TENDER DOCUMENTS

FOR

EXTERNAL HT & LT ELECTRICAL WORKS

OF

NEW STUDENTS HOSTEL BUILDING AT IMD COLONY, PASHAN, PUNE

INDIAN INSTITUTE OF TROPICAL METEOROLOGY, Dr. HOMI BHABA ROAD, PASHAN, PUNE-411008

Tender No. IITM/EM/41/2013-14

INDIAN INSTITUTE OF TROPICAL METEOROLOGY
PASHAN, PUNE-411 008
Tender No.:- IITM/EM/41/2013

E-TENDER NOTICE

Director, Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, Pashan, Pune - 411 008 (India) invites sealed tenders (Part-I – Technical Bid, Part-II – Commercial Bid) in separate sealed covers for the below work from outside electrical contractors having valid Electrical Contractor License.

Name of work: External HT & LT Electrical Works of New Students Hostel Building at IMD Colony Pashan, Pune.

Tender documents can be downloaded from the institute's website http://www.tropmet.res.in or e–Procurement website http://eprocure.gov.in and can also be obtained from the Electrical wing of the institute.

The tender document fee: Rs.1000-/, (Rupees -One Thousand only) [Non Refundable] by demand draft drawn in the favor of The Director, IITM Pune.

Start Date of Issuing Tender Documents	**:**	**26/02/2014**
Pre - Bid Meeting	**:**	**07/03/2014 (1100hrs)**
Venue of Pre-Bid meeting	**:**	**IITM, Pashan, Pune**
Last date of receipt of Tender at IITM, Pune	**:**	**18/03/2014 (1230hrs)**
Opening of Tenders (Technical Bids only)	**:**	**18/03/2014(1500hrs)**

The Institute reserves the right to reject any or all tenders without assigning any reasons thereof. For further details please visit our website *www.tropmet.res.in* and *www.eprocure.gov.in* . Corrigendum if any will be published on the above websites only.

Electrical Engineer
For Director

Email: jnanesh@tropmet.res.in

E-TENDER NOTICE

Name of Work	**External HT & LT Electrical Works of New Students Hostel Building at IMD colony Pashan, Pune**
Period of Completion	120 Days from the date of receipt of LOI
Cost of Tender Documents (Non – Refundable)	Rs. 1000/-(Rupees One Thousand only) by Demand Draft drawn from any Nationalized or Scheduled Banks in India payable at Pune in favor of Director, Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, NCL post, Pashan Pune – 411008 .INDIA
Start date of Issuing Tender Documents	**26/02/2014.** (NOTE: Tender documents can be downloaded from the institute's website http://www.tropmet.res.in or e – Procurement website http://eprocure.gov.in and can also be obtained from the Electrical wing of the institute.)
Earnest Money Deposit (EMD)	Rs. 3,00,000 (Rs. Three lakhs Only) by Demand Draft, drawn from any Nationalized or Scheduled Banks in India payable at Pune in favour of The Director, Indian Institute of tropical Metrology, NCL post, Pashan, Pune-411008 (or) By Irrevocable Bank Guarantee from any Nationalized or Scheduled Banks in India.
Pre-Bid Meeting	**07/03/2014 at 1100 hrs.**
Last date for submission of bids	**18/03/2014** at 12:30 Hrs Bids to be submitted on or before the mentioned time and date at "DISPATCH SECTION" Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, NCL post, Pashan Pune – 411008. INDIA
Opening of Technical bid	**18/03/2014** at 15:00 Hrs

INSTRUCTIONS TO THE BIDDERS

INSTRUCTIONS TO THE BIDDERS

1) The tender is to be filled properly and all relevant information asked, shall be provided for in due format.

2) The bid is to be submitted in two sealed envelopes each duly superscribed with name of work and Tender No...IITM/ EM/41/2013-14

a) The 1st envelop shall contain the Technical Bid along with pre-qualification documents as per Section-B, EMD and Tender fee document in requisite form.

And

b) The 2nd envelop shall contain the commercial bid as per format enclosed only.

3) The Date and Time of opening for Commercial Bid will be intimated only to technically qualified vendors after evaluation of technical bid.

4) All section wise total amounts shall be written in words also.
The tenderers are requested to furnish information about similar works handled, staff and infrastructure details etc., in technical bid.

5) All drawings and documents issued to the tenderers are confidential and shall be returned back with the tender.

6) EMD shall be in the form of DD/B.G of Nationalized Bank or as mentioned specifically in Tender Notice and shall be enclosed in a separate envelope along with the tender.

7) The duly completed tender shall be submitted at the following address in a sealed envelope before the time indicated.

8) Preliminary drawings shall be available for reference & discussions at our office.

9) Time is the essence of contract, hence contractor has to mobilize proper manpower & material in a short mobilizations period to site. No extension will be given for the completion period, without proper and genuine reasons.

10) All bidders should visit the site prior to giving quotes to get acquainted with site conditions. No demand shall later be entertained due to site conditions.

11) Pre-bid meeting for technical queries will be held on 07.03.2014, at **1100hrs** at I.I.T.M. Bidders are requested to be present in the meeting. All technical queries will be answered by I.I.T.M and consultants.

12) Bidders are requested to give deviations / comments / assumptions clearly in deviation pages based on the site observations.

13) Bidders are requested to highlight the make of material considered while quoting in the list of approved makes.

14) Bidders are requested to quote value for supply & installation of material but client may provide some or all capital items free of cost. So, while quoting labour / installation rates, material handling charges should be considered accordingly.

15) The Director IITM, Pune reserves the right to accept or reject any or all the quotations without assigning any reasons.

16) Soft copy of covering letter and priced BOQ shall be submitted along with tender in the CD provided. Bidders shall not change format of BOQ.

17) Any Bid received by the Employer after the deadline will not be considered.

18) Duly completed tenders shall be submitted on or before **18/03/2014** at 12:30 Hrs.

19) WORKING DRAWINGS:

a) Electrical layout drawings furnished by Director IITM Pune during order placement shall be referred for a general guideline purpose. Errors or inconsistencies discovered by the Contractor in the Drawings and Specifications shall be promptly brought to the attention of the Director IITM Pune through the Project Engineer for interpretation or correction. Local conditions, which may affect the work, shall likewise be brought to the Director IITM Pune attention. If at any time, it is discovered that work is being done which is not in accordance with

the Contract Drawings / approved working drawings and Specifications, the Contractor shall correct the work immediately.

b) All Drawings, Bill of Quantities and Specifications, including copies thereof furnished to the Contractor are the property of the IITM, Pune. They shall not be used on any other work and shall be returned to the Director IITM Pune, on request upon completion or termination of the contract.

20) TOOLS & OTHER MATERIAL:

All special tools and tackles required for the proper erection and assembly of equipments covered by the Contract shall be obtained by the Contractor himself. All sundry materials such as foundation bolts, nuts etc. required for the erection of equipments/ switch boards including base channels (If required & mentioned) to raise the level of the switch boards shall be included in the erection costs of respective items. Necessary scaffolding shall be arranged by the Contractor. Scaffolding shall be so fastened that swaying/ swinging from structure or building shall be prevented.

21) AS BUILT DRAWINGS:

a) On completion of work, the contractor shall submit a soft copy along with 4-sets of as-built drawings in hard copy. These shall include - Detailed drawing showing layouts cables routing, earthing, lighting system, etc. as installed.
b) Manufacturer's operation and maintenance instructions manuals for supplied items.
c) Test results after Consultants acceptance.
d) Contractor's instructions for routine maintenance of the work.
e) Any other drawings/ details seemed necessary by the Director IITM Pune for satisfactory maintenance of the work.
f) List of recommended spares for 2 years operation.
g) Relay co-ordination details (if any).
h) Quality assurance plan.
i) Catalogues of major equipments.
j) Commissioning reports and settling parameters.
k) Warranty certificates by OEM.
l) Release orders by authorities.
m) Commissioning documents with MSEDCL.
n) Acknowledgement/ Memos etc.
o) Approvals and NOCs in originals.

22) CARE OF WORKS:

a) From commencement to the completion of works, the Contractor shall take full responsibility of all work related to this Contract and those of other agencies, including temporary works.
b) In case of any damage, loss or injury to the works; either of Contractors or other agencies, the Contractor shall repair/ make good and acceptable.
c) The Contractor is also liable for any damages to the works his or others, caused by him in the course of any operations carried out by him for the purpose of carrying out his obligations.
d) Any delay occurring on account of any of the above shall be to the account of Contractor.
e) Contractor may employ watchman for safe custody of materials. Security and safety of all works related to this Contract is Contractor's sole responsibility.

23) The Contractor shall make good all civil works damaged/ disturbed by him while carrying out the electrical installation, immediately after installation work or in any case before end of the

Duly completed tenders shall be submitted on scheduled date & time to the following address:-

Indian Institute of Tropical Meteorology
Dr. Homi Bhabha Road, Pashan, Pune - 411 008
Tel. No. 020 – 25904200

Contact Person: Shri Jnanesh, Electrical Engineer.
Tel No. : - 020 - 25904200

SECTION – A

DEFINITION OF TERMS

1) **'Owner/Purchaser'** shall mean the client on whose behalf this enquiry is issued and his authorized representative.
2) **'Engineers'** shall mean Engineer / Architect / Consultant appointed by Director,IITM for the project.
3) **'Bidder'** shall mean party who quotes against this enquiry.
4) **'Contractor' shall** mean the successful `BIDDER' whose bid has been accepted by Director,IITM and on whom Purchase/Work Order is placed.
5) **'PROJECT'** shall mean the project specified in Section - B.
6) **'SITE'** shall mean the actual place of work as detailed in specification / Section B.
7) **'SPECIFICATIONS'** shall mean collectively all the terms and stipulations contained in those portions of contract as general and special conditions, amendments, deletions, revisions as made in agreement or written agreements made pertaining to method of work.
8) **'Month'** shall mean calendar month.
9) **'Plant/Equipment'** and 'Works' shall mean respectively the goods to be supplied and services to be provided by contractor.
10) **'Contract/Work Order'** shall mean the order specifying works and associated specifications to be executed by "Director,IITM and Contractor".
11) **'Contract Period'** shall mean the period during which "Director,IITM" and "Contractor" shall execute the entire contract as agreed.
12) **'Guarantee Period'** / "Defect Liability Period" shall mean period during which the plant / equipment and installations shall give same and trouble free performance as guaranteed by contractor.
13) **'Engineer's Instructions'** shall mean instruction oral or written, drawings, direction, explanations issued by Consultant / Engineer / Architects on behalf of the Director, IITM from time to time during period of contract. (All 'oral' instructions shall be authenticated by written instructions immediately).
14) **'Performance Tests'** shall mean all tests to be carried out by contractor as per specifications prior to installation being taken over by Director,IITM under guarantee.
15) **'Commissioning' shall** mean integrated activity of carrying out performance tests, initial and trial operations of system.
16) **'Drawings'** shall mean all drawings furnished by Engineer / Owner for basis of proposal or for carrying out works, from time to time; all drawing submitted by vendor provided such drawings are acceptable to Engineer/Owner.
17) **'UR'** means quote unit rate.

ARTICLES OF AGREEMENT

Articles of Agreement ----------
made on the---------- day of---------- 2014.
Between:

(Hereinafter called "The Owner") of the part and ---------- ---------- of (or whose registered office is situated at) ---------- ---------- (Herein after called "The contractor") of the other part.

Whereas the Director,IITM is desirous of awarding the External Work for ---------- ----------. Drawing and Bill of Quantities showing and describing the work to be done prepared by under the direction of:

And where as the Contractor has supplied the owner with a Fully priced copy of the said bills of quantities (Which copy herein after referred to as "The Contract Bills"). And where as the said Drawings (herein after referred to as "The Contract Drawings") and the Contract Bills have been signed by or on behalf of the parties hereto and where to and where as the Contractor has deposited the sum of rupees ------- ---------- with the DIRECTOR,IITM for the due performance of this Agreement. Now it is hereby agreed as follows:

1. For the consideration herein after mentioned the Contractor will upon and subject to the condition annexed, carry out and complete the work shown upon the contract Drawings and described by or referred to in the Contract Bills and the said Conditions.

   The Director,IITM will pay the Contractor the sum of Rs. ---------- ----------
   (herein after referred to as "Contract sum") or each other sum as shall become payable here under at the time and in the manner specified in the said conditions.

2. The terms "The Consultant" in the said condition shall mean the said or in the event of his death or ceasing to be Consultant for the purpose of this contract, such other persons as the Director,IITM shall nominate for that purpose provided always that no person subsequently appointed to be the Consultant under this contract shall be entitled or over rule any certificate or decision or approval or instruction given or expressed by the earlier Consultant.

3. The said condition and Appendix hereto (Sections) Shall be read and construed as forming part of this Agreement, and the parties hereto shall respectively abide by, submit themselves to these Conditions and perform the agreements on their parts respectively in such Conditions contained.
   As Witness the hands of the said parties.

Signed by the:
In the presence of:

Witness :
Name :
Address :

SECTION-B

QUALIFICATION INFORMATION

The information to be filled in by the Bidder in the following pages will be used for the purposes of qualification criteria as provided for in Clause of the Instructions to Bidders. This information will not be incorporated in the Contract.

To be eligible for Qualification, BIDDERS shall provide evidence to suitability of their meeting the Criteria indicated in this Clause and furnish details giving their full bio-data, organizational set up, technical experience, availability of plant and equipments etc. to establish their capacity and competence, and possession of adequate resources to carry out the contracts effectively and for this, the BIDS submitted shall include the following:

List of Documents to be submitted along-with technical bid-
Technical Bid documents including duly filled data sheets mentioned in the technical specifications, tender drawings duly signed on each page with company seal must be submitted

1. The bidder should be well established and must be a reputed Electrical Contractor having License for working as electrical contractor of 22 KV/11KV/415 Volts substations issued by Maharashtra state/ state administration of the state in which the contractor is working. The copy of the same shall be submitted must be valid for current financial year.

2. The bidder should have annual turnover of minimum Five Crore in similar kind of electrical work during last three financial years ending on 31st march 2013. The copy of the audited balance sheets shall be submitted.

3. Bidder must have completed at least three similar contracts from previous 36 months prior to tender opening of value not less than Rs.1,50 crores each. Financial reports for the last three years, balance sheets, profit and loss statements, auditors' reports (in case of companies/corporation), etc Information shall be submitted as per enclosed format - H.

   Total value of electrical work executed and payments received in the last three years (in Rs. Crores)
   2010-2011_____
   2011-2012_____
   2012-2013_____

4. Form of tender (as enclosed after section-B.)

6. Constitution or legal status of Bidder
   Information shall be submitted separately.

7. Attach satisfactory completed work certificate(s) from the Client on client's company Letterhead and as per enclosed format -K

8. Attach audited balance sheet certificate from Chartered Accountant.

9. Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

   A) Existing commitments and on-going works if any.
   Information shall be submitted as per enclosed format-J.

   B) Works for which bids already submitted but yet to be finalized. Information to be given separately.

   C) Details of similar completed works in last three years as per enclosed format-I.

10 Qualifications and experience of key personnel proposed for administration and execution of the Contract. Information shall be submitted separately

11 Details of termination of contract by previous client if any in last five years Information shall be submitted separately

12. A detailed description of any method of approach specially devised by the contractor to speed up the work.

13. Sales Tax /RTGS/Works Contract Tax / VAT / PAN Registration and Clearance Certificate shall be submitted.

Note: **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 or his authorized representatives reserves the right to verify any part of the information furnished by the BIDDER in the above statements without any prejudice to the terms and conditions of the Contract. The BIDDER is deemed to have given his consent for the right of verification by the **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 or his authorized representative, when the BIDDER submits the above statements. If it comes to the notice of **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 that the BIDDER has suppressed any information or furnished misleading or inaccurate information, or in case whether any litigation currently in progress at the time of submission of BIDS lead to the decree by the Court of Law against the BIDDER, the **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 reserves the right to nullify the Qualification and to disqualify the BIDDER. If such information becomes available to **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 prior to issue of Letter of Intent, the BIDDER will be disqualified and will not be considered for award of work. If such information comes to the knowledge of the Client after the award of work, **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY,DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 of the BIDDER and such action would include but not Ltd to forfeiture of all deposits, guarantees etc. furnished in any form. **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE-411008 will also reserve the right to recover any Retention Money, Mobilisation Advance paid by invoking of Bank Guarantees submitted, including invoking of the Performance Bond.

The entire work executed upto the stage of such termination including materials procured and delivered at site will be taken over by **The DIRECTOR,** INDIAN INSTITUTE OF TROPICAL METEOROLOGY, DR.HOMI BHABA ROAD, PASHAN, PUNE- 411008 and adjusted towards any payment due, as per contract conditions.

FORM OF TENDER

To,

The Director,
Indian Institute of Tropical Meteorology
Dr. Homi Bhabha Road, Pashan, Pune - 411 008
Tel. No. 020 – 25893825

Dear Sir,

Having examined the drawings, specifications and schedule of quantities of work specified below and having visited and examined the site of works for acquiring requisite information. I/We hereby offer to execute the works specified below in the specified time period at the rates quoted in the Schedule of Prices attached in accordance with the drawings, designs, specifications, conditions of contract and in all other respects with such conditions as applicable.

a)	Description of Work	:	**External HT & LT Electrical Works of New Students Hostel Building at IMD colony Pashan, Pune.**
b)	Earnest Money Deposit	:	**Rs.300000/-(Three Lakhs only) in form of D.D/B.G from Indian Nationalized Bank drawn in favour of "Director Indian Institute of Tropical Meteorology, Pune".**
c)	Completion Period	:	**120 Days from the date of receipt of LOI**

1. Should this tender be accepted, I/We_____ for a minimum period of 120 days.
2. I/We hereby deposit a sum of Rs. ----------Drawn on bank---------- Dated.....as EMD which is not to bear any interest. Should I/we fail to execute the contract when called up to do so, this sum shall be forfeited by me/us.
3. Our Bankers are
4. Names of Owner/Partner of Firm

1)

2)

3)

Name of Partners/Director of
Firm Authorized to Sign.

Name of Person having Power of Attorney to Sign the Contract:

PLACE :
DATE :

Signature & Seal of the Contractor

SIGNATURE, NAME & ADDRESSES OF WITNESSES.

1)

2)

FORMATS TO BE FILLED
AS MENTIONED IN SECTION-B

FORMAT-H

FINANCIAL INFORMATION

Sl. No.	Description	Details to be filled in by Bidder
A	Annual Turnover in the last five financial years (In INR crores)	
1	Year : April 2009 - to March 2010	
2	Year : April 2010 - to March 2011	
3	Year : April 2011 - to March 2012	
B	**Financial Information (In INR Crores)**	
I	Year : April 2010 - to March 2011	
	a. Total assets	
	b. Current assets	
	c. Total Liabilities	
	d. Current Liabilities	
	e. Profits before taxes	
	f. Profits after taxes	
	g. Net worth	
	h. Working Capital	
II	Year : April 2011 - to March 2012	
	a. Total assets	
	b. Current assets	
	c. Total Liabilities	
	d. Current Liabilities	
	e. Profits before taxes	
	f. Profits after taxes	
	g. Net worth	
	h. Working Capital	
III	Year : April 2012 - to March 2013	
	a. Total assets	
	b. Current assets	
	c. Total Liabilities	
	d. Current Liabilities	

	e. Profits before taxes	
	f. Profits after taxes	
	g. Net worth	
	h. Working Capital	
C	Solvency Certificate (in INR Crores) a. Name of Banker with address	
	b. Date of Certificate	
	c. Amount	
D	Credit facilities available to Bidder – Fund and non-fund based such as Cash Credit, Working capital term loans, LCs and Bank Guarantees - Banker's or Bankers' Letter must be produced - (In INR Crores)	
	a. Name of Banker with address	
	b. Date of Letter of Support	
	c. Amount	
E	Bidder's Financial resources for this project	
	a. Own resources	
	b. Banker's or Bankers' credits	
F	a. Approximate total value of on-going works	
	b. Total Value of works to be completed as of now Note: 1) The Bidder should furnish the value of work to be completed as of now along with break-up details of each work. 2) The Bidder has to ensure that the list of works covered in this Proforma should be same as the ones listed in STATEMENT - E (List & details of Ongoing works) with Performa of each work.	
G.	Anticipated total value of new works for the next financial year.	

Place : **Signature of Bidder**

Date: **Official Seal**

Note: Balance sheet, Profit and loss statement, auditor's report etc. duly signed by Charted Accountant is required to be attached separately

FORMAT-I

DETAILS OF COMPLETED WORKS IN LAST THREE YEARS

S.No	Details required	To be filled by the Bidder
1	Name of work	
2	Country and location	
3	Client's name and address	Name: Address :
4	Consultants name and address.	Name: Address :
5	Total tendered cost of work Agreement No. Date	INR ..... Crores Agreement No: Date :
6	Total actual cost of work after completion.	INR ..... Crores
7	Excess / less in percentage.	.....%
8	Explain if Excess / less is higher by 20% of the tendered cost of work.	
9	Date of commencement	
10	Period of completion	
11	Stipulated date of completion	
12	Actual date of completion	
13	Extended by the contractor, if any. Reason for non-completion of work in stipulated time limit / extended time limit, if so furnish details	Yes / No
14	Extension of time granted by the Client, if any. If yes, please specify the reason for extension of time.	Yes / No
15	Brief description of works including principal features and quantities of main items of the work	
16	Name of Contractor's Engineer in-charge of the Project & Qualifications	Name : Qualification :

17	Details of specialized work executed under this Contract.	
18	Details of specialized work executed by their own divisions under the Contract	
19	Whether the Programming and planning plan was followed in the form of Pert Chart or Bar Chart?	Yes / No
20	Whether the Quality Control and Quality Assurance function was carried out? If yes, Please give details and copies of quality formats used in anyone project	Yes / No
21	Whether the safety measures were followed? If yes, Please give details	Yes / No
22	i) Were there any labour strikes? If yes, Please give details.	Yes / No
	Whether corrective action taken immediately?	Yes / No
23	Were there any penalties / fines / stop notice / compensation / liquidated damages imposed during execution of the project? If Yes, Please give amount, details and reason.	Yes / No Amount : Reason :
24	Whether the contract of the work was terminated? If Yes, furnish the details.	Yes / No Name of the Project : Reason :
25	Please specify the details of litigation / arbitration cases, if any, pertaining to works completed. If Yes, furnish the details i.e. Nature of litigation / arbitration. Please furnish whether the litigation is initiated by the Company or against the Company.	Yes / No
26	Attach client's certificate, as may be available (Not below the rank of Director or equivalent)	Yes / No

Place : **Signature of Bidder**
Date: **Official Seal**

FORMAT-J

DETAILS OF ON-GOING WORKS

S.No.	Details required	To Be filled by the Bidder
1	Name of work	
2	Country and location	
3	Client's name and address	Name : Address :
4	Consultants name and address	Name : Address :
5	Total tendered cost of work (Agreement No. and Date)	INR ..... Crores
6	(a) Brief description of works including principal features and quantities of main items of the work.	
7	i) Percentage of physical completion	
	ii) Amount billed for the work completed.	
	iii) Cost of work remaining to be executed as on the date of submission	
	iv) Stipulated date of completion	
	v) Anticipated date of completion	
8	Name of Contractor's Engineer in-charge of the Project & Qualifications.	Name : Qualification :
9	Details of specialized works under this Contract	
10	Specialized works being executed by their own divisions	

11	a. Details of the sub-contracted specialised works by the Bidder	
	i) Total value of work sub-contracted.	INR ..... Crores
	ii) Trade-wise value of work sub-contracted.	1.INR..... Crores 2.INR..... Crores. 3.INR..... Crores. 4.INR ..... Crores.
	iii) Trade-wise Name of sub-contractors Use separate sheet for details of such subcontractors experience, capability, and testimonial.	1. 2. 3. 4.
12	15 i) Were there any labour strikes? If yes, Please give details.	Yes / No
	ii) Whether corrective action taken immediately?	Yes / No
13	Were there any penalties / fines / stop notice / Compensation / liquidated damages imposed? If Yes, Please give amount, details and reason.	Yes / No Amount : Reason :
14	Please specify the details of litigation / arbitration cases, if any, pertaining to works ongoing	Yes / No
15	Attach client's certificate, as may be available (Not below the rank of Director or equivalent)	Yes / No

Place : **Signature of the Bidder**

Date : **Official seal**

FORMAT-K

CERTIFICATES

Enclose Certificates in support of suitability, technical knowledge and capability for having successfully completed similar nature of works in the last five years.

Also furnish the following details in the enclosed certificate.

S.No.	Name of Works	Period of Work	Name of Client / Owner with Address

Place : **Signature of the Bidder**

Date : **Common seal of the Company**

SECTION : C
GENERAL CONDITIONS OF CONTRACT

1 WORK ORDER:

The work order conveys final agreement between Director, IITM and contractor on terms and conditions and is exclusive statement of terms of their agreement. In case of discrepancy between general conditions and specifications, drawings furnished by owner, the latter shall take precedence.

2 MODIFICATION AND VARIATION:

The order may be amended, modified or rescinded only in writing by both the parties and their duly authorized representatives pursuant to terms stated therein.

3 MATERIALS AND SERVICES:

3.1 LABOUR & TOOLS

The contractor shall provide at his cost, all necessary material, tools, tackles, skilled manpower for proper execution of works specified in the schedule of the quantities and as per drawings and specifications. Any discrepancy in schedule of quantities and drawings shall be brought to notice of engineer/owner for decision, immediately.

3.2 ACTIVITY CHART RELATED TO CIVIL WORK:

Contractor shall provide detail Bar chart of activities based on completion period and civil work schedule made on MS project or similar software and get approval prior to starting the work. Mile stones for supply of important material & completion of specific jobs shall be indicated clearly.

3.3 MAKE OF MATERIAL:

Contractor shall provide all material of specific makes accepted during discussion stage or from approved list of makes.

In case of any problem / difficulties in procurement of such items, alternative makes will be approved by Engineer & owner based on samples and specifications submitted by contractor. Alternative material shall be procured only after written approval for makes.

Procurement and use of material of makes not in approved list shall be sole responsibility of the contractor. Contractor shall replace all such material at no additional cost within a stipulated period.

4 AUTHORITIES AND LAWS:

Contractor shall confirm to all provisions of any law pertaining to works and to the regulations and by laws of related authorities and for water/electricity supply. Contractor shall indemnify owner/Engineer from all conflicts arising out of provisions of regulations & laws.

5 MATERIAL AND WORKMANSHIP:

All the materials to be supplied for execution of works shall be of first quality, new and strictly as per specifications. In case employer procures such items and hands over the same for fixing to the contractor, the contractor will receive the goods, open the crates and report any discrepancies, store it in his custody until required, install and commission it with necessary care and the best workmanship.

The contractor shall be responsible for any loss or damages once the materials are supplied to him in good order and condition.

All the installation rates are deemed to include handling, erection, fabrication services & erection hard ware required for all items.

All the works shall be executed with highest quality of workmanship and as directed by owner/engineer. In case of mockups or approved samples, the quality of the same shall be adhered to for all works and any work quality & material below that standard will be rejected.

6 SUPERVISION:

A competent representative of contractor shall be available at work site for supervision of works and for co-coordinating, receiving instructions from owner/engineer during entire period of contract.
The supervisory staff required shall depend on value & complexity of job. The supervisory infrastructure planned shall be provided in writing along with a bar chart.
He will be assisted by adequate supervisory staff. He should have project execution & planning experience. Adequate engineers & supervisory staff will assist him.

7 ACCESS TO WORK:

Owner / Engineer or their authorized representative shall have access to works being carried out at all reasonable times. No person, not authorized by owner/engineer except representatives of public authorities shall be allowed at work site at any time.

8 SUB-CONTRACT:

The complete work included in the contract shall be executed by the contractor and the contractor shall not sub-contract/sub-let work or part thereof without prior written consent from owner/engineer. However, contractor shall not be relieved from the responsibility of execution of works as per contract under any circumstances.

9 SCHEDULE OF QUANTITIES AND DRAWINGS

9.1 SCHEDULE OF WORK:

The schedule of quantities indicates nearest approximate quantities of the items works. There is a possibility of upward or downward variation of quantities due to site modifications. Any variation of quantities of the individual items as per schedule and overall cost variation of 25% shall be accepted by contractor without any financial implication. Contractor shall take exact measurements for items like cables, earth strips prior to bringing and cutting the same. If variation is beyond above stipulated limits, such items shall be carried out after written mutual agreement. However no excess payment claims for additional quantities shall be entertained if variation is established prior to deliveries of stipulated quantities.

9.2 GENERAL INFORMATION ON DRAWINGS:

Rates quoted for all 'Unit Rate' (UR) items shall be deemed as valid for any quantity as may be required for completion of work. The drawings enclosed indicate extent and general arrangement of various equipments. These are for guidance of contractor and exact locations, dimensions; clearance will be governed by site conditions, buildings and statutory rules. Contractor is required to go through the drawing and regulations prior to starting of works. Any discrepancy/changes required shall be reported to consultant and owner. Contractor shall prepare all **`working drawings' and** get them approved from consultants prior to starting the work. The working drawing shall be submitted to consultant within a specific time frame from date of order as mutually decided. Drawing for all bought out items / panels shall be submitted for consultant's approval within a specific time frame & prior to starting any work. All drawings shall be submitted in at least 3 sets.

9.3 PROCUREMENT OF MATERIALS:

Contractor shall bring quantities of items like cables, earthing strips, trays etc. after specific measurement. Client will not take over excess quantities of any items unless it is specifically agreed. Contractor shall have to take back all such quantities without any financial burden on client.

10 SUFFICIENCE OF SCHEDULE:

The contractor shall be deemed to have satisfied himself before tendering as to correctness and sufficiency of his tender for works and prices quoted therein which shall cover all obligations under contract for satisfactory completion of works, and stipulated performance of system/equipment in his preview.

11 MEASUREMENTS & BILLS:

Measurements and billing shall be done by specific method detailed below.

11.1 Contractor shall maintain a proper measurement book (Triplicate) on site and take measurement from time to time.

11.2. Owners representative / Engineer shall check these measurements from time to time. Coordination for checking will be contractor's responsibility.

11.3. Contractor shall make bills based on checked measurements only.

11.4. Bills shall be made in standard and cumulative formats only. Non cumulative Bill will not be accepted.

11.5. Contractor shall submit minimum 3 copies of bill with

a) Measurement sheets copies duly signed
b) Copies of signed challan
c) Summary sheet.
d) Site progress photographs.

12 REMOVAL OF WORKS:

The owner/engineer during the progress of work have power to order in writing removal from the works any material / installations which in their opinion are not as per specifications or instructions, and for carrying out rectification/rework within specified time and contractor shall carry out such removals/rework as per Specification at his own cost. The owner/engineer can get such rectification /rework done from other agencies at the cost of contractor, if the same are not carried out by them in the stipulated and agreed period.

13 COMPLETION CERTIFICATE:

13.1 COMMENCEMENT DEFECT LIABILTY PERIOD:

The work shall be deemed to have been completed on written certificate by Consultant, PMC and Engineer-in-charge of IITM, Pune that they have been virtually completed. The "Defect Liability Period" shall commence from the date of such certificate.

13.2 COMPLETION DRAWINGS & DOCUMENTS:

On completion of works, prior to getting completion certificate contractor shall prepare as built drawings in association and to satisfaction of consultant/Engineer giving all particulars.

a) Exact dimensions and clearances.
b) Fuse & switchgear ratings, ratings of equipments.
c) Cable sizes, cable schedule.
d) Earthing details.

Contractor shall submit the as-built drawing in 3 sets of prints and one set of reproducible to the client.

Contractor shall also submit detail drawings, instruction & maintenance manuals & test certificates for all bought out items. Test certificates of all tests carried out at site shall also form part of this.

One set of all handing over documents shall be given to Engineer /Consultant.

14 DEFECT LIABILITY PERIOD:

Any defects, faults, deterioration in performance of the material and installations which may appear; during the "Defect Liability Period" of **Three** years from virtual completion of contract shall be amended/made good by the contractor at his own cost within a reasonable time. In case of default, Director,IITM may employ and pay other person to make good the defects and deduct the expenses from the dues payable to contractor on certification from engineer. The defect liability period shall be **Three** years from the virtual date of completion.

15 CONTRACTOR'S RESPONSIBILITY:

Contractor shall be responsible for injury to person animal or things, for all damages caused to property from operations or negligence of himself or his employees/sub-contractors. The contractor shall indemnify IITM and their employees and hold them harmless in respect of any and all expenses arising from such injury or damage and claims arising thereof.

The damages to the property, plant and equipment caused due to such negligence shall be made good by the contractor at his own cost to the satisfaction of the owner / engineer within a specific time. The owner in concurrence with engineer shall be entitled to deduct amount of damage, compensation for loss arising from such damages / injuries/ accidents in case of default. All laws related to PF, ESI, Medical insurance etc., shall be adhered to by the contractor. No child labour shall be employed by contractor.

16 LABOUR LAWS:

CONTRACTOR shall comply with the provision of all laws including Labour Laws, rules, regulations and notifications issued there under from time to time. All safety and labour laws enforced by statutory agencies and by local bodies shall be applicable and the compliances of the same shall be the sole responsibility of the bidder under the performance of this CONTRACT and CONTRACTOR shall abide by these laws.

CONTRACTOR shall take all measures necessary or proper to protect the personnel, work and facilities and shall observe all reasonable safety rules and instructions. No smoking shall be permitted outside the living quarters, and welding jobs will be carried out with full safety precautions. The contractor's employees also shall comply with safety procedures/policy.

The CONTRACTOR shall report as soon as possible any evidence which may indicate or is likely to lead to an abnormal or dangerous situation and shall take all necessary emergency control steps to avoid such abnormal situations. Moreover the contractor shall get the entire necessary work site, employees and his personnel insured under CAR policy. However, that such liability shall be limited to 110% of the CONTRACT Price and other necessary insurance schemes as well as the acts such as Workmen's compensation Act, ESI Act & PF Act under the relevant acts of the Government as required for the execution of the project and shall consider the amounts arising out of the same in the bid quoted.

16.2 GENERAL INSURANCE:

Contractor shall provide necessary insurance cover for all equipment and material in his scope till the system is handed over. Necessary insurance cover shall also be provided for man power employed on site. Contractor shall indemnify Owner/Engineer

and their representatives employed and hold them harm less in case of any damages injuries/accidents and any claims arising out of them.

16.3 INDEMNITY

INDEMNITY BY CONTRACTOR:

CONTRACTOR shall indemnify and keep indemnified the Institute, from all actions, proceedings suits, claims, demands, liabilities, damages, losses, costs, charges, expenses(including without limitation, wreck or debris, removal costs, where wreck or debris removal is ordered by a competent authority) judgments and fines arising out of or in the course of or caused by the execution of work under the CONTRACT or other obligations hereunder directly or indirectly associated herewith including but not limited to :

a) Personal injury, illness or death of :

   i) Any of Contractor's or subcontractor's personnel (even if caused by or contributed to by the negligence or fault and

   ii) Subject to clause 17.2 (a) (I) any other person to the extent the injury, illness or death is caused by the negligence or fault of the Contractor or Contractor's personnel or subcontractors or subcontractor's personnel and

b) Loss or damage to :

   i) Any property owned, hired or supplied by Contractor or Contractor's personnel or subcontractors or subcontractor's personnel including Constructional Plant (even if caused by, or contributed to by, the negligence or fault or

   ii) Subject to clause 17.2 (b) (I) any other property to the extent the loss or damage is caused by the negligence or fault of the Contractor or Contractor's personnel or subcontractors or subcontractor's personnel.

17 DATE OF COMMENCEMENT:

The date of commencement of work shall be accounted from the date of issue of LOI.

18 PENALTY CLAUSE:

The contractor shall pay penalty of 1% per week / subject to a maximum of 10% at value of work order in case of delays beyond the accepted completion period for reasons solely attributed to him.

19 TIME EXTENTION:

If in the opinion of owner/engineer the work is delayed (a) by force majeure, (b) by reasons beyond control of contractor, extension of time for carrying out the works can be sanctioned by owner/engineer on written request from contractor with due reasoning / supporting.

Force majeure shall mean & include compliance with statutory laws & regulation, Government order or change in orders, war & war like conditions, acts of civil & military authorities, fires, floods, earthquakes and other acts of God, sabotage, revolt, Strikes & lockout of more than 2 weeks. However, contractor & Director, IITM in such case should devise means of expediting the progress for performance as per contract.

20 TERMINATION OF CONTRACT:

Owner shall be entitled to terminate the contract in case contractor fails to fulfill one or more conditions of contract or if the engineer/consultant certify to the Director, IITM in writing that the contractor;

a) Has abandoned the work.

b) Has failed to commence the work or has without any lawful excuse under contract conditions suspended work progress for more than one week or,

c) Has failed to proceed with the works and failed to make such due progress for timely completion of works or.

d) Has failed persistently to observe and perform works as per specifications and contract conditions or.

e) Has employed services of sub-contractors/sub-let all or part of works without prior permission of owner/engineer.

Then and in any of the above said cases Director,IITM may not withstanding any previous waiver, can terminate the contract after giving seven days notice in writing to the contractor without affecting powers of engineer and obligation and liabilities of the contractor.

If the payment of the amount payable by the owner under certificate of engineer is unpaid for thirty days or if owner interferes or obstructs issue of such certificate or if the works of owner/engineer or by any injunction or other orders by court of law, then and in any of the said cases contractor shall be at liberty to terminate the contract by giving seven days notice to the owner and shall be entitled to recover payment from owner on account of work executed or any loss sustained. Owner shall also be entitled to recover any losses due to default of contractor, incurred by him for carrying out / completing works as certified by consultant.

21 CERTIFICATION AND PAYMENTS:

The contractor shall be paid by Director,IITM from time to time under interim measurements certified by engineer/consultant on account of work executed in accordance with contract & to satisfaction of Engineer with certain retention till the work is completely executed. On virtual completion of the works, contractor shall be paid final installment retaining certain fixed percentage over a period known as "Defect Liability Period" as security. The final balance shall be payable to the contractor after expiry of "Defect Liability Period" and after such certificate is issued by engineer/consultant. Engineer/Consultant shall have power to withhold payment against work or part thereof not carried out to his satisfaction.

22 The decisions, opinion, direction, certificates with respect to clauses 9,13,17,18 here of shall be final conclusive and binding on the parties without appeal. All other decisions, opinion, direction certificates etc. shall be subject to right of arbitration.

23 ARBITRATION:

Except as otherwise provided elsewhere in the CONTRACT if any dispute, difference, question or disagreement arises between the parties here to or the respective representatives or assignees, at any time in connection with construction, meaning, operation, effect, interpretation or out of the CONTRACT or breach thereof the same shall be decided by an Arbitral Tribunal consisting of three Arbitrators. Each party shall appoint one Arbitrator and the Arbitrators so appointed shall appoint the third Arbitrator who will act as presiding Arbitrator.

In case a party fails to appoint an arbitrator within 30 days from the receipt of the request to do so by the other party or the two Arbitrators so appointed fail to agree on the appointment of third

Arbitrator within 30 days from the date of their appointment, upon request of a party, the

Chief Justice of India or any person or institution designated by him (in case of International Commercial Arbitration) shall appoint the Arbitrators/ Presiding Arbitrator. In case of domestic contracts, the Chief Justice of the High Court or any person or institution designated by him within whose jurisdiction the subject purchase order/contract has been placed/made, shall appoint the Arbitrator/ Presiding Arbitrator upon request of one of the parties.

If any of the Arbitrators so appointed dies, resigns, incapacitated or withdraws for any reason from the proceedings, it shall be lawful for the concerned party/arbitrators to appoint another person in his place in the same manner as aforesaid. Such person shall proceed with the reference from the stage where his predecessor had left if both parties consent for the same; otherwise, he shall precede de novo.

It is a term of the CONTRACT that the party invoking arbitration shall specify all disputes to be referred to arbitration at the time of invocation of arbitration and not thereafter.

It is also a term of the Agreement that neither party to the Agreement shall be entitled for any antelate (pre-reference) or pendente-lite interest on the amount of the award.

The Arbitral Tribunal shall give reasoned award and the same shall be final, conclusive and binding on the parties.

The venue of the arbitration shall be the place from where the Agreement has been placed.

The fees of the arbitrators shall be borne by the parties nominating them and the fee of the presiding Arbitrator, costs and other expenses incidental to the arbitration proceedings shall be borne equally by the parties.

Subject to as aforesaid, the provisions of Arbitration and Conciliation Act, 1996 India and any statutory modifications or re-enactment in lieu thereof shall apply to the arbitration proceedings under this clause.

SETTLEMENT OF DISPUTE / AMBIGUITIES

In case of disputes/ ambiguities while interpreting any of tender/ contract conditions Director IITM Pune decision in the matter shall be final and binding.

24 TECHNICAL SCRUTINY OF FINAL BILL:

The Director, IITM shall have right to get works and bills technically scrutinized at the time of payment of final bill. Director, IITM shall be entitled to recover any money found to be over paid or over certified during such scrutiny.

25 CO-ORDINATION:

Contractor or his authorized representative shall be responsible for co-ordination with all other agencies working at site for smooth functioning and timely completion of works. The Contractor shall arrange his work program to suit the building progress and priorities given by Owner/Consultancy.

Site meeting: Qualified/responsible representative shall attend necessary site meeting from contractor's side to take site instruction/decision in view of trouble shooting and progress review of works. Consultant/his representative shall attend the meetings as required.

26 PRICES:

Prices payable to the Supplier as stated in the Contract shall be firm and not subject to adjustment during performance of the Contract, irrespective of reasons whatsoever, including exchange rate fluctuations, changes in taxes, duties, levies, charges, etc. The contractor shall consider in the bid all the taxes such as VAT, Service tax, Professional tax, Octoroi, Central

excise duties, levies, Insurance, freight charges, transportation charges & related taxes etc. Please note that under no circumstances, the addition of any taxes, duties or levies shall be allowed post opening of the bids.

27 ESCALATION:

Contractor may be required to carry out extra items due to site requirements or changes. All such items shall be carried out by contractor after written consent from client. Contractor shall submit a rate analysis of these items based on market rates. Escalation shall not be allowed on the extra items without prior approval from Institute.

28 SECURITY DEPOSIT:

Successful bidder shall have to pay an amount of 5% of the order value at the time of starting the work in terms of bank guarantee of equal amounts in favor of the Director, IITM for entire period of contract.

29 PERFORMANCE GUARANTEES:

The contractor shall guarantee performance of plant and equipment and workmanship against fault for a period of Three years called as "Defect Liability Period".
A certain percentage of work value 1 0 % or as per payment terms shall be retained for the entire "Defect Liability Period" as security. Such retention can be released on furnishing a performance bank guarantee of equal amount for Three years in favour of Director, IITM, Pune.

30 PAYMENT TERMS:

(a) 60% payment against delivery of the equipment,
(b) 30% payment shall be released after completion of satisfactory installation, commissioning.
(c) Balance 10% will be released upon receipt of Bank Guarantee from Indian nationalized / commercial bank for 10% of total Order value towards performance bank guarantee to be valid for the period of warranty including extension if any, from the date of installation.. If no Bank Guarantee is given, the balance 10% will be paid after assessing, after sales service during warranty period i.e. payment after warranty period.
(d) All applicable taxes such as TDS, labour cess, wct etc will be deducted as per government rules and regulations.

31. EXTRA ITEMS

The rate of extra items shall be worked out in accordance with the following rules.

a). The rates for the extra items shall be derived from the rate of an appropriate item of the similar class for which the rate has already been accepted, where same can be directly derived.

b). The contractor shall be bound to carry out any extra items of work as per site requirement. The rate for extra items shall be derived from the rate already quoted. Where the items are not specified in the BOQ the rate shall be worked out at cost of material + labour + Taxes + 10% overheads, wastage and transportation & profit.

c). Wherever applicable the basic rate difference in materials (mentioned in tender) shall be payable plus-minus without any profits, overheads etc., on said rate difference.

d. Variation and Non-Tendered items, if any, shall be carried out under specific written instruction by architects and prior sanction by the Institute. Sanction for all extra items shall be sought by the contractor within seven days from the occurrence such necessity.

32. Change Orders

A) The Institute may, at any time, by a written order given to the Supplier, make changes within the general scope of the Contract in any one or more of the following:

(a) Method of shipment or packing;
(b) Place of delivery;
(c) Technical and functional specifications
(d) Services to be provided by the Supplier.

B) If any such change causes an increase or decrease in the cost of, or the time required for the Supplier's performance of any provisions under the Contract, an equitable adjustment shall be made in the Contract Price or delivery schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this clause must be asserted within **thirty (30) days** from the date of Supplier's receipt of Institute's changeorder.

SECTION-D

SAFETY REGULATIONS

1 Readily accessible First **Aid Kit** including adequate sterilized cotton and dressing shall be provided on site.

2 Any injured person shall be taken to nearest public hospital without delay.

3 All workmen working at heights shall be provided with **safety belts**.

4 Portable ladders shall be of heights less than 8 meters. In case of ladders above 8 meters additional man shall be provided for holding the ladders.

5 Workers engaged in welding and related works shall be provided with protective eye shields and gloves.

6 The excavations, trenches etc., shall be provided with necessary signals**, barricades, obstacles** etc.

7 All the electrical connections taken for construction purpose shall have earthings wires provided for equipment earthings.

8 **Open/temporary jointing of the cables** shall be avoided and all connections shall be taken through proper sockets & plug tops, Insulated joints and switches etc.

9 **Live wires** shall not be laid on ground / road or taken on surface without protective cover.

10 All water sumps shall be underground or otherwise shall have covers.

11 **All workmen and supervisors** shall be provided with **helmets / safety caps**. **All visitors / Engineers** shall also **wear helmets** when moving on sites.

12 Safety apparatus like hand gloves of appropriate class shall be used for all testing commissioning activities. Proper care through danger notice boards, personal vigil shall be taken during such operation to avoid Injury and damage.

13 **Protective switchgear** shall also be used for **all temporary work;** 1000V megger shall be used for testing 3 phase 415 Volt systems.
All HT cables shall be pressure tested after making the end joints at site. Insulation resistance tests shall be done by 5000V megger for all H.T. Cables.

13.1 It shall be the duty of the contractor to acquaint his staff with all safety regulations as proposed by any statutory authorities.

13.2 The contractor shall indemnify IITM against any violation of safety laws, rules and regulations while carrying out operations as required by the contract.

13.3 All liabilities, owing to injury/death due to negligence or miscommunication or during discharging regular work of the staff of the contractor, will be to the contractor and what so ever the work, in any case IITM will not be responsible for any liabilities of injury/death etc. It's the duty of contractor to guide the staff regarding safety measures.

13.4 All staff while working on electrical installation & infrastructure should use adequate safety/protection equipment such as

a) Electrical safety gloves.
a) Rubber shoes.
b) Safety belt.
c) Earthing discharge rod.
d) Insulated line tester.

13.5 The workmen shall execute the work as per IS code of practice of relevant equipments and follow the IE rules 1956. The contractors staff has to follow the safety & procedures & practices in electrical works as per IS 5216 part 1 and 2.

ELECTRICAL SPECIAL CONDITIONS

AND

TECHNICAL SPECIFICATION

A. ELECTRICAL SPECIAL CONDITIONS OF CONTRACTS

1. This Specification covers the requirements of Supply, Installation, Testing and Commissioning (SITC) of electrical equipment and accessories mentioned as here under and the attached Bill of Quantities for the various items described therein. This also covers the procedure to be adopted for Inspection, Testing and Commissioning for all electrical equipments at site. The works shall be carried out strictly in accordance to the Tender conditions. The Electrical contractor should be well established and must be a reputed Electrical Contractor having License for working as electrical contractor of 22 KV/11KV/415Volts substations issued by Maharashtra state/ state administration of the state in which the contractor is working.

2. The scope of contract is explained below.

2.1 Plan Approval from Electrical Inspector, MSEDCL etc.
2.2 Supply, Erection, testing & commissioning of HT Feeder pillars,
2.3 MSEDCL Metering KIOSK,
2.4 HT Panels,
2.5 Transformer
2.6 L.T. Panels & Accessories,
2.7 11KV-E- Grade XLPE/PVC HT Cable as per MSEDCL Specification,
2.8 Earthing System
2.9 D.G. Set - 415 V-1X320KVA with AMF panel
2.10 External Street Lighting System
2.11 Hybrid Solar Power System for Street Light system.
2.12 Miscellaneous civil works like excavation & back filling, Sand, Half round pipes, red burnt bricks etc for electrical external cabling works.

Quantities as estimated or approximated are as mentioned in schedule of quantities. Contractor shall however ascertain the exact quantity required at site and supply and install the materials accordingly, for which quantity based items rates shall be payable. Supply of the Materials shall be to the Specification of this Tender document and installation shall be as described, as per drawings approved, instructions issued by consultant and/or the purchase from time to time. Certain jobs shall be as per prevailing practices of Maharashtra state Electricity Distribution Company Ltd (MSEDCL) & IE codes.

The Contractor shall take into account prevailing ambient temperature/ weather conditions at site while designing the equipment. Any de-rating factors related to ambient temperature shall be considered as per relevant IS specs. This scope shall be generally as per Contract Agreement and shall include additional jobs or additional quantities as may be required to be carried out for the completion of the electrical installation work in the opinion of the Director IITM Pune. Any other jobs/ items required to be carried out shall be evaluated on the basis of similar item rates under the Contract. Where such similar items do not exist the Contractor shall submit cost analysis to arrive at the item rates for the approval of Director IITM Pune. (Actual invoice / price list & discount, tax details shall be submitted along with rate analysis for each extra item.) Maximum 10 % overheads, profit, etc. shall be allowed to the contractor on landed cost accepted by Director IITM, Pune.

3. LIASONING

3.1. This shall include Obtaining Load Sanction Approval from MSEDCL & Load release from MSEDCL after completion of works.

3.2. Getting the installation approval and obtaining permission to energise the system from State/ Central Government Electrical Inspectorate authority.

3.3. Arranging visit of electrical inspector to site for Inspection of entire Electrical Installation which includes HT Cables, HT VCB, Transformer, D.G. set LT Panels etc as and when required.

3.4. Obtaining Approval from MPCB/CPCB for D.G. set installation if any.

3.5. Submission of necessary test reports.

3.6. All required permission from any Government/ Semi Government/Municipal corporation/Fire Office shall be part of scope of work

4. Contractor shall submit installation detail working drawings for Director IITM Pune approval within 1 week of the award of contract.

The details shall comprise but not limited to the following.

- Earthing pits, Earth bus, equipment/ panel earthing, etc.
- HT/LT Substation Layout/Point of supply /Underground cable route layout etc.
- External Lighting with Solar Power System layout.
- D.G. Set layout.
- Cable trays: - Details shall include pre-fabricated accessories such as risers, bends, tees, couplers, reducers, etc.
- Civil work like wall opening/ cut out/ inserts/ pockets sleeves/ Hume pipes/ RCC pipes for laying cables at road crossings required.
- Any other drawings as may be required by Director IITM Pune for completing the project on time without cost over-run.

5. EQUIPMENT/ WORKMANSHIP

The equipment to be supplied under this Contract shall be strictly as per specifications of the Contract and relevant IS specifications. In the event of any ambiguity/ dispute the Director IITM PUNEs verdict shall be final and binding on the Contractor.

6. QUANTITIES

Quantities mentioned in the Tender documents are approximate. Before placing order Bidder is advised to check the quantity with his working drawings and arrive at actual required quantities as per site conditions. In any case, the payment will be made on the basis of finally supplied and erected quantities on completion of work. Director IITM PUNE keep option to pay for any additional quantities left balance and not erected, but do not bind themselves to do so. If the orders are split for supply and erection, it is the responsibility of erection Contractor to prepare working drawings and inform Director IITM Pune so that supply Contractor can be informed to supply quantities required for satisfactory completion of project.

Bidder to note that no claims for loss/ compensation/ escalation on the grounds of increase/ decrease in the quantities indicated in the tender schedule of quantities, shall be entertained under any circumstances, nor will the Contractor shall be entitled to prefer any claims whatsoever on these grounds

B. TECHNICAL SPECIFICATIONS

B.1 11/0.433KV, 315 KVA ONAN- OFF CIRCUIT TAP CHANGER TRANSFORMER

1 TRANSFOREMR

1.1 Voltage and Frequency Variations

a) Transformers shall operate without injurious heating, on any tap, under the following conditions, provided increase in voltage is not accompanied by reduction in frequency:

i) At rated KVA, with voltage variation of + or - 15 % of the voltage with corresponding & responding to the particular tap.

ii) At rated current, with 105 % rated voltage.

b) Transformers shall accept, without injurious heating, combined voltage and frequency fluctuations which produce the following over- fluxing conditions:

i) 120 % for 1 minute for all transformers.

ii) 35 % for 1 minute for generator transformers and 160 % for 5 seconds other special transformers

1.2 Operation with Cooling Equipment Outage

Starting from hot conditions, all transformers shall be capable of operating, without exceeding permissible temperature rises and with all forced cooling out of operation, under the following conditions:

i) At rated voltage and frequency for not less than 1 - hour without load current.

ii) At rated KVA for not less than 10 minutes.

1.3 Operation under Overloads

It shall be possible to operate all transformers as per loading guide IEC294 upto overloads of 150 %. There shall be no limitations imposed by bushings, tap changers, auxiliary equipment etc. to meet this requirement.

2 CONSTRUCTIONAL FEATURES

2.1 Similar parts, particularly removable ones, shall be interchangeable.

2.2 Screws, studs, nuts and bolts shall be as per relevant IS.

2.3 Nuts, bolts, pins used inside the transformers and tap changer compartments shall be locked.

2.4 Exposed parts shall not leave pockets where water can get collected.

2.5 Internal design of transformer shall ensure that air is not trapped in any location.

2.6 Facility shall be provided for lubrication of bearings and mechanisms. Mechanisms shall be constructed of non- corrodible material.

2.7 Materials in contact with oil shall be such as not to contribute to the formation of acid in oil. Surfaces in contact with oil shall not be galvanized or cadmium plated.

2.8 Labels, indeliably marked, shall be provided for all accessories like relays, switches, fans, current transformers etc.

3 Core

3.1 The magnetic circuit shall be of "core type" constructions. The core shall be built out of high grade, non-ageing, low loss and high permeability, cold rolled grain oriented silicon steel laminations.

3.2 After being sheared the laminations shall be treated to remove all burrs. Both sides of the laminations and the cut edges shall be treated with carlite insulation.

3.3 The finally assembled core shall be free from distortion. It shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibrations during operation.

3.4 The core clamping structure shall be designed to minimize eddy current loss.

3.5 The core shall be provided with lugs suitable for lifting the complete core and coil assembly.

3.6 The core and coils assembly shall be so fixed in the tank that shifting of the complete assembly will not occur during transport or short circuit.

3.7 All steel sections used for supporting the core shall be thoroughly sand-blasted, after cutting drilling and welding.

4 Internal Earthing

4.1 All internal metal parts of the transformer, with the individual clamping plates; shall be earthed. Core clamps and core bolts shall be insulated from the core by class B insulation unless other insulation is approved by Purchaser.

4.2 The top clamping structure shall be connected to the tank by a copper strap. The bottom clamping structure shall be earthed by one or more of the following methods.

a) By connection through vertical tie-rods to the top structure.

b) By direct metal to metal contact with the tank base.

c) By a connection to the top structure on the same side of the core as the main earth connection to the tank.

4.3 The magnetic circuit shall be connected to the clamping structure at one point only, through a link placed in an accessible position beneath an inspection opening on the tank cover. The link shall be on the same side of the core as the main earth connection.

4.4 When the magnetic circuit is sub-divided by oil ducts or insulated barriers above 0.25 mm thick, tinned copper strip bridging pieces shall be inserted to maintain electrical continuity between packets.

4.5 Coil clamping rings of metal at earth potential, shall be connected to the adjacent core clamping structure on the same side as the main earth connection.

5 Windings

5.1 Windings shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service.

5.2 Coils shall be supported at frequent intervals by means of wedge type insulation spacers permanently secured in place and arranged to ensure proper oil circulation.

To ensure permanent tightness of winding assembly, the insulation spacers shall be dried and compressed at high pressure before use.

5.3 Windings shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. No strip conductor wound on edge shall have width exceeding six times the thickness.

5.4 Materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or be otherwise affected under the operating conditions.

5.5 All threaded connections shall be locked. Leads from the winding to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

5.6 Windings and connections shall be braced to withstand shocks during transport or short circuits.

5.7 Coil clamping rings shall be of steel or of a suitable insulating material built from flat laminations.

5.8 Permanent current carrying joints in the windings and leads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil. Steel bolts, if used, shall be suitably treated.

5.9 Terminals of all windings including unloaded stabilizing windings shall be brought out of the tank through bushings for external connections.

5.10 Both MV and LV windings shall be made of copper.

6 Tank

6.1 Tank shall be made from good commercial grade low carbon steel and shall be of welded construction.

6.2 Tank shall be designed to permit lifting, by crane or jacks, of the complete transformer assembly filled with oil.

6.3 Tank shall be braced to withstand full vacuum of 760 mm of mercury and internal pressures during normal and abnormal conditions such as short circuit inside the transformer.

6.4 Suitable guides shall be provided in the tank for positioning the core and coil assembly.

6.5 Adequate space shall be provided at the bottom of the tank for collection of sediment.

6.6 The transformer base shall be designed to permit skidding of the complete transformer unit in any direction, when using plates or rails. The under base shall be detachable unless transport facilities permit a fixed base.

6.7 The transformer top shall be provided with a detachable cover with a bolted flanged gasket joint. Lifting lugs shall be provided for removing the cover. The surface of the cover shall be suitably sloped so that it does not retain rain water.

6.8 When specified in Data Sheet - A, the tank shall have an oil-tight bolted flanged gasket joint near the base of the transformer, so that the tank can be lifted off to have access to core and coils. Suitable projecting guides shall be provided on the core

and coil assembly, to facilitate removal of the tank without lifting the coils. It shall be feasible to weld-off the flanged joint at the base in case of oil leakages.

6.9 Necessary measures shall be adopted like increased clearances and separate aluminum shields to minimize eddy current losses in large capacity and high impedance transformers.

6.10 The material used for gaskets shall be cork-neoprene or approved equivalent. Gasketted joints for tank and manhole covers, bushings and other bolted attachments shall be so designed that the gasket will not be exposed to the weather. Stops to prevent crushing shall be provided for compressible gaskets.

7 Under Carriage

The undercarriage of the transformer shall be provided with detachable steel flat wheels or flat rollers as specified in Data Sheet-A Wheels shall be provided with suitable bearings which will resist rust and corrosion and shall be equipped with fittings for lubrications. Unless otherwise approved, it shall be possible to swivel the wheels or rollers in two directions, at right angles to or parallel to the main axis of the transformer, thereby permitting movement in two directions. The wheels or rollers will be swiveled after jacking the transformer and they shall be lockable in the two positions.

8 Oil

Transformer and associated oil filled equipment shall be supplied with first filling of oil upto the maximum levels as indicated plus 10% extra in non-returnable drums. The oil shall conform to IS 335 No inhibitors shall be used in the oil. The make of oil shall be subject to Purchaser's approval.

9 Bushings

9.1 Solid porcelain or oil communicating type bushings may be used.
9.2 Condenser type bushings shall be provided with -

a) Oil level gauge
b) Oil filling plug and drain valve if not hermetically sealed.
c) Taps for capacitance test.
d) Stress rings and lower end shields.

9.3 When bushings have an under oil end of re-entrant form, the pull through lead shall be fitted with a gas bubble deflector.

9.4 Oil for the bushings shall be same as transformer oil.

9.5 Bushings shall have non- ferrous flanges and hardware.

9.6 Bushings shall be provided with adjustable spark gaps. For BIL upto and including 200 kV, the gaps shall be of the double series type to minimize interference from birds.

9.7 Where bushing current transformers are specified, the bushings shall be removable, without disturbing the current transformers.

10 Cable Boxes and Disconnecting Chambers

10.1 **For cable connection on M.V (11KV) side unless otherwise approved, disconnecting chamber shall be provided for disconnecting and moving away the transformer without unsealing the cables or draining oil from the main tank, leaving the cable box or chamber behind on Purchaser's external supports.**

10.2 Cable boxes and sealing ends shall be complete with jointing materials, compound and all other accessories including wiping glands, armour and earthing clamps.

10.3 The cable box shall have all standard facilities including fitting and drain plugs, relief vent, level glass and body earth terminal.

10.4 The disconnecting chamber shall preferably be air insulated. If oil insulated, the oil shall be segregated from transformer tank oil or cable box oil.

Bushings, oil filling and drain plugs, relief vent, level glass, and removable cover shall be provided for the disconnecting chamber. Plates through which high current carrying conductors pass shall be non-magnetic unless otherwise approved by Purchaser.

10.5 Phase to phase and phase to ground clearances within the chamber shall be subject to Purchaser's approval.

11 Bushing Current Transformers

11.1 Current transformers shall comply with IS 2029.

11.2 It shall be possible to remove turret mounted CTs from the transformer tank, without removing the cover.

11.3 All secondary leads, including tappings, shall be brought to an outlet box near the bushing.

12 Transformer Cooling Equipment

12.1 Built-In Radiators

Unless otherwise approved, tank mounted radiators shall be of the detachable type with bolted flanged connections. The following accessories shall be provided for each radiator:

a) Shut off valves and blanking plates on transformer tank at each point of connection.

b) Top and bottom shut off valves and blanking plates on each radiator.

c) Lifting lugs.

d) Top oil filling hole with cap.

e) Air release plug at top.

f) Oil drain plug at bottom.

13 Off Load Tap Changing Gear: The off circuit tap changer shall be operable by means of an operating handle brought outside the tank. It shall be equipped with an indicating device to show the tap in use and shall be provided with a locking arrangement to lock the switch in position.

14 Fittings And Accessories

The following fittings and accessories shall be provided.

14.1 Inspection manhole (s) with cover(s) on the top cover of the transformer.

14.2 Lifting lugs or eyes for lifting of fully assembled transformer by crane.

14.3 Lifting arrangement for core and coils.

14.4 Earthing pads: Two earthing pads of copper or other non-corrodible material on transformer tank together with clamp type terminals suitable for Purchaser's earthing conductors.

Suitable earthing terminals on cable boxes and separately mounted radiator banks.

14.5 Neutral earthing bar of copper of specified section installed from the neutral bushing to ground level suitably supported along its run on porcelain insulators, together with clamping arrangements at neutral bushing and for two number Purchaser's earth conductors.

14.6 Terminal marking and rating plates shall be as per IS 2026.

14.7 Conservator (for transformer ratings as per IS 2026. The conservator shall be of sufficient volume to maintain the oil seal from the minimum ambient temperature of -5 deg.C upto an oil temperature of 100 deg.C, with oil level varying within the minimum and maximum visible levels. The conservator shall be provided with the following accessories:

a) Filling plug, sump and drain valve.

b) 150 mm diameter Magnetic type Oil Level Gauge & oil sight gauge, both provided with markings for minimum oil level, and oil level at 30 deg. C as specified in Data Sheet - A.

c) A bolted cover for cleaning.

d) Valve for shutting off oil to the transformer.

14.8 **Valves**

The following valves shall be fitted on the transformer tank.

14.8.1 Main tank drain valve with flanged or threaded connection.

14.8.2 Top filtering valve with plug located on the same side as the main drain valve.

14.8.3 Bottom filter connection with plug to drain oil from the lowest part of the tank. This connection shall not be tapped through the bottom of the transformer.

14.8.4 Adequate number of air relief vents.

14.8.5 Valves for the cooler systems are indicated in the respective sections. These valves shall be lockable in closed or open positions and shall be provided with an indicator to show position of the valve.

14.9 Pressure Relief Devices:
A pressure relief vent (explosion vent) mounted on the tank shall be provided for relieving pressure within the transformers. It shall operate for pressure less than the hydraulic test pressure for the tank. The explosion vent shall be provided with diaphragm (s) and a screen to prevent fragments of a shuttered diaphragm being sucked into the transformer under vacuum.
Equalization of air pressure in the vent may be achieved by a pipe connection to the conservator.

14.10 Dial Type Thermometer

15 Painting

15.1 The interior of all transformer tanks and other oil filled chambers and internal structural steel work shall be cleaned of all scale and dust by shot - blasting unless otherwise approved. These surfaces shall be painted with not less than two coats of heat resistant, oil insoluble and insulating varnish. Steel surfaces exposed to the weather shall be thoroughly cleaned and applied a priming coat of zinc chromate. The second coat shall be of an oil/epoxy and weather resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a glossy oil/ epoxy and weather resisting non fading paint of specified shade.

15.2 All exposed bolts, nuts and washers shall be of stainless steel unless otherwise approved.

15.3 Metal parts not accessible for painting shall be made of corrosion-resistant material. Machined finished and bright surfaces shall be coated with a suitable compound and wrapped.

15.4 Interior surfaces of mechanism chambers and knocks shall receive three coats of paint after proper cleaning the final coat shall be of a light-colored anti-condensation paint.

16 Drawings / Documentation For Approval

16.1 Following Drawings in 6 sets shall be furnished for approval.

a) G.A. Drawing
b) Dimensions of L V Box
c) Flange Details
d) Bushings
e) Rating and Diagram Plates
f) NCT 1 Nos Standby Earth Fault Protection if specified in data sheet
g) Foundation Drawing for Information

17 Tests

All transformers shall be completely assembled at Works to ascertain that all parts fit correctly.

18 **Routine Tests**

Routine tests as per IS 2026, shall be performed on all transformers. The following additional points may be noted:

a) Resistance of winding shall be measured at principal and the two extreme taps
b) Impedance voltage shall be measured at principal and the each taps.

c) No load loss and exciting current shall be measured at rated frequency at 100 % and 110 % rated voltage. These tests shall be done before and after impulse tests if the later are specified. Exciting current shall be measured on each phase and recorded.
d) Oil Pressure Test: All oil filled compartments shall be filled with transformer oil and subjected to a pressure of 0.35 Kg/cm above the pressure that would obtain under normal conditions with full head of oil. The pressure shall be maintained for 12 hours during which time no oil leakage shall occur. When heat run test is specified, the oil pressure test shall be performed immediately after the heat run. Otherwise the test may be performed at ambient temperature.

e) Power taken by cooling equipment shall be measured for all transformers.

19 Type Tests

Manufacturer shall supply Type Test Certificates for the following tests:

a) Impulse Test: This shall include chopped wave test. Item wise prices shall be given for
   i) Impulse test on one leg (MV & LV) of the transformer.
   ii) Impulse test on all legs of the transformer.
b) Temperature rise test.
c) Measurement of zero sequence impedance.
d) Measurement of acoustic noise level.

e) Measurement of tan delta and capacitance of each winding to earth (with all other windings grounded) and between all windings (connect together) to earth.

f) Short circuit impedance of each limb of the transformer with single phase voltage from both H.T. and L.T. sides. This is required to check mechanical displacement between windings.

g) Partial discharge test.

h) Switching surge withstand test.

20 Type Test Certificates for tests carried out on similar voltage and rated transformer shall be submitted.

21 Inspection

The Transformer shall be inspected at the Manufacturer's works.

1) Tank Fabrication, Core Assembly and processing of MV and LV winding.

2) Final Inspection before dispatch for carrying out various tests as per IEC 60076.

   The Manufacturer shall send advance copies of all the Routine and Type Tests as per IEC 60076 at least one week before the Inspection.

22 Rejection

Purchaser may reject any transformer if during tests or service any of the following conditions arise :

22.1 a) No load loss exceeds the guaranteed value.

b) No load current (Magnetizing current) exceeds the guaranteed value.

22.2 Load loss exceeds the guaranteed value.

22.3 Impedance value exceeds the guaranteed value.

22.4 Oil or winding temperature rise exceeds the specified value.

22.5 Transformer fails on impulse test & in heat run test.

22.6 Transformer fails on power frequency voltage withstand test.

22.7 Transformer is proved to have been manufactured not in accordance with the agreed specification.

22.8 Purchaser reserves the right to retain the rejected transformer and take it into service until the Seller replaces, at no extra cost to Purchaser, the defective transformer by a new transformer.

23 Auxiliary Equipment

All auxiliary equipment shall be tested as per the relevant IS. Test certificates shall be submitted for bought out items. High voltage withstand test shall be performed on auxiliary equipment and wiring after complete assembly. The copies of these certificates shall be submitted.

24 TEST REPORTS

Four copies of preliminary test results shall be submitted for Purchaser's approval before dispatch of transformer.

Additional bound copies as per enclosed distribution schedule of complete test results including all tests on transformer, auxiliaries, and current transformer characteristics shall be furnished with the transformer.

25 LOSSES

25 .1 Bids will be evaluated based on the losses furnished by each bidder.

25 .2 For the purpose of evaluation of bids, the quoted load losses and iron losses shall be increased by 10 % to reflect + 10 % tolerance as permitted by I.S.

25 .3 Should the losses as measured on the transformer after manufacture be found in excess of the values of the guaranteed losses with plus 10 % tolerance indicated in the proposal, vendor shall pay to Purchaser based on the charges indicated in Data Sheet - A.

26 DATA SHEET FOR TRANSFORMER: Must be filled as per ANNEXURE-D.

B.2 TECHNICAL SPECIFICATION FOR 11KV VACUUM CIRCUIT BREAKER (INDOOR TYPE)

1 TECHNICAL SPECIFICATION FOR H.T. SWITCHGEAR

1.1 This specification covers the design, material construction features, manufacture, inspection and testing at SUB-VENDOR's works, delivery to site and performance testing of Metal-clad Switch- gear rated 11 KV systems.

1.2 Codes and Standards

1.2.1 The design, material, construction, manufacture, inspection, testing and Performance of metal-clad switchgear shall comply with all currently applicable Statutes, regulations and safety codes in the locality where the Equipment will be Installed. The Equipment shall also conform to the latest applicable standards.

1.3 Constructional Features

1.3.1 Metal clad switchgear and control gear shall comprise metal enclosed switchgear and control gear in which components are arranged in separate compartments with metal enclosures intended to be earthed.
The metal clad switchgear and control gear shall have separate compartments for the following components:

a) Each set of busbar

b) Current transformers

c) Each main switching device

d) Cable chamber suitable for heat shrinkable or push on type cable Termination of cables indicated in single line diagram.

e) Metering and relaying devices.

The partitions of forelisted compartments shall have the following degrees of protection:

Complete protection against approach to live parts or contact with internal moving parts i.e. IPH-6 class for all the above compartments except for item (a) i.e. each set of busbars. Compartments of each set of busbars shall be provided with protection against approach to live parts or contact with internal parts, by tools, wires or similar objects of thickness greater than 2.5 mm i.e. Class IPH-4.

1.3.2 Switchgear shall comprise Indoor, metal clad, Drawout type circuit breakers.

1.3.3 Switchgear shall be dust, moisture and vermin proof.

1.3.4 All doors, panels, removable covers shall be gasketted all around with neoprene gaskets. All louvers shall have screens and filters. Vent openings shall be covered by fine mesh on the vertical face. The screens and grills shall be made of either brass or galvanized iron wire mesh.

1.3.5 Metal clad unit shall comprise rigid welded structural frame enclosed completely by metal sheets, minimum 2.5 mm thick (hot rolled) or 2.0 mm thick (cold rolled), smooth finished, levelled and free from flaws.

1.4 Painting

a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with relevant standards for phosphating iron and steel.

b) Oil, grease and dirt shall be thoroughly removed by emulsion cleaning.

c) 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.

d) After phosphating, thorough rinsing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.

e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be 'flash dried' while the second coat shall be stoved.

f) After application of the primer, two coats of finishing epoxy paint shall be applied, with each coat followed by stoving. The colour for the finishing paint shall be as specified.

g) The final finished thickness of paint film on steel shall not be less than 100 microns, and shall not be more than 150 microns.

1.4.1 Switchgear design shall comprise fully compartmental execution having separate vertical sections for each compartment. Compartments with doors for access to operating mechanism shall be so arranged as not to expose high voltage circuits. Switchgear cubicles shall be provided with hinged doors on the front with facility for padlocking door handles.

1.4.2 Structure, buses and control wiring troughs shall be so designed and arranged to make future extensions readily feasible.

1.4.3 Instruments, relays and control devices shall be mounted flush on hinged door of the metering compartment located in the front portion of cubicle. Panel door shall be supported by strong hinges and braced in such a manner as to ensure freedom from sagging, bending and general distortion of panel or hinged parts. All auxiliary relays not requiring manual resetting will be mounted inside the L.T. compartment.

1.4.4 Switchgear cubicles shall be provided with bottom sheet metal plates 2 mm thick (minimum). Removable gland plate shall be 3 mm thick.

1.4.5 Mounting in the form of mild steel channels properly drilled shall be supplied along with anchor bolts for mounting the switchgear cubicles. These shall be dispatched in advance so that they may be installed and leveled when concrete foundations are poured.

1.4.6 Each switchgear cubicle shall be fitted with a label on the front and rear of the cubicle. Each switchgear shall also be fitted with label indicating the switchgear designation, rating and duty. Each relay, instrument, switch, fuse and other devices shall be provided with separate label.

1.5 Safety Interlocks

Switchgear shall be provided with following interlocks:

1.5.1 Operation of an isolator shall not be possible unless the associated circuit breaker is in the open position.

1.5.2 Compartment door of a breaker or an isolator shall not open unless the associated breaker or an isolator is in open position.

1.5.3 Caution name plate, 'Caution Live Terminals' shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end, i.e. incoming terminals of main isolators.

1.6 **Main Busbars**

1.6.1 Main busbars shall be of copper and non-segregated type.

1.6.2 Busbars shall be located in air insulated enclosures and segregated from all other compartments of the cubicle. Direct access or accidental contact with busbars and primary connections shall not be possible. To provide a seal between adjacent cubicles, busbars shall be taken through seal-off bushings or insulating pads.

1.6.3 All busbars joints shall be thoroughly cleaned and antioxide grease shall be applied. Plain and spring washers shall be provided to ensure good contacts at the joints and taps. Wherever aluminum to copper connections is required, suitable bimetallic connectors or clamps shall be used.

1.6.4 Busbars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings specified in Data Sheet A. Maximum temperature of the busbars and busbar connections, under operating conditions, when carrying rated normal current at rated frequency shall not exceed 90 deg. C.(45 + 45 = 90)

1.6.5 Busbars shall be adequately supported on insulators, to withstand dynamic stresses due to short circuit current specified in Data Sheet - A. Busbar support insulators shall conform to relevant standards.

1.6.6 The busbar clearances in air shall be suitable for the short circuit levels specified in Data Sheet - A.

1.6.7 Busbars shall not be painted and all performance characteristics specified shall be obtained with unpainted busbars.

1.7 **Circuit Breakers**

1.7.1 Circuit breakers shall be Vacuum type. These shall conform to relevant standards specified and shall be of draw out type. Circuit breakers shall comprise three separate identical single pole units operated through a common shaft by the operating mechanism.

1.7.2 Circuit breakers shall be suitable for switching duty of transformers whose capacities are furnished in the single line diagram.

1.7.3 Isolating plugs and sockets for power as well as control circuits shall be of robust design and fully self aligning. Plugs and sockets for power circuits shall be silver faced and shall be insulated with PVC or other insulating material shrouds.

1.7.4 VCB circuit breakers shall have completely sealed interrupting units for interruption of arc inside the Vacuum chamber. It shall be possible to isolate easily the vacuum interrupter unit from the breaker operating mechanism for mechanical testing of the interrupter to check loss of Vacuum. The VCB breakers

shall be complete with surge arrestors to provide protection to the equipment controlled by the breaker, against switching surges.

1.7.5 Breaker internal wiring upto the plug shall be similar for all breakers.

1.8 **Operating Mechanism**

1.8.1 Circuit breaker shall be power operated, by a motor charged spring operated mechanism. Main poles of the breakers shall be such that unless otherwise specified, the maximum difference between instants of contacts touching during closing shall not exceed half cycle of rated frequency.

1.8.2 Operating mechanism shall be provided with Anti -pumping feature, electrically and mechanically. Electrical antipumping feature shall be obtained by means of an auxiliary relay.

1.8.3 Main poles of the breaker shall operate simultaneously. There shall be no objectionable rebound and the mechanism shall not require any critical adjustment. It shall be strong, rigid, positive and fast in operation.

1.8.4 Mechanism shall be such that failure of any auxiliary spring shall not prevent tripping and will not cause tripping or closing operation of the power operated closing devices. When the circuit breaker is already closed, failure of any auxiliary spring shall not cause damage to the circuit breaker or endanger the operator.

1.8.5 A mechanical indicator shall be provided to show open and closed positions of breaker. It shall be located in a position where it will be visible to the operator standing on the front of the switchgear with cubicle door closed.

1.8.6 The closing coil shall operate correctly at all values of voltage between 80 % and 110 % of the rated voltage. A shunt trip shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and all values of supply voltage between 50 % and 110 % of rated voltage.

1.8.7 Mechanical trip and close devices shall be provided for manual operation of the breaker. Access to mechanical closing device shall be only after opening the cubicle door. However, the mechanical trip device shall be brought out to the front of the cubicle door.

1.8.8 Working parts of the mechanism shall be of corrosion resisting material. Bearings which require grease shall be equipped with pressure type grease fittings. Bearing pin, bolts, nuts and other parts shall be adequately pinned and locked to prevent loosening or changing adjustment with repeated operation of the breaker.

1.8.9 Auxiliary switches mounted on the fixed portion of the cubicles and directly operated from the breaker operating mechanism on each breaker having 8 'NO' and 8 'NC' potential free contacts rated for 10 amps. 240V AC and 10 amp (inductive breaking) 24 V DC shall be provided. The contacts shall be in addition to those utilized in the control circuit of each breaker and shall be exclusively meant for the PURCHASER's use in external interlocks and controls.

1.8.10 **Spring Operated Mechanism**

a) Spring operated mechanism, shall be complete with motor, opening spring, closing spring with limit switch for automatic charging and all necessary accessories to make the mechanism a complete operating unit.

b) As long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply to the motor, at least one open- close-open operation of the circuit breaker shall be possible.

c) Breaker operation shall be independent of the motor which shall be used solely for compressing the closing spring.

d) Closing action of the circuit breaker shall compress the opening spring ready for tripping.

e) When closing springs are discharged, after closing a breaker, closing springs shall automatically be charged for the next operation.

f) Motor shall be such that it requires only about 30 sec. for fully charging the closing spring. Motors shall be rated for or 240V AC and shall operate satisfactorily at all values of voltage between 80 % to 110 % of rated voltage.

g) Mechanical indicators to indicate charged and discharged condition of spring shall be provided.

1.8.11 **Operating Mechanism Control**

a) The closing and tripping control shall be by a control switch mounted on the cubicle door.

b) The mechanical trip and close devices shall be provided on the breakers in addition to above.

1.9 **Earthing**

1.9.1 An earthing bus shall be provided and extend throughout the length of switchgear. It shall be bolted/brazed to the framework of each unit and each breaker earthing contact bar.

1.9.2 The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current for 1 second as specified in Data Sheet - A, without exceeding maximum allowable temperature rise.

1.9.3 Suitable clamp type terminals at each end of the earth bus shall be provided to suit the size of the PURCHASER's earthing conductor.

1.9.4 All non-current carrying metal work of the switch-board shall be effectively bonded to the earth bus.

1.9.5 Bolted joints, splices, taps etc. to the earth bus shall be made with at least two bolts.

1.9.6 Hinged doors shall be earthed through flexible earthing braid.

1.9.7 Positive earthing of circuit breaker frame shall be maintained when it is in the connected position and in all other positions whilst the auxiliary circuits are not totally disconnected.

1.10 **Cubicle Module Accessories and Wiring**

1.10.1 Cubicle accessories and wiring shall include following accessories:

1.10.2 Inter-cubicle wiring between cubicles of same switchgear shall be carried out by the vendor Separate schematics, internal and inter-cubicle wiring diagrams and external cable connection diagrams for each cubicle shall

be furnished by the vendor. The external connection drawings shall indicate all external connections to be made by the PURCHASERS to the respective cubicles from the PURCHASER's remote equipment.

Necessary data for remote connections will be furnished by the PURCHASER to the vendor

1.10.3 Terminal blocks (including 10 % spare terminals) with complete internal wiring and inter-cubicle wiring as required.

1.10.4 Inter-cubicle looping of control space heating supplies for all the panels of switchgear shall be carried out by the VENDOR.

1.11 Cable Termination Compartment

1.11.1 Supply of Cable glands and termination kits is not included in the scope of switchgear Supplier. However, adequate space shall be provided in the switchgear to install and terminate the cables details of which are given in Data Sheet - A.

1.11.2 Gland plate for control and power cables shall be of removable type and shall be of 3 mm thick.

1.12 Instrument Transformers

1.12.1 The current transformers shall conform to the requirements stipulated in relevant standards specified.

1.12.2 The CTs shall be of cast resin type (insulation Class 'E') and shall be able to withstand the thermal and mechanical stress resulting from the maximum short circuit and momentary current ratings of the switchgear. These shall be completely encapsulated.

1.12.3 CTs shall have polarity marks indelibly marked on each transformer and at the associated terminal block. Facility shall be provided for short circuiting and earthing the CT secondary at the terminal blocks.

1.13 Miscellaneous Accessories

1.13.1 Heater & Light Point

Each switchgear cubicle shall be equipped with heater to prevent moisture condensation within the enclosure and shall be complete with switchfuse unit for power supply. Heaters and switchfuse units shall be suitable for continuous operation on 240 V, 1 phase, 50 Hz, AC supply, 20W F.T. L. with door switch shall be provided in control cubical.

1.13.2 Plug Point

A 240 V, 1 phase, 50 Hz, AC plug point shall be provided in the interior of each cubicle with an ON-OFF switch for connection of hand lamps.

1.14 Tests and Test Reports

1.14.1 The VENDOR shall completely assemble, with all the associated equipment including bought out items mounted and wired and test each cubicle as per relevant standard. All routine tests shall be carried out as per this standard.

1.14.2 Type test certificate shall be furnished alongwith routine tests reports.

1.14.3 Copies of the test certificates shall be submitted for the PURCHASER's approval before dispatch of the switchgear. Bound copies of complete test results as specified in the distribution schedule shall be furnished with the switchgear.

These shall include complete reports and results of the routine tests as also certified copies of type tests carried out on equipment of identical design.

1.14.4 Oscillographic test records for closing and tripping timings of the breakers shall also be furnished.

1.15 **Drawings and Data**

1.15.1 The VENDOR shall submit 4 copies of following drawings for approval.

a) Complete assembly drawings of the switchgear showing plan, elevation and typical section views and locations of cable, compartment, busbar chamber, metering and relay compartment and terminal blocks for external wiring connections.

b) Schematic diagrams for control and supervision of circuit breakers.

c) Foundation plan showing location of foundation channels, anchor bolts and anchors, floor plans and openings for cables etc.

d) Bill of Material

1.15.2 4 sets of manuals/catalogues for all components / equipments, 4 sets of as built drawings alongwith two set of reproducible shall given at the time of despatch.

1.15.3 VENDOR shall submit G.A. Drawings within 15 days from the date of LOI.

1.16 **DATA SHEET FOR 11 KV. VCB Panel: Must be filled as per ANNEXURE-D.**

1.16.1 **Inspection and Testing**

a) The switchgear will be subject to inspection at your works and at site in the presence of our representatives.

b) Purchaser reserves the right to carry out the stage inspection if required. You shall offer the equipment for witnessing the routine testing, before dispatch, with a notice period for inspection of around 10 to 15 days.

c) During final inspection the Purchaser will inspect necessary tests at your works.

d) You shall depute your service and commissioning engineer at site during commissioning of the equipments. Two site visits (Total ten days) during commissioning will be entirely free of charge.

1.16.2 **Rejection**

The material rejected by us on inspection must be taken back by you at your cost within seven days from the date of inspection of goods/material rejection advice, other- wise it will be kept in our premises at your cost and risk or sent back to you at our option at your expense. For rejected material, replacement should be completed within seven days time from the date of receipt of Buyer's report of rejection at the place of supply specified by Buyer, otherwise replacement material will be bought in open market on Supplier's account and the amount will be deducted from the bill or debited to Supplier's Account.

1.16.3 **Drawing Submission**

All relevant drawings such as G.A. drawing showing plan / Elevation / Section, HV/LV cable entry, Detail Wiring diagram, Bill of Material with make, Relays with CT, P.T. ratio, Aux. supply, voltage shall be submitted within two weeks from the date of LOI.

LIST OF SOME OF THE APPLICABLE CODES AND STANDARDS

IS 3427	:	Metal Enclosed Switchgear and Control Gear
IS 2516	:	Circuit Breaker
IS 2705	:	Current Transformers
IS 3156	:	Voltage Transformers
IS 3231	:	Protective Relays
IS 722	:	A.C. Electricity Meters
IS 1248	:	Electrical Indicating Instruments
IS 8686	:	Alarm Annunciators
IS 9224	:	Fuses
IS 6875	:	Control Switches
IS 2298	:	Electric Call Bell and Buzzers
IS 375	:	Marking and Arrangement for Switchgear Bus-Bars Main Connection and Auxiliary Wiring

B.3 : TECHNICAL SPECIFICATION FOR LOW VOLTAGE SWITCHBOARD

1.1 SCOPE

1.1.1 This specification covers the design, material, construction features, manufacture, inspection and testing, delivery to site and performance testing of metal enclosed low voltage switchgear of voltage not exceeding 1000 V AC for Proposed project.

1.1.2 The switchgears would comprise of Power Control Centre (PCCs), PDBs required for the supply of power to and for the control of low voltage equipments in the plant.

1.2 CODES & STANDARDS

1.2.1 The design, construction, manufacture and performance of equipment shall conform to latest applicable standards and comply with all currently applicable statutory, regulations and safety codes in the locality where the equipment will be installed. Panel manufacturer must have CPRI test certificates for their panel assembly.

1.2.2 Equipment shall conform to the latest applicable contractual standards as mentioned below. In case of conflict between the Standards and this specification, this specification shall govern.

1.2.3 The equipment will conform to the latest IS Specification as under -

IS - 8623	:	Specification for LV Switchgear & Control Gear assemblies
IS - 13947	:	LV Switchgear and Control Gear Part I : General Rules Part II : Circuit Breakers Part III : Switches, disconnectors and switch disconnectors and fuse combination units Part IV : Contactor and Motor Starters Part V : Electro Mechanical Control devices
IS - 2516	:	Circuit Breakers
IS - 8828	:	Miniature Circuit Breakers
IS - 12640	:	Residual Current Circuit Breaker
IS - 4064	:	Fuse Switches and Switches
IS - 13703 (I & II)	:	LV HRC fuses
IS - 8544	:	Overload Relay with built in single phasing preventor
IS - 3156	:	Voltage Transformer
IS - 2705	:	Current Transformer
IS - 3842 and IS - 3231	:	Power System Relays
IS - 1248	:	Analog measuring instruments and meters

2 SHEET METAL WORK

2.1 The switchgear frame shall be fabricated using suitable mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2.5 mm.

2.2 Frames shall be enclosed by sheet steel of thickness not less than 2 mm cold rolled or 2.5 mm hot rolled, smoothly finished, leveled, and free from flaws. Doors and covers shall be made of sheet steel of thickness not less than 1.6 mm cold rolled or 2 mm hot rolled. Stiffeners shall be provided wherever necessary. Required sheet steel thicknesses are indicated in Data Sheet A.

2.3 All panel edges and door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

2.4 Cut-outs shall be true in shape and avoid of sharp edges.

2.5 The complete structure shall be rigid, self-supporting, free from vibration, twists and bends.

3 PAINTING

Painting shall be Synthetic Enamel / Powder coated as per Data Sheet D. of this Annexure.

3.1 All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with applicable standards.

3.2 Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning.

3.3 Rust and scale shall be removed by pickling with dilute acid followed by washing and running water, rinsing with slightly alkaline hot water and drying.

3.4 After phosphating, thorough, rinsing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.

3.5 The phosphate coating shall be sealed by the application of two coats of ready mixed, storing type zinc chromate primer. The first coat may be 'flash dried' while the second coat shall be stored.

3.6 After application of the primer, two coats of finishing paint shall be applied, with each coat followed by storing. The second finishing coat for the exterior of panels shall be applied after completion of tests.

3.7 Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.

3.8 The final finished thickness of paint film on steel shall not be less than 100 microns, and shall not be more than 150 microns.

3.9 Finished painted appearance of equipment shall present an aesthetically pleasing appearance, free from dents and uneven surfaces.

4 CONSTRUCTIONAL FEATURES

4.1 Switchgear shall be:

a) of the metal enclosed, indoor, floor mounted modular type

b) made up of the requisite vertical sections

c) of dust and verminproof construction

d) provided with a degree of protection as specified in Data Sheet D of this Annexure.

e) easily extendable on both sides by the addition of vertical sections after removing the end covers.

f) provided with a metal steel frame made of structural steel channel section properly drilled for mounting the switchgear along with necessary mounting hardware. Hardware shall be zinc plated and passivated.

g) provided with labels on the front and rear indicating the switchgear designation.

h) provided with cable entry facilities at top/bottom as specified in Data Sheet A with 3 mm thick removable gland plates and necessary cable glands. For 1 core cables these plates shall be non-magnetic.

i) of uniform height of not more than 2450 mm.

j) of single front execution with back access is permissible

k) provided with gaskets all round the perimeter of adjacent panels, panel and base frame, removable covers and doors.

l) The maximum mounting height of operating handle / switch not exceed 1800 mm from FFL and the minimum height not below 300 mm.

m) provided with busbars running at the top or bottom, as required, all along the length of the switchgear in a separate sheet steel enclosure.

4.2 Operating devices shall be incorporated only in the front of the switchgear.

4.3 The switchgear shall be divided into distinct vertical sections each comprising
The minimum requirement of construction i.e. Form-3 as mentioned separately in Annexure `D' for individual panels.

a) A completely metal enclosed busbar compartment running horizontally.

b) Individual feeder modules arranged in one -tier formation.

c) Enclosed vertical busbars serving all modules in the vertical section. For safety isolation of the vertical busbars, insulating barrier with cut-outs shall be provided to allow the power stab contacts to engage with vertical busbars.

d) A vertical cable alley covering the entire height. The cable alley shall be minimum 300 mm wide for motor control modules and 500 mm wide for circuit breaker controlled modules.

e) A horizontal separate enclosure for all auxiliary power & control buses, as required, shall be located so as to enable easy identification, maintenance and segregation from the main power buses. Tap - off connections from these buses shall be arranged separately for each vertical section.

4.4 **Each vertical section shall be equipped with space heaters with thermostat which is to be located in the cable alley**.

4.5 One metal sheet shall be provided between two adjacent vertical sections running to the full height of the switchgear except for the horizontal busbar compartment**. However, each shipping section shall have metal sheets at both ends.**

4.6 All equipments associated with a single circuit shall be housed in a separate module compartment of the vertical section. The compartment shall be sheet steel enclosed on

all sides and the rear, with the withdrawable units in position or removed, except on the cable alley side. A plate cover with a slot to permit wiring connections shall be provided on the side corresponding to the cable alley. The front of the compartment shall be provided with a hinged door.

4.7 For draw-out type modules, only the handles of control and selector switches, push buttons, knobs & cut-outs for lamps and meters shall be arranged on the front doors of the respective compartments to permit operation without opening the door. On circuit breaker controlled circuits, protective relays shall be mounted on the front door of the compartment. All other equipment pertaining to a circuit shall be mounted on the withdrawable chassis. All cut-outs shall be provided with gaskets for the purpose of dust proofing.

4.8 Current transformers shall not be directly mounted on the buses. Current transformers on circuit breaker controlled circuits shall be mounted on the fixed portion of the compartment.

4.9 In breaker compartments, suitable barriers shall be placed between circuit breakers and all control, protective and indication circuit equipment including instrument transformers. External cable connections shall be carried out in separate cable compartments for power and control cables.

4.10 After isolation of the power and control connections of a circuit, it shall be possible to safety carry out maintenance in a compartment with the busbars and adjacent circuits live.

4.11 The withdrawable chassis shall move on suitable guides and on suitably plated steel or stainless steel rollers or balls to facilitate easy withdrawal.

4.12 Cable alleys shall be provided with suitable hinged doors. It shall be possible to safely carry out maintenance work on cable connections to any one circuit with the busbars and adjacent circuits live. Adequate number of slotted cable support arms shall be provided for cleaning the cables.

4.13 Rear of single front switchgear shall be provided with removable panels. It shall be possible for one person to remove and fix the removable panel.

4.14 All doors shall be provided with concealed type hinges and captive screws.

4.15 The withdrawable chassis housing circuit breakers shall be of the fully drawout type.

4.16 The mounting plate housing feeder control and motor control equipment not incorporating circuit breakers shall be of the fixed type as specified in 6.16.1.

4.16.1 Fixed Type Construction

In this type of construction all power connections to the equipment mounted on the withdrawable mounting plate shall be of the bolted type. All control circuit connections to equipment mounted on the withdrawable mounting plate shall be carried out through conventional terminal blocks mounted in the respective mounting plate. It shall be possible to drawout the mounting plate after unbolting/unscrewing all the power and control circuit connections to the equipment mounted on the withdrawable mounting plate.

5 Interchangeability

5.1 All identical equipment and corresponding parts including chassis of draw out modules of the same size shall be fully interchangeable, without having to carry out modifications. For trouble free interchangeability, the draw out arrangements shall be designed such that normal dimensional variations are taken care of by self- aligning features of the modules.

5.2 Components and equipment that are not fully interchangeable are liable for rejection. Manufacturer shall replace all such equipment by fully interchangeable equipment at his cost.

5.3 The draw-out contacts shall be only between copper/copper alloy/aluminium faces, which are silver or tin plated. The contact design shall be such that there should be no arcing / deformation under the peak short-circuits current.

5.4 Switchgear shall be designed in such a way that all component equipment and bus-bars operate satisfactorily without exceeding their respective maximum permissible rise in temperature under ambient temperature conditions prevailing within the switchgear cubicle, with reference ambient temperature outside the switchgear cubicles as specified in Data Sheet A.

5.5 Provision of ventilating louvers is considered undesirable. If ventilating louvers are considered essential by the Manufacturer, these may be provided. **However, all ventilating louvers shall be provided with fine-screened brass or GI meshes to prevent entry of vermin and dust.**

5.6 All dummy cubicles necessary to meet the requirements of this specification shall be included in the Manufacturer's scope.

6 MAIN AND AUXILIARY BUSES

Main Buses & Taps

6.1 Switchgear shall be provided with three phase or three phase and neutral busbars as specified in Data Sheet - A. of this section.

6.2 Busbars shall be of uniform cross section throughout the length of the switchgear, and upto the incoming terminals of feeder circuit breaker / switch.

6.3 The busbars shall be made of high conductivity Electrolytic Aluminium Copper as specified in Data Sheet – A & On Tender Electrical SLD

6.4 Busbars shall be provided with at least the minimum clearances in air as per applicable standards for a 1000 V, 3 phase system.

6.5 All bus-bars, bus-taps shall be insulated with close fittings sleeve of hard, smooth, dust and dirt free plastic insulation of high dielectric strength (450 V/mm) to provide a permanent high dielectric non-ageing and non-tracking protection, impervious to water, tropical conditions and fungi. The insulation shall be non-inflammable and self-extinguishing and in fast colours to indicate phases. The joints shall be insulated in such a way as to provide for accessibility of contact bolts for maintenance. The dielectric strength and properties shall hold good for the temperature range of 0 deg. C to 90 deg. C. If the insulating sleeve is not coloured busbars shall be colour - coded with coloured bands at suitable intervals.

6.6 Busbars shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents for the associated switchgear. Busbar supports shall be made of Hylam sheets, glass reinforced moulded plastic material or SMC as specified.

6.7 Separate supports shall be provided for each phase of the busbars. If a common support is provided for all three phases, ant tracking barriers shall be incorporated.

6.8 Busbar joints shall be complete with high tensile steel bolts and Belleville washers and nuts. Busbars shall be thoroughly cleaned at the joint locations and suitable contact grease shall be applied just before making a joint.

Auxiliary Buses

6.9 Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These buses shall be insulated, adequately

supported and sized to suit specified requirements. The material of control power supply buses shall be Electrolytic Aluminium. The material for space heater power supply buses shall be same as that for the main power buses. Supply transformer(s), auxiliary busbars and necessary connections to the supply transformers and associated circuits shall be in the Manufacturer's scope.

7 AIR CIRCUIT BREAKERS

7.1 Air Circuit breakers shall be -

7.1.1 of the air break draw out type, mounted alongwith its operating mechanism on a wheeled carriage moving on guides, designed to align correctly and allow easy movements.

7.1.2 of the shunt and/or series trip type as specified in Data Sheet- A1.

7.1.3 provided with an operating mechanism of the type specified in Data Sheet A.

7.1.3 provided with mechanically operated targets to show 'Open', 'Closed', 'Service' and 'Test' positions of the circuit breaker.

7.1.4 provided with mechanically operated, red 'trip' push button, shrounded to prevent accidental operation.

7.1.5 provided with locking facilities in the 'Service', 'Test', and 'Isolated', positions. In test position the breaker will be tested without energising the power circuits. The breaker shall remain fully housed inside the compartment in the test position.

7.1.6 provided with 6 NO + 6 NC potential free auxiliary contacts, rated 10 A at 240 V AC and 1A (inductive breaking) at 24 V DC for remote application for each feeder.

7.1.7 provided with 'red', 'green', and 'amber' indicating lamps to show 'closed' 'open', and 'Auto-trip' conditions of the circuit breaker when breaker operation is controlled by a control switch.

7.2 Circuit breakers shall be provided with the following interlocks:

7.2.1 It shall not be possible to plug-in a closed circuit breaker, or to draw out a circuit breaker in the closed position.

7.2.2 It shall not be possible to operate a circuit breaker unless it is in the fully plugged-in, test, or fully isolated position.

7.2.3 Circuit breaker closing and trip coils shall be rated for satisfactory operation on a control supply system indicated in Data Sheet A.

7.2.4 Whenever specified in Data Sheet A, breakers shall be provided with key interlocking device to prevent parallelling of two breakers.

7.2.5 Closing and trip coil shall operate satisfactorily under the following conditions of supply voltage variation:

7.2.5.1 Closing coils as mentioned in data sheet A

7.2.5.2 Trip coils as mentioned in data sheet A

7.2.6 When series trip circuit breakers are specified the series trip microprocessor releases with adjustable settings shall be provided.

7.2.6.1 In addition to the adjustable current setting range specified in the Data Sheet, short circuit releases shall be provided with at least four adjustable time delay settings.

7.3 Facilities shall be provided for blocking the under- voltage release, if so required at site.

7.3.1 Each of the forgoing releases shall be provided with a single pole, double throw, and potential free alarm contact.

7.3.2 The breakers controlling motors shall operate satisfactorily under following conditions

a) Direct -on-line starting of the specified motor.

b) Breaking no load current of the specified motor.

7.4 Operating Mechanism

7.4.1 Circuit breaker shall be provided with a manual operating mechanism or power operated mechanism as specified in Data Sheet A.

7.4.2 Manually operated mechanism shall be of the spring charging stored energy type, unless otherwise specified in Data Sheet A.

7.4.3 Power operated mechanism shall be of the motor wound spring charging stored energy type.

7.4.4 Speed of closing of contacts shall be independent of the speed with which the handle is operated.

7.4.5 All stored energy mechanism shall be provided with mechanical indicators to show the 'charged and discharged' conditions of the spring.

7.4.6 Circuit breakers provided with stored energy operating mechanisms shall be provided with the following interlocks.

a) The circuit breaker shall not close unless the spring is fully charged.

b) Shocks, vibrations, or failure of springs shall not operate the breaker or prevent intended tripping.

7.4.7 Power operated mechanism shall be :

a) Provided with a universal motor suitable for operation on A.C. and D.C. control supplies specified in Data Sheet - A with voltage variation from 85 % to 110 % rated voltage.

b) Designed to enable a continuous sequence of closing and opening operation as long as power is available and at least one opening operation on power supply failure.

c) Provided with emergency manual charging facilities.

7.4.8 Spring charging time for power operated mechanism shall not exceed 15 seconds.

7.4.9 Power operating mechanism shall be provided with the following additional features.

a) Closing of the circuit breaker shall automatically initiate recharging of the spring ready for the next closing stroke.

b) The motor shall be mechanically decoupled as soon as the emergency manual charging handle is coupled.

c) The circuit breaker mechanism shall make one complete closing operation once the control switch has been operated and the first device in the control scheme has responded even though the control switch is released before the closing operation is complete provided there is no counter trip impulse.

d) Closing controls shall be so arranged that only one closing operation of the circuit breaker shall result from each close initiating impulse, even if the breaker trips while the initiating device is held in the 'Close' position. An electrical anti pumping relay shall be provided on the circuit breaker chassis for this purpose, in addition to the mechanical anti pumping feature incorporated in the circuit breaker.

7.5 Protection Coordination

It shall be the responsibility of the Manufacturer to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers/fuses/motor starters, to provide satisfactory discrimination.

7.6 SWITCH FUSE UNIT: Deleted

7.7 FUSES: Deleted

7.8 MOTOR STARTERS: Deleted

8 MOULDED CASE CIRCUIT BREAKERS

8.1 Moulded case circuit breakers (MCCBs) shall be provided when called for in Data Sheet A, mandatory requirements for ACB, MCCB, MCB. The MCCBs shall conform to the latest application standards

8.2 MCCBs in AC circuits shall be of triple pole construction arranged for simultaneous three pole manual closing and opening and for automatic instantaneous tripping on short circuit. If indicated in Data Sheet - A, power closing device for remote operation may be provided. Operating mechanism shall be quick- make, quick-break and trip-free type. The ON, OFF and TRIP positions of the MCCB shall be clearly indicated and visible to the operator when mounted as in service. Front of board operating handle shall be provided.

8.3 MCCBs shall be capable of withstanding the thermal stresses caused by overloads and locked rotor currents of values associated with protective relays settings of the motor starting equipment and the mechanical stress caused by the peak short-circuit current of value associated with the switchgear rating. The maximum tripping time under short circuit shall not exceed 20 milliseconds.

8.4 The instantaneous short circuit release shall be so chosen by the Manufacturer as to operate at a current in excess of the peak motor in rush current and a range of settings shall be provided for the PURCHASER'S selection.

8.5 MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.

8.6 Under-voltage release and overload inverse time release shall be provided if specified in Data Sheet - A.

8.7 There shall be provision to fix shunt trip coil for all MCCBs for any remote opening of MCCB.

9 MINIATURE CIRCUIT BREAKERS

9.1 Miniature circuit breakers for use on motor space heater control circuits shall comply with the require-ments of applicable standards, as mentioned in Data Sheet A.

9.2 CURRENT TRANSFORMERS: As per Data sheet A

9.3 VOLTAGE TRANSFORMERS: Deleted

10 INDICATING INSTRUMENTS AND METERS

10.1 Electrical indicating instruments shall be of minimum 96 Sq.mm size, suitable for flush mounting as specified in Data Sheet - A.

10.2 Analogue type Indicating instruments shall have provision for zero adjustment outside the cover

10.3 Instrument dials shall be parallex free with black numerals on a white dial.

10.4 Ammeters provided on motor circuits shall be provided with a suppressed extended scale to indicate motor starting current.

10.5 Watthour meters shall be of the direct reading digital type with RS485 connectivity as called in Data sheet-A

10.6 Meters shall be Analog / Digital as specified in Data Sheet A.

11 INDICATING LAMPS

11.1 Indicating lamps shall be :

11.1.1 of the LED type and of low watt consumption as specified in Data Sheet - A.

11.1.2 provided with series resistors.

11.1.3 provided with translucent lamp covers of colours 'Red', 'Green' and 'Amber' as required in the control wiring diagrams.

11.1.4 Bulbs and lenses shall be easily replaceable from the front.

12 CONTROL AND SELECTOR SWITCHES

12.1 Control and selector switches shall be :

12.1.1 of the rotary type

12.1.2 adequately rated for the purpose intended (minimum acceptable rating is 10 A continuous at 240 V AC and 1A (inductive break) 24 V DC.

12.1.3 provided with escutcheon plates clearly marked to show the positions.

12.2 Control switches shall be :

12.2.1 of the spring return to normal type

12.2.2 provided with pistol grip type handles.

12.3 Control switches for circuit breaker control shall be provided with :

12.3.1 contact development as specified.

12.3.2 sequencing device

12.4 Wherever specified in data sheets, control switches with built-in flashing type discrepancy lamps shall be provided to control circuit breakers in lieu of the normal

control switch, red, green and amber indicating lamps. The discrepancy lamp shall be replaceable from the front of the module door.

12.5 Selector switches shall be :

12.5.1 of the maintained contact stay put type. Switches in ammeter circuits shall have make-before-break type contact.

12.5.2 provided with oval handle.

13 PUSH BUTTONS

13.1 Push buttons shall be :

13.1.1 of the momentary contact, push to actuate type rated to carry 10 A at 240 V AC & 1A (inductive breaking) at 24 V DC.

13.1.2 fitted with self reset, 2 NO and 2 NC contacts.

13.1.3 provided with integral escutcheon plates marked with its function.

13.2 'Start', 'Open', 'Close' push buttons shall be green in colour.

13.3 'Stop' push buttons shall be red in colour.

3.4 All other push buttons shall be black in colour.

13.5 'Emergency Stop' push buttons shall be of the lockable in the pushed position type and rotate to release and shall be shrouded to prevent accidental operation. Key shall be required for the operation of the push button if specified in Data Sheet - A.

13.6 Push button switches with a built-in indicating lamp if specified under Notes in Data Sheet - A shall be supplied.

14 SPACE HEATERS

14.1 Space heaters for switchgear panels shall be :

14.1.1 suitable for operation on a supply system specified.

14.1.2 provided with single pole MCB with overload and short circuit release.

14.1.3 provided with thermostats to cut off the heaters at 45 deg. C.

15 INTERNAL WIRING

15.1 Wiring inside the switchgear shall be carried out with 650/1100 V grade, PVC insulated, stranded conductor wires. Minimum size of conductor for power circuits is 4 Sq.mm. copper conductor. Control circuits shall be wired with copper conductor of at least 2.5 sq.mm. for CT circuits & 1.5 sq.mm. for other circuits, the number and size of strands shall be 7 of 0.67 mm and 0.5 mm diameter respectively.

15.2 Engraved identification ferrules, marked to correspond with the wiring diagrams shall be fitted to each wire. Ferrules shall be of yellow colour with black lettering.

15.3 Wires forming part of a tripping circuit of circuit breaker shall be provided with an additional red ferrule marked 'T'.

15.4 Spare auxiliary contacts of all equipment forming part of the switchgear shall be wired up to the terminal blocks.

15.5 Wiring for equipment if supplied by the PURCHASER for which the Manufacturer has to provide cut-outs (where indicated in the data sheets) shall be provided upto the terminal blocks.

15.6 Spare and unassigned modules shall be complete with internal wiring.

15.7 Wiring shall be terminated on preferably study type terminal blocks such that the wires are connected by cable lugs with nuts & washers/lock-nuts.

15.8 Not more than two connections shall be made on any one terminal.

16 TERMINAL BLOCKS

16.1 Terminal blocks (both for power dand control circuits) shall be of reputed make specially for CT and VT circuits. It shall comprise finely threaded pairs of brass studs of atleast 6 mm diameter, links between each pair of studs, washers, nuts and locknuts. The studs, shall be securely locked within the mounting base to prevent their turning. Insulated barriers shall be provided between adjacent terminals.

16.2 Terminals for circuits with voltage exceeding 125 V shall be shrouded. Terminal blocks shall be grouped depending on circuit voltage. Different voltage groups of terminal blocks shall be segregated.

16.3 Terminal blocks shall be adequately rated to carry the current of the associated circuit. Minimum rating of the terminal block is 10 A.

16.4 Terminals shall be numbered for identification as per enclosed drawings. Engraved white-on-black labels shall be provided on the terminal blocks, describing the function of the circuit.

16.5 Where duplication of a terminal block is necessary, it shall be achieved by solid bonding links.

16.6 Terminal blocks for CT secondary lead wires shall be provided with shorting and disconnecting/earthing facilities.

16.7 Terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks.

16.8 Control terminals for external connections shall be suitable for terminating at least two conductors each of 2.5 sq.mm size.

17.0 LABELS

17.1 All labels shall comprise white letters on a black background.

17.2 Labels shall be made of non-rusting metal & rebating type.

17.3 Labels shall be properly fixed, with provision to prevent distortion due to expansion.

17.4 Size of lettering shall be 6 mm, unless otherwise specified.

18.0 EARTHING

18.1 Each PCC, MCC shall be provided with an earth busbar running along the entire length of the board. Material and size of the earth busbar shall be as specified in data sheets. At either end of the earth bus, one (1) clamp type terminal with nuts, bolts and washers shall be provided for bolting the PURCHASER's earthing conductor of size

and materialf indicated in data sheets. In case the earth bus is provided near top of the switchgear, one down comer at either end shall be provided for connection to the PURCHASER'S earthing conductor.

18.2 Earth busbars shall be supported at suitable intervals.

18.3 Positive connection between all the frames of equipment mounted in the switchboard and earth busbar shall be provided by using insulated copper wires/bare busbars of cross section equal to that of the busbar, or equal to half the size of circuit load current carrying conductor, whichever is smaller.

18.4 All instrument and relay cases shall be connected to the earth busbar using 1100/650 V grade, 2.5 sq.mm stranded, copper earthing conductor.

19 INSPECTION

Stage and Final Inspection of LV Switchgear Assembly will be carried out at the Manufacturer's Works as per need to be assessed from time to time.

20 TESTS

20.1 Routine Tests

20.1.1 Mechanical operation test.

20.1.2 High voltage test.

20.1.3 Electrical control, interlock and sequential operation tests.

20.1.4 Verification of wiring as per approved schematic.

20.1.5 Mili –Volt Drop test for each busbar joint.

20.1.6 Primary Injection Test

20.1.7 Secondary Injection Test

20.2 Test Reports

20.2.1 The Manufacturer shall completely assemble with all the associated equipments including bought out items mounted and wired and test the switchgear as per relevant standards. All Routine Test shall be carried out as per relevant standards in presence of Purchaser / Purchaser's Representatives.

20.2.2 Certified copies of all Type Test Certificates shall be furnished along with Routine Test Report for the Purchaser's approval at least one week prior to the Final Inspection.

20.2.3 Copies of the Test Certificates shall be submitted for the Purchaser's approval before despatch of the Switchgear in case inspection / testing is not done in presence of Purchaser's Representatives. Bound copies of complete test results as specified in the distribution schedule shall be furnished with the switchgear. These shall include complete reports and results of the routine test as also certified copies of type test carried out on equipment of identical design.

21.0 DRAWINGS & DATA

21.1 Information as per Data Sheet 'D' will be supplied alongwith the bid.

21.2 The Manufacturer shall submit 6 copies of following drawings for approval.

a) Complete assembly drawing of the Switchgear showing G.A., Plan, Elevation, Typical Sectional use and Location of Cable compartment, busbar chamber,

b) metering and relay compartment and terminal blocks for external wiring connection.

b) Schematic diagram for control and supervision of the switchgear.

c) Bill of Material.

d) Mounting / Erection details

21.3 Manufacturer shall submit G.A. drawings within 6 days from date of LOI.

21.4 Foundation plan showing location of foundation channel, Anchor bolts and Anchor, Floor Plans and openings for cables etc.

21.5 Following Information will be supplied by the bidder after awarding of contract.

21.5.1 **LIST OF DRAWINGS**

The Manufacturer shall furnish the following drawings for each panel and switchgear.

21.5.1.1 Overall outline dimensions and general arrangement including plan, front elevation, rear and side elevations, clearances required in front and back, details of busduct connections, supporting calculation for selection of busbar sizes erc.

21.5.1.2 Switchgear layout plan, fixing arrangements and loading details.

21.5.1.3 Schematic control diagrams to cover controls, the protection, interlocks, instruments, space heaters, etc. for each type of module.

21.5.1.4 a) Detailed internal wiring diagram of each type of module, including terminal block numbers, ferrule numbers and the PURCHASER's.

b) Itemwise bill of material for each module, listing all devices mounted and also otherwise furnished like cable glands, indicating the MANUFACTURER's type, rating, quantity and special notes, if any.

21.5.1.5 Interpanel interconnection wiring diagram including terminal numbers and ferrule numbers.

21.5.1.6 Switch development diagrams.

21.5.1.7 Each type of protective relay and circuit breaker release characteristics.

21.5.1.8 Fuse characteristics curves for each type and rating of fuse.
Space heater ratings and numbers provided per cubicle and the internal distribution scheme for the same, for each switchgear.

NOTES

a) The Manufacturer shall be entirely responsible for the corrections of the internal wiring diagrams mentioned against Item 1.4.

b) The Manufacturer shall ensure that the characteristics of the CTs, fuses, protection relays, VTs and all other devices offered by him are such as to be suitable for the purpose for which they are intended.

21.5.2 **INSTRUCTION MANNUALS**

The Manufacturer shall furnish specified number of copies of the instruction manual which would contain detailed instructions for all operational and maintenance

requirement. The manual shall be furnished at the time of dispatch of the equipment and shall include the following aspects:

a) Outline dimension drawings showing relevant cross- sectional views, earthing details and constructional features.

b) Rated voltages, current, duty-cycle and all other technical information which may be necessary for correct operation of the switchgear.

c) Catalogue numbers of all components liable to be replaced during the life of the switchgear.

d) Storage for prolonged duration

e) Unpacking

f) Handling at site

g) Erection

h) Pre-Commissioning tests

i) Operating procedures

j) Maintenance procedures

k) Precautions to be taken during operation and maintenance work

l) Recommended spares list for the period 1 Years duration.

6 copies of Descriptive Manuals on principal technical data of all equipments ordered.
6 copies of complete type and routine test report sets of the manuals / catalogues for all components / equipments.
6 sets of As Built Drawings alongwith 2 sets of reproducible shall be given at the time of handing over.

B.4- TECHNICAL SPECIFICATIONS FOR STAND BY DIESEL GENERATORS SETS

INTRODUCTION

The scope covers the design, supply, and installation, testing and commissioning of 1No. 433 KV.320 KVA with AUTO-MAIN FAILURE (AMF) panel.

1.0 GENERAL SCOPE OF WORK

The scope of work includes, design, manufacturing, inspection, testing at works, of D.G.Set/s alongwith Acoustic Enclosure and its Auxiliaries, Accessories with Electrical System.

The bidder are also requested to offer separately the Maintenance & Consumable spares for 2 Years / 5000 hrs of safe & trouble free operation of D.G.Set/s.

2.0 SITE CONDITIONS & ELECTRICAL SYSTEM

2.1 SITE CONDITION

Ambient Temp.	:	45°C Max. - 5°C Min.
Design Ambient Temp.	:	40°C
Relative Humidity	:	60% Min. - 80% Max.
Altitude above MSL	:	550M
Atmosphere	:	Non-polluted, urban area

2.2 ELECTRICAL SYSTEM

System Voltage	:	433V, 3 Phase
Voltage Variation	:	+/- 5%
Frequency	:	50 Hz
Neutral Earthing	:	Solidly earthed

3.0 PAST EXPERIENCE & QUALIFICATION CRITERIA FOR D.G. VENDOR

The manufacturing firms dealing in supplying, Installation, Erection, Testing and commissioning of D.G. Sets, who wish to tender for the work will have to fulfill the following Qualification criteria:

3.1 The firm should be well-established having designed and manufacturing facility and should also have after sales service and spare parts availability in and around Pune.

3.2 The firm should have successfully executed the job of designing, manufacturing, supplying, installation, erecting, testing & commissioning of single job of aggregating capacity not less than 1000 KVA and also the capacity of each D.G.Set should not be less than 500 KVA during last three financial years.

3.3 The firm should have also successfully executed at least one job of Acoustic of DG Room / Enclosure for not less than 500 KVA capacity D.G.Set during last three financial years.

4.0 SPECIFICATION & REQUIREMENTS FOR D.G.SET & ACOUSTIC ENCLOSURE

4.1 GENERAL

The HSD DG Set/s shall be of state-of-the-art design, economical to operate highly reliable & shall be suitable for continuous operation.
The DG Set/s shall comprise of an alternator/s of required rating coupled to a suitable capacity diesel engine/s through a flexible coupling & installed on a common base frame. The DG Set/s shall be complete in all respects & shall include all auxiliaries & controls required for proper operation of DG set/s to produce desired power output as per specifications.
The System shall have the facility for 5 minutes test run of DG Set/s (w/out load) automatically at every pre-set interval (approx. 100Hrs.) for checking the healthiness of the D.G.Set/s.

The DG Set/s shall be designed for Water Cooling with Radiator Type Cooling System.

4.2 DIESEL ENGINE

Engine Rating

The Engine/s offered shall be from original manufacturers, the Latest design; High Speed Diesel operated, economical in operation, reliable & robust in construction. It should be 4 stroke cycle, water cooled type with suitable cooling tubes, turbo charged, after cooled Type and all required accessories & auxiliaries.

The diesel engine/s shall be capable to develop suitable BHP after considering power requirement for all internal engine driven & external auxiliaries for giving continuous output at 0.8pf at the load terminals at 1500rpm under site conditions mentioned. The firm/s should support the calculation for net output considering the duration for site conditions & loss of power for auxiliaries etc.

The engine/s shall also have 10% overload capacity for one hour in any 12 hours continuous run. The engine shall conform to all relevant Standards like ISO: 3046 BS 5514/ BS: 649/IS 10002 amended up to date etc.

The engine/s shall be fitted with all required accessories but not limiting to the following:

i) Dynamically balanced Flywheel to suit SAE disc plate flexible coupling with guards for constant speed generator duty.

ii) Necessary Heavy-duty flexible coupling and guard for alternator and engine.

iii) Heavy-duty Dry & replaceable elements type Air cleaner with and with service indicator.

iv) Turbocharger/s with all fittings.

v) Water Cooled type

vi) A GAC-electronic governing systems to maintain the engine speed at all conditions of load.

vii) Radiator type Cooling System

viii) Exhaust Manifold with residential type silencer.

ix) Fuel System

Fuel System comprising of Fuel Pre-filters, Main Filters, Water Separators, Fuel Injection Pump/s, Injectors and internal piping.

MS Sheet fabricated daily Fuel Service Tank of 990 Ltrs. capacity with inlet, out-let connection, air-vent tap, drain plug and level Indicator.

x) Lubricating System

Lubricating System comprising of Lub. Oil, Sump, Gear type Lubricating Oil Pump, Strainer, Lubricating Oil Cooler, Lub.Oil filters. Lub. Oil measuring dip stick should have facility to measure lub. Oil level during running of Engine.

xi) Safety controls to stop engine against Low lubrication Oil Pressure, High Water Temp., Engine Ove rspeed, Engine Under speed

xii) Fuel Control Solenoid

xiii) Starting System

Electric Engine Starting System comprising of Electric Starter, Axial type Gear to match with the toothed ring on fly wheel, a Timer Control to protect the starter motor from excessively long cranking, Battery Charging Alternator Unit, required capacity Heavy Duty Lead Acid type Batteries, Battery Leads, Battery Stands and Static Battery Charger etc.

xiv) Exhaust Piping
All the MS pipes for exhaust lines shall be medium class conforming to relevant IS. The work includes necessary lagging for exhaust pipe work using glass wool / aluminum cladding (Min 50mm thick). The exhaust pipe work includes necessary supports, its foundation etc. to avoid any load & stress on turbo charger. Discharge end of Piping shall be at maximum peak which shall be above building height & as per government norms.

4.3 ALTERNATOR

General:

The Alternator/s shall be suitable to couple with the Engine/s offered and shall be continuous duty, salient pole, revolving field, self-regulated brush type conforming to IEC-34-7. The alternator/s shall also be suitable for parallel operation with Grid and with similar units. The alternator/s shall also be designed for unbalanced load upto 15% of the rated capacity.

The alternator enclosure shall be conformity with IP-21 Degree of protection.

Exciter:

The exciter shall be brushless 3-phase AC Exciter. The voltage generated by A 3-phase exciter rotor winding shall be rectified using a 3-phase Silicon – Diode Bridge circuits and shall be fed to rotor of the alternator. The voltage regulation of the alternator is carried out by alternating the exciter current in the exciter. This is carried out by using a permanent magnet pilot exciter. The exciter shall be provided with moisture, oil and acid resistant polyester varnish.

The stator housing shall be of welded construction comprising of stator core made out of silicon steel lamination compressed hydraulically and rigidly held by pressure plates to form a compact unit. The stator core shall be designed for low reactance and maximum efficiency. The stator winding shall be either of temperature Class-F or Class-H with temperature limited to Class-B. The winding shall be of copper and insulation shall be provided with vacuum impregnated. The impregnation shall be done with high-grade

solvent free epoxy resin of low viscosity in a vacuum vessel and subsequent hardening in a drying oven. The insulation of winding shall afford the following: -

- High di-electric strength
- High thermal conductance
- High resistance to thermal stress
- Neutral to attack by moisture, oil, fungi and chemical aggressive atmosphere
- Resistance to tropical climates and termite attack
- Shall withstand the HT test
- Shall withstand 3rd,9th & 15th harmonics in voltage wave form, avoid excessive neutral currents
- The pole and tooth design shall be so-as-to ensure very low wave form distortion

Rotor:

Rotor shaft shall be turned either from a high tensile MS bar or from an MS forging. Field coil shall be bound with synthetic enamel covered or varnish bonded & glass covered copper strips of high conductivity. Poles shall be of bolt-on type made of sheet steel of high permeability. The insulation between the pole & coil shall comprise of varnished fibreglass cloth backed mica around the body & thick insulating washers on the top & bottom of the coil. Coils shall be impregnated with resin and the complete rotor spray finished with a moisture-protection varnish suitable for tropical conditions. However, 100% epoxy impregnation & an overcoat of resilient insulating material shall be preferable. The rotor shall be dynamically balanced to ensure minimum vibration in operation (better than BS 6861 Part-I grade 2.5).

Damper Winding:

Damper windings shall be provided to assist parallel operation of alternator. The Damper bars of copper brazed to heavy copper. The damper winding shall be fully interred connected.

Automatic Voltage Regulator (AVR):

The Automatic Voltage Regulator shall be state-of-the-art technology electronic type and fail safe design. The AVR shall be suitable for unbalanced loads and fluctuating load and shall have 3-phase sensing unit. The AVR shall be tropicalised and shall be suitable for operation in the temperature range of 0°C to 60°C. The AVR shall afford protection of alternator during under speed operation, over excitation, over voltage etc. It shall be possible to replace the AVR PCB Module in shortest possible time.

Ventilation:

Axial ventilation shall be employed. The shaft mounted centrifugal fan shall be fitted to supply and direct adequate airflow for efficient cooling of alternator.

Terminals shall be housed in a suitable MS box fitted on stator frame. The terminal shall have ample clearance between phases and between phases to earth and shall be readily accessible.

The bearings shall be heavy-duty pre-lubricated ball or roller bearings. The end frame of the rotor shall be removable (from stator) without disturbing the bearings.

The performance characteristics of the alternator/s shall be as below:

Voltage regulation	:	+/- 1% at 0.8 Lag PF from No Load to Full Load, Cold to Hot and including Speed variation upto 4%
Efficiency at Full Load, 0.8pf	:	Not less than 94%
Wave Form distortion	:	Less than 3%
Transient Voltage Dip	:	Less than 10% for any load
Overload capacity		
10% Overload	:	1 hour
50% Overload	:	Minimum 120 sec.
Telephone interference THF	:	Less than 2% as per BS 4999 Part-40
Radio interference	:	Suppression to BS-800 & VDE Class
Voltage surges	:	Surge suppressor shall be provided to Protect the exciter rectifier against short Circuits or out of phase paralleling

REQUIREMENTS:

Brushless, Permanent Magnet, self-excited, screen protected, self regulated, horizontal foot mounted type in double bearing construction suitable for the following:

Rated Capacity (Continuous)	:	Min. 320k.V.A. At 0.8 p.f. at site Condition
Rated PF	:	0.8 (lag)
Rated Voltage	:	433V
Rated Frequency	:	50Hz
No. Of Phase	:	3Phase, 4Wire
Enclosure	:	SPDP
Degree of Protection	:	IP-21
Ventilation	:	Self-ventilated, Air-cooled
Ambient Temp.	:	40 Deg.C.
Insulation Class	:	Class-F/H
Temperature rise	:	Within Class-B limit
Voltage Regulation	:	+/- 0.5%
Voltage variation/adjustment	:	+/- 5%
Frequency variation	:	+/- 1% or better
Excitation	:	Brushless
Type of AVR	:	Fast Acting Electronic
Type of Bearing	:	Anti-friction, Ball Bering
Standards	:	BS as amended up to date

The alternator/s shall be supplied with quadrate Droop CT and the winding shall be star connected type.

Terminal Box

The alternator shall be supplied with suitable terminal box suitable for LT XLPE 3.5CORE 300SQ.MM CABLES FOR cable termination and box for forming neutral point.

Earth Terminals

2Nos. Earth terminals on opposite side of alternator shall be provided with suitable galvanized washer and nuts.

Space Heaters

The bidder shall supply alternator/s with suitable space heaters to maintain the winding temperature automatically such that it does not absorb moisture during long idle periods. The heater terminals shall be grouted to a separate terminal box and shall be suitable for 230V AC supply.

4.4 ACCOUSTIC

The DG Set/s are to be operated in urban area and hence, the noise level shall be within the permissible limits as per the pollution norms. It is envisaged that the DG Set/s are to be housed in in a suitable Acoustic Enclosure.

Enclosure:

The Enclosure for the DG Set shall be designed & manufactured from a fabricated MS Steel sections and CRCA sheet steel with providing suitable sound absorption material i.e. Glass wool / Mineral wool of suitable grade.

The Enclosure shall be suitable for out-door application to protect the DG Set under all kinds of weather and shall have sufficient space / arrangement for maintenance /repair works with suitable doors.

The Enclosure shall have the arrangements for:

- Lifting
- Exhaust Air Louvers according to the radiator size/ Genset dimension in front of the DG Set
- Inlet Louvers to maintain the required ventilation for the Enclosure and shall be provided at the back of the Genset
- Slides or out-side openable and lockable doors
- Interior lighting arrangement

The complete Enclosure shall be treated from anticorrosive process and nicely spray painted. The housing shall be fitted with chassis of the DG Set / rested on leveled floors so-as-to easily disconnect from the DG Set for the purpose of shifting of complete unit / major overhaul / maintenance or as required.

The scope of supply shall also include the casting of foundation for DG Set/s as required and nothing shall be paid extra.

The bidders are also requested to offer separately the Shed with finish floor that required for housing of DGSet/s with Enclosure/s.

4.5 AUTO-MAIN FAILURE PANEL. (AMF -PANEL)

3.1 AMF panel shall be floor mounted, IP 52 enclosure broadly comprising of:

3.3.1 ACB – 630 A, 4 pole 35k.A. EDO Type with LSIG microprocessor release as indicated on SLD

3.3.2 Protection scheme as shown on tender electrical SLD

3.3.3 Electronic Load manager for KWH, KW, KVA,KVAH,PF,TDH, KVARH, HZ etc with RS 485 serial port.

3.3.4 Indicating Scheme as per Requirement

3.3.6 Instrument fuses as required

3.3.7 PLC based controller for each D.G.

3.3.8 Battery Charger

3.3.9 D.G. Set auxiliaries Indication

SYSTEM OPERATION

The Panel/s offer shall afford the following operational requirements

Auto Mode:

Mains Voltage Monitor which shall monitor the supply voltage on each phase. When the main supply voltage fails completely or falls below the set value on any phase, the monitor module shall intimate start up of Diesel Engine. To avoid initiation due to momentary disturbance, a time delay adjustment shall be incorporated in start up initiation.

A minimum 6 (Six) attempt starting facility shall be provided with timer circuit for adjustable cranking time, delay between successive cranking. If the after end of last attempt, the engine/ D.G. Set does not start, and then it shall lock out further action & initiate the alarm.

Once the alternator has built up the rated voltage, VCB & Vacuum contactor in Neutral circuit of D.G. shall be closed automatic with time delay.

Manual Mode

In the manual mode, it shall be feasible to start-up the Engine/D.G.Set/s by operator on activating start command by Push Button. Six attempt starting facility shall be operative for start-up during this Mode. Mains Breaker Trip & D.G. Contactor close operation shall be by intervene of operator only, however interlocking circuit shall be operative to avoid damage during wrong operation.

Load Test Mode

In this Mode, Even if, the Mains supply is within the specification, it shall be feasible to start the D.G. Set . This is to check the healthy-ness of Engine/ D.G. Set

5.0 Information, Data Drawings

A. Documents for approval within 10 days of LOI/PO (4 copies each)

a) General arrangement drawings showing plan, elevation of the Panels complete with overall dimensions, foundation plans, weight etc.

b) Schematic wiring diagram for the control panel and battery charger along with complete bill of materials (make, range, rating, size, accuracy class etc.) and control cable requirements.

c). Refer enclosed Tender Electrical SLD for D.G. Set with ASP Panel.

6.0 Engine Protection

- Low Lub. Oil Pressure
- High Lub. Oil Temperature
- High Coolant/ Water Temperature
- Low Water Level
- Low Fuel
- Low Battery Voltage
- High Battery Voltage

ANNUNCIATION & INDICATION:

The Annunciation & Indication for each fault/ trip for Engine and Generator mentioned above shall be provided in the Control Panel. The Annunciation shall be window type preferably with event recording facility.

7.0 TECHNICAL DATA-SHEET

The Bidders are requested to filled up the Guaranteed Technical Particular's / Data sheet in the prescribed format as per Annexure--D attached herewith, failing to this shall liable to reject the Tender.

8.0 INSPECTION & TESTING

All material / Equipment offered / to be supplied by bidder shall be Type/ Routine Tested as per relevant BS standard prior to assembly / Dispatch. The general test carried out for various equipments are as listed bellow. Purchaser, at their discretion, may depute his representative or appoint third party, to inspect any/or all major equipments / Assembly requiring inspection at manufacture's work. The successful bidder will intimate the date of Testing of Equipment/s at the manufacture's works before dispatch. The successful bidder shall give sufficient advance notice regarding the dates proposed for such test. The engineer incharge / agency at his discretion may witness such testing. The suppliers shall have to submit all the original Type/ Routine Test Certificates.

Engine Test:

Each Engine shall be tested at works in accordance with BS / IEC or any other acceptable international standard:

During the test, the following shall be noted and recorded:

- Load
- Speed
- Fuel Consumption
- Lub-oil Consumption
- Operating temperatures for fuel, Lub.Oil, Coolant, Exhaust gas etc.
- Checks for correct functioning of governors & over speed devices
- Checks for protection and warning devices
- Checks for automatic operation of temperature and pressure controls on engine
- Block tests as per following sequences.
- 0% To 25 %
- 0% To 50 %
- During above tests Voltages, Currents, Frequency, Speed, Drop etc shall be recorded with strip chart recorder.

Alternator:

Alternator shall be tested at manufacturer's works as per BS or any other acceptable international standard.
Residual voltage measurement
Voltage symmetry
Phase sequence test
Load characteristics
Set point potentiometer range/voltage adjustment range
Voltage regulator:
Short time overload with pf=0.1 or at short-circuit Winding test
Over speed test at 120% of rated speed
Insulation resistance measurement

Auxiliary Equipment:

For auxiliary equipment offered / used, such as Valves / Pumps etc. for manufacturing / Erection of D.G.Set/s by the DG set supplier, the manufacturer's test certificate will be acceptable. However the same are also type / routine tested as applicable & specified bellow.

COMMISSIONING & TESTING:

D.G.Set Test:

The DG Set/s shall be tested for performance after the same is installed and trial run at site. The set/s shall be deemed commissioned only after successful completion of performance tests and acceptance of test results.

For the purpose of performance tests, customer shall provide the following:

- Load
- Lub.Oil
- Fuel

The supplier shall depute his testing and commissioning engineer with a team of technicians to conduct the performance tests and demonstrate the adequacy of the plant as per l contract specifications. The tests shall be conducted for a period not less than 8 hours. In case, customer is unable to provide the full load for testing of the DG Set/s, the load test could be conducted at available load.

The test shall include the following:

ENGINE:

- Measurement of following parameters at various loads.
- Speed
- Fuel Consumption
- Lub-oil Consumption
- Operating temperatures for fuel, Lub. Oil, Coolant, Exhaust gas etc.
- Checks for correct functioning of governors, over speed devices & Speed regulation from No Load to Full Load
- Checks for protection and warning devices
- Checks for automatic operation of temperature and pressure controls on engine Functional Tests:
- Functioning of governors
- Functioning of protection & warning devices
- Functioning of controls on engine
- Functional tests on engine control panel

ALTERNATOR:

- Voltage regulation test from No Load to Full Load
- Frequency regulation test
- Measurement of harmonics
- Synchronizing tests
- Functional test on control & relay panel
- Testing of operation of engine-alternator interlocks

DOCUMENTS / DRAWINGS

The Bidders are requested to furnish all relevant Technical Literature, catalogues and drawings of all equipment & Material offered in the prescribed format as per Appendix-B attached herewith along with Technical bid.

The supplier shall carryout detailed engineering for the auxiliary services required for the power plant. The detailed engineering shall include the following, but not limited to the test given below:

- Exhaust gas ducting
- Engine Cooling System (Radiator / Heat exchangers, pumps, piping & cooling towers as applicable)
- Control & instrumentation
- Structural steel for supporting piping, tanks etc.
- Design of foundations for DG Set, chimney, tanks, support structure for piping etc.

The supplier shall furnish detailed working drawings for:

- DG set lay out showing trenches, equipments etc. including sectional views
- Piping layout, P&I diagrams and sectional views
- RCC foundation drawings
- Structural steel supports
- Pipe support details
- Wall openings/floor openings
- Exhaust gas ducting layout
- Schematic diagrams for control & instrumentation
- Required documentation and drawings for statutory approvals (Electricity Board/Pollution Control Board/Electrical Inspector etc.)
- Drawings & documents shall be submitted in quadruplicate for scrutiny and approval. Four sets of approved drawings and documents shall be supplied for customer's use.

Technical Documentation:

The supplier shall furnish the following technical documents:

- Operation Manual for engine & alternator
- Spare parts & catalogue
- Description/Maintenance instruction for engine auxiliaries, controls and control panels
- Circuit diagrams for controls and electric panels (including logic)
- As built drawings (layout / etc)
- Test certificates for engine/alternator/aux. equipment etc.
- Warranty for the entire power plant

B.5 Technical specification for cross linked polyethylene (XLPE) power and control cables

1. SCOPE

This specification covers the design, manufacture, testing at works, inspection and delivery at site of XLPE insulated Armoured PVC outer sheathed power and Control cables.

2. STANDARDS

The cables covered by this specification shall, unless otherwise stated, be designed manufactured and tested in accordance with the latest revisions of relevant Indian standards.

IS-694	:	PVC insulated cables for working voltages upto and including 1100 volts.
IS-1554	:	PVC insulated heavy duty cables for working voltages upto and including 1100 volts.
IS-3961	:	Recommended current ratings for PVC insulating and PVC sheathed heavy-duty cables.
IS-8130	:	Conductors for insulated electric cables and flexible cords.
IS-5831	:	PVC insulation and sheath of Electric cables.
IS-3975	:	Mild steel wires, strips and tapes for armouring of cables.
IS-7098	:	Cross linked polyethene insulated PVC sheathed cables.
IS-6130	:	Conductors for insulated electric cables and flexible cords

3. CONDUCTOR

The conductor shall be Aluminium / Copper as specified in the Schedule of Quantities. It shall be smooth, uniform in quality and free from scale and other defects. The stranded conductor shall be clean and reasonably uniform in size and shape. The conductor shall be either circular or shaped.

4. CONDUCTOR SHIELD

Conductor shield shall be extruded in the same operation as the insulation. The semi-conductor polymer shall be cross linked.

5. INSULATION

a) Insulation shall be cross linked polyethylene and it shall preferably be gas-cured for XLPE cable

b) Insulation shall be FRLS Type cable as specified in the Schedule of quantities.

6. OUTER SHEATH:

All cables specified in the Schedule of Quantities shall have following outer-sheath.

a.	Oxygen Index	-	29 when tested at 27 + 2°C.
b.	Temperature Index	-	Minimum 250°C at Oxygen Index 21.
c.	Flammability	-	As per IS 10810 Part 53 – 61 & 62.
d.	Smoke Generator	-	Smoke density rating shall not be More than 60%.
e.	Acid gas generation	-	Less than 20% by weight.

7. INSULATION SHIELD

This shall preferably be of the strippable, triple-extruded thermoset type.

8. ARMOUR

The armour may be of galvanised steel wires or galvanised steel strips

9 SERVING

The cable serving shall protect the cable sheath and armour from electrolysis caused by stray currents, and from galvanic action. It shall also protect the cable from mechanical damage and corrosion.

10 GENERAL

The cable shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.

11 TEMPERATURE RISE

The maximum conductor temperature shall not exceed 90 degree C during continuous operation at full rated current. The temperature after short circuit for 1.0 second shall not exceed 250 degree C with initial conductor temperature of 90 degree C.

Bidder shall give the following information in the Bid for each conductor cross section specified.

a. Rated continuous current
b. Rated 1.0 second short circuit / short time current

Rating factor shall be given by the Bidder for the following:

a. Variation in ground temperature
b. Variation in soil thermal resistivity
c. Variation of Ambient Temperature
d. For the cables laid side by side, at ID spacing and in Tier formation.

The Bidder shall also indicate the percentage overload that the cable can carry and its duration, when operating initially at a conductor temperature of 90 degree C, with peak conductor temperature of 130 degree C.

12 CABLE DRUMS

Cables shall be supplied in non-returnable drums of sturdy construction. All ferrous and other metal parts of drum shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage. Type of dust preventive finish and coating adopted may be mentioned.

The length of cable on each drum shall be determined by manufacturer considering the transport limitations from manufacturer's works to the site.

13 TESTS

i Routine Tests (To be performed on each drum length)

All tests as per relevant IS shall be conducted and shall be witnessed by the Client.

ii Type Tests

The Bidder shall furnish two (2) copies of type test certificates conducted on similar cables along with the Bid.

a. Partial discharge test
b. Bending test followed by partial discharge test
c. Dielectric power factor as function of voltage
d. Dielectric power factor as function of temperature
e. Heating cycle test followed by dielectric power factor as a function of voltage and partial discharge tests.
f. Impulse withstand test
g. High voltage test.

B.6 TECHNICAL SPECIFICATION FOR EARTHING STATION.

The pipe electrode shall be of 65 mm dia x 3000 mm long G.I. pipe. Salt and charcoal shall be filled in alternate layers of 25 cm as per the drawing. The brick chamber (600 x 600) shall be made 75 mm above FGL and shall have heavy duty cast iron frame and hinged cover at top for inspection. The earthing shall be carried out as per IS 3043, IE rules and statutory requirements.
The lightning protection shall be carried out as per IS 2309-1969.

B.7 TECHNICAL SPECIFICATION FOR CABLE GLANDS AND LUGS.

a) All cable glands shall be made out of brass and shall be of double compression type.

b) All cable lugs shall be of aluminum for aluminum conductor & tinned copper for copper conductor, crimping type.

B.8 TECHNICAL SPECIFICATION FOR CABLE TRAYS

Cable trays shall be G.I. perforated pre-fabricated type/ladder type or M.S. angle and strips ladder type as directed by Engineer-in-Charge. The tray supports shall be applied with two coats of red oxide epoxy primer and two coat of epoxy paint. All structural steel used in the installation of electrical equipments shall also be painted as mentioned above at no extra cost. The construction of the cable tray shall be as per the site requirement. The guage of prefabricated cable tray shall be 14 SWG (2 mm) and ladder cable tray shall be 12 SWG (2 .5mm)

B.9 TECHNICAL SPECIFICATION FOR INSTALLATION

1 LT Switchgears

i) The switchgears shall be checked for dimensions as per manufacturers drawings. The locations of LT switchgears shall be checked as per the layout drawing. The base plates, channels to be embeded in the trench wall/flooring shall be placed well in advance of the actual erection of panel.

Availability of clearances required as per drawings shall be ascertained by the contractor.

ii) The switchgear should be handled with care under guidance of a competent supervisor. Base channels shall be grouted, levelled in cement concrete. All foundations grouted bolts shall be cured for a minimum period of 48 hours.

iii) All the panels shall be assembled, aligned and leveled as per the instructions of the manufacturers drawings. It should be checked that panel to panel coupling bolts and bus bar links fit properly without any strain on any part. It should also be checked that lowering, lifting, racking in and out of breakers and all motions are free from any obstructions. The fixing bolts shall be grouted only after satisfying all the requirements.

iv) After completion of the panel erection, all the cubicles, switches, starters, CTs, bus bar chambers should be cleaned and checked for tightness. All wiring connections shall also be checked for their correctness as per drawings.

Metering and protective CTs/PTs as per the polarities and phase sequence.

Insulators shall be checked for any damage.

v) All starters, switches, contactor contacts should be cleaned with C.T.C.

vi) Hinges of panel doors should be lightly lubricated to give free and noiseless movement.

vii) All the control wiring, bus bars, other live parts of switchgear and incoming and outgoing cables should be meggered with 500 V / 2500 V megger (For LT/HT).

viii) The panels must be completely sealed to prevent entry of any dust and vermin.

ix) The gland plate shall be drilled for the number of cables as per cable schedule/ SLD.

x) The panels must be cleaned with a vacuum cleaner. All loose material lying in the panel shall be removed.

xi) Before commissioning any switchgear panel, the following points must be checked and ensured for safe energisation of the board.

a) That the erection of panel to be commissioned is complete in all respects including all mountings and earthing.

b) That all the openings in floor inside and outside the panel have been sealed off.

c) That all the metering instruments have been checked and calibrated by primary injection.

d) That all the relays have been checked and calibrated by primary and secondary injection.

e) That all control circuit fuses are of proper rating and showing continuity.

f) That all the indicating lamps are healthy and in position.

g) That the H.V. Test of breakers bus bars and outgoing and incoming cables has been conducted and is satisfactory.

h) That the IR value has been recorded for bus bars, circuit breaker, incoming and outgoing cables.

i) That all the surroundings and panels have been cleaned and temporary earth leads have been removed.

j) That mechanical and electrical interlocks are OK.

k) Each panel before erection shall be checked for all above and shown to Purchaser at site. Joint Inspection Report shall be made.

2 HT/LT Cables

2.1 Laying of cable

a) The cables shall be laid in trenches, trays or conduits or buried in ground as specified in cable schedule / shown on drawing. Cable routing given on the drawings shall be checked in the field to avoid interference with structures, piping, ducting and minor adjustments shall be made to suit the field conditions.

b) All cables shall be carefully measured and cables cut to the required length leaving sufficient length for final connections to the equipment on both side.

c) The quantity indicated in the cable schedule is only approximate. The contractor shall ascertain the exact requirement of cable for a particular feeder by measuring at site along the actually finalised route.

He shall prepare cut length schedule of cables before taking up cable laying.

d) Cables shall be laid in complete uncut length from one equipment to other.

e) Cables shall be neatly arranged in the trenches / trays in such a manner, that crisscrossing is avoided and final take off to the motor/switchgear is facilitated. LV cables of same voltage grade may be laid in maximum two layers in each tray for cables up to 3.5 C x 95 sqmm. Arrangement of cables within the trench/tray shall be the responsibility of the contractor.

f) All cables shall be identified close to their termination point and also at an interval of 25 M of cable run by cable numbers as per schedule
Cable numbers will be punched on aluminium straps (2 mm thick) securely fastened to the cable and wrapped around it.

Underground cable shall be provided with cable markers. These posts shall be located at every 50 M and every corner.

g) All temporary ends of cables shall be protected against dust and moisture to prevent damage to the insulation. While laying the cable, ends of cables shall be taped with PVC tape.

h) Cables shall be handled carefully during installation to prevent mechanical injury to the cables. Ends of cables leaving trenches shall be coiled and provided with protective cover until the final termination to the equipment is completed.

i) Direct specified on layout drawings. The trenches shall be of 800 mm depth for LT and 1000 mm depth for HT cables and sufficient width for accommodating all the cables correctly spaced. Before cables are placed, the trench bottom shall be filled with a layer of sand. This sand shall be levelled and cables laid over it. The cable shall be covered with 150 mm of sand on top of the largest dia. Cable and sand shall be lightly pressed. A protective covering of bricks shall then be laid on it. The balance trench area shall then be back filled with soil, rammed and levelled.

Cables shall be subjected to insulation test in the presence of Engineer-in-charge before covering. Any cable which proves defective shall be replaced before covering.

j) All wall openings shall be effectively sealed after installation of cables.

k) Where cables rise from trenches to motor, control station, lighting panels etc. they shall be taken in GI pipes for mechanical protection up to a minimum of 600 mm above grade level. The diameter of the GI pipe shall be at least 3 times the diameter of the cable.

l) Cable ends shall be carefully pulled through conduits to prevent damage to the cable.

3 Transformer

Transformer shall be erected on the foundation made for the same.

a) The transformer shall be examined for any signs of damage during transit. Particular attention shall be paid to the damages to following.

1. Cooling tube vented
2. Oil Sight glass broken
3. Bushings cracked or broken
4. Oil leakages along welds and in valves

The same shall be indicated to the Purchaser within 2 days of Inspection and damages shall be rectified.

b) The transformer shall be placed on the grouted channels. The transformer shall be levelled aligned and checked for free movement on the channels. Stoppers shall be provided immediately to prevent any movement.

c) All accessories such as radiators, valves, conservator tank, explosion vent pipe and other devices shall then, be fixed on the transformer as per manufacturers drawings.

c) A 5 kV and 1 kV megger shall be used for measuring the insulation resistance. Dielectric strength of oil shall withstand 50 kV for 1 minute with 2.5 mm gap. Necessary required oil filtration and drying out can be carried out if oil test report is no satisfied.

e) Before commissioning following points shall be checked :

i) All the accessories have been fixed properly and transformer body and neutral are properly earthed.

ii) Oil level in the transformer conservator tank is upto the marked point and the oil has been tested for dielectric strength.

iii) The silica gel is in reactivated condition.

f) The transformer shall be energized after ensuring all above parameters. The primary voltage and current shall be checked. The transformer shall be checked for undue noise or vibration.

g) After 4 to 6 hours of energisation on no load the transformer shall be switched off. Any abnormality noticed shall be corrected.

h) The transformer shall now be energised and loaded gradually. The voltages and currents on HT and LT panels shall be recorded. The temperature readings shall be taken at intervals.

i) A log book containing all the readings shall be maintained for future reference.

4 Termination

All XPLE cables shall be terminated at the equipments / panel by means of double compression type brass glands and tinned copper lugs.

a) Power cables shall be identified with red, yellow and blue PVC tapes. Where copper to aluminum connections are made, necessary bimetallic washers shall be used.

b) In case of control cables, all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules. Wire numbers shall be as per inter-connection diagrams to be furnished to the contractor.

c) Contractor shall drill holes for fixing glands wherever necessary at no extra cost.

d) The cable shall be taken through adequate size gland inside the panel or any other electrical equipment. The individual cores shall then be dressed and taken along the cable ways or shall be fixed to the panels with polyethylene straps. Only control cables and lighting cables may be directly terminated on to the terminals / junction box respectively.

e) Cable leads shall be terminated at the equipment terminals by means of crimped type solderless connectors.
Crimping shall be done by hand crimping up to 95 Sq.mm & hydraulically operated tool above 95 sq.mm cables shall be used. Conducting jelly shall be applied on the conductors. Insulation of the leads should be removed immediately before the crimping.

5 Testing of Cables

Before energizing, the insulation resistance of every circuit shall be measured from phase to phase and phase to ground. For LT cables a 1000 V megger shall be used and high voltage test for H.T. cable.

6 Earthing System

All Electrical Equipment must be efficiently double earthed in accordance with the requirement of IS-3043/IEEE 80 and relevant regulations of Electric Supply Authority. The earth pits shall be as per IS with proper arrangement for testing. All earthing conductors shall be hot dip galvanized / electrolytic grade base copper conductor. The main earthing rings shall be done as per practice laid in Indian Standard. The earthing of individual electrical equipment by two distinct strips/conductors shall be done as per practice laid in Indian Standard.

The sizes and material of conductors for earthing various equipment shall be as per relevant Earthing Drawing / General Notes for Earthing and Earthing Schedule. All electrical equipment shall be connected to the earth bus at two points except the lighting fittings and junction boxes. Following earthing resistances shall be measured and recorded in the presence of Institute during the dry season.

Resistance of each earth electrode with electrode isolated from the system.
Combined earth resistance of the installation measured at the substation, switch room and any other point as directed by the Institute.

The method of testing shall be as per Clause No. 10.1 and 10.2 of IS-3043. The contractor shall prepare the test report on standard Format. The effective earth resistance of the system shall be <1ohm.

All hardware for bolted joints shall be galvanized and the size of the bolt shall not be more than quarter of the size of earth conductor. Tinned copper lugs shall be provided where round earthing conductors are used.

The 415V neutral shall be solidly earthed by means of two separate and distinct connections to earth. Each connection shall be connected to an independent earth pit near the transformer. The earth pits shall be interconnected between themselves and the main earthing grid to form an earthing ring. The neutral earthing leads shall be kept away from the transformer tank. All joints in the main earthing conductors shall be welded. Terminal joints on the equipment shall be bolted. The earthing conductors running underground shall be laid approximately 500 mm / 600 mm below the grade level. Removable test links shall be provided near the earth pits to facilitate testing of earth pits.Where the earthing terminal diameter provided on equipment is larger than quarter of the size of the earth conductor, connection shall be made using a wider flag welded to the conductor. The quality of galvanizing shall be subject to test in the presence of Institute. Unless otherwise approved by Director IITM Pune, all equipment (Rotary/ Static) shall be earthed at two points. The equipment to be earthed shall be connected to a common earth grid of power system. The pipes shall be earthed, if resistance of earth exceeds 106 ohms. For equipment earthing, suitable GI bolts with spring and plain washers to suit the thread of earth boss of equipment, etc. shall be provided by Electrical Contractor.

Materials for Earthing

The Sizes and Material of Conductors for earthing various Equipment shall be as per relevant Earthing Drawing / General Notes for Earthing and Earthing Schedule prepared for particular Project.

Earth Pits

The number of earth pits will depend upon soil resistivity and the voltage of the system. The location of the earth pit will be as shown in the drawing. The earth pit together with the electrode shall be constructed as per IS-3043-1987. The minimum distance between two earth pits shall not be less than twice the length of the electrode. A bolted assembly link shall be provided in the connection between earth electrode and the main earth conductor. GI pipe for watering shall be included in the rate of earth pit.

Earth Bus and Earth Wires

The earth wire may be of solid bars or flats or stranded. Sufficient care should be taken to prevent corrosion and mechanical damage. Interconnections of earth continuity conductors and main and branch earth wires shall be made in one of the following manners:

Riveted connection

a) Welded connection (mainly applicable in the case of M.S.)

b) Brazed connection (for copper)

c) Bolted connection

Framework and other non-current carrying metal work associated with each system e.g. transformer, tanks, switchgear frame work, etc. shall be earthed. Extraneous metal framework not associated with the power system e.g. boundary fence, steel structure, sheaths of communication cables, etc. will have to be earthed.

Each incoming and outgoing cable shall be bonded to the switchboard earth so that the armour and sheathing with feeders and interconnection shall form an earth system. The complete earthing system inside a substation shall be given a coat of black asphaltic varnish, if insisted by Institute.

Following also shall be earthed:-

Metallic noncurrent carrying parts of all electrical equipments such as transformer, switchgear, panels, power sockets, lighting fixtures., shall be earthed at one point for and up to 230V and at two points for working voltage of 415 Volts.

- Steel structures / columns
- Cable trays, spheres, vessels and other process equipment.
- Fence and gate of electrical equipment (of transformer yard)
- Cable shields and Armour.
- Street light poles near to main earth grid shall be earthed by tapping from main earth grid. For remote located street light pole, individual earth electrodes shall be constructed. Earth strips from Lightning arrester shall be laid and connected to Earth stations directly. Strips shall be of specified size. These shall be connected with plant main grid, whenever specified only below ground.

- Equi-potential jumpers for any or all of the above equipment joints / sections intended for earthing.

Artificial Treatment of Soil

If the earth resistance is too high and the multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride sodium carbonate, copper sulphate, salt and soft coke or charcoal in suitable proportions.

Earth Resistance

Earth resistance of main bus and in turn at connections to equipments shall be less than 1 ohm. For further Details please refer BOQ. Sizes mentioned in the layout drawing shall supersede the above.

7 Fabrication of Steel

The steel section for cable trays and supports shall be cleaned by wire brush before painting. The cable trays and supports shall be applied with two coat of epoxy base primer (30 microns) and two coat of epoxy paint (30 microns each). All structural steel used in the installation of electrical equipments shall also be painted as mentioned above at no extra cost. The construction of cable trays shall be as per the site requirement.

8 Illumination System

The cabling, installation and commissioning of complete illumination system shall comply with all currently applicable statutes, regulations, fire insurance and safety codes in the locality.

a) **General Requirements**

Except as specifically approved by the Site Officer installation of conduits and lighting fixtures shall be taken only after all major services such as piping, structural work etc., in that particular area have been completed. Location of lighting fixtures, switches and receptacles shown on the drawing, are indicative and shall be relocated to suit site condition LP's shall be provided with labels indicating LP number and O/G ckt feeder numbers.

Steel surfaces exposed, to weather shall be thoroughly cleaned for removal of rust and shall be given a primary coat of zinc chromate and two finishing coat of paint. All metal parts not accessible for painting shall be made of corrosion resistant material. Lps shall be provided with cable gland for incoming cable and knockouts for outgoing conduit / Cable termination.

Cable / Conduit supports shall be provided at an interval of 300 - 400 mm for horizontal runs and 400 - 500 mm for vertical runs.
Cable / Conduits shall be kept, wherever possible at least 300 mm away from pipes, heating devices and other equipments.
For the purpose of calculating connected loads of various circuits a multiplying factor of 1.25 will be assured to the rated lamp voltage for lamp fixtures to take into account the losses in the control gear.
Contractor shall supply junction boxes, pull boxes, terminal blocks, glands, conduits and accessories (elbows, tees, bends etc.) and supporting / anchoring materials to make the installation complete.

Contractor shall work in co-ordination with the civil contractor when openings, sleeves are required in walls and floors. Holes made by contractor shall necessarily be patched in a good and approved manner.
In all types of cabling due consideration shall be given for neatness and good appearance. Decision of Consultant / Site Engineer is final.

b) **Wiring in Conduits**

Individual lighting circuits inside building shall be wired with 650 V grade 2.5 sq.mm stranded copper, conductor FRLSZH insulated flexible wires. The circuit wire shall be colour codes as follows.

Red	-	Phase
Black	-	Neutral
Green	-	Earth Wire

Pull wires in a conduit shall be drawn simultaneously during installation of conduits.

c) **Testing**

Lighting installation shall be tested as per the instructions of the Engineer-in-Charge and shall include but not limited to the following.

I) Measure the insulation resistance of each circuit without the lamps being in place and it should not be less than 1 M ohms to earth.

ii) Current and voltage of all the phases shall be measured at the lighting panel bus bars with all the circuits switched on with lamps, if required load shall be balance on three phases.

iii) Check the earth continuity for all socket outlets. A fixed relative position of the phase and neutral connections inside the socket shall be established for all sockets.

iv) After inserting all the lamps and switching on all circuits, minimum and maximum illumination level should measured in the area.

9 Civil Works

Following civil works are included in the contractor's scope.

i) Road Crossings by Hume Pipes (As required)

ii) Excavation, back filling and brick laying and sand filling for directly burried cables and earthing strips. (Type of soil-murum)

iii) Any other minor civil works required such as opening and making of wall, floor, road etc.

iv) Sealing of pipe sleeves for preventing water seepage.

A) **Road Crossing by Hume Pipes**

As far as possible necessary hume pipes will be provided by client at the road crossings. However, wherever required, hume pipes of required diameter shall be provided across the road for road crossings. The hume pipes shall extend from trench to trench. For directly burried cables, the hume pipe shall extend at least 500 mm beyond the road edge. The hume pipe shall be laid at least 600 mm below road level or at the trench bottom. The rate quoted for hume pipe shall be inclusive laying, back filling and re-doing of the road.

B) **Trench for directly buried cables / Earthing grid**

Some cables shall be laid directly in trenches. The trench shall be excavated along the cable route and upto the depth as per drawing / directions of Engineer-in-Charge. A sand bed of at least 150 mm shall be made before cables are laid. After laying the cables, the remaining portion upto the top surface of cable shall be covered by sand. On this, Brick in single layer shall be placed covering the width of the cables. The remaining portion of the trench shall be filled in by the excavated soil and cable markers placed at every 50 Meters and at each bend. The excavation, supply and laying of sand, supply and fixing of bricks back filling are measured separately.

C) All openings made by the contractor for laying of conduit / cable / earthing strip etc. shall be made good at no extra cost. Wherever such openings are required the contractor shall work in coordination with the main civil contractor to minimise break ups and openings of walls.

B.10 . LIST OF APPROVED MAKE / MANUFACTURER OF MATERIALS

Sr. No.	Brief Description of Equipment / Material	Makes
1	MSEDCL CT PT Metering Kiosk	Hupen Or MSEDCL Approved vendor
2	11k.V.H.T. Vacuum Circuit Breaker-Switchgears	SIEMENS/SCHNEIDER/ABB/ GE/L&T
3	Transformer Oil Cooled	VoltAmp, Kiroloskar, Raychem/Universal
4	Diesel Engine Set with AMF Panel	Cummins/Kirloskar/Sterling & Wilson/FG Wilson/CatterPillar.
5	Alternator for Diesel Engine	Kirloskar/Stamford/AVK/Leroy Somer
6	LT Power & Control Cables	RPG/Universal/ Polycab / KEI
7	HT Power Cables	RPG/Universal/ Torrent/Polycab/KEI
8	L.V. Switchgears ACB/MCCB/MCB	Schneider, Siemens,L&T,ABB
9	L.V. Panel Builders	CPRI Approved
10	HT/LT CTs- resin cast (To be used in Panel)	AE / Pragati / Kappa / Gilbert & Maxwel/ Starlite
11.	Control Equipments	Salzer / Technik / Rishabh /Siemens/ Schneider
12.	Energy Meters Electronic	Schneider /Secure/L&T/GE
13	HT CHECK KWH METER –in HT Panel	As per MSEDCL approved make
14.	Terminal Blocks & Connectors	Elmex / Connectwel/L&T
15	Cable Trays	Ashlesha /Indiana/Profab/shruti
16	Cable Tray Support	Hitech / Amtech / Profab
17	Exhaust Fan	Almonard/GEC/ Crompton
18	Metal Clad Plug & Socket (Industrial)	GE/Legrand /Schneider/Neptune/Mennekes
19	External Lighting Luminaries	GE/WIPRO/PHILIPS/BAJAJ
20.	H.T.Jointing kit	Raychem,3M
21	Solar Power System	Tata BP, Deity Fuel,Vikram Solar, Akshay Urja, Jain Irrigation -As System Integrator

Special Note :-

(1)All Bidders must be submitted all materials Guaranteed Technical Particulars (GTP) Submittal in addition to Data Sheet mention in Technical specification of this tender.

(2) 11 k.v. ht related ht equipments shall be ordered/procured by contractor after confirmation of load approval from MSEDCL official .

B.11. ELECTRICAL TENDER DRAWINGS SCHEDULE:

(EXTERNAL HT/LT ELECTRICAL WORK)

SR. NO	DRAWING TITLE	DRAWING NO.
1	MAIN SINGLE LINE DIAGRAM 1/2	IITM-P-HST-Ele00-01-07-167855
2	MAIN SINGLE LINE DIAGRAM 2/2	IITM-P-HST-Ele00-01-07-173007
3	POINT OF SUPPLY LAYOUT	IITM-P-HST-Ele01-01-05-173004
4	LT SUBSTATION ROOM & DG LOCATION LAYOUT	IITM-P-HST1-Ele01-01-03-173001
5	OVERALL CABLE ROUTE & EARTHING LAYOUT	IITM-P-HST1-Ele01-01-05-173002
6	EXTERNAL LIGHTING LAYOUT	IITM-P-HST1-Ele01-01-07-173003

NOTE: Based on above Tender drawings contactor will prepare shop drawings /layout drawings and will obtained approval from Architect/Consultant before commence of any work by Contractor.
(Except Electrical SLD).

DATA SHEETS: Data sheets as per annexure -D for following major equipments must duly filled & signed. Bid submitted without Data sheets /incomplete data sheets shall be rejected.

1. TRANSFORMER

2. HT PANEL

3. ALL LT PANELS

4. D.G. SET

5. AMF PANEL

6. 11 KV. HT CABLES

7. L.T. CABLES

ANNEXURE-D-

DATA SHEETS TO BE FILLED BY BIDDERS

1. TRANSFORMER DATA SHEET

Sr.No	Particulars	Requirements for Transformer	To be filled by Bidder
1	**Electrical Parameters**		
1.1	Rated kVA at rated voltage and principal tap	315 k.V.A.	
1.2	Overloading as per IS 6600-1972	Required	
1.3	3 phase power supply system in which transformer is to be used	11 kV	
1.4	Primary side (HV) maximum voltage	12kV	
1.5	Secondary side (LV) maximum voltage	433 Volts	
1.6	System earthing		
	- Primary side (HV)	MSEDCL 11k.V.System Solidly Earthed	
	- Secondary side(LV)	Solidly earthed	
1.7	Minimum 3 phase and ground fault levels		
	- Primary side (HV) - Secondary side (LV)	As per IS 2026 Table 4 As per IS 2026 Table 4	
1.8	Direction of power flow	Unidirectional	
1.9	Transformer application	LT. Power Distribution	
1.10	Impedance & Losses		
1.10.1	Percentage impedance voltage at rated current, frequency, principle tap and 75º C	4% ± As per IS Tolerance	
1.10.2	No Load Losses	650Watts	

1.10.3	Full Load Losses	3500Watts	
1.11	Rated Frequency	50Hz	
1.12	Rated Insulation Level		
1.12.1	One minute power frequency withstand voltage		
a.	HV winding	28k.V.	
b.	LV winding	3k.V.	
1.12.2	1.2x50 micro second lighting impulse withstand voltage level	75 kV Peak for HV	
1.12.3	Induced over voltage withstand		
a.	HV winding kV(RMS)	As per IS 2026 Part III	
b.	LV winding KV (RMS)	As per IS 2026 Part III	
1.13	Efficiency at 75 deg. C winding temperature.		
a.	At full load	To be filled by bidder	
b.	At 75% load	To be filled by bidder	
c.	At 50% load	To be filled by bidder	
2	**Transformer type/Cooling**		
2.1	Indoor/outdoor	Out door but will be suitable for indoor Installation	
2.2	Type	Oil Cooled	
2.3	Type: Auto wound/two winding/three winding	Two winding	
2.4	Method of cooling	ON-AN	
3	**Temperature Rise**		
3.1	Maximum Temperature rise of oil by thermometer inclusive of 5°C tolerance at rated kVA and principal tap. over design ambient temperature of 45^0C.	50^0 °C	

3.2	Maximum Temperature rise of oil by resistance method inclusive of 5°C tolerance at rated kVA and principal tap. over design ambient temperature of 45^{0}C	55^0 °C	
4	**Tapping**		
4.1	Winding in which tapping is required	H.V.	
4.2	Off-circuit/ON load	Off Circuit	
4.3	Number of Positions	Positions(+5%,-10%)	
4.4	Percentage variation / step	2.5%	
5	**Winding data**		
5.1	Thermal Class	Class A for 105°C	
5.2	Number of windings	Two	
5.3	Winding material	Copper	
5.4	Winding connection		
5.5	- HV winding	Delta	
5.6	- LV winding	Star with neutral brought out fully insulated for connection to earth	
5.7	Vector groups (HV-LV)	DyN 11	
6	**Core laminations**		
6.1	Type	CRGO	
6.2	Material	Silicon steel laminations	
6.3	Thickness	0.3	
7	**Terminal Bushing minimum clearance in Air**		
7.1	11k.V. Phase to Phase	To be filled by vendor	
7.2	433Volts.Phase to Ground	To be filled by vendor	
7.3	Minimum Creepage Distance	528mm	
8	**Terminal connection**		
8.1	M.V. Winding	3Cx120Sq.mm A2XFY 11k.V.	

8.2	L.V. Winding :	2 Run 3.5Cx300Sq.mm A2XFY 1.1k.V.	
8.3	Purchaser Earth :	2Nos x50x6 mm G.I. Strip	
8.4	Busbar Size of LT Terminal	Suitable for 1.2 times of full load current at desired fault level	
8.5	Neutral End :	To be brought out	
8.6	Disconnecting Chambers	Required for 11k.V. & LT. Cable box.	
9	**Miscellaneous**		
9.1	Test required		
9.1.1	All routine test as per IS		
9.2	Colour shade 632 of final painting as per IS : 5	Dark Admiral Gray.	
10	**List of Standard fittings & accessories**		
10.1	Explosion vent	Required	
10.2	Conservator with oil filling hole with cap& drain plug	Required	
10.3	Oil l level gauge with 3 position	Required	
10.4	Silica gel breather(500Gms)	Required	
10.5	LV Cable end box with 2nos earthing terminals	Required	
10.6	HV Cable end box with 2nos earthing terminals	Required	
10.7	Filter valve 25mmsize	Required	
10.8	Detachable radiator with shut off valve	Required	
10.9	Rating & terminal marking plate	Required	
10.10	Rainforcement angle:2Nos	Required	
10.11	Pulling lugs:4 Nos	Required	
10.12	Earthing boss:2Nos	Required	

10.13	Base Channel Size 100x50	Required	
10.14	Drain Valve 25mm	Required	
10.15	Air release valve	1No Required	
10.16	Thermometer pocket for dial type thermometer	1No Required	
10.17	Lifting lugs for cover: 2 Nos	Required	
10.18	Lifting lugs for Tank: 2 Nos	Required	
10.19	Neutral terminal for earthing	Required	
10.20	Weather Proof Marshaling Box with hinged doors, lamp and heater with switch.	Required	
10.21	Off circuit tapping switch handle with locking arrangement.	Required	
10.22	Removable bi-directional Flat Type rollers	4Nos required.	
10.23	150mm Dia Winding temperature indicators with A& T contacts	Required	
10.24	150mm Dia Oil temperature indicators with A& T contacts	Required	
10.25	Weather proof Marshling box with connection for above auxiliary protection with Lamp holder with Switch	Required	

2. DATA SHEET -11k.V. HT SWITCHGEAR-

Sr. No	Particulars		Requirement for 11k.V. Switchgears panel Assemblies	To be filled by Bidder
1	**General**			
1.1	Nominal System Voltage, Phases & frequency		11000V, 3PH, 50Hz, 10%	
1.2	Maximum System voltage		12k.V.	
1.3	System Neutral Earthing		Non-effectively earthed through resistance.	
1.4	Material of bus bars for Phase & Earthing		Electrolytic copper	
1.5	Heat shrinkable PVC sleeves for bus bars		Required.	
1.6	Thickness of sheet steel enclosures.		2 mm with cold rolled /3mm with hot rolled.	
1.7	Thickness of removable gland plate		3mm	
1.8	Degree of protection		IP 4 X or better	
1.9	Colour finish shade		RAL 7032	
1.10	Clearance of live parts in air		Suit to impulse voltage	
1.11	Busbar insulation		Unpainted	
1.12	Requirement of space heater		Required operating at 230 Volts with thermostat control	
1.13	24 D.C. Control Supply.		In Built 24 V D.C. Power Pack for Closing ,Tripping & maximum 12 Hours battery back up for Indications circuits	
2	**Current transformer details**			
	(i)	Type	Window/bar primary, cast resin	
	(ii)	Class of Insulation	Class E or better	
	(iii)	Secondary Current	1 Amp	
	(iv)	Short Time rating	26 kA for 1 seconds.	
	(v)	Accuracy Class	Metering : CL1 & for Protection : CL:5P20	

3	**Voltage transformer details**			
	(i)	Type	Cast Resin	
	(ii)	Rated Voltage-Primary	11000 / √3 V	
		- Secondary	110 / √3 V	
	(iii)	Method of connection	Star / Star	
	(iv)	Class of insulation	Class B or better	
	iv).	Numbers	As per requirement	
	v).	Rated voltage factor	1.2 continuous, 1.9 for 30 seconds.	
	vi).	One minute power frequency Withstand voltage KV (rms)	28 kV	
	vii).	Lightning Impulse withstand voltage kV 1.2/50 μ -seconds (peak)	75 kV	
	viii).	Numbers	As per requirement	
	ix).	Accuracy Class	LPT : 1	
4	**Meters , Indications & Announciation**			
4.1	Meters as under			
	(i)	Digital Microprocessor Load manager with RS 485 serial Port	Required to read & record of Line voltage/Line current, Hz, Kw, KWH, KVA, KVAH, KVAR, KVARH, p.f., Maximum Demand, TDH.	
	Ii	Analogue type Voltmeter 120x120mm	Required with VSS	
	(iii)	Accuracy Class	1	

4.2		Indications Lamp	As indicated in Tender SLD	
4.3		Breaker control switch	Breake Control switch of spring return to Neutral type with TNC contacts+ 1 No Emergency trip push button+ Push button for trip circuit healthy supervision	
4.4		Annunciation	12 Points window Annunciations with Accept Push button for Transformer faults .	
5.	**Vacuum Circuit Breaker**			
5.1	Type of circuit breaker		Vacuum circuit breaker (Trip free)	
5.2	Type of execution		Indoor	
5.3	Rated voltage		12 KV	
5.4	Rated frequency		50 Hz, + 5%	
5.5	Number of poles		Three	
5.6	Rated normal continuous current		630Amp	
5.7	Maximum temperature of bus bars, droppers, connectors & contacts at continuous current rating under site reference ambient temp.		85 deg.C	
5.7	Breaker application		Control of incoming supply & Transformer Control	
5.8	Reference standard		IEC-56, IS-13947-1993 Part 2, IS-13118-1991	
5.9	Draw out/Non-draw out type		Draw out type, with individual rack in / rack out handle for each breaker	
5.10	Rated insulation level			
5.11	One minute power frequency withstand voltage		28 KV (RMS)	
5.12	1.2/50s lightning impulse withstand voltage		75 KV (peak)	

5.13	Maximum temperature rise when carrying rated current	Within limits as per IEC-56	
5.14	Short time current rating	26 KA for 3 sec	
5.15	Symmetrical breaking current	26 KA	
5.16	Making current	100 KA (peak)	
5.17	No. of breaks per phase	One	
5.18	Rated operating sequence	O-0.3 min-CO-3min-CO	
5.19	Operating timings		
5.19.1	Closing time	To be indicate by Vendor	
5.19.2	Tripping time		
5.20	Operating mechanism details		
5.21.1	Type of operating mechanism	Stored energy type. Motor operated spring charging	
5.21.2	Operating voltage of the motor	230 V AC	
5.21.3	Type of spring charging motor	AC	
5.21.4	Permissible percentage variation in operating voltage of the motor	70% to 110 %	
5.21.5	Class of insulation	Class-B or better	
5.21.6	Over load and short circuit protection	To be provided	
5.21.7	Electrical & Manual close/trip facility	To be provided	
5.21.8	Provision for charging of the closing spring immediately after closing operation of the VCB	To be provided	
5.21.9	Mechanical indicators for closing spring 'Charged & Released'	To be provided	
5.21.10	Manual charging of closing spring	Will be provided with individual handle for each breaker	
5.21.11	No. of handles	One	
5.21.12	Mechanical indication for 'ON/OFF' status	To be provided	
5.21.13	Number of auxiliary contacts	Contractor to indicate (min 8 NO + 8 NC)	
5.21.14	Maximum operating voltage of auxiliary contacts	24V DC	

5.21.15	Permissible continuous current of auxiliary contacts	10 A DC	
5.21.16	Closing and tripping release		
a.	Operating voltage	24 V DC	
b.	Permissible percentage variation in operating voltage of the coils	85%-110% for closing coil 70%-110% fir tripping coil	
5.21.17	Anti-pumping feature	To be provided	
5.21.18	Material of support insulators for poles	Epoxy cast resin type	
6	**Protections**		
6.1	**Numerical Relays (11KV System)** Numerical relays for 11KV Switchgears will comply with but not limited to the following technical requirements.		
6.1.1	Auxiliary Supply	24 V DC	
6.1.2	CT Secondary Current	1 Amp.	
6.1.3	PT Secondary Voltage	110 V AC, 3 Phase	
6.1.4	Ambient Temperature	45Deg C	
6.1.5	Required are Protections as under		
6.1.6	IDMT-Phase fault (for all phases)	Required , ANSI :Designation : 50/51	
6.1.7	IDMT-Earth fault (1Element)	Required . ANSI :Designation : 50N/51N	
6.1.8	Under Voltage Relay	Static -Equivalent EE make under voltage relay typ VAGM - 22 with 40-80 % setting range. The relay shall be provided with Inbuilt time delay facility Designation : 27 (After each opening of VCB due to Under voltage, Auto reclosing of VCB by means of Electronic ON DELAY timer shall be provided)	
6.1.9	Monitoring	Self-diagnostic facility.	

6.2.0	Transformer Auxiliary Protection with reset type mechanical flag	Suitable No VAA 33 Relay required for Transformer Auxiliary Protection for 315 KVA Transformers Designation : 74	
6.3.0	Trip Circui Supervision Relay	Micro supervision relay suitable for 24 V DC supply. Designation : 97	
6.4.0	Master Lock out relay	Hand reset lockout relay. Designation : 86	

3. DATA SHEET -LOW TENSION SWITCHGEARS ASSEMBLIES.

3.1 DATA SHEET:POWER CONTROL CENTER (PCC)

Sr. No	Particulars	Requirement for Low Tension Switchgears panel Assemblies	To be filled by Bidder
1	**General**		
1.1	Power supply		
1.1.1	Rated voltage & frequency	415 V, 3ph 4 wire (Neutral solidity grounded), 50 Hz	
1.1.2	Control Voltage	230V AC 1ph 50 Hz, to be derived from Panel incomers of breaker	
1.1.3	Rated insulation Voltage	1100 V	
1.2	Cubicle		
1.2.1	Type of enclosure	IP-52 or better for bus bar ratings up to 630 Amps.	
1.2.2	Minimum thickness of sheet steel requirement	Sheet steel of not less than 2 mm thickness for load bearing members and 1.6 mm thickness for non-load bearing members.	

1.3	Design ambient temperature	45 degree C.	
1.4	Tier formation	Single tier for breaker feeders & single/ double tier for other feeder modules. PCC will be single front.	
1.5	Type, size & number of cables (minimum) that can be terminated in each of cubicle	Refer enclosed tender electrical SLD	
1.6	Termination of incomer to PCC	Top/Bottom as per final approved layout	
1.7	Outgoing feeder cable entry/Bus trunking	Top/Bottom as per final approved layout.1No feeder suitable for connection of bus main riser.	
1.8	Minimum clearances at front and back of switch board	As Indicated in Tender Electrical layout drg.	
1.9	Maximum limiting dimensions	As shown in in Tender Electrical layout drg.	
1.10	Paint shade	RAL7032	
1.11	CPRI Approval	Panel manufactures must have valid CPRI approved for 35k.A. type test certificate	
2	**Busbars**		
2.1	Continuous current rating at design ambient temperature	As per enclosed Electrical SLD.	
2.2	Bus bars material & other informations		
2.2.1	Main busbars	Aluminum alloy EC Grade E91E(63401) (Conforming to IS : 5082-1988)	

2.2.2	Bus connections to circuit breakers	As per rated current of breakers at 0.8 Amp/Sq.mm current density.	
2.2.3	Temperature rise at rated continuous current of the bus bars in the bus bar chamber	Limited to 45°C over an ambient of 45 °C.	
2.2.4	Type of bus bar insulators	Resin cast / fibre glass / DMC / SMC	
2.3	Minimum clearances in air in mm		
2.3.1	Between phases	25.4	
2.3.2	Between live parts and ground	19.0	
2.4	1 minute PF withstand voltage	3 kV for Power Circuit 2KV for control Circuit	
2.5	Short Circuit Ratings		
2.5.1	1 second short time rating of PCC	35 kA (RMS)	
2.5.2	Dynamic through fault current	75 kA (peak)	
2.6	Current Density for Aluminum	0.8Amp/Sq.mm	
2.7	Insulating Sleeves	To be provided as per phase identification	
3	**Air Circuit Breakers(Transformer & D.G. Incomers)**		
3.1	Service	Indoor	
3.2	Type	Electric Operated Draw Out type (EDO)	
3.3	No. of poles	4	
3.4	Built in protective release for Incomer ACB	Microprocessor based Adjustable over current, Short Circuit, Instantaneous short circuit , Adjustable Earth Fault Release.	
3.6	Rated service voltage	415 V +/- 10%	
3.7	Rated Current	As per tender SLD	
3.8	Rated frequency	50 Hz +/- 5%	

3.9	System earthing	Solidly grounded	
3.10	Rated short time withstand current for 1 second	35 KA (r.m.s.)	
3.11	Rated Symmetrical breaking current at rated voltage	35 KA (r.m.s.)	
3.12	Rated making capacity	70KA (r.m.s.)	
3.13	Duty cycle	O-0.3 min-CO-3 min-CO	
3.14	Utilization category :	B with **Ics = Icu**	
3.15	Operating mechanism	Stored energy type.	
3.16	Closing	Motor wound spring with closing coil	
	Opening	Trip coil	
3.17	Latching coil arrangement	Mechanically & Electrically trip free.	
3.18	Auxiliary Voltage		
	Closing	240V A.C. (85%-110%)	
	Tripping	240V A.C. (70%-110%)	
	Spring charging motor	240V $\pm$ A.C. 10%A.C.	
3.19	Space heater & lamp	240V $\pm$ 10% AC 50 Hz	
3.20	Anti-pumping feature	Electrical anti-pumping feature will be provided as per requirement.	
3.21	Aux. Switch contact	Min (6 NO + 6NC)	
3.22	Limits of temperature	As per IS : 13947 Part II	
3.23	Connection of incoming cables	From Bottom	
3.24	Rack-in/rack out handle	To be provided	
3.25	Releases for Auto Reclosing		
3.26	Shunt release	Required	
2.27	Under voltage release	Required	
3.28	Electronic timer with Time delay	Required	

3.29	Electrical operation	To be provided with Auto reclosing arrangement with time delay for closing	
3.30	Type of Interlocks	Electrical & Mechanical Interlock by means of clutch type /Bowden wire suit to auto operation.	
4	Incomer Section specific requirement		
4.1	Surge Arrestor	4Pole Modular type 35k.A. to be provided	
4.2	Under voltage Relay/Power failure relay(PFR)	3 Phase Power failure relay to incomer section required	
4.3	Meters As under		
4.3.1	Voltmeter	1 No96 x 96 mm, taut band, circular scale, , voltmeter to read phase and line voltage, class 1.0 with 7 position V.S.S.	
4.3.2	Power Monitoring Unit	1No Digital load manager with RS 485 serial port to read & record of Line voltage, Line current KW,KWH,KVA,KVAH,KVA RH, pf , Hz, TDH parameters.	
4.3.3	Cluster LED Indication as under		
4.3.3.1	Presence of Phase	R,Y,B	
4.3.3.2	Breaker Status	ON(Red) ,OFF(Green) Trip On Fault(Amber)	
4.3.3.3	Rated voltage of Indication lamp	240V AC	

4.4	Selector Switch as under		
4.4.1	Selector Switch	Manual/Auto Operation of main	
4.4.2	Switch for Breaker Manual Operation	Spring return to neutral ODC breaker control switch	
5	**Moulded Case Circuit Breakers For Outgoing Feeders in PCC**		
5.1	Type	Fixed type manual, feeder duty/Motor duty as per tender electrical SLD	
5.2	Reference standard	IS : 13947(Pt-3), 1993	
5.3	Rated current	As per approved SLD	
5.4	No of poles	4Poles	
5.5	Feature required	Microprocessor based Adjustable over current, Short Circuit, Instantaneous short circuit , Adjustable Earth Fault Release.	
5.6	Rotary Handle	Extended type required	
5.8	Door interlock	Required with rotary handle.	
5.9	Padlocking in On/Off position	Required.	
5.11	Withstand capability	Symmetrical breaking capacity not less than the system short circuit current.	
5.12	Auxiliary contacts	2NO + 2 NC	
5.13	Cluster LED Indication as under		

5.13.1	Breaker Position	ON(Red) ,OFF(Green) Trip On Fault(Amber)	
5.13.2	Rated voltage	240V AC	
5.13.3	Meter for Outgoing feeder	3CT Operated Digital KWH meter with Rs 485 for each outgoing except Capacitor feeder in which Ammeter with ASS is to be provided	
6	**Current Transformers For Incoming & Outgoing**		
6.1	Service	Indoor	
6.2	System	415V, 3 phase, 4 wire, 50 Hz, Solidly earthed neutral	
6.3	Type	Cast Resin	
6.4	Rated voltage	415 V + 10%	
6.5	Quantity required	As per approved Electrical SLD	
6.6	Ratio and burden	As required, C.T. secondary rating will be 5 Amp.	
6.7	Accuracy	Class-1 for all Metering metering	
6.8	Power frequency withstand voltage	2.5KV(r.m.s.) for one minute	
6.1	Rated short time current		
	Short time withstand current for 1 sec	35 KA (r.m.s.)	
6.9	Dynamic current	70 KA (peak)	
6.10	Mounting	Inside switchgear cubicle in stationary portion.	
6.11	Insulation	Class 'E' or better	
6.12	Mounting	Fixed on Busbar.	

3.2 DATA SHEET:COMMON SERVICE PANEL

Sr. No	Particulars	Requirement for Low Tension Switchgears panel Assemblies	To be filled by Bidder
1	**General**		
1.1	Power supply		
1.1.1	Rated voltage & frequency	415 V, 3ph 4 wire (Neutral solidity grounded), 50 Hz	
1.1.2	Control Voltage	230V AC 1ph 50 Hz, to be derived from Panel incomers of breaker	
1.1.3	Rated insulation Voltage	1100 V	
1.2	Cubicle		
1.2.1	Type of enclosure	IP-52	
1.2.2	Minimum thickness of sheet steel requirement	Sheet steel of not less than 2 mm thickness for load bearing members and 1.6 mm thickness for non-load bearing members.	
1.3	Design ambient temperature	45 degree C.	
1.4	Tier formation	Panel will be single front.	
1.5	Type, size & number of cables (minimum) that can be terminated in each of cubicle	Refer enclosed tender electrical SLD	
1.6	Termination of incomer	Top/Bottom as per final approved layout	
1.7	Outgoing feeder cable entry	Top/Bottom as per final approved layout	
1.8	Minimum clearances at front and back of switch board	As Indicated in Tender Electrical layout drg.	
1.9	Maximum limiting dimensions	As shown in Tender Electrical layout drwg.	

1.10	Paint shade	RAL7032	
1.11	CPRI Approval	Panel manufactures must have valid CPRI approved up to 35k.A. type test certificate	
2	**Busbars**		
2.1	Continuous current rating at design ambient temperature	As per enclosed Electrical SLD.	
2.2	Bus bars material & other informations		
2.2.1	Main busbars	Aluminum alloy EC Grade E91E(63401) (Conforming to IS : 5082-1988)	
2.2.2	Bus connections to circuit breakers	As per rated current of breakers at 0.8 Amp/Sq.mm current density.	
2.2.3	Temperature rise at rated continuous current of the bus bars in the bus bar chamber	Limited to 45°C over an ambient of 45 °C.	
2.2.4	Type of bus bar insulators	Resin cast / fibre glass / DMC / SMC	
2.3	Minimum clearances in air in mm		
2.3.1	Between phases	25.4	
2.3.2	Between live parts and ground	19.0	
2.4	1 minute PF withstand voltage	2.5 kV for Power Circuit 2KV for control Circuit	
2.5	Short Circuit Ratings		
2.5.1	1 second short time rating of PCC	25 kA (RMS)	
2.6	Current Density for Aluminum	0.8Amp/Sq.mm	

2.7	Insulating Sleeves	To be provided as per phase identification	
3	**Moulded Case Circuit Breakers (MCCB)For Incoming & Outgoing Feeders**		
3.1	Type	Fixed type manual, feeder duty/Motor duty as per tender electrical SLD	
3.2	Reference standard	IS : 13947(Pt-3), 1993	
3.3	Rated current	As per approved SLD	
3.4	No of poles	4Poles for Incomers & 3 Poles with Neutral link for Outgoings.	
3.5	Feature required	Microprocessor based Adjustable over current, Short Circuit, Instantaneous short circuit , Adjustable Earth Fault Release.	
3.6	Rotary Handle	Extended type required	
3.7	Door interlock	Required with rotary handle.	
3.8	Padlocking in On/Off position	Required.	
3.9	Withstand capability	Symmetrical breaking capacity not less than the system short circuit current.	
3.10	Auxiliary contacts	2NO + 2 NC	
3.11	Cluster LED Indication as under		
3.11.1	Breaker Position	ON(Red) ,OFF(Green) Trip On Fault(Amber)	
3.11.2	Rated voltage	240V AC	
4	Incomer Section specific requirement		

4.1	Meters As under		
4.1.1	Voltmeter	1 No96 x 96 mm, taut band, circular scale, , voltmeter to read phase and line voltage, class 1.0 with 7 position V.S.S.	
4.1.2	Digital KWH meter	1No digital KWH meter with Rs 485 serial port.	
4.1.3	Ammeter	digital Ammeter with 4Position ASS	
4.2	Cluster LED Indication as under		
4.2.1	Presence of Phase	R,Y,B	
4.2.2	Breaker Status	ON(Red) ,OFF(Green) Trip On Fault(Amber)	
4.2.3	Rated voltage of Indication lamp	240V AC	
5	**Current Transformers For Incoming & Outgoing**		
5.1	Service	Indoor	
5.2	System	415V, 3 phase, 4 wire, 50 Hz, Solidly earthed neutral	
5.3	Type	Cast Resin	
5.4	Rated voltage	415 V + 10%	
5.5	Quantity required	As per approved Electrical SLD	
5.6	Ratio and burden	As required, C.T. secondary rating will be 5 Amp.	
5.7	Accuracy	Class-1 for all Metering	
5.8	Power frequency withstand voltage	2.5KV(r.m.s.) for one minute	
5.9	Rated short time current		
	Short time withstand current for 1 sec	25 KA (r.m.s.)	
5.10	Mounting	Inside switchgear cubicle in stationary portion.	

5.11	Insulation	Class 'E' or better	
5.12	Mounting	Fixed on Busbar	
5.13	Quantity	As per requirement	

3.3 DATA SHEET: AUTOMATIC POWER FACTOR CORRECTION PANEL

Sr. No	Particulars	Requirement for Low Tension Switchgears panel Assemblies	To be filled by Bidder
1	**General**		
1.1	Power supply		
1.1.1	Rated voltage & frequency	415 V, 3ph 4 wire (Neutral solidity grounded), 50 Hz	
1.1.2	Control Voltage	230V AC 1ph 50 Hz, to be derived from Panel incomers of breaker	
1.1.3	Rated insulation Voltage	1100 V	
1.2	Cubicle		
1.2.1	Type of enclosure	IP-4X Or Better	
1.2.2	Minimum thickness of sheet steel requirement	Sheet steel of not less than 2 mm thickness for load bearing members and 1.6 mm thickness for non-load bearing members.	
1.3	Design ambient temperature	45 degree C.	
1.4	Tier formation	Panel will be single front.	
1.5	Type, size & number of cables for incoming	Refer enclosed tender electrical SLD	
1.6	Termination of incomer	Bottom as per final approved layout	
1.8	Minimum clearances at front and back of switch board	As Indicated in Tender Electrical layout drg.	
1.9	Maximum limiting dimensions	As shown in Tender Electrical layout drg.	
1.10	Paint shade	RAL7032	

1.11	CPRI Approval	Panel manufactures must have valid CPRI approved up to 35k.A. type test certificate	
2	**Busbars**		
2.1	Continuous current rating at design ambient temperature	As per enclosed Electrical SLD.	
2.2	Bus bars material & other informations		
2.2.1	Main busbars	Aluminum alloy EC Grade E91E(63401) (Conforming to IS : 5082-1988)	
2.2.2	Bus connections to circuit breakers	As per rated current of breakers at 0.8 Amp/Sq.mm current density.	
2.2.3	Temperature rise at rated continuous current of the bus bars in the bus bar chamber	Limited to 45°C over an ambient of 45 °C.	
2.2.4	Type of bus bar insulators	Resin cast / fibre glass / DMC / SMC	
2.3	Minimum clearances in air in mm		
2.3.1	Between phases	25.4	
2.3.2	Between live parts and ground	19.0	
2.4	1 minute PF withstand voltage	2.5 kV for Power Circuit 2KV for control Circuit	
2.5	Short Circuit Ratings		
2.5.1	1 second short time rating of PCC	25 kA (RMS)	
2.6	Current Density for Aluminum	0.8Amp/Sq.mm	
2.7	Insulating Sleeves	To be provided as per phase identification	

3	**Moulded Case Circuit Breakers (MCCB)For Incoming & outgoing of each steps of capacitor unit**		
3.1	Type	Fixed type manual, Capacitor duty	
3.2	Reference standard	IS : 13947(Pt-3), 1993	
3.3	Rated current	As per approved SLD	
3.4	No of poles	3Poles with neutral link for Incomers & 3 Poles for each stage of capacitor	
3.5	Feature required	Adjustable Thermal magnetic type over current, Short Circuit, Release for incoming & outgoing	
3.6	Rotary Handle	Extended type required	
3.7	Door interlock	Required with rotary handle.	
3.8	Padlocking in On/Off position	Required.	
3.9	Withstand capability	Symmetrical breaking capacity not less than the system short circuit current.	
3.10	Auxiliary contacts	2NO + 2 NC	
3.11	Cluster LED Indication as under		
3.11.1	MCCB Position	ON(Red) ,OFF(Green) Trip On Fault(Amber) for Incomer only	
3.11.2	Rated voltage	240V AC	
4	Incomer/Outgoing Section specific requirement		
4.1	Meters As under		
4.1.1	Voltmeter for Incomers	1 No96 x 96 mm, taut band, circular scale, , voltmeter to read phase and line voltage, class 1.0 with 7 position V.S.S.	

4.1.2	Ammeter for each capacitor stage	3 C.T. Operated 48X48mm Ammeter with 4 Position ASS	
4.1.3	Power Factor Relay-On Incomer side	1No microprocessor 8stage p.f. relay with Rs 485 serial port.	
4.1.4	Selector switch-On Incomer side	1No Selector switch for AUTO/Manual operation of each stage of Capacitor stage	
4.5	Cluster LED Indication as under		
4.5.1	Presence of Phase for incomer	R,Y,B	
4.5.2	Each Stage Indication	ON(Red)& OFF (Green)indication for each stage operation to be provided	
4.5.3	Rated voltage of Indication lamp	240V AC	
4.6	Push Button	ON (Red) OFF(Green) Push button to be provided for each stage of contactor for manual operation of each stage	
5	**Current Transformers For Incoming & Outgoing**		
5.1	Service	Indoor	
5.2	System	415V, 3 phase, 4 wire, 50 Hz, Solidly earthed neutral	
5.3	Type	Cast Resin	
5.4	Rated voltage	415 V + 10%	
5.5	Quantity required	As per approved Electrical SLD	
5.6	Ratio and burden	As required, C.T. secondary rating will be 5 Amp.	
5.7	Accuracy	Class-1 for all Metering	
5.8	Power frequency withstand voltage	2.5KV(r.m.s.) for one minute	

5.9	Rated short time current		
	Short time withstand current for 1 sec	25 KA (r.m.s.)	
5.10	Mounting	Inside switchgear cubicle in stationary portion.	
5.11	Insulation	Class 'E' or better	
5.12	Mounting	Fixed on Busbar	
5.13	Quantity	As per requirement	
6	**CAPACITOR DUTY CONTACTOR**		
6.1	Service	Indoor within steel cubicle for maximum system voltage, & maximum capacitor duty	
6.2	No. Poles	3	
6.3	Rated service voltage	440 V + 10%	
6.4	Rated frequency	50 Hz + 5%	
6.5	Continuous Current	1.5x Capacitor Full load current	
6.6	Short circuit level	35 KA(rms)at 415V	
6.7	Control supply	230V $\pm$10% 1-phase derived from 415 provided in each cubical	
6.8	Limits of operation		
6.9	Closing (pick-up)	85% to 110%	
6.10	Dropout	85% to 110%	
6.11	Limits of temperature	As per IS : 13947 Part 4, Sec-4)	
6.12	Auxiliary Contact requirement	Minimum 2 No + 2NC contacts	
6.13	Auxiliary Contact requirement	Minimum 2 No + 2NC contacts	
6.14	High voltage test values (one Minute value)		
6.14.1	Main power circuit	2.5KV	
6.14.2	Control & auxiliary circuits	2KV	

7	**CAPACITOR UNITS**		
7.1	Rated kVAR	100 kVAR	
7.2	Rated Voltage	3Phase 440Volts	
7.3	Type of Die-electric	MPP	
7.4	Electrical Characteristics of Impregnating medium	Non conducting	
7.5	Material of conducting plate	Multilayer Metallization of Aluminum, Zinc and Silver	
7.6	Total Loss per W/ kVAR	0.5 W/KVAR	
7.7	Type and location of discharge resistors	Wire wound epoxy coated across the terminals	
7.8	Material of sheet steel of container	Aluminum Can	
7.9	Type of bushing terminal	Screw type fast-on SIGUT terminals	
7.10	Material used for fixing bushing	Tinned copper	

4 DATA SHEET: 320KVA DIESEL GENERATING SET

Sr. No	**Particulars**	**Requirement for Low Tension Switchgears panel Assemblies**	**To be filled by Bidder**
1	**General**		
1.1	Rating	320k.V.A	
1.2	Voltage & Frequency	3 Phase 4W-440Volts, 50 Hz	
1.3	Pf	0.8 Lag	
1.4	Type of Fuel	HSD	
1.5	Automatic Facility for 5 Minutes at every pre-set interval test run without Loads	Required	
1.6	Installation :Outdoor/Indoor	Outdoor type	
1.7	Name of Manufacturer	Refer Make approved make list	
1.8	Reference Standard	IS10000/ISO3046/BS64 /BS5514 Ammended up to date.	
1.9	No of Cylinders	4 Stroke cycle	

1.10	Type of Cooling	Water cooled type Engine Mounted Radiator.	
2	**Diesel shall be provided with following accessories**		
2.1	Dynamically balanced fly wheel	Required	
2.2	Necessary flexible coupling and guard for alternator and engine	Required	
2.3	Air Cleaner as per Manufactured standard	Required	
2.4	Mechanical & ELECTRONIC governor	Required	
2.5	Daily Fuel service tank of 520 Litres with complete inlet /outlet connections & other accessories etc	Required	
2.6	Dry Exhaust manifold with suitable exhaust hospital grade silencer	Required	
2.7	Self starter 12V/24 V DC	Required	
2.8	Battery charging alternator unit & voltage regulator suitable for starting of batteries, with Battery ,battery rack with interconnection leads and terminal	Required	
2.9	Gear Driven Oil Pump	Required	
2.10	Naturally aspirated/Turbo Charger	Required	
2.11	Lubrication oil cooler	Required	
2.12	Lubrication oil filters	Required	
2.13	Crank case Heater	Required	
2.14	Fuel Injection: system in order to achieve low fuel consumption	Required	
2.15	Fuel control solenoid	Required	
2.16	Fuel pump with engine speed adjustment	Required	

2.17	**Digital Engine control panel with RS 485 serial port for followings**		
2.17.1	Start Stop Key Switch	Required	
2.17.2	Lube oil pressure indication	Required	
2.17.3	Water temperature indication	Required	
2.17.4	RPM Indication	Required	
2.17.5	Engine hours indication	Required	
2.17.6	Battery charging indication	Required	
2.17.7	Low lube oil trip indication	Required	
2.17.8	High Water temperature indication	Required	
2.17.9	Over Speed Indication	Required	
2.17.10	Radiator	Required	
2.17.11	Any other item not included /specified but is standard design of manufacturer	Bidder to confirm .with separate list	
3.0	**ALTERNATOR**		
3.1	Type of excitation	Self	
3.2	Rated Voltage	415Volts	
3.3	Rated Frequency	50Hz	
3.4	No of Phases	3 Phase 4 W	
3.5	Enclosure	SPDP	
3.6	Degree of protection	IP-23	
3.7	Ventilation	Self ventilated air cooled	
3.8	Ambient Temperature	40°C Maximum	
3.9	Insulation Class	F/H	
3.10	Temperature Rise	Within class F/H limit at rated loads.	
3.11	Voltage Regulation	±1%	
3.12	Voltage Variation	±5%	
3.13	Overload duration/capacity	for one hour in every 12 hours of continuous use	
3.14	Type of AVR	Electronic	

3.15	Type of bearing and lubrication standard	Anti-friction bearings with Grease lubrication	
3.16	Standard	IS 4722,IS 4889, BS269 & IEC 34 as amended up to date.	
3.17	Output at 40°C ambient & at 50% RH at 1000meter MSL	320k.V.A	
3.18	Facility for removing of excitation during fault by AVR	During fault of over voltage, hight bearing temperature/high winding temperature or an external fault this facility required.	
3.19	Limit of Voltage dip for any step or transient loads. as per ISO 8528	20%	
3.20	Efficiency	Not less than 93.5%	
3.21	Total distortion factor	Less than 3%	
3.22	Cable Terminal Box	Suitable for 2 Nos 3.5 core 300A2XFY Cable	
3.23	Earth Terminals	2No on opposite side With vibration proof connection non ferrous hardware etc.with galvanized plate and passive washer of minimum 12mmdia	
4	**Acoustic Enclosure**	Shall be as per MPCB /CPCB approved	

5 DATA SHEET:320k.V.A- D.G. SET AMF PANEL

Sr. No	**Particulars**	**Requirement for AMF Panels**	**To be filled by Bidder**
1	AUTO-MAIN FAILURE PANEL SPECIFIC REQUIREMENTS		
1.1	No of DG set	One(1)	
1.2	Voltage required of common Bus	433 V +/- 15 %	

1.3	Frequency	50 Hz +/- 2 %	
1.4	Capacity of DG	320 KVA	
1.5	Auto Main Failure	Required as per Data sheet mentioned for AMF panel .	
1.6	Vital protections	Required	
1.7	Over Current Protection (50/51)	Required	
1.8	Earth fault Protection(50N/51N)	Required	
1.9	Stand by earth fault protection 51-G	Required	
1.10	Over speeding Protection	Required	
1.11	Voltage Assymmetry	Required	
1.12	Reverse power Protection	Required	
1.13	Any other which are required as per manufacturer recommendation.	To be confirm by Bidder	
1.14	Phase Sequence supervision	MUST	
1.15	Control Voltage	D.G.Set Battery Voltage for D.C Control & 240 Volts for A.C.System to be derived from Incoming section of AMF Panel	
2	**General**		
2.1	Rated voltage & frequency	415 V, 3ph 4 wire (Neutral solidity grounded), 50 Hz	
2.2	Control Voltage	To be confirm by manufacturer	
2.3	Rated insulation Voltage	1100 V	
2.4	Cubicle		
2.4.1	Type of enclosure	IP-6x or better suitable for outdoor Installation.	
2.4.2	Minimum thickness of sheet steel requirement	Sheet steel of not less than 2 mm thickness for load bearing members and 1.6 mm thickness for non-load bearing members.	
2.5	Design ambient temperature	45 degree C.	
2.6	Tier formation	.AMF will be single front.	

2.7	Type, size & number of cables (minimum) that can be terminated in AMF Panel	2X3.5.C X300sq.mm A2XFY	
2.8	Termination of incomer	Bottom as per final approved layout	
2.9	Outgoing feeder cable entry	Bottom as per final approved layout.	
2.10	Paint shade	RAL7032	
2.11	CPRI Approval	Panel manufactures must have valid CPRI approved for 35k.A. type test certificate	
3	**Busbars**		
3.1	Continuous current rating at design ambient temperature	630Amp.	
3.2	Bus bars material & other informations		
3.2.1	Main busbars	Aluminum alloy EC Grade E91E(63401) (Conforming to IS : 5082-1988)	
3.2.2	Bus connections to circuit breakers	As per rated current of breakers at 0.8 Amp/Sq.mm current density.	
3.2.3	Temperature rise at rated continuous current of the bus bars in the bus bar chamber	Limited to 45°C over an ambient of 45 °C.	
3.2.4	Type of bus bar insulators	Resin cast / fibre glass / DMC / SMC	
3.3	Minimum clearances in air in mm		
3.3.1	Between phases	25.4	
3.3.2	Between live parts and ground	19.0	
3.4	1 minute PF withstand voltage	2.5 kV for Power Circuit 2KV for control Circuit	

3.5	Short Circuit Ratings		
3.5.1	1 second short time rating of PCC	35 kA (RMS)	
3.5.2	Dynamic through fault current	75 kA (peak)	
3.6	Current Density for Aluminum	0.8Amp/Sq.mm	
3.7	Insulating Sleeves	To be provided as per phase identification	
4	**Air Circuit Breakers & Associates Control system For AMF Panel**		
4.1	Service	**Outdoor**	
4.2	Type	Electric Operated Draw Out type (EDO)	
4.3	No. of poles	4	
4.4	Built in protective release for Incomer ACB	Microprocessor based Adjustable over current, Short Circuit, Instantaneous short circuit , Adjustable Earth Fault Release.	
4.6	Rated service voltage	415 V +/- 10%	
4.7	Rated Current	630Amp	
4.8	Rated frequency	50 Hz +/- 5%	
4.9	System earthing	Solidly grounded	
4.10	Rated short time withstand current for 1 second	35 KA (r.m.s.)	
4.11	Rated Symmetrical breaking current at rated voltage	35 KA (r.m.s.)	
4.12	Rated making capacity	70KA (r.m.s.)	
4.13	Duty cycle	O-0.3 min-CO-3 min-CO	
4.14	Utilization category :	B with **Ics = Icu**	
4.15	Operating mechanism	Stored energy type.	
4.16	Closing	Motor wound spring with closing coil	
	Opening	Trip coil	

4.17	Latching coil arrangement	Mechanically & Electrically trip free.	
5	**Other Control Accessories**		
5.1	Auxiliary Voltage		
	Closing	240V A.C. (85%-110%)	
	Tripping	24V D.C. Or As per Battery Voltage of D.G. Set (70%-110%)	
	Spring charging motor	240V ± A.C. 10%A.C.	
5.2	Space heater & lamp	240V ± 10% AC 50 Hz	
5.3	Anti-pumping feature	Electrical anti-pumping feature will be provided suit to AMF operation	
5.4	Aux. Switch contact	Min (6 NO + 6NC)	
5.5	Limits of temperature	As per IS : 13947 Part II	
5.6	Connection of incoming cables	From Bottom	
5.7	Rack-in/rack out handle	To be provided	
5.8	Releases for Performing AMF Operation		
5.8.1	Shunt release-D.C.	Required	
5.8.2	Under voltage release	Required	
5.9	Auto /Manual /Test/Off Selector switch	Required	
5.10	2Nos Over Voltage Relay	Required	
5.11	2Nos Under Voltage Relay	Required	
5.12	2Nos Reverse Power Relay	Required	
5.13	Main Supply Failure Monitor	Required	
5.14	Supply failure timer	Required	
5.15	Restoration timer	Required	
5.16	Control unit with 3 impusle automatic engine start/stop& failure to start lockout	Required	
5.17	Impulse counter with locking and reset facility.	Required	

5.18	ON/OFF/Control circuit switch with indicator	Required	
5.19	Battery Charger with transformer rectifier ,D.C. Voltmeter,and Ammeter, selector switch for trickle ,off, and boost and current adjustment.	Required	
5.20	Audio/Video annunciation for following parmeter	Required	
5.20.1	High water temperature	Required	
5.20.2	Low lubricating Oil pressure	Required	
5.20.3	Engine Over Speed	Required	
5.20.4	Engine fails to start	Required	
5.20.5	Full Load/Maximum Load Warning	Required	
6	**Meters & Indication Lamps**		
6.1	Voltmeter	1 No96 x 96 mm, taut band, circular scale, , voltmeter to read phase and line voltage, class 1.0 with 7 position V.S.S.	
6.2	Power Monitoring Unit	1No Digital load manager with RS 485 serial port to read & record of Line voltage, Line current KW,KWH,KVA,KVAH,KVA RH, pf , Hz, TDH parameters.	
6.3	Cluster LED Indication as under		
6.3.1	Presence of Phase when D.G. Set is under running condition.	R,Y,B	
6.3.2	Breaker Status	ON(Red) ,OFF(Green) Trip On Fault(Amber)	
6.3.3	Indication Lamps for Load on Mains	Required	

6.3.4	Indication Lamps for Load on D.G. Set	Required	
6.3.5	Rated voltage of Indication lamp	240V AC	
7	**Current Transformers**		
7.1	Service	Outdoor	
7.2	System	415V, 3 phase, 4 wire, 50 Hz, Solidly earthed neutral	
7.3	Type	Cast Resin	
7.4	Rated voltage	415 V + 10%	
7.5	Quantity required	1 Set(3Nos) for Protection & 1 set (3Nos) for metering	
7.6	Ratio and burden	As required, C.T. secondary rating will be 5 Amp.	
7.7	Accuracy	5P10 for protection & Class-1 for all Metering	
7.8	Power frequency withstand voltage	3KV(r.m.s.) for one minute	
7.9	Rated short time current		
	Short time withstand current for 1 sec	35 KA (r.m.s.)	
7.9	Insulation	Class 'E' or better	
7.10	Mounting	Fixed on Busbar	

6 DATA SHEET: 11k.V. HT POWER CABLES

Sr. No	Particulars	Requirement for 11k.V. HT Cables	To be filled by Bidder
1	System voltage	11 kV(E), 3 phase, 3 wire	
2	Standard Applicable	IS: 7098(Part2)1985,IS8130-1984,IS:3975.	
3	Highest system Voltage	12kV (rms)	
4	Installation	Laid on / buried in half round pipe as per MSEDCL specification	

5	Ambient temperature	45^0C	
6	Conductor Material	Aluminum (grade H4, Class 2 as per IS : 8130)	
7	Conductor Screen	Non metallic Extruded semi-conducting compound	
8	Insulation	Extruded ,XLPE as per IS:7098 Part-2	
9	Insulation Screen	Extruded semi-conducting compound with a layer of non magnetic metallic tape(0.3mm)	
10	Metallic shield	0.045mm copper tape	
11	Armour	Galvanized round steel wire for multi core & as per MSEDCL specification	
12	Sheath material	Extruded PVC inner and outer sheath conforming to type ST-2 (as per IS:5831-1984)with FRLS compound additive	
13	Inner Sheath - Material & thickness & colour	Extruded, PVC, type ST-2as per IS:5381,0.7 mm & Black colour.	
14	Outer Sheath - Material & thickness & colour	Extruded, PVC, type ST-2as per IS:5381,0.7 mm & colour as per MSEDCL specification.	
15	Core identification	Red, Yellow, Blue	
16	Maximum D.C. resistance at 20°C	To be filled by Bidder	
17	Maximum A.C. resistance at 90°C	To be filled by Bidder	
18	Cable Size	120Sq.mm	
19	Number of cores	3 Core	
20	Maximum Standard Length	As per MSEDCL specification. (Minimum length of Drum shall be 600mtrs)	

7 DATA SHEET: 1.1KV. LT POWER CABLES

Sr. No	Particulars	Requirement for Low Tension Switchgears panel Assemblies	To be filled by Bidder
1	Insulation Level	1100V	
2	Standard Applicable	IS:7098(Part1), IS 5831,IS8130,IS3975, Amended up to date.	
3	Ambient temperature	45^0C	
4	Conductor Material	Multi-Stranded compacted sector Aluminium Conductor for 10sqmm to 300sqmm multi core cables & stranded copper conductor for 2.5. to 6 sq.mm multi core cables	
5	Insulation	Cross Link Polyethylene (XLPE) as per IS 7098 part-1	
6	Armour	Galvanized steel flat strip as per IS 3975	
7	Inner Sheath - Material & thickness & colour	Extruded, PVC,type ST-2as per IS:5831	
8	Outer Sheath - Material & thickness & colour	Extruded, PVC, type ST-2as per IS:5831	
9	Core identification	Red, Yellow, Blue & Black	
10	Cable Size	As per requirement/As per SLD	
11	Number of cores	As per requirement/As per SLD	
12	Maximum Standard Length	500/1000Meter	

COMMERCIAL BID

INDIAN INSTITUTE OF TROPICAL METEOROLGY,(IITM) PUNE-NEW STUDENT HOSTEL BUILDING				
TOTAL EXTERNAL ELECTRICAL COST SUMMARY :IITM -PASHAN				
S.No. & Section		**DESCRIPTION**		
			Amount in Rs.	
			Supply	**Installation**
1	A.	TOTAL OF SECTION A-MSEDCL WORKS(UP TO POINT OF SUPPLY)		
2	B	TOTAL OF SECTION B-SUBSTATION EQUIPMENTS		
3	C	TOTAL OF SECTION C : LT CABLES AND CABLE TERMINATIONS		
4	D	TOTAL OF SECTION- D- EARTHING (GROUNDING)		
5	E	TOTAL OF-SECTION - E-EXTERNAL LIGHTING & SOLAR POWER SYSTEM		
6	F	TOTAL OF SECTION F- MISC.		
7	G	SECTION -G -D.G. SET :		
		TOTAL OF EXTERNAL ELECTRICAL COST		
		TOTAL EXTERNAL : SUPPLY & INSTALLATION COST	-	

INDIAN INSTITUTE OF TROPICAL METEROLOGY, IITM PUNE

PROPOSED CONSTRUCTION OF HOSTEL FOR STUDENTS AT IMD COLONY, PASHAN, PUNE

BILL OF QUANTITIES

HT AND LT EXTERNAL ELECTRICAL WORKS

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
A	**SECTION A-MSEDCL WORKS (UP TO POINT OF SUPPLY)**													
1	**H.T CABLES:** Supply,Testing (IR Test & Hi-pot test), tagging, laying, & commissioning of following 11kV grade XLPE HT cable on readymade Trench/Excavation with , sand cushioning of 75mm, covering with RCC half round hume pipe of 200 mm dia. and refilling of cable trench, leveling of cable trench etc. as required The scope also includes supply 200mm half round pipe.. (Note: Quantity is tentative as Route is tentitively decided. Cable shall be supply & laid as per MSEDCL Specification ,Tender data sheet/Specifications. Excavation shall be measured separately)													
1.1	3core 120Sq.mm. 11k.V.-E-Stranded Alumimum conducotr-XLPE insulated , Galvanised ROUND Armour Cables with Extruded PVC Outersheath Cables.	Mtr	950											
2	Providing, laying and fixing dia 300mm dia RCC pipe NP2 class (light duty) in ground complete with RCC collars, jointing with cement mortar 1:2 (1 cement : 2 fine sand) including trenching (75 cm deep) and refilling etc as required for road crossing of Cables)	Meter	50											
3	**H.T. CABLE TERMINATIONS :** supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required :													
a	120 sq. mm	Each	5											
3.2	Supplying and making outdoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required :													
a	120 sq. mm	Each	2											
3.3	Supplying and making straight through cable jointing with heat shrinkable jointing kit complete with all accessories including ferrules suitable for following size of 3 core, XLPE aluminium conductor cable of 11 KV grade as required :													

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
a	120 sq. mm	Each	4											
4	**MSEDCL HT EQUIPMENTS**													
4.1	Supply,taking delivery installation, testing and commissioning of 11k.V. ,400Amps ,19.68k.A. 3 Way Hermiaticaly sealed Feeder Pillars as per MSEDCL Specification and approval ,including obtaing approval ,testing from MSEDCL	Set	1											
4.2	Supply,taking delivery installation, testing and commissioning of CT PT Metering kiosk for 11k.V. System, including testing& obtaing approval from MSEDCL .Details of CT & PT should be as per load sanction of MSEDCL Pune Division	Set	1											
4.3	Supply & installation H.T. Static Three Vector T. O. D. Meter as per MSEDCL.The scope also including calibration & testing of meter from MSEDCL	Job	1											
5	**EARTHING SYSTEM & MISC FOR MSEDCL SYSTEM**													
5.1	Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 metre long etc. with charcoal/ coke and salt as required.	Each	10											
5.2	Supplying and fixing of 20 mm X 3 mmCu Strip on cables trays/trenches including all necessaryWelding/Brazing accessories and forming effecting necessary earth connections.for MSEDCL CT/PT metering kiosk,HT Panel ,Feeder Pillars etc.	Metre	125											
5.3	Supply & fixing of G. I. Pipe-CL -B- 150mm dia.for supporting of HT Cables connected to Overhead Lines ,road crossing etc for MSEDCL incoming cable including required all accessories to complete the works.	Mtr	10											
5.4	Liasioning works for obtaining load sanction & load released from MSEDCL for 269 KVA with installed Transformer capacity for 315 k.V.A. from MSEDCL.The scope also includes to obtained all statutary approval from Govt Electrical Inspectorate for complete electrical installation including energisation of new HT & LT Electrical system.	Job	1											
	TOTAL OF SECTION A-MSEDCL WORKS(UP TO POINT OF SUPPLY)													
B	**SECTION -B-HT/LT SUB-STATION EQUIPMENT(HT/LT Works after MSEDCL point of supply)**													

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
1	**11k.V. HT. VCB PANEL** :Supplying ,instalation ,testing & commissioning of indoor type floor mounted metal clad, 11k.V. VCB Panel with 1 No VCBs ,totally encosed & fully interlocked ,horizontal drawout ,horizontal isolation type breakers as per IS 13118,as amended up to date and additional specifications,having capacities mentioned below, single break trip free mechanism,motorised & manually charged and auto /manually closing breaker suitable for use on 11k.V. 3Phase ,50Hz, A.C. supply with short circuit fault level of 26k.A.,complete with self contained,fully interlocked, rack in rack out mechanism, air insulated but encapsulated copper busbars of 630Amps capacity,breaker featured with mechnical ON/OFF indicator with hand trip device, 230V Single Phase A.C. spring charge coil, 24Volts D.C. shunt & Closing coil & auxiliary switch of 4No +4NC, with in built 24 Volts D.C. power pack & as per Tender technical specification ,Data sheet & Electrical SLD.	Set	1											
2	**TRANSFORMER:** Supply,Taking deliver at site storing at site, shifting from the place of storage to the place of installation, installation,with all fittings and accessories, testing and commissioning, drying out and oil filteration(till adequate values of insulation resistance of windings and break down value of oil are achieved is included in the scope) of 315 kVA, 11/0.433 kV Transformer of vector group of Dyn-11& with off circuit tap changer on HV side as mentioned in Tender Technical Data sheet.The transformer shall be as per latest IS 2026 & suitable for Outdoor installation with HT & LT cable box for indoor cable terminations & required accessories etc as per tender technical specification & Data sheet.	No	1											
3	**L.T. PANELS :**Supply ,Installation, testing and commissioning of following L.T. panel boards Compartmental cubicle type, freestanding with appropriate cable entries, with Cu busbars & manufactured based on IS 8623,unloading, shifting, unpacking, Section assembly from storage place to desired Installation.All required protections will be as per Tender technical specification,Data sheets & tender electrical SLD.													
3.1	**Panel Reference: Transformer Isolation Panel** -Near Transformer as per enclosed electrical Single line diagram reference IITM /CRN/EMEA/SEL/01	Set	1											
3.2	**Panel Ref.: Main Power Distribution center**-PCC I -as per enclosed electrical Single line diagram ref IITM/CRN/EMEA/SL/01	Each	1.00											
	NOTE: Both Incomer of above panel shall be suitable for Auto Reclosing type arrangement for their respective incoming supply source as indicated on SLD													
3.3	**Panel Ref.: 100KVAR Automatic Power Factor correction Capacitor Panel** as per enclosed electrical Single line diagram ref IITM/CRN/EMEA/SL/01	Set	1.00											
3.4	**Panel Ref.: COMMON SERVICE PANEL** as per enclosed electrical Single line diagram ref IITM/CRN/EMEA/SL/01	Set	1.00											

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
3.5	Supply, Installation, Testing & Commissioning of **External Lighting D.B.** as per standard fabrication details mentioned above & as per following configurations .	Each	1.00											
	Incomer : 63 Amp -4 Pole MCB + 1 No 4 Pole-70 Amp Moduler Contractor Outgoing 12 Nos 32 Amp TP MCB 10K.A. CL + 32Amp 4 Pole ELCB - 30m.A. per Outgoings& 24 Hrs Timer + Photo Cell with Manual / Auto Selctor switch, Interface provision with BMS & its control wiring etc.													
	TOTAL OF SECTION B-SUBSTATION EQUIPMENTS													
C	**SECTION C : LT CABLES AND CABLE TERMINATIONS**													
1	Supply, Installation, Testing and Commissioning of 1100V grade L.T. XLPE/ PVC insulated multistrand Al./ Cu. conductor cables on provided prefabricated trays/ pipe/ in trenches with necessary clamps, identification tag. & all other items required to complete the work. (Note:-Actual cable lengths shall be measured at per site requirement..Refer tender data sheet& specifications for requirement of Cables													
1.1	3.5.C x 300 Sq.mm. A2XFY(XLPE- AL-Armoured)	MTR	600											
1.2	3.5.C x25 Sq.mm. A2XFY(XLPE- AL-Armoured)	MTR	500											
1.3	4CX6Sq.mm. XFY(XLPE -CU-Armoured)	MTR	600											
1.4	4CX2.5Sq.mm. YWY(PVC -CU-Armoured)	MTR	500											
1.5	4CX1.5Sq.mm. YWY(PVC -CU-Armoured)	MTR	250											
1.6	12CX1.5Sq.mm. YWY(PVC -Cu-Armoured)	MTR	50											
	LT cable Termination :													
2	Supply & making of Termination of XLPE insulated, PVC sheathed, 650/1100 V grade, armoured cable including stripping of cable insulation, supplying and fixing of Aluminum / tinned plated copper lugs and crimping the same to the conductor, supply and fixing of double compression cable glands including all 'labour supply and consumable material required for jointing / terminations													
2.1	3.5.C x 300 Sq.mm. A2XFY(XLPE- AL-Armoured)	Each	10											
2.2	3.5.C x25 Sq.mm. A2XFY(XLPE- AL-Armoured)	Each	6											
2.3	4CX6Sq.mm. XFY(XLPE -CU-Armoured)	Each	30											
2.4	4CX2.5Sq.mm. YWY(PVC -CU-Armoured)	Each	10											

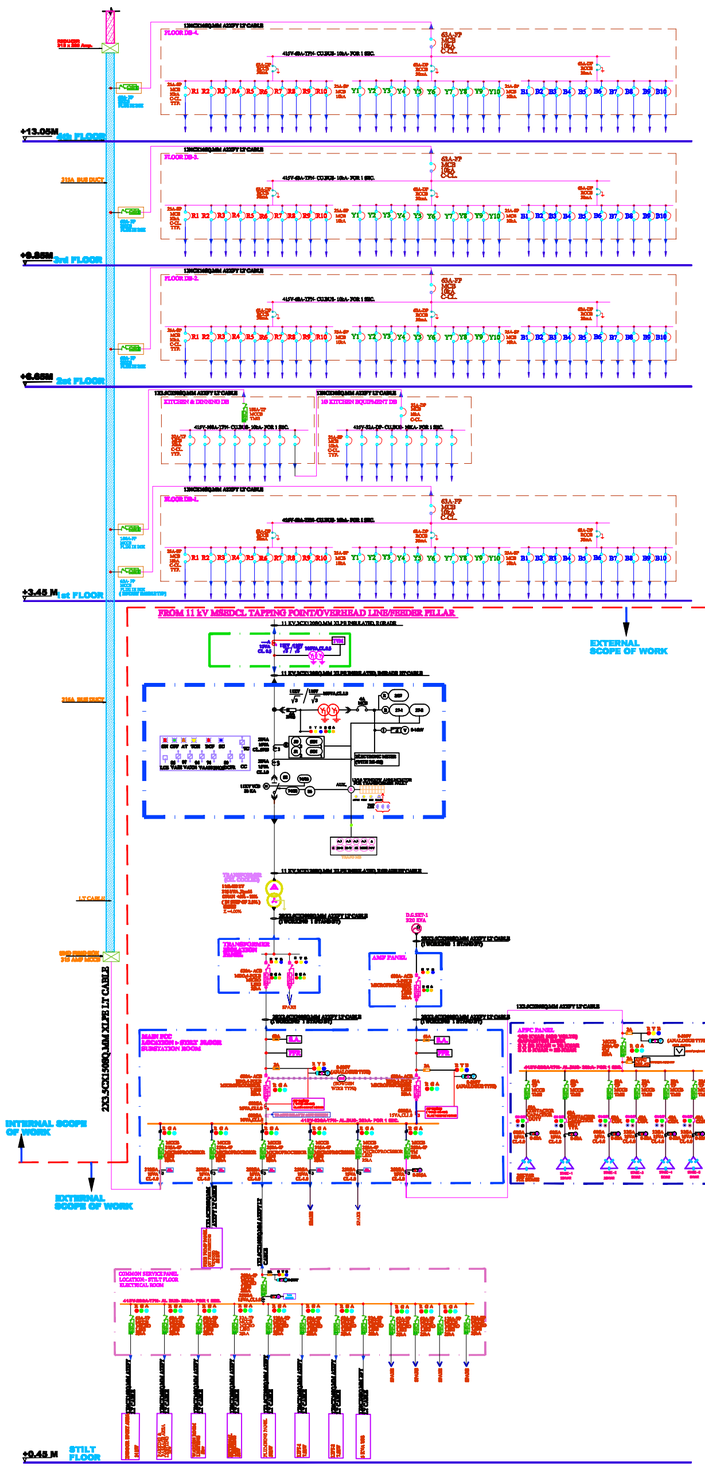
Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
2.5	4CX1.5Sq.mm. YWY(PVC -CU-Armoured)	Each	6											
2.6	12CX1.5Sq.mm. YWY(PVC -Cu-Armoured)	Each	6											
	Note: Aluminum Lugs shall be used for ALUMINUM Conductor Cables & Copper Lugs for COPPER Cables													
	TOTAL OF SECTION C : LT CABLES AND CABLE TERMINATIONS													
D	**SECTION D:EARTHING SYSTEM**													
1	Supply, installation, testing of GI/ Cu. earthing strips & wires in ground at a depth of 600 mm. or in ready made trenches or on ready tray with necessary clamps & bimetallic strips as per specification. (excavation required for this will be measured separately.) Refer layout & tender spec for various applications													
1.1	50 mm x 5 mm GI Strip	Mtr.	300											
1.2	25 mm x 5 mm GI Strip	Mtr.	500											
2	Providing earthing stations at locations as called for including providing and laying 3 Mtr Long x 65mmDia G.I. electrode with 50 x 6 mm thick G.I. strip, To form earth electrode with inspection chamber,Watering funnel with 20 gauge G I wire ,600 x600 mm heavy duty Chamber with CI Manhole cover etc.(Scope including excavation by manual/Machines /Boaring, Charcoal, salt, or Bentonie slurry etc)	No	15											
	TOTAL OF SECTION- D- EARTHING (GROUNDING)													
E	**SECTION -E- EXTERNAL LIGHTING & SOLAR POWER SYSTEM**													
1	Supply Installation testing and commissioning of 70 W HPSV integral post top lantern fixture(IP65) consisting of die cast aluminum powder coated, cylindrical decorative acrylic bowl supported by spun aluminum top cover to reduce upward light spill and protection,mouting base plate suitable for 60mm diameter poles , complete with accessories such as copper wound chock and condensor housed with the lantern with necessary wiring ,including supply of 70 Watt HPSV Lamps & the power factor of light fitting shall be >0.85. The finished coloured of complet assembly shall be as per instruction of Engineer -in Charge.(Light fitting Similar to PHILIPS TYPE : SPC102 1x 70 W (E))	Each	4											
2	95 W LED IP 66 Street light fixture to fixed on 7.5 to 9 Meter hight poles including supply and pulling of 3 Core x 1.5 Sq..mm Cu Flexible ,-FRLS cables from Pole mouted looping junction box to each fitting terminals	Each	19											

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
3	Supply and erection of Pole / Surface /wall /column mounted 150 Watt flood light composed of two piece housing made of die cast aluminium alloy & reflector of made of polished and anodised aluminum.The complete light fittings shall be with adjustable mounting clamp, polyster powder coating ,integral control gears, copper wound choke,condensor , electronic ignitor etc. with necessary wiring & supply of 1 no 150 W metal halide lamp. The power factor of light fitting shall be >0.85 (Light fitting Similar to SCHREDER /PHILIPS/GE/WIPRO)	Each	8											
4	Supply & Installation of Steel tubular swaged ISWP -14, pole having dimension of 168.3 x 139.7 x 114.3 mm diameter with 4.85x 4.5 x 3.65 mm thickness (5+ 2 + 2 mtr.) length respectively and total length9 mtr long as per IS-2713 (Part-II) complete duly painted with two coats of red oxide paint and one coat of bituminous paint for the 1/6 th length which is to be embeded in ground & two coates of aluminium paint for the remaining portion. The poles shall be supplied with bottom welded MS base plate of 300 x300x 6mm. The scope also included required excavation, Cement concrete 1:3:6 foundation, 2 Nos 50mm diax1.2 meter long including bends GI pipes for lopping cables in foundation etc	Each	19											
5	As above but with top plate of 300mmx300mmx6mm thick mounted on top of poles suit to mount 150 W Flood light poles	Each	8											
6	Supply and erecting street light bracket suitable for above steel tubular welded pole for fixing of 1 no HPSV street light fixture of any rating,with 40mm dia 2mm long "B" grade M.S. pipe welded to pole cap of 125 mm dia x600mm long duly welded with supporting M.S. plate of 3mm and with bolts of suitable size duly painted two coats of red oxide paint and 2 coat of aluminium paint and duly wired in approved manner.	Each	19											
7	Supply, installation and fixing of Weather proof IP65 type cast iron junction box with 2 Nos. earthing terminal to receive 4 x 10sq.mm Aluminum Armoured cable (2 Nos.) .The scope also includes supply and pulling of 3Nos. 2.5 sq.mm stranded copper flexible cables from Junction box to Lighting luminaries with supply ,fixing of 10Amp SP -C-CL,10k.A.MCB , elmex terminals etc (Minimum size of Junction box is 215 mm x 125 mm x88 mm)	Each	27											
8	Supply , Designing, Installation, Testing & commissioning of 6kWP roof top solar power system for area street light application with 12 Hours Battery Back up including all associates following accessores to complete the works (Contractor to submit all suporting documents for proveness of 6 Kwp rating with 12 Hours battery back up) The complete scope of work shall be including followings.	Job	1											
	Solar Panels with supporting structure and junction box suit to 6Kwp Output power Make: Tata BP,Vikram Solar, Mosebaer, Deity, Akshay Urja													
	Solar Charge Controller (MPPT) with charge indicator / counter 6 KWp capacity -1No :Make: Emerson, Appolo,Optimal													
	Solar Inverter with Line conditioner & with Normal supply ATS facility and as per MEDA specification with wiring system - 1No- Make: Vinite/Stabiline/Power Plus													

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
	LMLA Batteries , Suitable for 12 Hours Back up Make Exide/ Indobat/ Amarraja/ Luminous - 32 Nos													
	Misc cabling and electrical items as required at site for complete commissioning of solar pack system.													
	TOTAL OF SECTION -E- EXTERNAL LIGHTING & SOLAR POWER SYSTEM													
F	**SECTION -F- MISCLLANEOUS**													
1	**Civil Works**													
1.1	Excavation for , Cable trenches ,Earthing strips foundation etc in Soft soil including dressing of sides and ramming of bottoms, lift upto 1.5 m including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 metres.	Cum	472.5											
1.2	As above but in murum	Cum	135											
1.3	As per 1.1 above but in hard rock	Cum	67.5											
1.4	Supply of fine river sand	Cum	75											
1,5	Suply of red burnt calss-2 Bricks	Nos	5000											
2	Providing and laying in position of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) for foundation of DG, set, Transformer etc including form work etc as required.	cum	8											
3	Supply & installation of Transformer yard gate made out of 40mm dia GI pipe 11/2" 8 SWG GI wire mesh and two leaves gate with clear width of 3000 mm.	No	1											
4	Supply & installation 8 SWG GI wire 1 1/2" mesh chain link fencing of 2.4 Mtr. height with 50 x 50x 6 MS angle at every 2 M interval and 50 x 50 x6 Angle at top. The fencing should be painted with 2 coat of red oxide primer with Aluminium paint	Mtr	9											
5	Supplying and making cable route marker with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) of size 60 cm X 60 cm at the bottom and 50 cm X 50 cm at the top with a thickness of 10cm including inscription duly engraved as required.	each	15											
6	Supplying and fixing cable route marker with 10 cm X 10 cm X 5 mm thick G.I. plate with inscription there on, bolted /welded to 35 mm X 35 mm X 6 mm angle iron, 60 cm long and fixing the same in ground as required.	each	25										-	-

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
7	Providing and fixing carbon dioxide (CO2) type fir extinguishers confirming to IS 2878-1976 and cylinders fully charged of 4.5. KG Capacity	Each	5										-	-
8	Supply and fixing safety instruction chart in word (English &Hindi) duly framed with 5 mm thick glass as required (Approximate front area 1.20Sq,mtr)	Each	2										-	-
9	Providing of set of 4 Nos 9.5 Ltr capacity GI bucket painted in post office red colour with prior coat of red -oxide paint and written with white paint FIRE and mounted on MS angle iron from with bracket of appropriate size & capacity including filling sand etc.	Each	1										-	-
10	Providing First Aid Box as approved by St.John Ambulance Brigade/Indian Red Cross confirmation to IS 2217-1963	Each	2									-	-	-
11	Supply and fixing shock treatment chart duly mounted on a wooden frame with 5mm thick glass as required (approximate front area 1.2 sq.mtr)	Each	2										-	-
12	Providing of rubber mat 1 mtr wide and 12mm thick to withstand 15k.V. dielectric strength as per IS 5424-1969	Mtr	3										-	-
13	Providing of rubber mat 1 mtr wide and 12mm thick to withstand 3.3k.V. dielectric strength as per IS 5424-1969	Mtr	1										-	-
14	Supply, fabrication and installation of cable tray cable tray supports, supports for cable trench covers, supporting frame for mounting of control panels, supports for mounting of ,Main Electrical Panel with 2 coats of enemel primer and 2 coats of epoxy paint Note - The rates shall be inclusive of grouting of supports , Anchor fastner,welding rods, nut,bolts,clamps,and any other consumable which required to complete the works.	MT	2										-	-
	TOTAL OF SECTION F- MISC.												**-**	**-**
G	**SECTION G -DIESEL GENERATING SET :**													
1	Supply, Transporation , unloading at site ,installation ,testing and commissioning of 'Silent Type' Diesel Generating set alongwith having prime Power rating of 320 KVA ,415 Volts at 1500RPM 0.8 Lagging power factor,consiting of the followings . The scope also includes exhaust piping as per CPCB norms & obtaining approval /Permission from CPCB/Goverment electrical Inspector, Local Muncipal authority etc.The complete D.G. Set shall be as Tender specification & Data sheets.	Set	1										-	-
1.1	**320 k.V.A D.G. SET AUTO MAIN FAILURE PANEL (AMF)**													

Sr.No	Item Decription	Unit	Quantity	Supply							Installation			
				Rate	Basic Cost	Duties & Taxes		Total Duties & Taxes		Total Amount Including Duties & Taxes	Rate	Basic Cost	Taxes	Total -Rs
						%ED	%VAT	ED-Rs	VAT-Rs				Service Tax	
2	Fabricating ,Installing ,Testing and commissioning of automatic mains failuer control including auto by-pass panel , suitable for 320 KVA silent Type DG Set Complete with relays, timers, set of CTs for metering & protection and energy analyser to indicate currents, phase & line voltage frequency,power factor ,KWH,KVARH& provison for over load, short circuit , retricted earth fualt ,under frequency,control cabling from AMF panel to Diesel engine & elsewhere if required, all complete & required inter locking The comple AMF panel shall be as per Tender technical specifcations & data sheets	Each	1.00										-	-
	TOTAL OF SECTION G- D.G. SET											-	-	-
	GRAND TOTAL											-	-	-
	TOTAL SUPPLY & INSTALLATION													



(A) NOTES FOR MAIN PCC & PDB

1) METERING KIOSK SHALL BE AS PER MSEDCL.

2) ALL INCOMER OF L.T. ACB'S ARE CONSIDERED FOR INTERCHANGEBILITY PURPOSE.

3) ALL L.T. INCOMER OF PCC SHALL BE 4-POLE -630 AMP - E.D.O. 35 KA WITH MICROPROCESSOR ADJUSTABLE OC, SC, EF & INST. RELEASE WITH ADJUSTABLE TIME SETTING.

4) OUTGOING M.C.C.B. SHALL BE FIXED TYPE & WITH INBUILT ADJUSTABLE MICROPROCESSOR O.C.+S.C. + EARTH FAULT.

5) LOAD MANAGER FOR D.G. & TRANSFORMER INCOMER FEEDER SHALL BE PROVIDED WITH RS 485 SERIAL COMMUNICATION PORT WITH FOLLOWING POWER PARAMETERS.

a) LINE VOLTAGE & PHASE VOLTAGE.
b) AMPS.
c) KWH.
d) KVAH.
e) KVARH.
f) Hz.
g) THD.
h) P.F.

6) GLAND PLATE FOR EACH INCOMER IN PCC SHALL BE ALUMINIUM -3mm THICK.

7) ALL OUTGOING FEEDERS IN PCC SHALL BE PROVIDED WITH DUAL KWH METER WITH RS 485 & WITH SEPARATE ANALOUGE TYPE AMMETER.

8) PANEL SHALL BE EXTENSIBLE TYPE FROM BOTH END OF THE MAIN BUSBAR SYSTEM .

9) ALL BUSBAR CROSS SECTION SIZE SHALL BE SUITABLE FOR 0.8 AMP./SQmm FOR ALUMINUM.

10) ANALOGUES TYPE VOLTMETER WITH V.S.S. & AMMETER SHALL BE PROVIDED TO EACH INCOMER.

11) D.G. & TRANSFORMER ACB INCOMER SHALL BE SUITABLE FOR AUTO RE CLOSING WITH TIME DELAY TYPE OPERATION FOR THEIR RESPECTIVE SUPPLY VOLTAGE CONDITION & WITH PHASE SEQUENCE PROTECTION.

12) REF. TENDER TECHNICAL SPECIFICATIONS FOR REQUIREMENT OF 11kV H.T. PANEL OF TRANSFORMER FEEDER PROTECTION.

12) ALL TAP OF BOXES SHALL BE 'PLUG IN TYPE' WITH SFU & ROTARY HANDLE.

13) CONTROL SUPPLY OF ALL CAPACITOR SHALL BE DERIVED FROM INCOMER OF L.T. A.C.B. OF TRANSFORMER FEEDER (INCOMING SIDE)

14) THE AUXILIARY SUPPLY FOR REF. IN D.G INCOMER OF PCC SHALL BE CONSIDERED 230V A.C.

15) THE AUXILIARY SUPPLY FOR ALL RELAYS INDICATIONS IN HT PANEL SHALL BE 24V D.C & TO BE DERIVED FROM INBUILT 24V D.C POWER PACK.

16) 3CORE X 2.5 SQ mm YWY CONTROL CABLE SHALL BE LAID BETWEEN EACH DUAL KWH METER TO CARRY D.G SET RUNNING SIGNAL (i.e FROM D.G INCOMER CIRCUIT BREAKER IN PCC TO LOOPING OF EACH DUEL KWH METER LOCATED IN EACH ELECTRICAL ROOM).

NOTES

(B) NOTES FOR AMF PANEL.

1) REF TENDER & BOQ SPECIFICATION

LEGEND

SYMBOL	DESCRIPTION	
	DIESEL GENERATING SET	
	POWER TRANSFORMER	
	MINIATURE CIRCUIT BREAKER	
	MECHANICAL CONNECTION	
●	INDICATING LAMP	A - CIRCUIT BREAKER 'TRIPPED' (AMBER)
		R - CIRCUIT BREAKER 'ON' (RED)
		G - CIRCUIT BREAKER 'OFF' (GREEN)
		B - GAS PRESSURE HEALTHY (BLUE)
		T - TEST
		A - ACCEPT
		R - RESET
	ELECTRICALLY OPERATED CIRCUIT BREAKER DRAWOUT TYPE AUTOMATIC CIRCUIT BREAKER WITH DISCONNECTOR FUNCTION WITH MICRO PROCESSOR WITH ADJUSTABLE LSIG RELEASE	
	MANUALLY OPERATED CIRCUIT BREAKER DRAWOUT TYPE CIRCUIT BREAKER WITH DISCONNECTOR FUNCTION WITH MICRO PROCESSOR WITH ADJUSTABLE LSIG RELEASE	
	BUSDUCT	
○	PUSH BUTTON	
V	VOLTMETER	
A	AMMETER	
	SELECTOR SWITCH	
	CURRENT TRANSFORMER (No. INDICATE NO. OF CTs.)	
	POTENTIAL TRANSFORMER	
	CIRCUIT BREAKER DRAWOUT TYPE ELECTRICALLY OPERATED	
	HRC FUSE	
	MICROPROCESSOR BASED METER FOR COSΦ, kW,kVA,V,AMPS,kWh WITH RS 485	
	CABLE WITH CABLE GLAND	
ø	TERMINAL INSIDE PANEL	
	CONNECTION OF CONDUCTOR	
TRAFO MB	MARSHALLING BOX OF TRANSFORMER	
CC	CLOSING COIL	
DCF	DC FAILURE	
DLM	DIGITAL LOAD MANAGER INCLUDING MAXIMUM DEMAND CONTROLLER	
DCFR	DC FAILURE RELAY	
IDMT	INVERSE DEFINITE MINIMUM TIME	
LCS	LOCAL CONTROL SWITCH	
NCT	NEUTRAL CURRENT TRANSFORMER	
OCTC	OFF CIRCUIT TAP CHANGER	
PT	POTENTIAL TRANSFORMER	
SC	SPRING CHARGED	
TC	TRIPPING COIL	
TCH	TRIP CIRCUIT HEALTHY	
SR	STATIC RELEASE	

LEGEND

SYMBOL	DESCRIPTION
[illegible]	MASTER TRIP RELAY
50	INSTANTANEOUS OVER CURRENT RELAY (A.C)
51	TIME DELAY OVER CURRENT RELAY (A.C)
50N	OVER CURRENT RELAY (INSTANTENOUS) (EARTH FAULT)
51N	A.C TIME DELAY OVER CURRENT RELAY
27-1 27-2	UNDER VOLTAGE RELAY (2 ELEMENTS)
74/86	TRIP CIRCUIT SUPERVISION RELAY (FOR 86)
86	LOCK OUT RELAY WITH HAND RESET
R AUX	AUXILIARY RELAY
52 CS	BREAKER CONTROL SWITCH
26 W	TEMPERATURE RELAY (WINDING TEMPERATURE)
51NS	A.C TIME DELAY OVER CURRENT RELAY (NEUTRAL) (STANDBY)
74/52	TRIP CIRCUIT SUPERVISION RELAY (FOR 52)
52	A.C CIRCUIT BREAKER OR CONTACTOR
30A	INDICATING DEVICE FOR FAULT OR OPERATING CONDITION (8 POINT ANNUNCIATOR)
[illegible]	TIME DELAY STARTING (ON DELAY TIME RELAY)
[illegible]	STANDBY EARTH FAULT RELAY
80	DC FAIL SUPERVISION RELAY
[illegible]	TRIP CIRCUIT SUPERVISION RELAY (VAX 31)
[illegible]	AUXILIARY RELAY FOR TRANSFORMER FAULT ALARM (VAA33)
COSΦ	POWERFACTOR METER
kW	KILO WATT METER
kWh	ENERGY METER WITH RS485 SERIAL COMMUNICATION PORT
TVM	TRIVECTOR METER
[illegible]	ELECTRICAL MECANICAL INTERLOCK
MI	MECHANICAL INTERLOCK
[illegible]	ANTIPUMPING RELAY
Hz	FREQUENCY METER
NIC	NEUTRAL ISOLATING CONTACTOR
●	LUMINOUS PUSH BUTTON
MDO	MANUALLY OPERATED DRAWOUT TYPE
LSIG	OVERLOAD, SHORT CIRCUIT, INSTANTANEOUS, EARTH FAULT
TM	THERMAL MAGNETIC RELEASE
△	CAPACITOR
S.A.	SURGE ARRESTOR 30KA
PFR	3 PHASE POWER FAILURE RELAY 1. OVER VOLTAGE 2. UNDER VOLTAGE 3. PHASE ROTATION
V	AUTO MANUAL SELECTOR SWITCH

KEY PLAN

Construction work shall be executed only as per the latest revision drawing. Once a revision drawing is issued, the validity of the previous revision drawing stands cancelled and as such construction shall not be carried out as per superseded revisions. The Contractor is expected to:
1. Maintain a register of Drawing Receipts, listing drawing number & revision number, title, from whom received, date received, number of copies received, details of transmittal from the issuer & any other relevant details to be advised from time to time.
2. Archive all previous revision issues immediately upon receipt of a new revision and no superseded drawing shall remain in the site of works except in the Contractor's archives for record and reference purposes only.
3. While archiving superseded drawing, the Contractor is expected to stamp all previously issued drawings / prints appropriately, mentioning the date and revision number of the new revision on account of which the previous revision is archived.
4. The Contractor shall allow the representative of Client / PMC / Architect to inspect Contractor's archives for ensuring compliance.
5. Any work carried out by the Contractor using a superseded drawing after the issue of a new revision is liable for rejection and reinstatement as per new revision at Contractor's risk and cost without any entitlement to extension of time.

T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG
REV.	DESCRIPTION	DATE	BY	CHD.

AMENDMENT

GRAPHIC SCALE:
0 0.5M 2M 4M
0.5M 0 1M 3M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL
AT IMD COLONY,PUNE

DRAWING TITLE:
MAIN SINGLE LINE DIAGRAM -
SHEET 1/2

SCALE : N.T.S
DRAWN : PNK
DATE : 20.12.12
CHKD : PHS

DRAWING NO:
IITM-P-HST-Elc00-01-07-167855

T1

LICENSED SURVEYOR:

CRN
C R NARAYANA RAO
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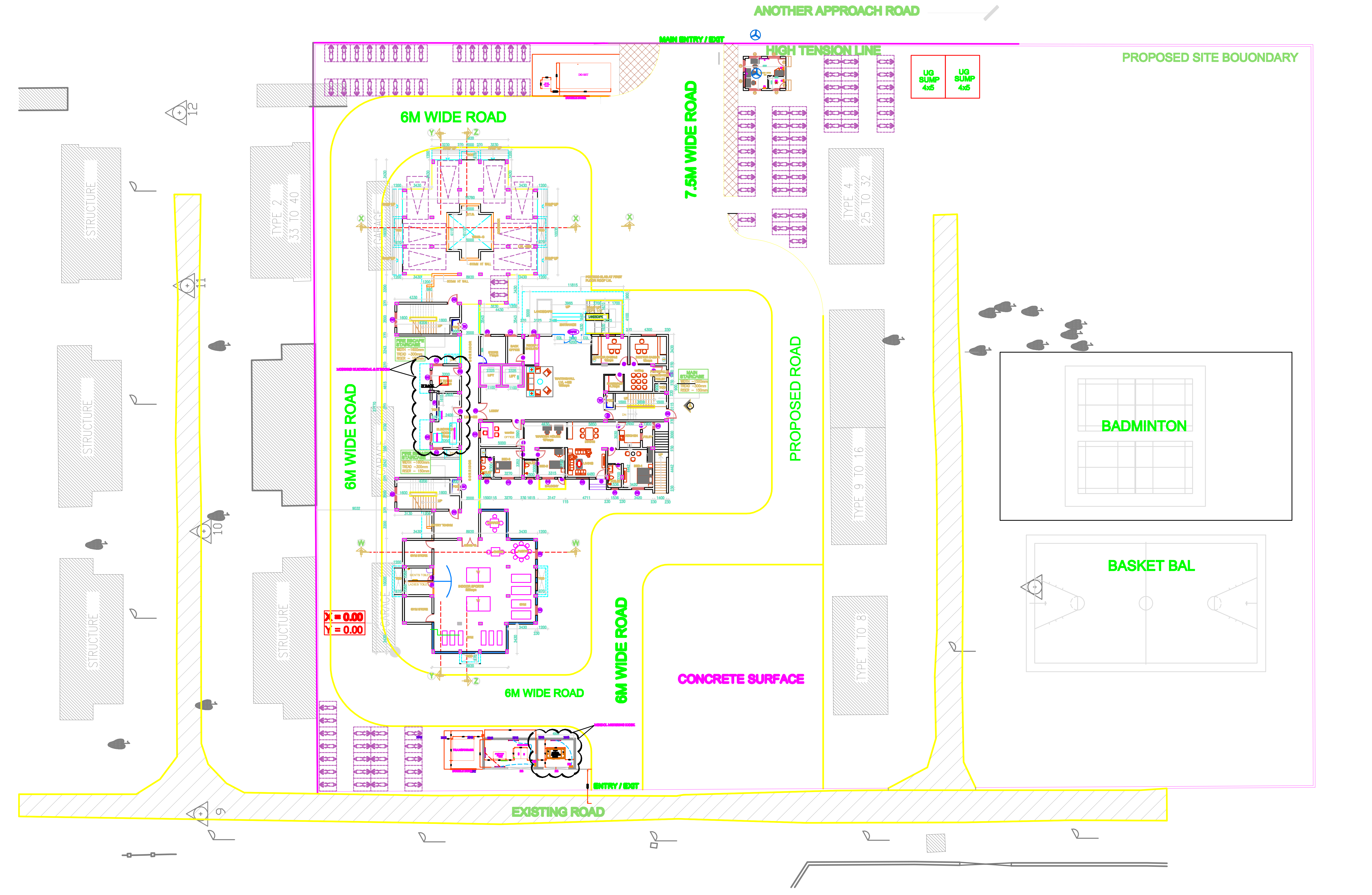
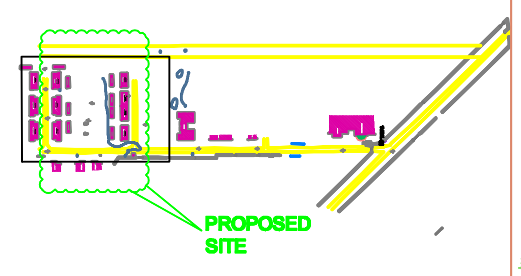
B.Tech, (Hons.), M.S., (Ill.), Ph.D., M.Am.Soc. C.E., F.I.E., F.I.V.,
Chartered Engineer – Registered Architect.



KEY PLAN



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T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG
REV.	DESCRIPTION	DATE	BY	CHD.

AMENDMENT

GRAPHIC SCALE: 0.5M 0 0.5M 1M 2M 3M 4M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL AT IMD COLONY,PUNE

DRAWING TITLE:
POINT OF SUPPLY LAYOUT

SCALE : 1:250	DRAWN : PNK	T1
DATE : 01.11.12	CHKD : PHS	

DRAWING NO:
IITM-P-HST-Ele01-01-05-173004

LICENSED SURVEYOR:
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C R NARAYANA RAO
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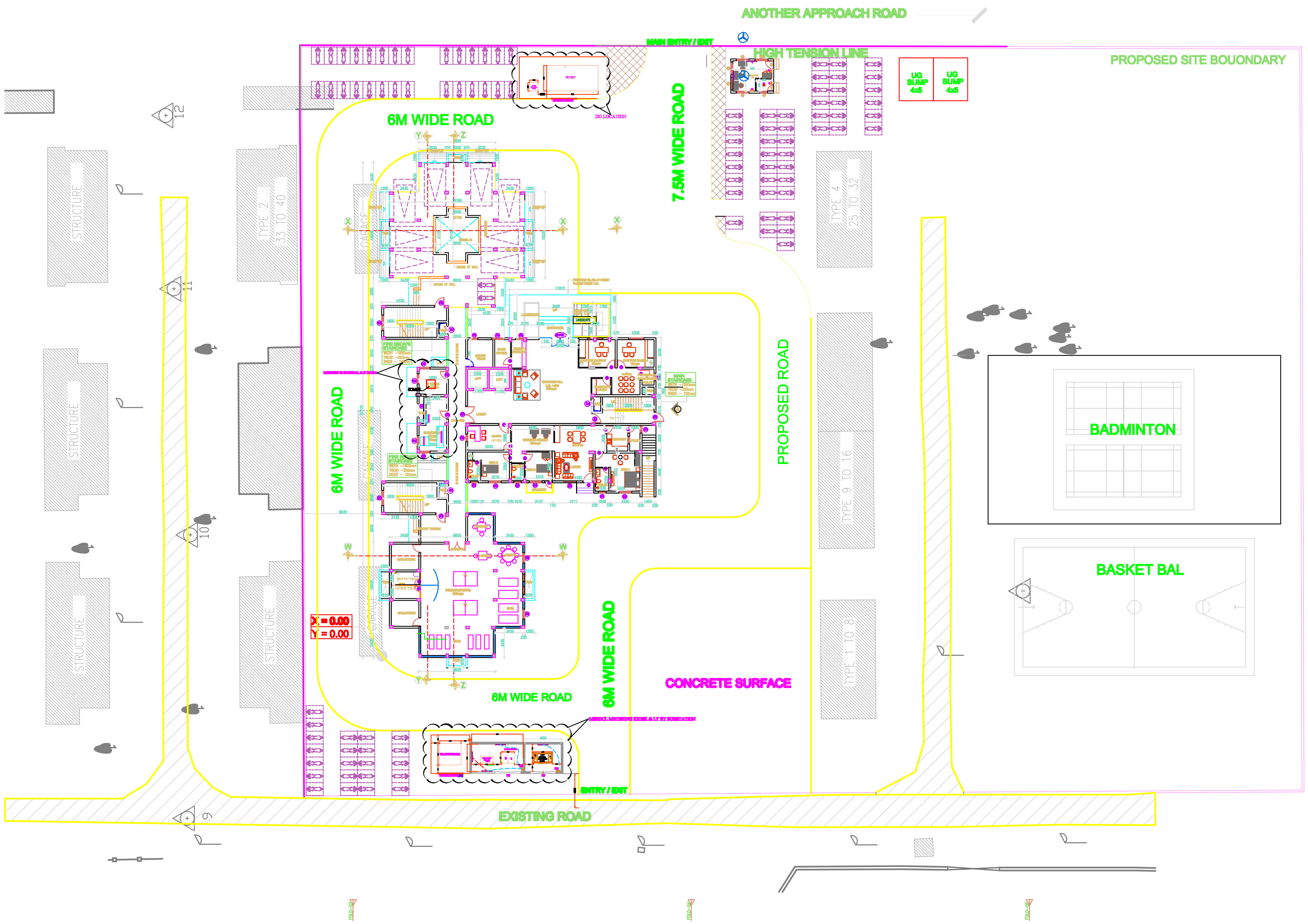
STUDENTS HOSTEL- TYPICAL FLOOR PLANS



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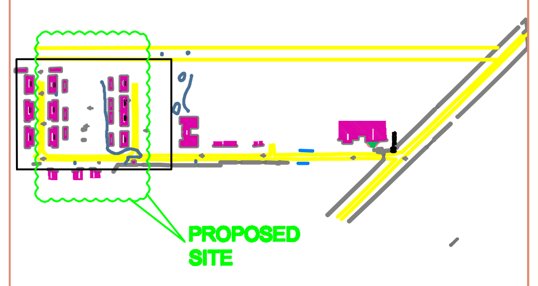

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REV.	DESCRIPTION	DATE	BY	CHD.
T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG

AMENDMENT

GRAPHIC SCALE: 0.5M 0 0.5M 1M 2M 3M 4M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL AT IMD COLONY,PUNE

DRAWING TITLE:
LT SUBSTATION ROOM & DG LOCATION LAYOUT

SCALE : 1:250 | DRAWN : PNK
DATE : 01.11.12 | CHKD : PHS

DRAWING NO:
IITM-P-HST1-Ele01-01-03-173001

T1

LICENSED SURVEYOR:
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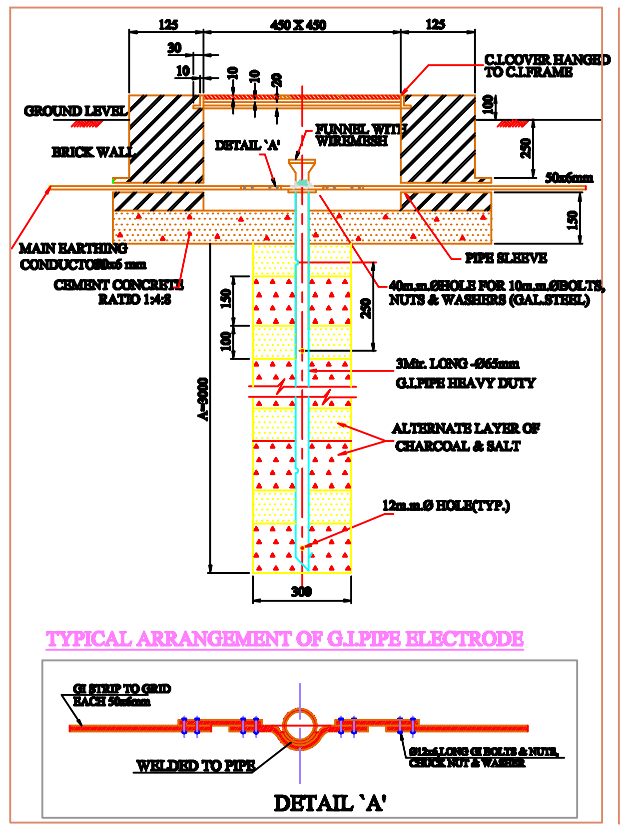
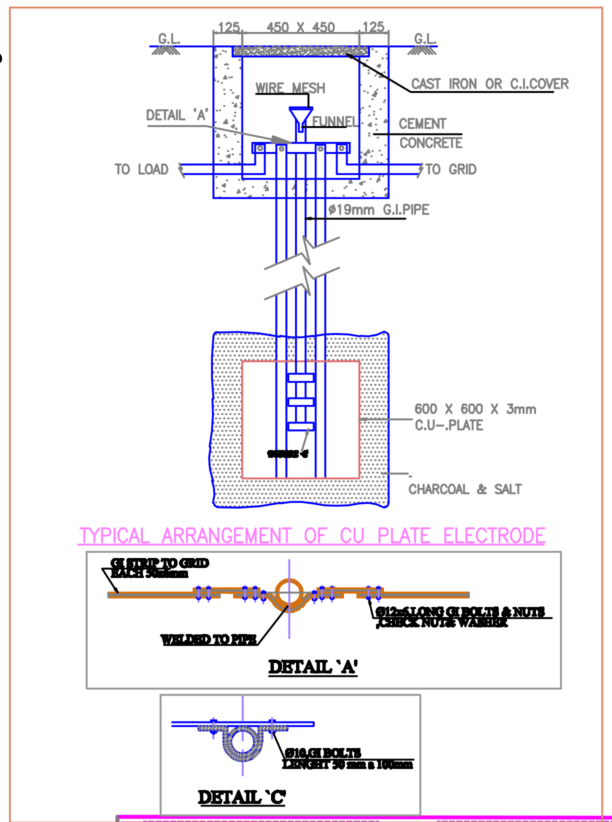
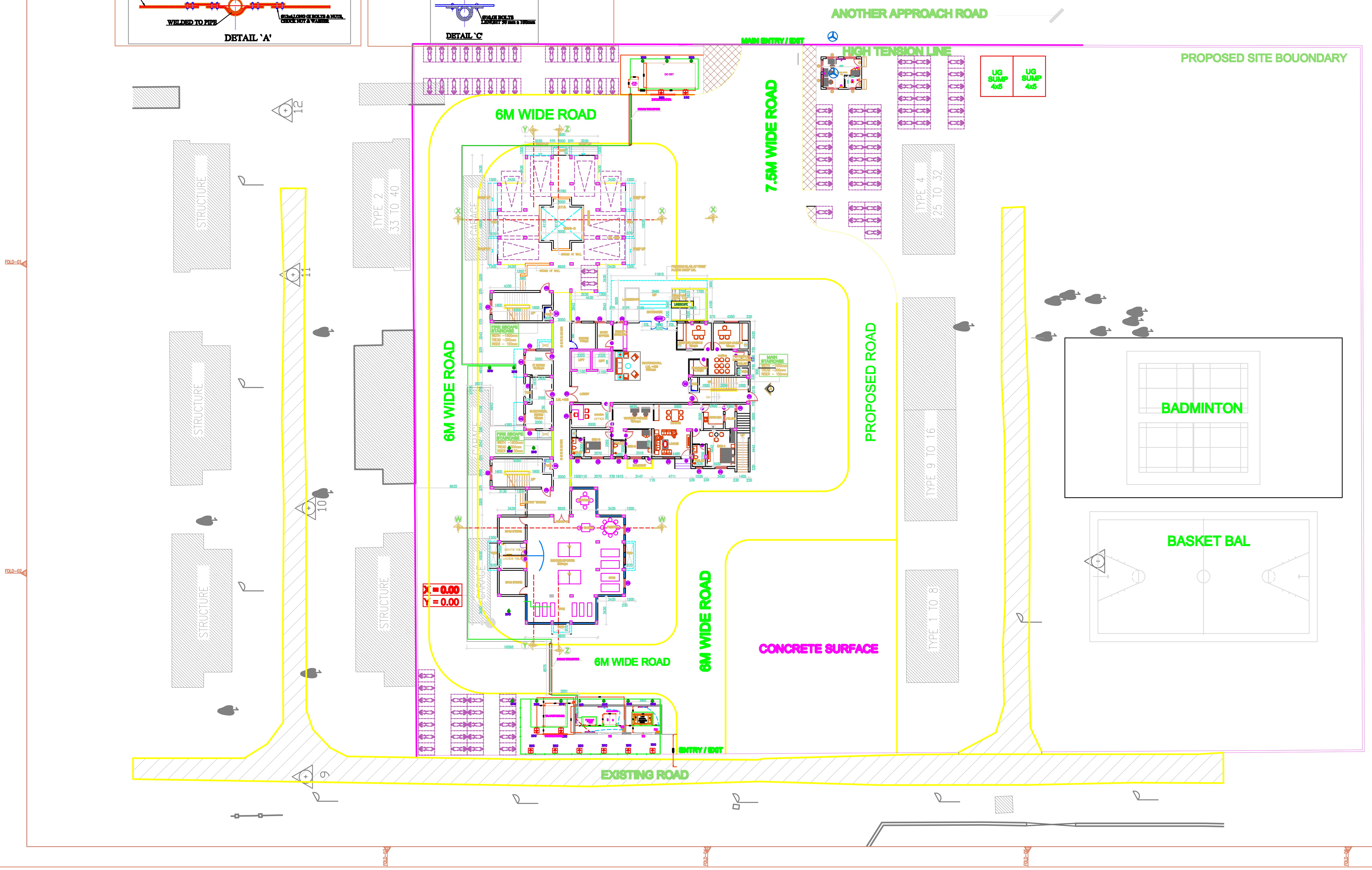




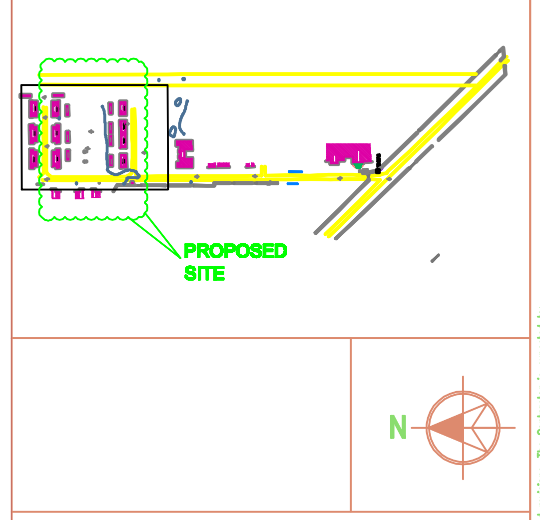
LEGEND

SYMBOL	DESCRIPTION
(red symbol)	CU EARTH PIT (PLATE ELECTRODE)
(green symbol)	G.I. EARTH PIT (PIPE ELECTRODE)
(thin line)	LT CABLE ROUTE
(green line)	EARTHING STRIP

DESCRIPTION	E.P.G.I.	E.P.COPPER
1. TRANSFORMER	02	02
2. D.G.SET	02	02
3. HT-PANEL	01	00
4. ISOLATOR PANEL	01	00
5. KIOSK	06	02
6. LT PANEL	01	00
7. CAPACITOR PANEL	01	00
8. BUILDING EARTHING	02	00
9. GRIDE	02	00



KEY PLAN



REV.	DESCRIPTION	DATE	BY	CHD.
T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG

AMENDMENT

GRAPHIC SCALE: 0.5M 0 0.5M 1M 2M 3M 4M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL AT IMD COLONY,PUNE

DRAWING TITLE:
OVERALL CABLE ROUTE & EARTHING LAYOUT

SCALE : 1:250 | DRAWN : PNK
DATE : 01.11.12 | CHKD : PHS

DRAWING NO:
IITM-P-HST1-Ele01-01-05-173002

T1

LICENSED SURVEYOR:
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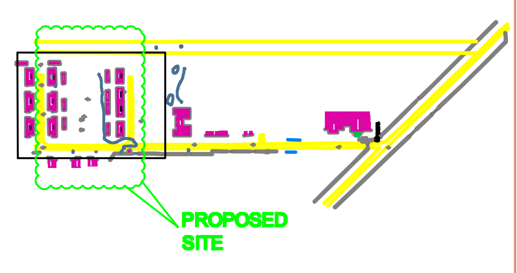
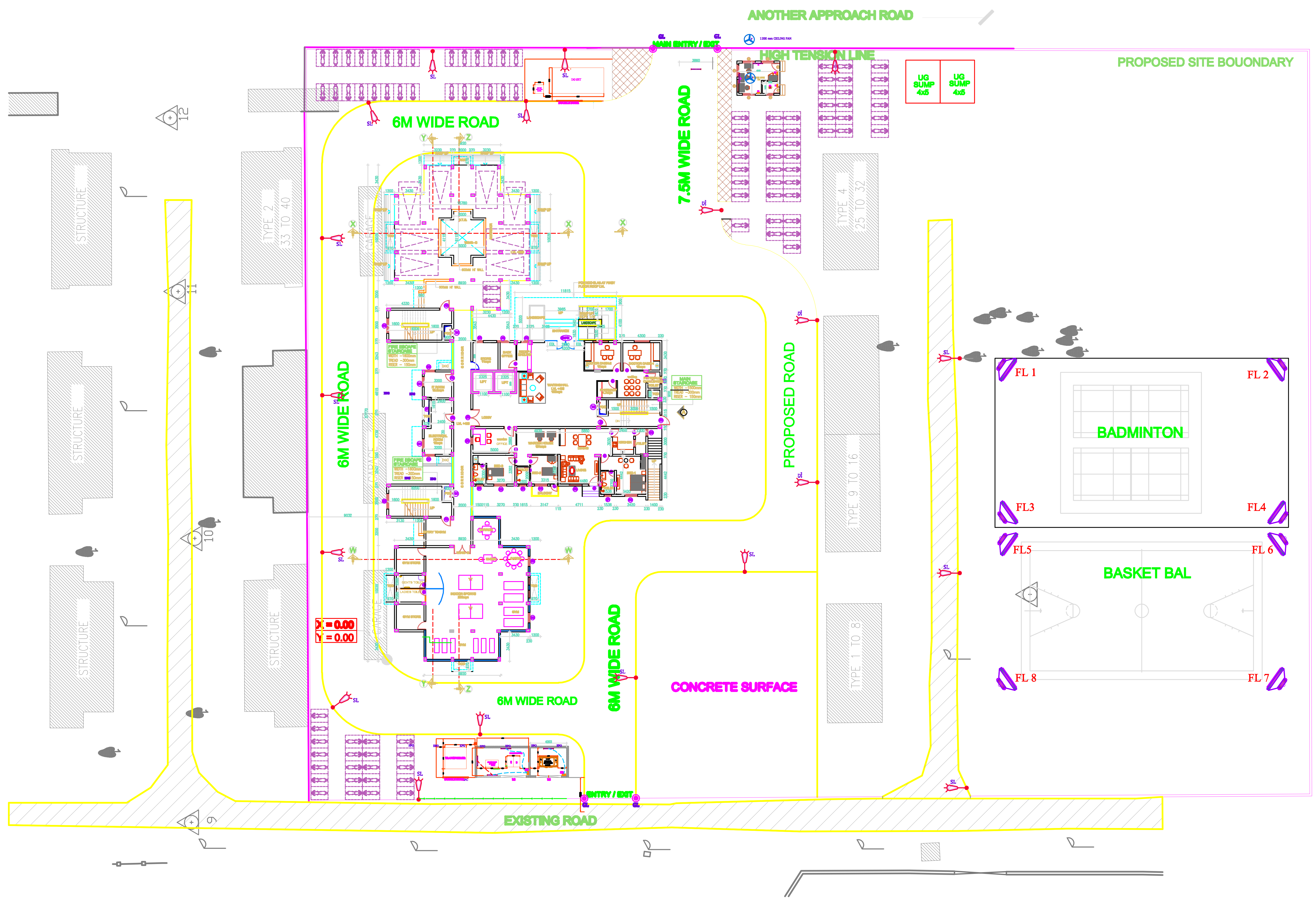


LEGEND

SYMBOL	DESCRIPTION	QTY
L	2X36W FTL INDUSTRIAL LUMINAIRE WITH STOVE ENAMELED REFLECTOR	06
SB	SWITCH BOARD	04
GL	70W POST- TOP LANTERNS	04
SL	95 W LED STREET LIGHT	19
	150 W FLOOD LIGHT	08



T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG
REV.	DESCRIPTION	DATE	BY	CHD.

AMENDMENT

GRAPHIC SCALE: 0.5M 0 0.5M 1M 2M 3M 4M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL AT IMD COLONY,PUNE

DRAWING TITLE:
EXTERNAL LIGHTING LAYOUT

SCALE : 1:250 | DRAWN : PNK
DATE : 01.11.12 | CHKD : PHS

DRAWING NO:
IITM-P-HST1-Ele01-01-07-173003

T1

LICENSED SURVEYOR:
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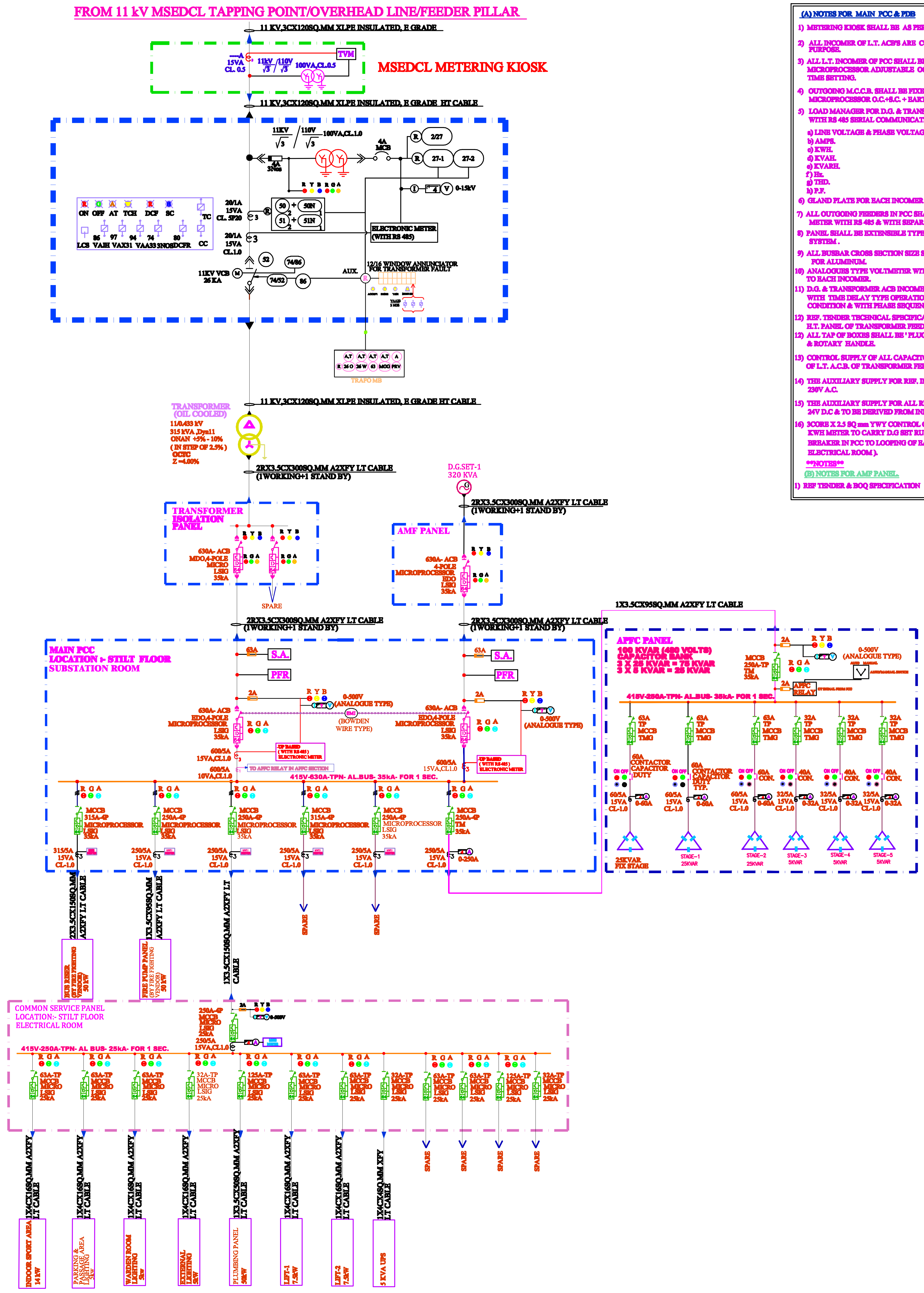

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10) ANALOGUES TYPE VOLTMETER WITH V.S.S. & AMMETER SHALL BE PROVIDED TO EACH INCOMER.
11) D.G. & TRANSFORMER ACB INCOMER SHALL BE SUITABLE FOR AUTO RE CLOSING WITH TIME DELAY TYPE OPERATION FOR THEIR RESPECTIVE SUPPLY VOLTAGE CONDITION & WITH PHASE SEQUENCE PROTECTION.
12) REF. TENDER TECHNICAL SPECIFICATIONS FOR REQUIREMENT OF 11kV H.T. PANEL OF TRANSFORMER FEEDER PROTECTION.
12) ALL TAP OF BOXES SHALL BE ' PLUG IN TYPE ' WITH SFU & ROTARY HANDLE.
13) CONTROL SUPPLY OF ALL CAPACITOR SHALL BE DERIVED FROM INCOMER OF L.T. A.C.B. OF TRANSFORMER FEEDER (INCOMING SIDE)
14) THE AUXILIARY SUPPLY FOR REF. IN D.G INCOMER OF PCC SHALL BE CONSIDERED 230V A.C.
15) THE AUXILIARY SUPPLY FOR ALL RELAYS INDICATIONS IN HT PANEL SHALL BE 24V D.C & TO BE DERIVED FROM INBUILT 24V D.C POWER PACK.
16) 3CORE X 2.5 SQ mm YWY CONTROL CABLE SHALL BE LAID BETWEEN EACH DUAL KWH METER TO CARRY D.G SET RUNNING SIGNAL (i.e FROM D.G INCOMER CIRCUIT BREAKER IN PCC TO LOOPING OF EACH DUEL KWH METER LOCATED IN EACH ELECTRICAL ROOM).

NOTES

(B) NOTES FOR AMF PANEL.

1) REF TENDER & BOQ SPECIFICATION

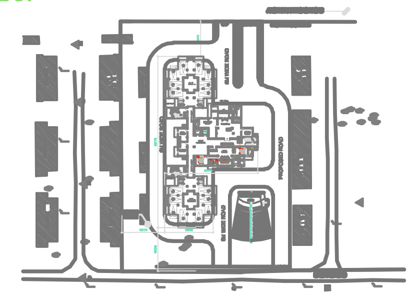
LEGEND

SYMBOL	DESCRIPTION	
(symbol)	DIESEL GENERATING SET	
(symbol)	POWER TRANSFORMER	
(symbol)	MINIATURE CIRCUIT BREAKER	
(symbol)	MECHANICAL CONNECTION	
(symbol)	INDICATING LAMP	A - CIRCUIT BREAKER 'TRIPPED' (AMBER)
		R - CIRCUIT BREAKER 'ON' (RED)
		G - CIRCUIT BREAKER 'OFF' (GREEN)
		B - GAS PRESSURE HEALTHY (BLUE)
		T - TEST
		A - ACCEPT
		R - RESET
(symbol)	ELECTRIC/MANUALLY OPERATED CIRCUIT BREAKER DRAWOUT TYPE AUTOMATIC CIRCUIT BREAKER WITH DISCONNECTOR FUNCTION WITH MICRO PROCESSOR WITH ADJUSTABLE LSIG RELEASE	
(symbol)	MANUALLY OPERATED CIRCUIT BREAKER DRAWOUT TYPE CIRCUIT BREAKER WITH DISCONNECTOR FUNCTION WITH MICRO PROCESSOR WITH ADJUSTABLE LSIG RELEASE	
(symbol)	BUSDUCT	
(symbol)	PUSH BUTTON	
V	VOLTMETER	
A	AMMETER	
(symbol)	SELECTOR SWITCH	
(symbol)	CURRENT TRANSFORMER (No. INDICATE NO. OF CTs)	
(symbol)	POTENTIAL TRANSFORMER	
(symbol)	CIRCUIT BREAKER DRAWOUT TYPE ELECTRICALLY OPERATED	
(symbol)	HRC FUSE	
(symbol)	MICROPROCESSOR BASED METER FOR COSΦ, kW,kVA,V,AMPS,kWh WITH RS 485	
(symbol)	CABLE WITH CABLE GLAND	
(symbol)	TERMINAL INSIDE PANEL	
(symbol)	CONNECTION OF CONDUCTOR	
TRAFO MB	MARSHALLING BOX OF TRANSFORMER	
CC	CLOSING COIL	
DCF	DC FAILURE	
DM	DIGITAL LOAD MANAGER INCLUDING MAXIMUM DEMAND CONTROLLER	
DCFR	DC FAILURE RELAY	
IDMT	INVERSE DEFINITE MINIMUM TIME	
LCS	LOCAL CONTROL SWITCH	
NCT	NEUTRAL CURRENT TRANSFORMER	
OCTC	OFF CIRCUIT TAP CHANGER	
PT	POTENTIAL TRANSFORMER	
SC	SPRING CHARGED	
TC	TRIPPING COIL	
TCH	TRIP CIRCUIT HEALTHY	
SR	STATIC RELEASES	

LEGEND

SYMBOL	DESCRIPTION
VAJH	MASTER TRIP RELAY
50	INSTANTENOUS OVER CURRENT RELAY (A.C.)
51	TIME DELAY OVER CURRENT RELAY (A.C.)
50N	OVER CURRENT RELAY (INSTANTENOUS) (EARTH FAULT)
51N	A.C TIME DELAY OVER CURRENT RELAY
27-1 27-2	UNDER VOLTAGE RELAY (2 ELEMENTS)
74/86	TRIP CIRCUIT SUPERVISION RELAY (FOR 86)
86	LOCK OUT RELAY WITH HAND RESET
R AUX.	AUXILIARY RELAY
52CS	BREAKER CONTROL SWITCH
26 W	TEMPERATURE RELAY (WINDING TEMPERATURE)
51NS	A.C.TIME DELAY OVER CURRENT RELAY (NEUTRAL) (STANDBY)
74/52	TRIP CIRCUIT SUPERVISION RELAY (FOR 52)
52	A.C.CIRCUIT BREAKER OR CONTACTOR
30.8	INDICATING DEVICE FOR FAULT OR OPERATING CONDITION (8 POINT ANNUNCIATOR)
2/27	TIME DELAY STARTING (ON DELAY TIME RELAY)
51-G	STANDBY EARTH FAULT RELAY
80	DC FAIL SUPERVISION RELAY
97	TRIP CIRCUIT SUPERVISION RELAY (VAX 31)
74	AUXILIARY RELAY FOR TRANSFORMER FAULT ALARM (VAA33)
COS	POWERFACTOR METER
kW	KILO WATT METER
kWh	ENERGY METER WITH RS485 SERIAL COMMUNICATION PORT
TVM	TRIVECTOR METER
EMI	ELECTRICAL MECANICAL INTERLOCK
MI	MECHANICAL INTERLOCK
94	ANTIPUMPING RELAY
Hz	FREQUENCY METER
NIC	NEUTRAL ISOLATING CONTACTOR
(symbol)	LUMINOUS PUSH BUTTON
MDO	MANUALLY OPERATED DRAWOUT TYPE
LSIG	OVERLOAD, SHORT CIRCUIT, INSTANTANEOUS, EARTH FAULT
TM	THERMAL MAGNETIC RELEASE
(symbol)	CAPACITOR
S.A.	SURGE ARRESTOR 35KA
PFR	3 PHASE POWER FAILURE RELAY 1. OVER VOLTAGE 2. UNDER VOLTAGE 3. PHASE ROTATION
(symbol)	AUTO MANUAL SELECTOR SWITCH

KEY PLAN



N

REV.	DESCRIPTION	DATE	BY	CHD.
T1	ISSUED FOR TENDER	29.11.13	ANUP	VPG

AMENDMENT

GRAPHIC SCALE: 0.5M 0 0.5M 1M 2M 3M 4M 5M

INDIAN INSTITUTE OF TROPICAL METEOROLOGY , PUNE.

PROJECT:
PROPOSED STUDENT'S HOSTEL AT IMD COLONY,PUNE

DRAWING TITLE:
MAIN SINGLE LINE DIAGRAM - SHEET 2/2

SCALE : 1:250 | DRAWN : PNK
DATE : 01.11.12 | CHKD : PHS

DRAWING NO:
IITM-P-HST1-Elc00-01-07-173007

T1

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