
<b>1</b>	LT Cable Termination/ Jointing Kit	Raychem/Birla 3M
<b>2</b>	Bus Duct/Rising main (Sandwich)	C&S / Schneider/Legrand
<b>3</b>	Chemical Earthing	OBO/DEHN/CAPE
<b>4</b>	Cable Tray	MNR ELECTRICALS/OBO/Legrand /VenkateswaraElectricals &Engineers
<b>5</b>	Polycarbonate Junction Boxes	OBO/Hensel/ Cape
<b>6</b>	Control Cable	KEI /Polycab/Universal
<b>7</b>	GI pipes	Jindal (Ghaziabad)/Surya
<b>8</b>	M S Conduit	AKG/BEC/RMCON
<b>9</b>	Heavy Duty Accessories for MS Conduit	Rama/Sharma/Seema
<b>10</b>	PVC Conduit & Accessories	SUDHAKAR/ANCHOR/POLYCAB
<b>11</b>	Switch Socket Accessories	Legrand (Arteor)/ Schneider (LIVIA)/ L&T/ Anchor (Vision)/Indoasian(ELVIRA)
<b>12</b>	Copper conductor PVC insulated wires (FRLS)	KEI/Polycab/ Universal
<b>13</b>	LT Cables(FRLS ,XLPE INSULATED ,AL,AR)	KEI/Polycab/ Universal
<b>14</b>	Light Fixtures (Service Area)	Bajaj/Wipro/Philips
<b>15</b>	Ceiling/Exhaust Fans	Crompton Greaves/Bajaj/Almonard
<b>16</b>	ACB	Schneider/ABB/C&S
<b>17</b>	MCCB	Schneider/ABB/C&S
<b>18</b>	MCB/ELCB/RCCB/DB	Schneider/ABB/C&S
<b>19</b>	Terminal Blocks	BCH/Industrial Control/ L-Mak/ Jainson
<b>20</b>	Switch Socket Accessories	Legrand (Arteor)/ Schneider (OPAL)/ L&T/ Anchor (Vision)/Crabtree
<b>21</b>	Timers & Contactors	ABB/Siemens/ Schneider/L&T
<b>22</b>	MV Contactors/Timer/ Starters	ABB/Siemens/ Schneider/L&T

<b>23</b>	Protective Relays	ABB/Siemens/ Schneider/L&T
<b>24</b>	kWh Meters (Electronic Digital type)/ Multifunction Meter/Ammeter/Voltmeter	Model:-Elite 500 Make :- Secure /ELMEASURE
<b>25</b>	Indication Lamps/Push Button	Esbee/Siemens/Kappa
<b>27</b>	Control Cable	KEI /Polycab/Universal
<b>28</b>	Selector Switch	C&S/Siemens/ Schneider
<b>29</b>	CT/PT	Kappa/Pragathi/ECS/Newtek Electricals
<b>30</b>	Surge Protection Devices	OBO/CAPE/PHONEIX/L&T
<b>31</b>	APFCR	Legrand / Schneider/ABB/C&T/C&S
<b>32</b>	Bus bar	Jindal/Indalco/Century/Equivalent

**END OF SECTION**

**External, Internal Electrification and Civil Works for Electrical Control Room****SUMMARY**

<b>Sr.No</b>	<b>Description.</b>	<b>Supply &amp; Installation Amount (Rs)</b>	<b>GST @ 18%</b>	<b>Total (Rs)</b>
1	ANNEXURE-1 EXTERNAL ELECTRIFICATION WORKS			
2	ANNEXURE-2 INTERNAL ELECTRIFICATION WORKS FOR ELECTRICAL CONTROL ROOM			
3	ANNEXURE-3 ELECTRICAL CONTROL ROOM CIVIL WORKS BOQ			
			<b>Grand Total</b>	

**External Electrification Works****ANNEXURE-1**

<b>Section</b>	<b>Description.</b>	<b>Supply Amount in Rs</b>	<b>Installation Amount in Rs</b>
1	External Electrification Works		
	Sub Total		
	Total (Supply + Installation)		
	GST @ 18%		
	Grand Total		

**BILL OF QUANTITY FOR SUPPLY, ERECTION, TESTING AND COMMISSIONING OF  
RETROFITTING WORKS FOR LIFTING OF L.T. ELECTRICAL PANELS AND HVAC RELATED EQUIPMENT ABOVE STORM WATER  
LEVEL IN EXISTING PLANT ROOM**

**ANNEXURE-1**

S.No	DESCRIPTION	QTY	UoM	UNIT RATE (Rs)		TOTAL AMOUNT (Rs)	
				SUPPLY	INSTALLATION	SUPPLY	INSTALLATION
<b>1</b>	<b>LT SWITCH BOARDS (INDOOR TYPE)</b>						
	<b>Supply, erection, testing &amp; commissioning of the following Outdoor/Indoor type panel boards</b>						
	<b>NOTE:- ALL THE HT/LT PANELS TENTATIVE DIMENSIONAL DETAILS HAS TO BE SUBMITTED BY THE BIDDER ALONG WITH QUOTATION.</b>						
<b>1.1</b>	<b>MPCC ( The MPCC Consisting of the Following ) (INDOOR PANEL)</b>	1	Each Job				
	<b>PLC PROGRAMMING</b>						
	<b>ELECTRICAL + MECHANICAL INTERLOCKING (ALL THE NECESSARY ACCESSORIES SHOULD BE TAKEN INTO THE PANEL FOR E+M INTRACTION)</b>						
	<b>Incoming Feeders on BUS SECTION</b>						
<b>i)</b>	<b>Incomer-1(From EB - Transformer - 1) EB I/C-1</b>						
	3200A, 4P, EDO ACB of 50KA breaking capacity with O/C, S/C, E/F and Micro Processor based Releases -1No's Each consisting of following.						
	6A, control MCB of C-Curve - 3Nos						
	Multifunction Meter(MFM) With RS485 communication port - 1 No.						
	LED Type R-Y-B Phase Indication Lamps. - (1 set)						
	On,Off & Trip Indications: (1 sets )						
	3200/5A, CL-1, 15VA, Tape wound CT's - 3Nos						
	Power Factor Relay-(1 set)						
<b>ii)</b>	<b>Incomer- 2 (From DG Synch Panel) D/G I/C-1</b>						
	2500A, 4P, EDO ACB of 50KA breaking capacity with O/C, S/C, E/F and Micro Processor based Releases -1No's Each consisting of following.						
	6A, control MCB of C-Curve - 3Nos						
	Multifunction Meter(MFM) With RS485 communication port - 1 No.						
	LED Type R-Y-B Phase Indication Lamps. - (1 set)						
	On,Off & Trip Indications: (1 sets )						
	2500/5A, CL-1, 15VA, Tape wound CT's - 3Nos						



	<b>Outgoing Feeders on BUS SECTION</b>						
<b>1)</b>	1250A, 4P, EDO ACB of 50KA breaking capacity with O/C, S/C, E/F and Micro Processor based Releases - <b>2 Nos (1DEDICATED + 1 Spare). Each consisting of following.</b>						
	6A, control MCB of C-Curve - 3Nos						
	Multifunction Meter(MFM) With RS485 communication port - 1 No.						
	LED Type R-Y-B Phase Indication Lamps. - (1 set)						
	On,Off & Trip Indications: (1 sets )						
	1250/5A, CL-1, 15VA, Tape wound CT's - 3Nos						
<b>2)</b>	800A, 4P, MCCB of 50KA breaking capacity with O/C, S/C, E/F and Micro Processor based Releases - <b>1 Nos (DEDICATED). Each consisting of following.</b>						
	6A, control MCB of C-Curve - 3Nos						
	Multifunction Meter(MFM) With RS485 communication port - 1 No.						
	LED Type R-Y-B Phase Indication Lamps. - (1 set)						
	On,Off & Trip Indications: (1 sets )						
	800/5A, CL-1, 15VA, Tape wound CT's - 3Nos						
<b>3)</b>	630A, 4P, MCCB of 50KA breaking capacity with O/C, S/C, E/F and Micro Processor based Releases - <b>1 Nos (DEDICATED). Each consisting of following.</b>						
	6A, control MCB of C-Curve - 3Nos						
	Multifunction Meter(MFM) With RS485 communication port - 1 No.						
	LED Type R-Y-B Phase Indication Lamps. - (1 set)						
	On,Off & Trip Indications: (1 sets )						
	630/5A, CL-1, 15VA, Tape wound CT's - 3Nos						
	<b>Busbar</b>						
	415V, 4000A, 3Ph, 4wire 50Hz, Aluminium busbars (91E electrical grade) having withstand ability symmetrical fault level of 50KA for 1 Sec. - LS (with 50% Neutral)						
<b>2</b>	<b>PANEL SHIFTING WORKS</b>						

2.1	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing AHU-3 Panel for Basement Wing -C (L=2.1 X W=0.4 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 5 mtr radius and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> as per Site requirement to the location shown by the user in the Chiller Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	1	Each Job				
2.2	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Main AC Panel for Plant Room (L=4.3 X W=1.2 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 5 mtr radius and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> as per Site requirement to the location shown by the user in the Chiller Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	1	Each Job				

<p><b>2.3</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Power Saver (L=1.0 X W=0.3 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 5 mtr radius and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> as per Site requirement to the location shown by the user in the Chiller Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				
<p><b>2.4</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Emergency Panel (L=5.5 X W=1.2 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				

<p><b>2.5</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Main PCC Panel (L=10.8 X W=1.3 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				
<p><b>2.6</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing 450KVAR APFC Panel-1 (L=2.8 X W=0.8 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				

<p><b>2.7</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing 450KVAR APFC Panel-2 (L=2.8 X W=0.8 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				
<p><b>2.8</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing APFC Panel-3 (L=1.2 X W=0.8 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				

<p><b>2.9</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing HVAC Panel for Animal House (L=0.65 X W=0.65 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				
<p><b>2.1</b></p>	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Change Over Panel (L=1.8 X W=0.8 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	<p>1</p>	<p>Each Job</p>				

2.11	<p>Dismantling /Removing / Taking down ,Handling, Receiving and unloading, Re Fixing, Shifting and Relocation of the <b>Existing Animal House &amp; Lift Panel (L=1.9 X W=0.8 ) Meters</b> indoor type including disconnection of connected cables , conductors, meggering of cables etc and re-fixing the same within 200 mtr away and connecting all conductors, cable glands, end terminations and marking of cable with insulation check and all Existing connected accessories without Damage Shifting/Reinstalling on <b>New MS Platform of 1 Meter Height</b> in New Main Electrical Panel Room located in Visitors Parking Area next to Security office as per Site requirement to the location shown by the user &amp; as per Tender Drawings in the New Electrical Panel Room Area as per the safety Guidelines and as per the Direction of the client.</p> <p><b>(MS Structure requirement is already quantified in the BOQ as a separate Line Item).</b></p>	1	Each Job				
3	<b>CABLES TERMINATIONS</b>						
	Removing Old Terminations and Supplying, terminating, connecting & commissioning the above underground cables with double compression type glands with required accessories and hardware.						
i	3.5CX400Sqmm Ar Al Cable	63	Nos.				
ii	3.5CX185Sqmm Ar Al Cable	20	Nos.				
iii	3.5CX150Sqmm Ar Al Cable	20	Nos.				
iv	3.5CX50Sqmm Ar Al Cable	20	Nos.				
v	4CX25Sqmm Ar Al Cable	30	Nos.				
4	<b>CABLES REMOVING WORKS</b>						
	<b>Removing and Re Laying (in Existing Cable trench) the following 1.1KV Grade AYFY/YFY/YWY Under Ground cables with necessary clamps screws etc.</b>						
i	3.5CX400Sqmm Ar Al Cable	500	Mtrs.				
ii	3.5CX185Sqmm Ar Al Cable	300	Mtrs.				
iii	3.5CX150Sqmm Ar Al Cable	300	Mtrs.				
iv	3.5CX50Sqmm Ar Al Cable	200	Mtrs.				
v	4CX25Sqmm Ar Al Cable	100	Mtrs.				
5	<b>Ms Platform Works</b>						
i	MS Chequered Plate for Platform Walk Way and MS Structural Steel (Angle or C Channel) for Panel Base Frame and Strucutural Supports. Cost Shall include Fabrication, Painting, Erection/Grouting as required as per site conditions.	28	Ton				

<b>6</b>	<b>Re-connecting and Charging the following 1.1KV Grade AYFY/YFY/YWY Under Ground cables with necessary clamps screws etc.</b>						
i	3.5CX400Sqmm Ar Al Cable FRLS	500	Mtrs.				
ii	3.5CX185Sqmm Ar Al Cable FRLS	300	Mtrs.				
iii	3.5CX150Sqmm Ar Al Cable FRLS	300	Mtrs.				
iv	3.5CX50Sqmm Ar Al Cable FRLS	200	Mtrs.				
v	4CX25Sqmm Ar Al Cable FRLS	500	Mtrs.				
<b>7</b>	<b>HT/LT CABLE SUPPLYING AND LAYING (Makes : KEI / HAVELLS POLYCAB).</b>						
	Supplying, laying, testing and commissioning of cables of the following sizes of cables on trays built up trenches or through GI pipes or clamping to column wall or structure using GI spacers and saddles (at an interval of 300mm for cables of OD up to 25mm and 500mm for the cables) scope shall includes supply of these saddles, hardware and consumables. Cables laid in trays shall be dressed and tied with black nylon ropes in the horizontal portions and clamped using the GI saddles at every 750mm in the vertical portion. What ever cables are laid through GI pipes scopes shall also include sealing the mouth of the GI pipes. Where ever cables are to be laid in built up trenches work shall be includes opening the RCC slabs before laying and replacing them after laying. The work shall be carried out as per the specification and as per the directions of the Engineer-in-charge.NOTE:All Aluminium Cable(Size) complying to IS 7098 Part 1,XLPE insulation,Inner & Outer Sheath complying ST2, Armoured Cable.						
<b>7.1</b>	<b>Supply &amp; Laying of below mentioned sizes of LT FRLS Cables 11KV (Makes : KEI / HAVELLS POLYCAB).</b>						
	<b>3.5 C AL,Ar XLPE Cable (Only AL)</b>						
i	3.5 C x 400 Sq.mm AL,Ar XLPE Cable	2100	mts				
ii	3.5 C x 300 Sq.mm AL,Ar XLPE Cable	100	mts				
iii	3.5 C x 150 Sq.mm AL,Ar XLPE Cable	0	mts				
<b>7.2</b>	<b>CABLE TERMINATIONS (including supply of cable glands and lugs)</b>						
	<b>3.5 C AL,Ar XLPE Cable (Only AL)</b>						
i	3.5 C x 400 Sq.mm AL,Ar XLPE Cable	40	Nos				
ii	3.5 C x 300 Sq.mm AL,Ar XLPE Cable	10	Nos				
iii	3.5 C x 150 Sq.mm AL,Ar XLPE Cable	0	Nos				
<b>8</b>	<b>CABLE TRENCH/CABLE TRAYS (Makes : OBO /LEGRAND ).</b>						
<b>8.1</b>	<b>CABLE TRENCH</b>						



	Excavation and construction of following size of Cable Trenches with Brick/Concrete including fixing of Cable trays , Angles ,Chekar Plate and Insert plate with all accessories like Nuts ,Bolts,Washers and Screws as per the requiremnt to do the work finishing.						
	1.2 Width ,1.2M Depth Trench.	U/R	Mtrs				
<b>8.2</b>	<b>CABLE TRAYS</b>						
	Supply & Installation of heavy duty hot dipped galvanized perforated type Cable trays of following sizes, suspended from ceiling or fixed vertically on wall / column as per including necessary supports like anchor bolts, hangers, brackets etc. and accessories like Elbows, Bends, Tee, requisite support / suspenders, hardware etc. as per site requirement. All supporting structure & hardware including nuts & bolts etc. shall be of galvanized iron as approved. Height of cable tray will be 50 mm. these all elbows, Bends, Reducers, Tees should be factory made. All the cable trays should be provided with 2mm thickness.						
<b>B</b>	<b>Ladder trays Without cover</b>						
1	600 MM width Ladder cable tray	100	Mtrs				
2	450 MM width Ladder cable tray	U/R	Mtrs				
3	300 MM width Ladder cable tray	U/R	Mtrs				
4	150 MM width Ladder cable tray	U/R	Mtrs				
5	75 MM width Ladder cable tray	U/R	Mtrs				
6	50 MM width Ladder cable tray	U/R	Mtrs				
7	Steel for supporting the above Cable Trays	0.5	MT				
<b>9</b>	<b>EARTHING SYSTEM Supplying, laying and connecting Earthing Strips- GI Flat laid in open fashion with necessary clamps,screws, interlinks etc for inter connecting of the earth pits</b>						
a	Supply, Laying and fixing of 50 x 6mm GI flat	400	Mts				
b	Supply, Laying and fixing of 25 x 6mm GI flat	100	Mts				
<b>10</b>	<b>EARTH PITS</b>						

10.1	<p>Seperate earth pit for the BODY with 100mm dia "B" class 2.5 long CI pipe with providing GI funnel covered with mesh of suitable size enclosed in a CC chamber of 450mm X 450mm X 3mm with suitable reinforced CI cover duly providing staggered holes of 16 nos of 12mm dia to the earth electrode filling salt and charcoal around 150mm from the bottom of the pipe to the bottom of CC chamber. The connections from the electrode through GI strip of 40 X 6mm length provided with suitable size of 14 nos holes with GI washers, nuts, bolts and all labour charges etc., complete.</p> <p><b>(For Transformers, HT panels Body, DG set and UPS)</b>  <b>(For Body Earthing of LT panels, Machinaries and Lightning Protection System etc)</b></p>	14	Nos				
	<p><b>Note:</b></p> <p><b>1) All Earth Pit Chambers need to be Constructed with 100mm Solid Blocks. All Earth Pit Chambers to be Numbered and Painted with Reputed make Paint.</b></p> <p><b>2) All Kind of Civil Works related to this Line Item will be in SRC Client Scope.</b></p>						
<b>11</b>	<b>SAFETY ACCESSORIES : ( Makes - OBO)</b>	1	Set				
	Supply and installation of following safety accessories.						
<b>i)</b>	10 class dry powder type fire extinguisher - 12						
<b>ii)</b>	Pair of sand brockets (two buckets on one stand) - 7						
<b>iii)</b>	Shock treatment chart in Telugu and English duly framed - 2						
<b>iv)</b>	First Aid Box - 5						
<b>v)</b>	Enamelled Danger Boards for 33KV - 2						
<b>vi)</b>	ABC Dry Chemical Powder fire Extingusher 1kg capacity stored pressure type fitted with guage and supplied complete with Intial charge wall bracket as per IS: 13489 with ISI mark. - 1						
<b>vii)</b>	ABC Dry Chemical Powder stored pressure type Fire extinuisher 2kg capacity fitted with pressure guage and supplied complete with Intial charge wall bracket as per IS: 13489 specification. - 1						
<b>viii)</b>	ABC DCP stored pressure 5kgs. capacity Fired Extingushier. With discharge hose and Nozzle. Supplied complete with Intial charge wall bracket as per IS: 13489 with as ISI mark and ABC DCP powder is as per IS:14609 with ISI mark. - 1						
<b>ix)</b>	CO2 type Fire Extingushier 4.5kgs. Capacity made from Brand seam less drawn steel cylinder with High pressure Discharge hose and HORN supplied complete with Intial charge wall bracket as per IS: 2878 specification with ISI mark. - 1						
<b>x)</b>	3 Buckets 9Ltr. Capacity with angle Iron stand - 1						

<b>xi)</b>	Electrical Insulating Rubber Mats for 33KV and 433V (HT and LT panels) should be of 3.0mm and 2.0mm respectively As per IS: 15652-2006 to be provided as per the requirements on site.						
<b>12</b>	<b>Miscellaneous</b>						
	The Miscellaneous items like.						
<b>i)</b>	GI Pipes 75 mm dia.	50	Mtrs.				
<b>ii)</b>	PVC Pipes 75 mm dia.	U/R	Mtrs.				
<b>iii)</b>	300mm RCC Hume Pipes.	200	Mtrs.				
<b>13</b>	<b>CIVIL WORK Civil works related to Electrical Services Executions:</b> - All Civil Works Related to Electrical Services mentioned below are included in Electrical Contractor Scope:-						
	a) Complete Earthing Works like excavation, digging and formation of Earth chambers of different sizes as per the BOQ.						
	b) Digging, laying and road crossing including placing hume pipes and manholes below the roads, wherever road crossings are there.						
	c) The Cable laying inside the cable Trench, Digging, Excavation, refilling including sand laying ,Brick laying for complete length/Width of Trench is under the scope of Electrical Contractor.						
	d) Wherever there is a road crossing while laying the cable, proper concrete Slab formation should be done on top of the Road Crossing as per the site condition for the vehicle movement by the Electrical contractor.						
	e) Making of opening and closing inside/outside of the building or Any core Cutting/Opening of holes inside the building for Cable Entry and then reclosing of the same core is under the scope of Electrical Contractor.						
	f) Cable Trench:-The contractor has to visit the site and visually inspect the Existing Cable trench within the electrical Room and Requirement of any extension of the Cable Trench for cable laying has to be studied by the Electrical Contractor and accordingly cable trench routing has to be finalized and any modification including suitable steel structure for cable installation to be established at site in presence of Project incharge at Site and the Electrical contractor need to quote accordingly .						
	g) The Civil works related to the Plinth and Foundation of the Transformers as per the Transformer GA Drawings has been considered under the scope of Electrical Contractor.						

	h) The civil works related to Fencing of Transformer yard area and, its Grouting, Gate/Door of 2Meter, Pad Lock and complete fencing has to be provided by the Tenderer/Electrical Contractor only. all the aforementioned activities are in the scope of the Electrical Contractor only.						
	i) Any Kind of Civil works such as construction of Foundation of the Transformer and VCB, ACB, METERING KIOSK and Double Pole Structure / Six Pole Structure ,LT Panel Foundation (if any).						
	j) All the civil related works like core Cutting/Opening of holes inside the building for Cable Entry,then reclosing of the same,wall openings/cut out, chipping the wall/floor and filling back with fire sealent/cement plaster, chicken mesh etc. complete to the clients satisfaction, related to electrical works shall be part of Electrical contractor scope.						
	k) Supply and Fixing of Fencing with Chain Links of 2.2M Height for the DG set two side and Transformer Yard Three Sides with all necessary requirements like Nuts,bolts,Washers and Rods as per requirement.						
<b>13</b>	<b>Civil works to be considered for LT PANEL WORKS AND ELECTRICAL PANEL ROOM</b>						
13.1	Major & minor civil works ( I,e Cutout in walls , unloading area clearance, Etc)	1	LS				
13.2	For Existing Directly Buried Cable Trenches ((20 X 1.2) Meters from LT Electrical Panel Room Located in Cellar area of Main Building (13.8 X 7.9) Meters to Pavement Area - Already existing road has to be dug up, excavated and existing cable to be removed which are underground laid .The existing underground cable trench is of (20 X 1.2) meter below Road. After removal of all cables the back filling of soil in the Trench and leveling it to the pre- existing road level has to be done and Road has to be complete remade as it is as it was earlier.	1	LS				
13.3	2)For Existing Directly Buried Cable Trenches (85 X 1.2) Meters from Pavement area located after the road next to LT Electrical Panel Room Located in Cellar area of Main Building (13.8 X 7.9) to the substation area- Total 85 meter length next to pavement area complete excavation removal of the existing cables, back filling of soil in the Trench and leveling it to the pre- existing pavement level and making sure that it is being remade as it is was earlier will be planned and same will be incorporated in the scope of work.	1	LS				

13.4	For Existing Directly Buried Cable Trenches (65 X 1.2) Meters from Gravel filled area located around the Substation Area to the substation office area crossing Transformer Yard - Total 65 meter length complete excavation removal of the existing cables, back filling of soil in the Trench and leveling it to the pre- existing pavement level and making sure that it is being remade as it is was earlier will be planned and same will be incorporated in the scope of work.	1	LS				
13.5	The Cable laying inside the cable Trench, Digging, Excavation, refilling including sand laying ,Brick laying for complete length/Width of Trench of (Width= 1200mm , Depth =800mm) 1.1KV LT Cable Trench for 180Meters.  Wherever there is a road crossing while laying the cable, proper concrete Slab formation should be done on top of the Road Crossing as per the site condition for the vehicle movement by the Electrical contractor. (Refer Tentative Layout enclosed for your information.) <b>(Refer Tentative Layout enclosed for your information.)</b>	1	LS				
13.6	LT substation in cellar main building (13.8 X 7.9) meters existing rolling shutter and wall height of more than the 2 feet has to be dismantled in order to remove all panels from existing electrical room which are being shifted in the New Electrical Panel room proposed near Visitors Parking next to the Security office.	1	LS				
						<b>Sub Total</b>	
						<b>Total (Supply + Installation)</b>	
						<b>GST @ 18%</b>	
						<b>Grand Total</b>	

**Internal Electrification Works****ANNEXURE-2**

<b>Sr.No</b>	<b>Description.</b>	<b>Supply Amount in Rs</b>	<b>Installation Amount in Rs</b>
1	INTERNAL ELECTRIFICATION WORKS FOR ELECTRICAL CONTROL ROOM		
	Sub Total		
	Total (Supply + Installation)		
	GST @ 18%		
	Grand Total		

INTERNAL BILL OF QUANTITY							
SUPPLY, ERECTION, TESTING AND COMMISSIONING OF INTERNAL ELECTRIFICATION							
ELECTRICAL CONTROL ROOM							
Item No.	DESCRIPTION OF ITEMS	UoM	QTY	RATE (Rs)		AMOUNT (Rs)	
A	SUB HEAD - A : WIRING			Supply	Erection	Supply	Erection
A-1	Wiring for Light / Ceiling fan / Exhaust Fan points in following groups with 2 X1.5 Sq. mm FRLS PVC insulated flexible copper conductor wire of 1100 volts grade drawn in ISI Marked 2mm thick PVC conduit on surface / recess of wall or in ceiling / false ceiling with continuous run of 1.5 Sq.mm FRLS PVC insulated flexible green colour copper earth wire for earthing the fixtures including modular switches, plates, metal box,FRLS PVC conduit & wiring etc. complete as required:-  Average length of the point 8-10 mtrs beyend that will taken as circuit measurment.(Please Refer Lighting and Power Layout Drawing for more clarity)						
(a)	<b>Light point</b> controlled by one 5/6A SP modular switch.	<b>Pts</b>	12				
(b)	<b>Light point</b> controlled by single pole MCB	<b>Pts</b>					
(c)	<b>Exhaust fan point</b> including 5/6 amp socket near the Exhaust fan and 5/6A SP switch in the switch board.	<b>Pts</b>					
(d)	<b>Ceiling fan point</b> with step type humfree Electronic speed regulator and 5/6 A. modular switch.	<b>Pts</b>	1				
	<b>Light Plugs with Modular Switches:</b>						
A-2	<b>Light Plugs with Modular Switches: (Dependent - For existing switchboard)</b>						
	Supply and fixing 3 pin 5/6 Amps. modular socket outlet and 5/6 Amps. one way modular switch, connections, painting etc. as required.	<b>No.</b>					
	<b>Power Plugs with Modular Switches:</b>						
A-3	Supplying and fixing Metal box of suitable size on surface or in recess with suitable size of inner plate and with front cover plate in the front including providing and fixing <b>3No of 3 pin 5/6 Amps.</b> modular socket outlet and 5/6 Amps. one way modular switch, connections, painting etc. as required. ( <b>Raw Power &amp; UPS Sockets</b> )	<b>each</b>					

A-4	Supplying and fixing Metal box of suitable size on surface or in recess with suitable size of inner plate and with front cover plate in the front including providing and fixing 3 pin 16 Amp modular socket outlet and 16 amps. one way modular switch, connections by providing pin type lugs and necessary crimping complete , painting etc. as required. (Power Plug Point)( <b>15A ,Raw Power &amp; UPS Sockets</b> )	each					
A-5	Supplying and fixing Metal box of suitable size on surface or in recess with suitable size of inner plate and with front cover plate in the front including providing and fixing of <b>1No of 5 pin 5/15 Amp</b> modular socket outlet and 16 amps. one way modular switch, connections by providing pin type lugs and necessary crimping complete , painting etc. as required with all the required accessories, as per approved drawings, specification and making good as per client satisfaction. (Power Plug Point) ( <b>5/15A ,Raw Power Universal Sockets</b> )	each	4				
A-6	Supplying and fixing Metal box of suitable size on surface or in recess with suitable size of inner plate and with front cover plate in the front including providing and fixing 3 pin 20 Amp modular socket outlet and 20 amps. one way modular switch, connections by providing pin type lugs and necessary crimping complete , painting etc. as required. ( <b>20A ,Raw Power Sockets</b> )	each					
A-7	Supplying and fixing Metal box of suitable size on surface or in recess with suitable size of inner plate and with front cover plate in the front including providing and fixing 5 pin 25 Amp modular socket outlet and 25 amps. one way modular switch, connections by providing pin type lugs and necessary crimping complete , painting etc. as required. (Power Plug Point) ( <b>25A AC SOCKET</b> )	each					
	<b>Light / Power Plug Points Wiring</b>						
A-10	Wiring for Light / Power Plug Points with following number and size of FRLS PVC insulated stranded copper conductor wires of 1100 volts grade in 2mm thick PVC recessed/ surface Conduit including thimbling, connections, interconnections and ISI marked 2 mm thick FRLS PVC conduit etc. complete as required:-						
	<b>Wiring for Ckt. (DB to switch board)</b>						



(a)	2 runs of 2.5 Sqmm FRLS PVC insulated multi strand Copper conductor wires with 1 run of 2.5 Sqmm PVC insulated multi strand copper conductor earth wire in and including 20mm dia. FRLS PVC conduit.	meter	10				
	<b>Wiring for Power Plug Points</b>						
	<b>Wiring for Ckt. (DB to 5A Socket)</b>						
(b)	2 runs of 2.5 Sqmm FRLS PVC insulated multi strand Copper conductor wires with 1 run of 2.5 Sqmm PVC insulated multi strand copper conductor earth wire in and including 20mm dia. FRLS PVC conduit.	meter					
	<b>Wiring for Ckt. (DB to 15A / 20A Socket)</b>						
(c)	2 runs of 4 Sqmm FRLS PVC insulated multi strand Copper conductor wires with 1 run of 4.0 Sqmm PVC insulated multi strand copper conductor earth wire in and including 25mm dia. FRLS PVC conduit.	meter	50				
	<b>Wiring for Ckt. (DB to 25A Socket)</b>						
(d)	2 runs of 6 Sqmm FRLS PVC insulated multi strand Copper conductor wires with 1 run of 6.0 Sqmm PVC insulated multi strand copper conductor earth wire in and including 25mm dia. FRLS PVC conduit.	meter					
	<b>PDB and Cables for all Industrial Sockets from Fabricated Power Distribution Boards to Sockets is given in ANNEXURE - 2</b>						
<b>B</b>	<b>SUB HEAD - B : Distribution Board/ Distribution Panels</b>						
B-1	Supply, installation, testing and commissioning of wall mounted distribution boards of 16 SWG sheet steel cubical design, double door, dust and vermin proof suitable for operation on 415 volts, 50 Hz three phase A.C. supply system, IP-43 protection, conforming to specifications and as per drawings complete with internal wiring, earthing, painting, mounted with specified equipment and accessories as required.						
	<b>NOTE:-ALL THE LIGHTING/ POWER, ELDB AND CAR CHARGING DB'S ARE PHASE SEGREGATED DB'S WITH INCOMERS AS MCB AS SUB INCOMERS AS RCBO.</b>						

A	TPN DB(LPDB)- 4Way TPN DB, Main Incoming: 63A, 4P, MCB,Sub Incomers-40A,DP,100ma,RCBO - 3Nos. With Outgoings: -10-16A 10KA SP MCB- 12Nos. <b>(LOC:-PANEL FLOOR)</b>	each	1				
A	TPN DB(ELDB)- 12Way SPN DB, Main Incoming: 63A, DP,RCBO ,30MA With Outgoings: -10-16A 10KA SP MCB- 12Nos. <b>(LOC:-PANEL FLOOR)</b>	each	1				
<b>C-1</b>	<b>Providing and fixing MS box of following sizes with phenolic laminated cover in recess/ surface as required</b>						
(a)	1-MODULE	each					
(b)	2-MODULE	each	1				
(c)	3-MODULE	each					
(d)	4-MODULE	each	1				
(e)	6-MODULE	each	1				
(f)	8-MODULE	each	1				
(g)	12-MODULE	each					
<b>D</b>	<b>Sub Head - E: Supply of Light Fitting/Fans/Luminaries and Fixtures</b>						
	Supplying of following lighting fixtures complete with special electronics low loss ballast/ lumilux tube/ lamp/ condenser/ starter /louvers / reflector/cover etc. complete without lamps as required:-						
	<b>NOTE :</b>						
	Supply of anchor fasteners / clutch wires / chain link / threaded rod / etc. all the required accessories for final installation at site shall be part of light fitting supplier/Electrical Contractor . (length of above accessories to be sufficient from Ceiling/Slab to light fitting)						
	Load bearing test for the suspenders used for fixing the light fixtures shall be carried out before installing the light fixture.						
	Supply should be in lot wise - Without written approval from Client/Consultant no light fitting should get dispatch from factory						
	Lighting Vendor/Supplier should produce illumination design reports for all the offices spaces indicating Average/minimum/max lux achieved & uniformity factors.						

	After completion of light fittings installation, Lighting Vendor/Supplier/Electrical Contractor should inspect the site, lux level to be measured and shown / proved ( Design Vs. actual obtained).						
	Incase of any quality issue or non achievement of the Lux level, all the light fixtures and associated accessories need to be replaced free of cost.						
	Removing of the cartoon/packing boxes shall be part of supplier/contractor.						
	After successfully completion of installation of light fittings, certificate shall be given by OEM to ensure the installations are done as per OEM standards.						
	Mockup of the light fixtures as per approved makes shall be done for finalisation of light fixtures.						
D-1	Panasonic Life Solutions India Pvt. Ltd LED Industrial Batten 40W IP66 Model No.:PBTM19407 (1.000)	<b>each</b>	12				
D-2	Exhaust Fans suitable for 230 Volt, 50 Hz, Single phase, A.C. supply and complete with all standard accessories such as motors, steel blades & louvers, brackets, rubber cushions etc. as required:						
(a)	300 mm dia. Crompton/Havells make	<b>each</b>					
D-3	1200/ 1400 mm dia. Ceiling fans with double ball bearings suitable for 230 Volt, 50 Hz, Single phase, A.C. supply complete with all standard accessories such as down rod, blades & capacitor etc. as required: (without speed Regulator).						
(a)	Ceiling Fan	<b>each</b>	1				
						<b>Sub Total</b>	
						<b>Total (Supply + Installation)</b>	
						<b>GST @ 18%</b>	
						<b>Grand Total</b>	

**ELECTRICAL CONTROL ROOM CIVIL WORKS BOQ-CDFD**

**ANNEXURE-3**

<b>S.No.</b>	<b>Description</b>	<b>UoM</b>	<b>Qty</b>	<b>Rate (Rs)</b>	<b>Amount (Rs)</b>
	<b>EARTH WORK</b>				
1	Clearing jungle including uprooting of rank vegetation, grass, brush wood,trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared as directed by Engineering- Incharge.	1Sqm	<b>387.36</b>		
2	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, <b>1.5 m in width as well as 10 sqm on plan</b> ) including getting out and <b>disposal of surplus excavated earth</b> lead upto 50 m and lift upto <b>1.5 m</b> , as directed by Engineer-in-charge. Extra for every <b>additional lift of 1.5 m</b> or part thereof in excavation / banking excavated or stacked materials. <b>All kinds of Soil</b>	1cum	<b>63.50</b>		
3	Excavation work by mechanical means (Hydraulic excavator)/ manual means in foundation trenches or drains (not exceeding <b>1.5m in width or 10 sqm</b> on plan), including dressing of sides and ramming of bottoms, <b>lift upto 1.5 m</b> , including getting out the excavated soil and <b>disposal of surplus</b> excavated soils as directed, within a lead of 50 m. Extra for every <b>additional lift of 1.5 m</b> or part thereof in excavation / banking excavated or stacked materials. <b>Ordinary rock</b>	1cum	<b>42.34</b>		
4	Excavation work by mechanical means (Hydraulic excavator)/ manual means in foundation trenches or drains (not exceeding <b>1.5m in width or 10 sqm</b> on plan), including dressing of sides and ramming of bottoms, <b>lift upto 1.5 m</b> , including getting out the excavated soil and <b>disposal of surplus</b> excavated soils as directed, within a lead of 50 m. Extra for every <b>additional lift of 1.5 m</b> or part thereof in excavation / banking excavated or stacked materials. <b>Ordinary rock</b>	1cum	-		
5	Removal and carting away excess / certified as surplus and not useful, excavated earth from work site with all lead and lift including loading, unloading and transportation as per instruction of Engineer In Charge. Dumping is permitted at approved designated place by the local authorities and shall be identified by the vendor himself. Contractor shall also obtain necessary permissions / approvals / authorization from the competent authority of local body / traffic / police as the case may be for removal of excavated earth/material. No payment/fees on this account shall be entertained by the department.	1cum			
	<b>PLAIN CEMENT CONCRETE</b>				
6	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : <b>1:4:8</b> (1 cement : 4 coarse sand (zone-III) derived from natural sources : 8 graded stone aggregate 40 mm nominal size derived from natural sources)	1cum	<b>8.00</b>		

	<b>ANTI TERMITE TREATMENT</b>				
7	<p>Providing anti termite treatment as per IS 6315 (Part-2) 2001 (pre-constructural chemical treatment measures) along the internal &amp; external vertical faces of the columns, plinth beams, basement and top surface of the basement filling below flooring bed as per the specified procedure confirming to IS 6315 (Part-2) 2001 and other relevent approved specification duly using Chlorpyriphos / Lindane emulsifiable concentrate 20% with 1% concentration @ 7.5 Liters/sqm of the vertical surface &amp; 5.0 Liters/sqm of the horizontal surface of the substructure to a depth of 500mm around columns &amp; 300mm deep around plinth beams, basements &amp; floor filling area including excavation channel along the wall &amp; rodding etc &amp; cost &amp; conveyane of all materials to the site, cost of labour for spraying, rodding etc complete for finished item of work as per the approval of the Engineer-in-Charge. ( The rate shall include cost of materials, labour, loading and unloading, transportation, scaffolding and all other incidental charges etc., with all leads and lifts, complete and as directed by the Engineer-in-charge at all levels. (Plinth area of the building at ground floor only shall be measured for payment). ) only Plinth area is measurable for payment , Guarantee for ATT should be for a period of 10 years from the date of practical completion of the project. Guarantee bond shall be submitted by the Main Contractor undertaking responsibility for free performance during the guarantee period.</p>	1Sqm	<b>54.00</b>		
	<b>BACKFILLING</b>				
8	<p>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundation etc in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming &amp; watering, lead up to 50m &amp; lift upto 1.5m.</p>	1cum	<b>66.27</b>		
9	<p>Excavating, supplying and filling of local earth (including royalty) by mechanical transport upto a lead of 5km also including ramming and watering of the earth in layers not exceeding 20 cm in trenches, plinth, sides of foundation etc. complete. Extra for compaction of earth work in embankment under optimum moisture conditions to give at least 95% of the maximum dry density (proctor density).</p>	1cum	<b>44.18</b>		
	<b>CRS , EXTERNAL PAVERS, PROTECTION UPTO FRL LEV</b>				
10	<p>Providing and constructing <b>Coursed Rubble Masonry</b> of thickness as specified with good quality stones in CM 1:6 (1 cement: 6 coarse sand) at the following levels, stone hammered dressed in courses not less than 200mm high, bond stones or through stones at 2m apart in each course or as per the applicable Indian Standards including raking out joints to receive pointing, scaffolding, curing, with all leads and lifts, cost of labour, materials, loading and unloading, transportation and all other incidental charges, etc., complete as per drawings, specifications and as directed by the Engineer- in-charge.</p>	1cum	<b>7.31</b>		

11	Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement : 3 coarse sand (zone-III) derived from natural sources : 6 graded stone aggregate 20 mm nominal size derived from natural sources) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including necessary excavation, levelling & dressing & finishing the top smooth.	1Sqm	<b>64.80</b>		
12	Providing & laying <b>boulder stone soling upto 230mm</b> thick in plinth/ basement / driveway/below floor/foundation & all other locations as directed using granite stones, packing the crevices with stone chips, supplying & spreading of approved Moorum binding material, mechanical consolidation and compaction with roller, necessary watering. The quoted rate shall include for all materials, labours, loading and unloading charges, tools & plants, transportation, finishing, with all lead and lifts at all levels, all other incidental charges, etc. complete and as directed by the Engineer-in-charge.	cum	<b>0.00</b>		
	<b>REINFORCED CEMENT CONCRETE</b>				
	Providing and laying in position ready mixed or site batched design mix cement concrete for reinforced cement concrete work; using coarse aggregate and fine aggregate derived from natural sources, Portland Pozzolana / Ordinary Portland /Portland Slag cement, admixtures in recommended proportions as per IS: 9103 to accelerate / retard setting of concrete, to improve durability and workability without impairing strength; including pumping of concrete to site of laying, curing, carriage for all leads; but excluding the cost of centering, shuttering, finishing and reinforcement as per direction of the engineer-in-charge; for the following grades of concrete. Note: Extra cement up to 10% of the minimum specified cement content in design mix shall be payable separately. In case the cement content in design mix is more than 110% of the specified minimum cement content, the contractor shall have discretion to either re- design the mix or bear the cost of extra cement.				
	<b>All works upto plinth level</b>				
	<b>Concrete of M25 grade with minimum cement content of 330 kg /cum</b>				
13	Footings,Columns ,Plinth Beams	1cum	<b>13.09</b>		
13.A	Same as above but for <b>M-35</b> Grade	1cum	<b>0.00</b>		
	<b>All works above plinth level upto floor V</b>				
	<b>Concrete of M25 grade with minimum cement content of 330 kg /cum</b>				
14	Columns,Roof Beams ,Roof Slabs ,Staircase Lintels ,Sunshades	1cum	<b>42.33</b>		
14.a	Same as above but for <b>M-35</b> Grade	1cum	<b>0.00</b>		
	<b>SHUTTERING WORKS</b>				

	Providing & fixing formwork with 12mm thick Plastic coated plywood with wooden frame work, bolts, nuts, MS span, MS Jacks, MS pipes ties, fasteners, necessary supports, etc., upto 5m height ( Design of Formwork, supporting system and staging to be approved by the Consultant prior to commencement of work). Rate should be inclusive of chemical releasing agent, joint tape for water tight joints, formwork of any shape, size and thickness, including propping, scaffolding, equipments, strutting, bracing, staging, preparing of surface for placing formwork, access platform, de-shuttering, cost of materials, labour, loading and unloading, transportation and all other incidental charges etc., with all leads and lifts, complete and as directed by the Engineer-in-charge at all levels.(for foundations MS shuttering shall be allowed) only concrete contacted area will be measured for payment.				
	<b>Below FFL works</b>				
15	Footings,Columns ,Plinth Beams	1Sqm	<b>76</b>		
	<b>Above FFL works</b>				
16	M -Columns,Tie Beams ,Roof Slabs ,Staircase Lintels ,Sunshades	1Sqm	<b>319</b>		
	<b>REINFORCEMENT STEEL</b>				
	Supplying, straightening, cutting, bending, placing in position reinforcement bars of all diameters to RCC work and binding with 20 SWG black annealed binding wire (double fold) etc., all complete as per drawings and specifications at the following levels. The rate shall include cost of materials, cost of binding wire, pvc cover blocks as specified, labour, loading and unloading, transportation, scaffolding and all other incidental charges etc., with all leads and lifts, complete and as directed by the Engineer-in-charge. (Payments will be based on actual approved BBS qty. Only authorized laps, chairs and spacers will be measured and paid for) (Base price (FOR site basis, Exclusive of all taxes/duties) of reinforcement bar - Rs. <b>58/- per KG</b> )				
	<b>Below &amp; above FFL works</b>				
17	Footings,Columns upto plinth ,Plinth Beams ,Tie Beams ,Roof Slabs ,Staircase Lintels ,Sunshades	1 kg	<b>6,568</b>		
17A	Preparing shop drawings, obtaining consultants approval, supplying, fabricating, delivering at site, hoisting and fixing in position, including all temporary staging and supporting work / cranes required for lifting the structural members and making all structural steel work in accordance with the design, drawings prepared by the consultants. The steel work shall include assembly, welding, botting, jointing, building up new sections and fabrication out of rolled or formed steel sections and / or plates of any thickness for columns, beams, trusses, purlins, etc. using plates, channels and angles, gusset plate, foundation bolts, cleats etc. as per drawing, steel conforming to IS : 226 with minimum yield strength of 250 Mpa. The rate shall include cleaning the surface of the steelwork with mild acid wash, wire brush and pressurised water jet. the rate to be inclusive of welding anchors, lifting hooks, rungs, templates etc., also including forming partial pockets in the concrete along with the embedment of the bolts, inserts etc.				

	Paint and finishing shall be done at factory and bought at site, final finishing / painting shall be done be on site.				
	<b>Masonry &amp; painting</b>				
	<b>Masonry</b>				
18	Providing and laying Brick Work with common burnt clay FPS(non modular) bricks of class designation 7.5 in super structure above plinth level upto Floor V level in all shapes & sizes Plinth Level upto Floor Five level -Cement Mortar1:6 (1-cement : 6-coarse sand) all complete as per directions of the Engineer-in-charge	1cum	<b>49.90</b>		
	<b>PLASTERING</b>				
19	Preparing the surface, providing & applying 18 MM sponge/rough finish water proof plaster in two layers, 12mm thick base coat in CM 1:6 & 6mm thick finishing coat in CM 1:3, laid in panels with jointless finish as per design to external walls including including hacking to RCC surfaces, scraping, cleaning the surface, waterproof compound as per manufacturers recommendation, rounding of corners ,fixing 150 mm wide GI plaster mesh of Arpitha or equivalent approved make with nominal thickness of individual thread 0.35mm with a Zinc coating of 120 gms per Sqm at the junctions of masonry & RCC work ,fixing of size 45mmx45mmx0.45mm GI corner beads of Arpitha or equivalent approved make with a Zinc coating of 120 gms per Sqm for door openings, openings up to lintel level, corner junctions of wall or other areas as specified, fixing the corner bead in CM 1:2 including typing in position with suitable nails/screws. wherever required and specified, forming grooves wherever necessary, cost of materials, labour, curing, loading and unloading, transportation, scaffolding and all other incidental charges, drip mould of all shape and sizes etc., with all leads and lifts, complete as per drawings, specifications at the following levels and as directed by the Engineer-in-charge.	1Sqm	<b>280.72</b>		
20	Preparing the surface, providing & applying plastering 12mm thick in CM 1:6 (1 cement: 6 fine sand) without lime rendering to uneven surface like internal masonry walls, jambs etc., including hacking to RCC surfaces, scraping, cleaning the surface, rounding of corners ,150 mm wide GI plaster mesh of Arpitha or equivalent approved make with nominal thickness of individual thread 0.35mm with a Zinc coating of 120 gms per Sqm at the junctions of masonry & RCC work ,fixing of size 45mmx45mmx0.45mm GI corner beads of Arpitha or equivalent approved make with a Zinc coating of 120 gms per Sqm for door openings, openings up to lintel level, corner junctions of wall or other areas as specified, fixing the corner bead in CM 1:2 including typing in position with suitable nails/screws. wherever required and specified, forming grooves wherever necessary. The work shall include cost of materials, labour, curing, loading and unloading, transportation, scaffolding and all other incidental charges etc., with all leads and lifts, complete as per drawings, specifications, at the following levels and as directed by the Engineer-in-charge.	1Sqm	<b>219.74</b>		

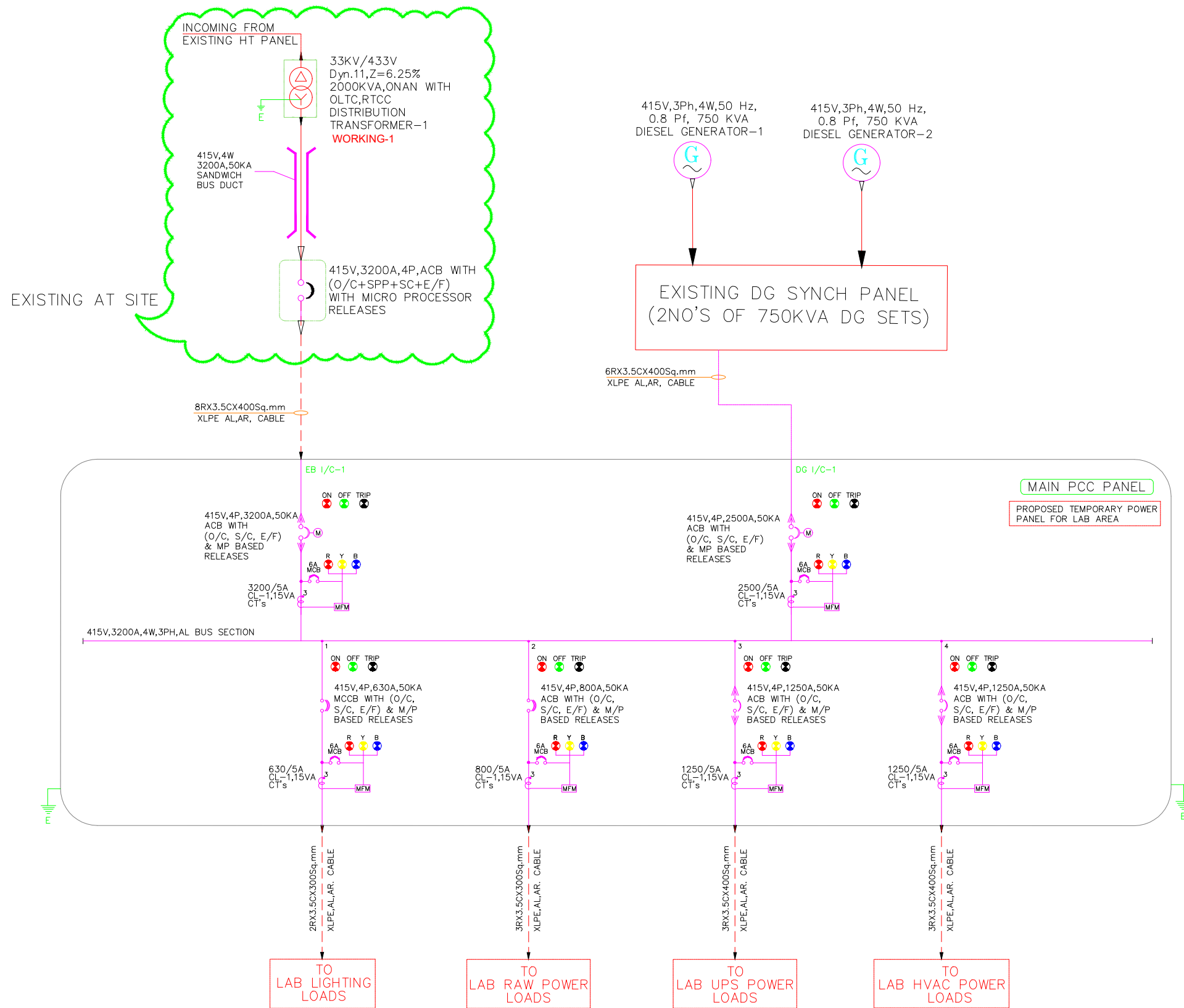


21	Preparing the surface, providing & applying plastering 12mm thick in CM 1:4 (1 cement: 4 fine sand) without lime rendering to uneven surface like <b>internal celings</b> , jambs etc., including hacking to RCC surfaces, scraping, cleaning the surface, rounding of corners wherever required and specified, forming grooves wherever necessary. The work shall include cost of materials, labour, curing, loading and unloading, transportation, scaffolding and all other incidental charges etc., with all leads and lifts, complete as per drawings, specifications, at the following levels and as directed by the Engineer-in-charge.	1Sqm	<b>183.20</b>		
	<b>PAINTING</b>				
	Finishing walls with 100% Premium acrylic emulsion paint having VOC less than 50 gm/litre and UV resistance as per IS 15489:2004, Alkali & fungal resistance, dirt resistance exterior paint of required shade (Company Depot Tinted) with silicon additives. New work (Two or more coats applied @ 1.43 litre/ 10 sqm. Over and including priming coat of exterior primer applied @ 0.90 litre/10 sqm. all completed inc labour ,scaffolding etc				
22	<b>External Walls</b>	1Sqm	<b>280.72</b>		
	Providing and applying white cement based putty of average thickness 1mm, of approved brand and manufacturer , over the plastered wall surface to prepare the surface even and smooth complete. Wall painting with premium acrylic emulsion paint of interior grade, having VOC (Volatile Organic Compound ) content less than 50 grams/ litre of approved brand and manufacture, including applying additional coats wherever required to achieve even shade and colour. all completed inc labour ,scaffolding etc Two coats				
23	<b>Internal Walls</b>	1Sqm	<b>219.74</b>		
24	<b>Internal Celings</b>	1Sqm	<b>183.20</b>		
	<b>Joinery</b>				

25	<p>Providing and fixing fire resistant door frame of section 50 x 60 mm on horizontal side &amp; 35 x 60 mm on vertical sides having built in rebate made out of 1.6 mm thick GI sheet (Zinc coating not less than 120gm/sqm) suitable for mounting 120 minutes Fire Rated Glazed Door Shutters. The frame shall be filled with mineral wool Insulation having density minimum 96Kg/sqm. The frame will have a provision of G.I. anchor fastners 14 nos (5 each on vertical style &amp; 4 on horizontal style of size M10 x 80) suitable for fixing in the opening along with factory made template for SS ball bearing hinges of Size 100x89x3mm for fixing of fire rated glazed shutter . The frame shall be finished with a approved fire resistant primer or powder coating of not less than 30 micron in desired shade as per the directions of Engineer - in- Charge. (Cost of SS ball bearing hinges is included).</p> <p>Providing and fixing 60 mm thick glazed fire resistant door shutters of 120 minutes Fire rating conforming to IS:3614 (Part II) or EN1634-1:1999, tested and certified as per laboratory approved by Engineer-in-Charge, with suitable mounting on door frame, consisting of vertical styles, top rail &amp; side rail 60 mm x 60 mm wide and bottom rail of 110 mm x 60 mm made out of 1.6mm thick G.I. sheet (zinc coating not less than 120gm/sqm) duly filled mineral wool insulation having density minimum 96 kg/cum and fixing with necessary stainless steel ball bearing hinges of size 100x89x3mm of approved make, including applying a coat of approved fire resistant primer or powder coating not less than 30 micron etc all complete as per direction of Engineer-in-Charge all complete</p>	Sqm	2.88		
	<p><b>Providing and fixing factory made uPVC</b> glazed/wire mesh windows/doors comprising of lead free uPVC multi-chambered frame, sash and mullion/coupler (where ever required) extruded profiles having minimum wall thickness of 1.70 mm for Series R1 and R2 profiles and 2.10 mm for Series R3 and R4 profiles conforming to EN: 12608 in any shape, colour and design duly reinforced with galvanized mild steel section made of required shape &amp; size as per CPWD Specification, uPVC extruded glazing beads, interlocks and Inline sash adaptor (where ever required) of appropriate dimension, EPDM gasket, hardware, SS 304 grade fasteners of minimum 8 mm dia with countersunk head, comprising of matching polyamide PA6 grade sleeve for fixing frame to finished wall as per IS 1367: Part 1 to 14, plastic packers, plastic caps and necessary stainless steel screws etc. Profile of frame, sash &amp; mullion (if required) shall be mitred cut and fusion welded/mechanically jointed duly sealed at all corners, including drilling of holes for fixing hardware and drainage of water etc. After fixing frame the gap between frame and adjacent finished wall shall be filled with weather proof silicon sealant over backer rod of approved size and quality, all complete as per approved drawing conforming to CPWD specification &amp; direction of Engineer-in-Charge. Section of steel reinforcement and cross sections of uPVC profiles to be as per design approved by Engineer-in-Charge.</p> <p>Wire mesh / Glazing of plain/ toughened/ laminated/ double glass unit with/without high performance coatings as per design requirements and conforming to IS: 3548 &amp; IS: 16231 included</p> <p>Note:-Structural design proof checked from a Government Engineering Institute, to be provided by the manufacturer for: (i) Sites with basic wind speed &gt; 45 m/sec as per IS 875 - Part 3 (ii) Sites with structure height more than 20m for all wind speeds</p>				

26	<p><b>Two and half track three panels sliding window with two glazed &amp; one wire mesh</b> panels with Aluminium channel for roller track, wool pile, nylon rollers with SS 304 body.  <b>Using R3 series with frame</b> (85mm &amp; above) x (40mm &amp; above) &amp; glazed sash (30mm &amp; above) x (55mm &amp; above) &amp; fly screen sash (20mm &amp; above) x (50mm &amp; above) with zinc alloy (zamak) powder coated touch locks with hook (Height upto 1.8 metre).  <b>5.0 mm thick glass</b> panes (weight not less than 12.50 kg/sqm).  <b>Fly proof stainless steel grade 304</b> wire gauge with 0.5 mm dia. wire and 1.4mm wide aperture with matching wood beading</p>	Sqm	<b>4.46</b>		
27	<p>Fixed window / <b>Ventilator without mullion</b> /transom  Using R1 series with frame (33mm &amp; above) x (35mm &amp; above). (Height upto 0.90 metre)  5.0 mm thick glass panes (weight not less than 12.50 kg/sqm).</p>	Sqm	<b>1.10</b>		
28	<p>Supplying and fixing <b>rolling shutters</b> of approved make, made of required size M.S. laths, interlocked together through their entire length and jointed together at the end by end locks, mounted on specially designed pipe shaft with brackets, side guides and arrangements for inside and outside locking with push and pull operation complete, including the cost of providing and fixing necessary 27.5 cm long wire springs manufactured from high tensile steel wire of adequate strength conforming to IS: 4454 - part 1 and M.S. top cover of required thickness for rolling shutters.  <b>80x1.25 mm M.S. laths</b> with 1.25 mm thick top cover -Rolling Shutters  Providing and fixing <b>ball bearing</b> for rolling shutters.  inc labour, materials, scaffolding, transportation, tools &amp; plants, welding, loading and unloading charges, devices for erection, finishing, all other incidental charges, etc. complete with lead &amp; lifts at all levels and as directed by Engineer-in-charge.</p>	Sqm	<b>16.00</b>		
29	<p>providing mechanical device chain and crank operation for operating rolling shutters.  Exceeding 10.00 sqm and upto 16.80 sqm in the area inc labour, materials, scaffolding, transportation, tools &amp; plants, welding, loading and unloading charges, devices for erection, finishing, all other incidental charges, etc. complete with lead &amp; lifts at all levels and as directed by Engineer-in-charge.</p>	nos	<b>1.00</b>		
	<b>Flooring</b>				
30	<p>Flooring with non-skid full body double charge vitrified tiles of size 600mm x 600mm and thickness between 7 - 8mm 1st quality conforming to IS: 13711, IS: 13712, IS: 13630(Part 1 to 15) of any colour and finish in all shades and designs as approved by Engineer-in-charge, set over base coat of cement mortar (1:8), 12mm thick using screened sand over CC bed already laid or RCC roof slab, including neat cement slurry of honey like consistency spread @ 3.3 Kgs per Sqm &amp; jointed neatly with white cement paste to full depth mixed with pigment of matching shade, including cost of all materials like cement, screened sand, water and tiles etc., and overheads &amp; contractors profit complete for finished item of work.</p>	sqm			

31	Providing skirting to internal walls to 10 cm height with double charge vitrified tiles screen printed and polished of thickness between 8 to 10mm 1st quality conforming to IS: 13711, IS: 13712, IS: 13630(Parts 1 to 15) of any colour and finish in all shades and designs, length equal to flooring tiles, set over base coat of CM(1:5) 12 mm thick using screened sand with cement slurry of honey like consistency spread at the rate of 3.30 kgs per sqm and jointing with white cement paste mixed with pigment of matching shade to full depth, including cost of all materials like tiles, cement, sand and water etc.,and overheads & contractors profit complete for finished item of work.	sqm			
32	Providing dadoing to walls with glazed full body ceramic wall tiles of size 300 x 600 mm with any type of design texture such as marble finish, wooden, bamboo, stone finishes etc., scratch less, stain free and thickness between 6-8 mm 1st quality conforming to IS:13711, IS:13712, IS:13630 (Parts 1 to 15) of any colour and finish in all shades and designs with borders as approved by Engineer-in-Charge set over base coat of CM(1:5) 12 mm thick using screened sand with cement slurry of honey like consistency spread at the rate of 3.30 kgs per sqm and jointing with white cement paste mixed with pigment of matching shade to full depth, including cost of all materials like tiles, cement, sand and water etc., complete overheads & contractors profit complete for finished item of work.				
			<b>Sub Total</b>		
			<b>GST @18%</b>		
			<b>Grand Total</b>		



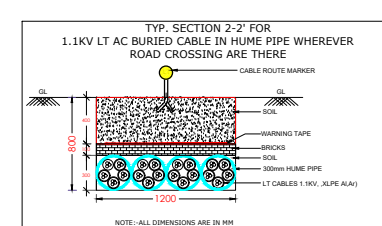
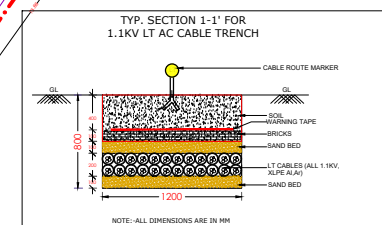
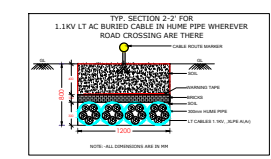
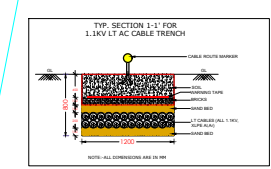
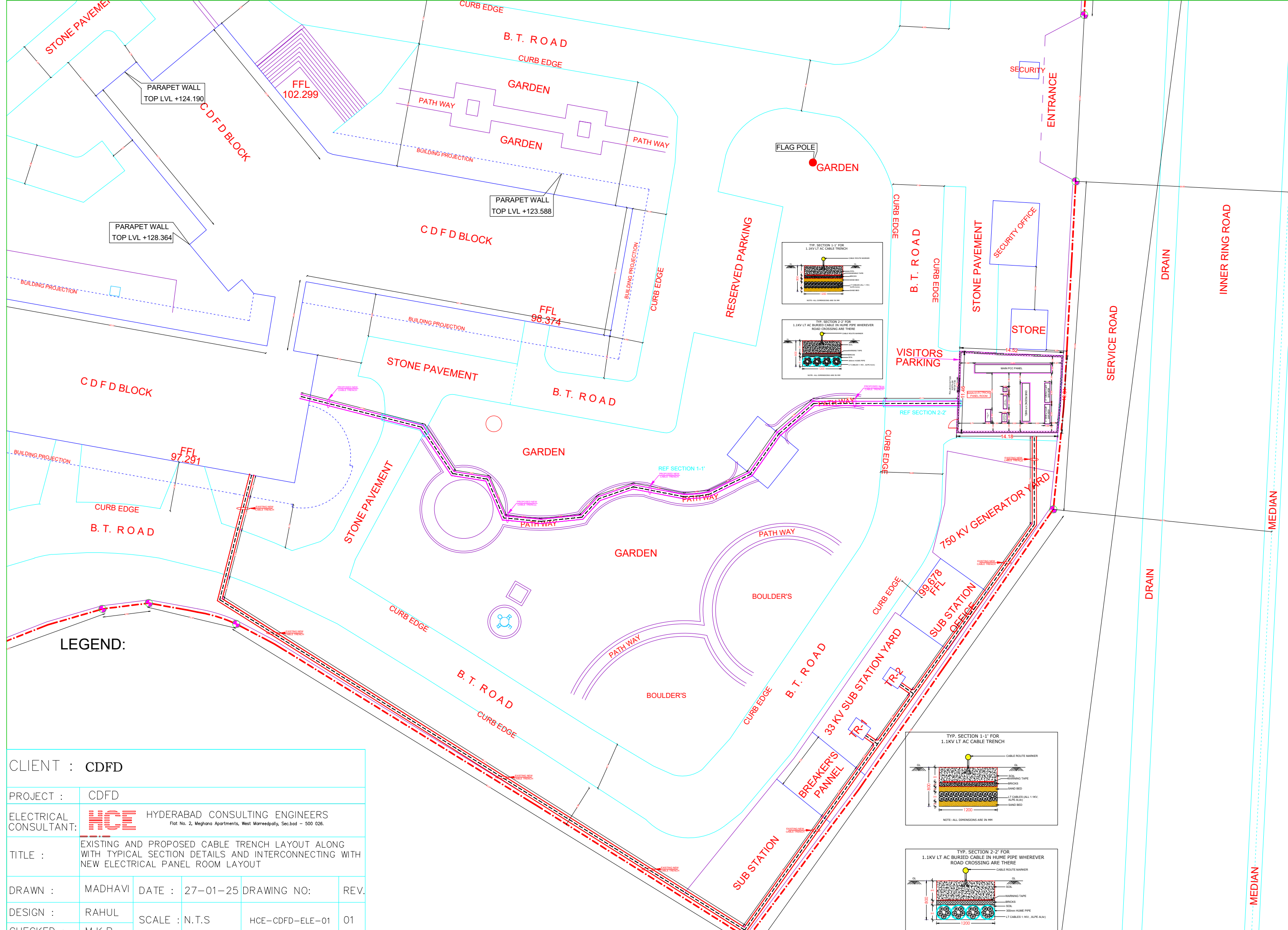
CLIENT : CDFD

PROJECT : CDFD

ELECTRICAL CONSULTANT: **HCE** HYDERABAD CONSULTING ENGINEERS  
 Flat No. 2, Meghana Apartments, West Marreepally, Sec.bad - 500 026.  
 Phone: +91 8169853813, +91 8688469625. E-mail: rahul@hceengineers.com

TITLE : PRELIMINARY SINGLE LINE DIAGRAM FOR TEMPORARY CONSTRUCTION POWER FOR LAB AREA

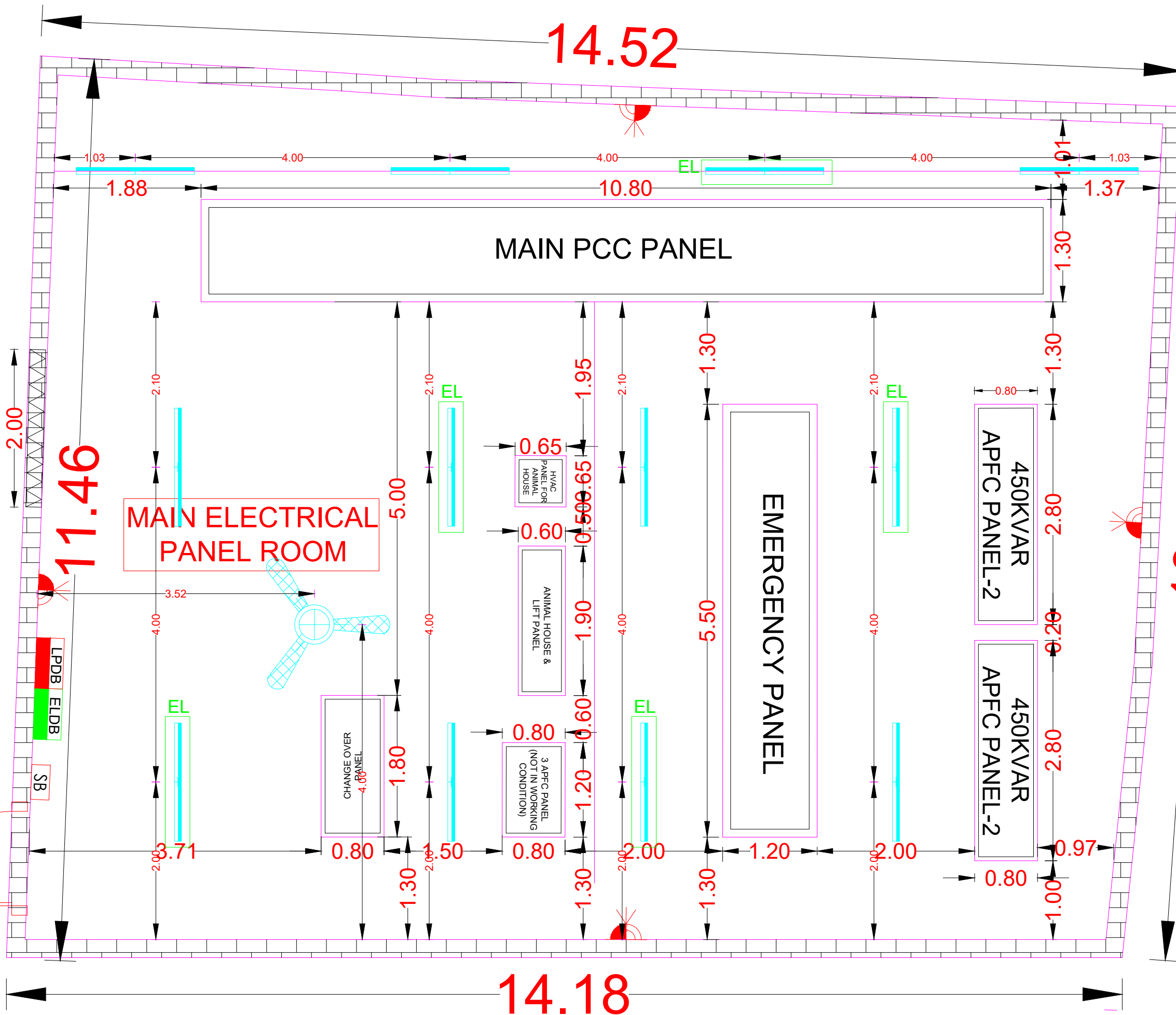
DRAWN :	HASITHA	DATE :	11-01-25	DRAWING NO:	REV.
DESIGN :	RAHUL	SCALE :	N.T.S	HCE-CDFD-ELE-SLD	00
CHECKED :	M.K.R				



LEGEND:

CLIENT :	CDFD			
PROJECT :	CDFD			
ELECTRICAL CONSULTANT:	<b>HCE</b> HYDERABAD CONSULTING ENGINEERS Flat No. 2, Meghana Apartments, West Marredpally, Sec.6d - 500 026.			
TITLE :	EXISTING AND PROPOSED CABLE TRENCH LAYOUT ALONG WITH TYPICAL SECTION DETAILS AND INTERCONNECTING WITH NEW ELECTRICAL PANEL ROOM LAYOUT			
DRAWN :	MADHAVI	DATE :	27-01-25	DRAWING NO:
DESIGN :	RAHUL	SCALE :	N.T.S	REV.
CHECKED :	M.K.R		HCE-CDFD-ELE-01	01

ROLLING SHUTTER  
WIDTH-2M  
HEIGHT-3M



## ELECTRICAL LEGEND

SYMBOL	DESCRIPTION	QTY
[SB]	SWITCH BOARD	01
[Socket]	5/15A POWER SOCKET	04
[Fan]	FAN POINT	01
[LPDB]	LIGHTING AND POWER DISTRIBUTION BOARD	01
[ELDB]	EMERGENCY LIGHTING DISTRIBUTION BOARD	01

## LIGHTING LEGEND

SYMBOL	DESCRIPTION	QTY
[Light]	40W BATTEN TUBE LIGHT	07

## EMERGENCY LIGHTING LEGEND

SYMBOL	DESCRIPTION	QTY
[EL]	40W BATTEN TUBE LIGHT	05

### NOTES:-

- ALL MATERIALS USED FOR ELECTRICAL WORKS SHALL CONFIRM TO RELEVANT I.S SPECIFICATIONS AND WIRING SHALL BE CARRIED OUT AS PER I.S: 732 AND NATIONAL ELECTRICAL CODE.
- ALL ELECTRICAL CONDUITS SHALL BE 2MM THICK MS(MILD STEEL) AND MINIMUM 19MM&25MM DIA SIZE ONLY.
- THE NUMBER OF WIRES THAT CAN BE DRAWN THROUGH A CONDUIT ARE GIVEN BELOW.

CONDUIT SIZE	1.5 Sq.mm	2.5 Sq.mm	4.0 Sq.mm	6.0 Sq.mm	10.0 Sq.mm
19MM	5 Nos	4 Nos	2 Nos	2 Nos	-
25MM	9 Nos	8 Nos	5 Nos	4 Nos	3 Nos
32MM	13 Nos	12 Nos	9 Nos	8 Nos	6 Nos
- THE SIZE OF WIRES FOR VARIOUS POINTS SHALL BE AS FOLLOWS.
  - FOR LIGHT/FAN/5A SOCKET POINTS: ( DB TO SWITCH BOARD) 2RUNS OF 2.5sq.mm MULTISTRAND COPPER CONDUCTOR PVC INSULATED WIRES WITH ONE RUN OF 1.0sq.mm EARTH WIRE.
  - FOR LIGHT/FAN/5ASOCKET POINTS:( SWITCH BOARD TO POINTS)2RUNS OF 1.0sq.mm MULTISTRAND COPPER CONDUCTOR PVC INSULATED WIRES WITH ONE RUN OF 1.0sq.mm EARTH WIRE.
  - FOR 15A/20ASOCKET OUTLETS: 2RUNS OF 4/6sq.mm MULTISTRAND COPPER CONDUCTOR PVC INSULATED WIRES WITH ONE RUN OF 2.5 sq.mm EARTH WIRE.
- THE FOLLOWING COLOR CODING SHALL BE FOLLOWED FOR ALL WIRING:

PHASES	RED/YELLOW/BLUE.
NEUTRAL	BLACK.
EARTH	GREEN
- FOR EVERY CIRCUIT SEPARATE NEUTRAL AND EARTH WIRES SHALL BE DRAWN ALONG WITH PHASE WIRE.
- FOR TELEPHONE WIRING 2 PAIR 0.51 MM DIA WIRE SHALL BE USED
- FOR TV WIRING APPROPRIATE WIRE SHOULD BE USED.
- SEPARATE CONDUITS SHALL BE LAID FOR TELEPHONES/TV. READ THE DRAWING TOGETHER WITH ARCH.DRGS. ALL MOUNTINGS HEIGHTS MENTIONED ARE WITH RESPECTIVE TO THE BOTTOM OF SWITCH BOARDS.
- READ THE DRAWING TOGETHER WITH ARCH.DRGS.
- ALL MOUNTINGS HEIGHTS MENTIONED ARE WITH RESPECTIVE TO THE BOTTOM OF SWITCH BOARDS.
- THE LOCATION OF SWITCH BOARD SHOULD BE 1200mm FROM THE FINISHED FLOOR LEVEL AND LOCATED 200mm. AWAY FROM THE EDGE OF THE DOOR FRAME.
- WHEREVER LDB LOCATION HAS BEEN FIXED THAT RESPECTIVE WALL SHALL BE MADE WITH 9" INCHES.
- DB'S POSITION SHOULD BE 300mm BELOW FROM FINISHED SLAB LEVEL.
- LIGHT POINT POSITION SHOULD BE 600mm BELOW FROM FINISHED SLAB LEVEL.
- POWER SOCKET POSITION SHOULD BE 600mm ABOVE FROM FINISHED FLOOR LEVEL.

NOTE:-  
PLEASE NOTE THAT THIS DRAWING NEED TO BE CONSIDERED AS CONCEPTUAL DRAWING ONLY AND THE ELECTRICAL CONTRACTOR NEED TO FURNISH/PREPARE THE FINAL SHOP DRAWING BEFORE STARTING THE ELECTRICAL WORKS AND AS BUILT DRAWINGS AFTER COMPLETION OF THE ELECTRICAL WORKS AS PER THE SITE CONDITION. ELECTRICAL CONTRACTOR IS DUTY BOUND TO PREPARE SHOP AND AS BUILT DRAWINGS.

CLIENT : THE CENTRE FOR DNA FINGERPRINTING AND DIAGNOSTICS.(CDFD)

PROJECT : CDFD

ELECTRICAL CONSULTANT: **HCE** HYDERABAD CONSULTING ENGINEERS  
Flat No. 2, Meghana Apartments, West Marreda, Sec-68 - 500 026.

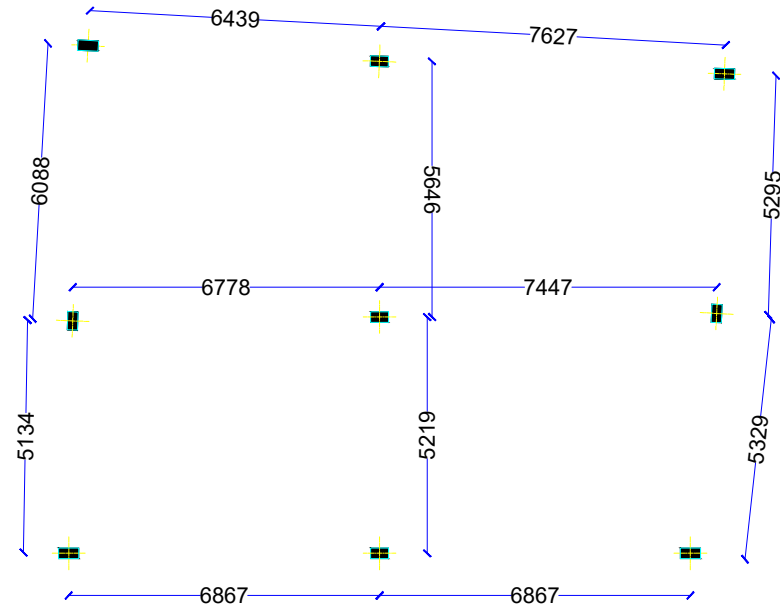
TITLE : PROPOSED ELECTRICAL PANEL ROOM LIGHTING AND POWER LAYOUT

DRAWN : MADHAVI DATE : 27-01-25 DRAWING NO: REV.

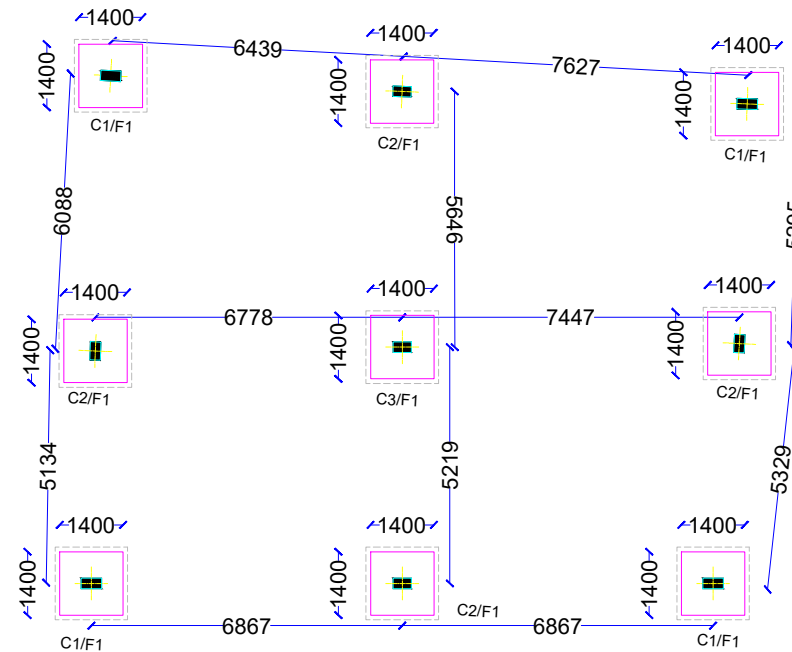
DESIGN : RAHUL SCALE : N.T.S HCE-CDFE-ELE-01 01

CHECKED : M.K.R

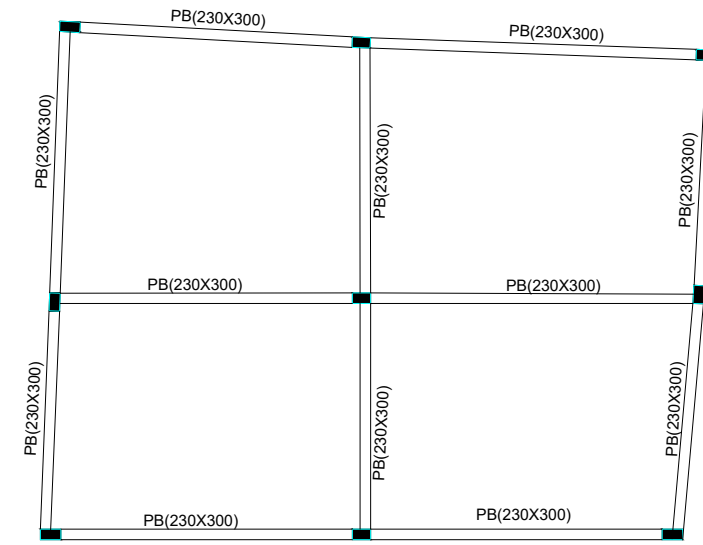




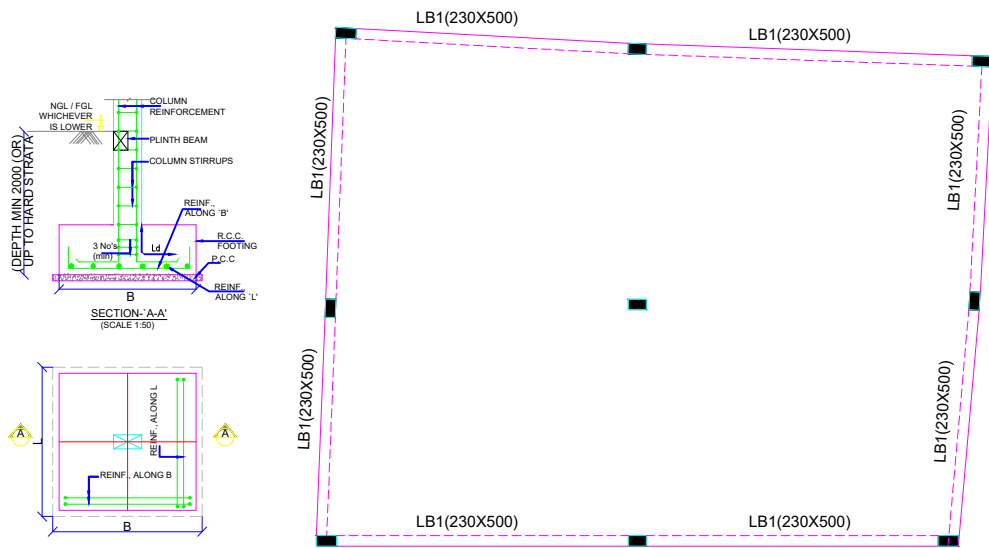
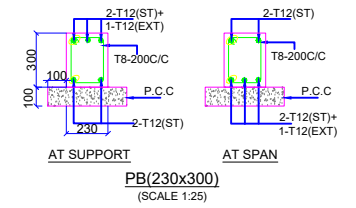
COLUMN MARKING LAYOUT



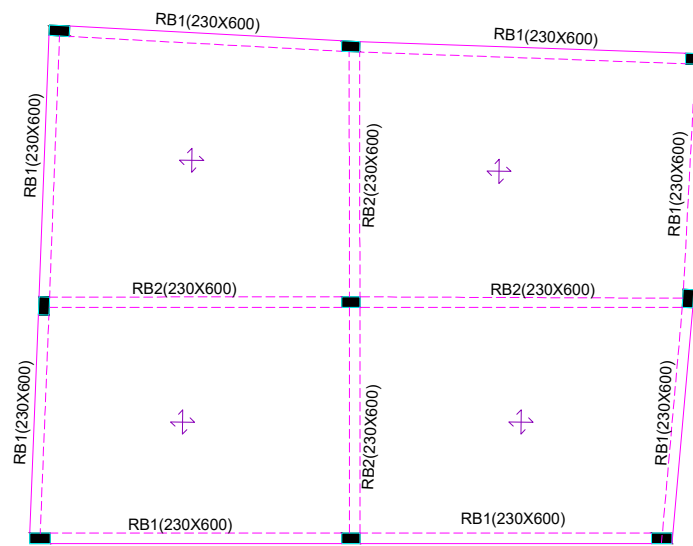
FOUNDATION LAYOUT



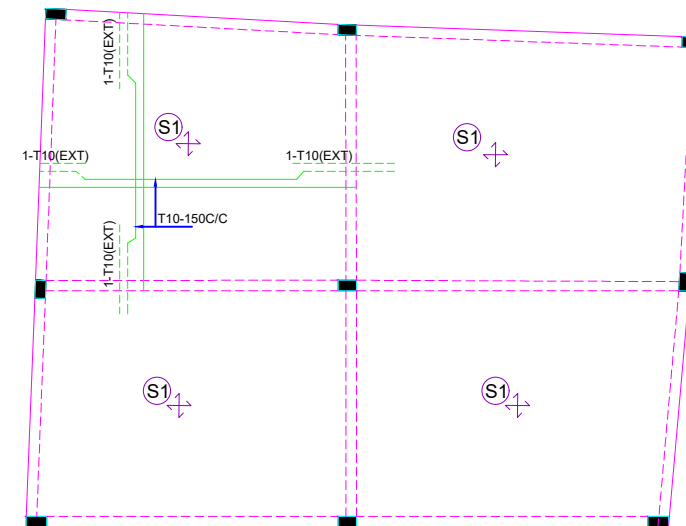
PLINTH BEAM LAYOUT



LINTEL(R.S.TOP) LEVEL BEAM LAYOUT



FLOOR LEVEL BEAM LAYOUT



FLOOR LEVEL SLAB LAYOUT

SCHEDULE OF COLUMNS:-

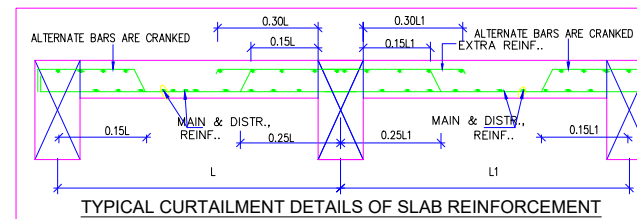
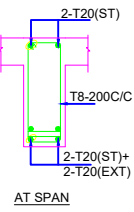
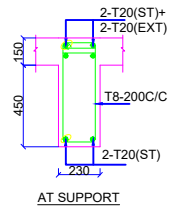
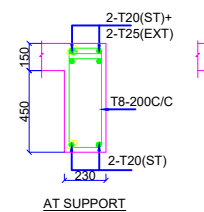
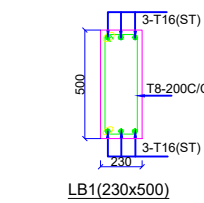
S.NO.	TYPE	No.s	SIZE	COLUMN DETAILS	TIE DETAILS	TIE SPACING
1	C1	04	230x450	4-T25+ 4-T16	2-TIES	T8-200c/c
2	C2	04	230x400	6-T16	1-TIE+1-LINK	T8-200c/c
3	C3	01	300x450	8-T25	1-TIE+1-LINK	T8-200c/c

SCHEDULE OF FOOTINGS :-

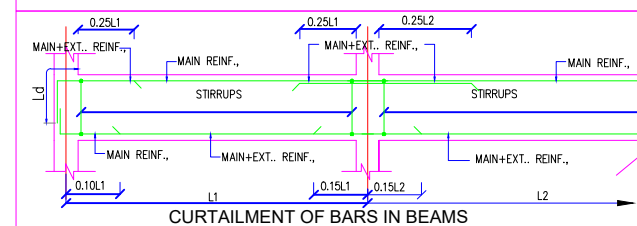
S.No	TYPE	No.s	SIZE L x B	DEPTH 'D'	REINF., DETAILS	
					ALONG 'B'	ALONG 'L'
1	F1	09	1400x1400	400	T12-150c/c	T12-150c/c

SCHEDULE OF SLABS :-

S.NO	NAME	TYPE	THK.	REINF. ALONG SHORT SPAN		REINF. ALONG LONG SPAN		DISTRIBUTION STEEL BOTH WAYS
				BOTTOM (SPAN)	TOP (SUPPORT)	BOTTOM (SPAN)	TOP (SUPPORT)	
1	S1		150	T10-150 C/C (ALT.CRANKED)	1-T10(EXT)	T10-150 C/C (ALT.CRANKED)	1-T10(EXT)	T8-300 C/C



TYPICAL CURTAILMENT DETAILS OF SLAB REINFORCEMENT



CURTAILMENT OF BARS IN BEAMS

GENERAL NOTES:-

- ALL DIMENSIONS ARE IN mm UNO.
- DO NOT SCALE THE DRAWING. READ FIGURED DIMENSIONS ONLY.
- MINIMUM DEPTH OF FOUNDATION SHALL BE 2000mm FROM NGL LEVEL AND S.B.C CONSIDERED IN THE DESIGN IS 300kN/m<sup>2</sup> AS PER SOIL REPORT.
- CLEAR COVER FOR MAIN REINFORCEMENT  
a) FOOTINGS - 50 b) COLUMNS - 40  
c) BEAMS - 25 d) SLABS - 20
- GRADE OF CONCRETE M25. P.C.C. (1:4:8)
- GRADE OF STEEL Fe500.
- WHEREVER REQUIRED DEVELOPMENT LENGTH SHALL BE 48Ø.
- LAPS SHALL BE STAGGERED AND NOT MORE THAN 50% OF THE BARS SHALL BE LAPPED AT ANY LOCATION.
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH RELEVANT ARCHITECTURAL DRAWING.
- THE BUILDING IS DESIGNED FOR GROUND FLOOR WITH WIND SPEED OF 44m/sec IN EARTHQUAKE ZONE-2.
- WE ARE NOT RESPONSIBLE FOR QUALITY OR STANDARDS OF CONSTRUCTION.

CLIENT : CDFD

PROJECT : CDFD

ELECTRICAL CONSULTANT: **HCE** HYDERABAD CONSULTING ENGINEERS  
Flat No. 2, Meghana Apartments, West Marredpally, Secbad - 500 026.  
Phone: +91 8168953811, +91 8668463825. E-mail:rahul@hceengineers.com

TITLE : CIVIL AND STRUCTURAL DETAILS OF ELECTRICAL PANEL ROOM

DRAWN : MADHAVI DATE : 27-01-25 DRAWING NO: REV.

DESIGN : RAHUL SCALE : N.T.S HCE-CDFD-ELE-EPR 00

CHECKED : M.K.R