INDIAN INSTITUTE OF TROPICAL METEOROLOGY
PASHAN, PUNE-411 008

Tender No. EM/28/2011

TENDER NOTICE

Director, Indian Institute of Tropical Meteorology, Dr. Homi Bhabha Road, Pashan, Pune-411008 (India) invites sealed tenders (Part-I – Technical Bid, Part-II – Commercial Bid) in separate sealed covers from Manufactures/Suppliers & accredited selling agents / Contractors registered in the approved list of PWD, MES, CPWD, Railways and P&T and any other government departments in appropriate class for following work.

Name of work – (1) Internal and External Electrical Work for 400 seated Multi Training Facility Building at this Institute.
(2) HVAC system work

Tender documents with BOQ can be obtained from Office of this Institute for both the works.

Date of issue of tender documents		**12.09.2011**
Pre bid meeting date & time (Electrical)		**21.09.2011 at 1100 hrs**
Pre bid meeting date & time (HVAC)		**21.09.2011 at 1500 hrs**
Last date of receipt of Tender at IITM, Pune:		**03.10.2011 at 1230 hrs**
Opening of Tenders (Technical Bids both works)	:	**03.10.2011 at 1500 hrs**

The Institute reserves the right to reject any or all tenders without assigning any reason thereof. For further details please visit our Website: **www.tropmet.res.in**

Civil Engineer
For Director
Email : anupam@tropmet.res.in

TENDER DOCUMENTS

FOR

(TECHNICAL SPECIFICATIONS PART-1)

FOR

INTERNAL & EXTERNAL ELCTRICAL WORK OF MULTI TRAINING FACILITY BUILDING

AT

INDIAN INSTITUTE OF TROPICAL METEOROLOGY, PASHAN,

PUNE.

INDEX

TENDER NOTICE

1. **Sealed item rate quotations are invited from reputed electrical contractors with valid Contractor's license who can carry out the work in state of MAHARASHTRA**

Name of Director IITM Pune	:	Indian Institute of Tropical Meteorology, Pune
Name of Work	:	INTERNAL & EXTERNAL ELCTRICAL WORK OF MULTI TRAINING FACILITY BUILDING
Cost of Tender documents	:	1000/-
Earnest Money Deposits	:	1, 10,000/- Rs. Only
Date of Complition	:	FOUR Months from the date of LOI

2. **The TENDER FORM will be available From 12.09.2011 on payment of cost of tender documents in the form of**

   Demand Draft from Nationalised bank at the address given below

   Director,
   Indian Institute of Tropical Meteorology,
   Dr.Homi Bhabha Road,
   Pashan, Pune-411008.

3. **Pre-bid meeting on- 21.09.2011 at 1100 Hrs.**

4. **Duly completed tenders shall be submitted in sealed envelops at the office of Director IITM Pune on address Given below on dated 03.10.2011 by 1230 Hrs.**

   Indian Institute of Tropical Meteorology,
   Dr.Homi Bhabha Road,
   Pashan, Pune-411008.
   Tel No. 020 -25904200.

   Contact Person: - Mr. Saxena

   E- Mail – anupam@tropmet.res.in

   Due Date & time 03.10.2011 by 1230 Hrs and opened at 1500 Hrs.

5. **The Director IITM Pune reserves right to accept or reject any or all the quotations without assigning any Reasons and shall not be bound to accept lowest quotation.**

6. **This tender notice shall form part of contract/order.**

INSTRUCTIONS TO THE TENDERER

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

2. **Technical and commercial bids are to submit in separate envelop. Technical bid is the blank BOQ (without price schedule) along with specifications and highlighted with the makes and material considered; duly signed on each page, super scribing the envelop**
    a. **As technical bid**

3. **Commercial bid with price schedule only, super scribing the envelop as commercial bid.**

4. **The schedule of rates shall be returned in two sets.**

5. **All section wise total amounts shall be written in words also.**

6. **The tenderers are requested to furnish information about similar works handled, staff & infrastructure etc in technical bid.**

7. **All drawing and documents issued to the tenderers are confidential and shall be returned back with the tender.**

8. **EMD shall be in the form of cheque or as mentioned specifically in Tender Notice and shall be enclosed in a separate envelop along with the tender.**

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

10. **Preliminary drawings, prints shall be available for reference & discussion at our office.**

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

12. **All bidders should visit site prior to giving quotes to get acquired with site conditions. No demand shall later be entertained due to site conditions.**

13. **Pre-bid meeting for technical queries will be held on 21.09.2011, 1100Hrs at IITM.Bidders are requested to be present in the meeting. All technical queries will be answered by IITM & consultants.**

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

15. **Bidders are requested to highlight the makes of material considered while quoting in the list of approved makes.**

16. **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.**

17. **Client reserves the right to accept or reject any or all bids without assigning any reasons (N.A.)**

18. **Duly completed tenders shall be submitted to addressee to following address**

The Director,
Indian Institute of Tropical Meteorology,
Dr.Honi Bhabha Road,
Pashan, Pune-411008.
Tel No. 020 -25904200.

Contact Person: - Mr. Saxena

E- Mail – anupam@tropmet.res.in

Due Date & time 03.10.2011 upto 1230 Hrs and opened at 1500Hrs.

19. **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.VAT & service tax calculation / supporting shall be kept separate.**

ARTICLES OF AGREEMENT

Articles of Agreement ----------made on the----------day of _____2011 at _____

Between

Client, (Hereinafter referred to as "The Director IITM Pune") ---------- ----------

Of (or whose registered office is situated at) ---------- ----------

(Hereinafter called "The Contractor") of the other part.

Whereas the Director IITM Pune is desirous of awarding the LOI for supply, installing of electrical system for the new Multi Training Facility Building at IITM Pune, Maharashtra Work as per enclosed drawings/ specifications and Bills of quantities showing/ describing the work to be done under the direction of:

And whereas the contractor has supplied the Director IITM Pune with a fully priced copy of the said bills of quantities (which is hereinafter referred to as "The Tender/ Contract Bill"). And whereas 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 whereas the contractor has deposited the sum of Rs……. with the consultant/ Director IITM Pune for the due performance of this agreement.

Now it is hereby agreed as follows:-

1. **For the consideration hereinafter mentioned, the contractor will upon and subject to the conditions annexed carry out and complete the work shown upon the contract drawings and described by or referred to in the contract bills and in the said conditions.**

2. **The Director IITM Pune will pay the contractor the sum of Rs……..……. (Here in after referred to as "the contract sum") of such other sum as shall become payable here under at the times and in the manner specified in the said conditions.**

3. **The terms "the Consultant" in the said conditions 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 Pune shall nominate for that purpose provided always that no person subsequently appointed to be the consultant under this contract shall be entitled to disregard or overrule any certificate or opinion or decision or approval or instruction given or expressed by the earlier consultant.**

4. **The said conditions and appendix here to shall be read and construed as forming part of this agreement, and the parties hereto shall respectively abide by, submit themselves to the 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:

Witness:
Name
Address

CONTRACTOR

SECTION –A

FORM OF TENDER

To,
M/S. Indian Institute of Tropical Meteorology,
Dr.Honi Bhabha Road,
Pashan, Pune-411008.

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, conditions of contract and in all other respects with such condition as applicable

A)	**Description of work**	**:**	**INTERNAL & EXTERNAL ELCTRICAL WORK OF MULTI TRAINING FACILITY BUILDING**
B)	**Earnest money deposit**	**:**	**1,10,000/- Rs. Only**
C)	**Completion Period**	**:**	**FOUR MONTHS**

1. Should this tender be accepted, I/We hereby agree to abide by and fulfil ll the terms and condition of contract as they may be applicable and in the default there of to forfeit and pay to Director IITM Pune sum of money mentioned in the said condition.

2. I/We agree that this offer shall remain open for acceptance for minimum period of --------- days.

3.I/We hereby deposit a sum of Rs.----------as EMD which is not to bear any intrest.Should I/we fail to execute the contract when called up to do so, this sum shall be forfeited by me/us.

4. Our bankers are

5. Names of Director IITM Pune/partner of firm

1)

2)

3)

Name of Partner/Directors of firm Authorized to sign.

Name of Partner having power of Attorney to sign the contract.

PLACE:

DATE:

Signature & Seal of contractor

Signature, Name & Address of Witnesses:

1)
2)

SECTION –B

PROJECT INFORMATION & SCPOE

DIRECTOR IITM PUNE	**:**	**M/S INDIAN INSTITUTE OF TROPICAL METEOROLOGY,PUNE**
PROJECT	**:**	**MULTI TRAINING FACILITY BUILDING**
WORK	**:**	**INTERNAL & EXTERNAL ELCTRICAL WORK MULTI TRAINING FACILITY BUILDING**
AVG. RAIN FALL	**:**	**800MM**
TEMPERATURES	**:**	**42° C MAX. & 8° C MIN.**
INCOMING SUPPLY	**:**	**415 V 3 PHASE, 4 WIRE**
DISTRIBUTION	**:**	**415 V 3 PHASE, 4 WIRE**

DETAILED SCOPE OF WORK:

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.**

2. **The scope of contract is explained below.**

   Inspector for approval of Drawings, TAC (if required), etc.

   Supply, laying, testing & commissioning of 1100V grade LT XLPE/PVC, power/control cables on pre-fabricated trays / underground and End termination of cables from the available feeder from Existing main LT panel to Main panel in the Multi Training Facility Building Panel room and Cabling/wiring in the Multi Training Facility Building including allied street light Cabling.

   Erection, testing & commissioning of 415V, LT Panels in proposed Panel room & Plant area as shown in drawings.

   Supply and erection of Cable trays, supports/ MS sections fabrication.

   Supply & erection of DBs, power sockets, point wiring in MS/PVC conduits, junction boxes/accessories for light, fan, exhaust fan, call bell, 5A, 15A points & 1100V grade Mains wiring for power outlets for machine load & convenience power etc.

   Supply & installation of lighting fixtures & fans.

   Supply & installation of street light / Flood Light poles / high mast with accessories.

   Supply, erection, & testing of Earthing system including earth conductors, earth leads, earth electrodes with test facility for Metering yard, Transformer substation

including Transformer with OLTC, RTCC & H.T. Breaker Panels & Equipment (as in installation scope) supports structure body Earthing.

Supply, installation & testing of Lightning arresters.

Supply & installation of Aluminium Raceways, PVC/M.S. conduit in office area for UPS/Raw mains wiring, data, telephone wiring.

Supply, laying, testing commissioning of mains wiring for computer, power & telephone wire/cable, data cabling related to switch cabinets, workstations etc

Supply, fabrication, erection & painting of M.S. supports for various panels/Equipments, and misc. work like civil work related to Electrical trench excavation, refilling etc.

3. **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 rates shall be payable.**

4. **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 Board (MSEDCL) & IE codes.**

5. **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.**

6. **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/ Consultant. 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/ Consultant.(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/ Consultant.**

GENERAL SCOPE:

Scope shall include testing and commissioning of all items installed by contractor. Necessary support by manufacturer can / shall be provided.

Scope also includes unloading of free issue items at site, & storing of these items. Contractor's person can accompany client's representatives for shop inspection if necessary for above items.

Contractor has to carry out all works as per respective IS standards & I.E.C. All required tools & tackles, testing kits, measuring instruments, safety equipment's shall be provided by contractor with skilled manpower required.

LIASIONING

1. **This shall include following and everything associated with the Execution, supervision testing and commissioning job.**
2. **Getting the installation approval and obtaining permission to energise.**
3. **Arranging visit of electrical inspector to site (including DG sets) as and when required.**
4. **Submission of necessary test reports.**

Achieving necessary drawing approvals. The Director IITM Pune intends to carry out the above said work(s) by appointing contractor(s) by calling competitive offers.

The Director IITM Pune will enter into Contract(s) with the successful Bidder(s) for carrying out the works as per specifications & conditions detailed here under. Notwithstanding the above, the Director IITM Pune reserves the right to reject any or all of the offers, without assigning any reason thereof. The Bidder shall not be entitled for any Compensation/ Claims towards the cost of preparation and submission of the offer.

The intent of this document is to describe, through specifications & drawings, the requirements of the works to be carried out by the contractor. The specifications and the accompanied drawings shall be read in conjunction & are intended to be complementary. Any other associated supply or works required for the completion shall be considered as if required under this tender.

Following documents shall form part of this tender enquiry:

- **Tender notice & tender form.**
- **This specification including all terms & conditions.**
- **Bill of quantities.**
- **Tender drawings issued herewith.**

All the documents as listed above are intended to be complementary. In the event of variance and/or ambiguity between various documents, following order shall prevail:

- **Special conditions of Contract.**
- **Commercial conditions of Contract.**
- **BOQ Description.**
- **Tender Drawings.**
- **Technical Specifications.**

The Specific qualifying requirements for the Bidder are as specified in the special conditions of the Contract.

SECTION-C

DEFINATION OF TERMS

In Construing these conditions, the specification, schedules, Tender and Agreement, following words shall have the meaning herein assigned to them, except where the subject or context otherwise requires.
The words imparting the singular only also include the plural and vice versa where the context requires, while applying the definitions given below:

Director IITM Pune/ Employer/ Clients: shall include their executors/ administrator assignees or legal representative or successors.

Contractor/ Bidder: Contractor/ Bidder shall mean successful Bidder and shall include his (their) heirs, legal representative/ s, assignee/s or successors.

Site: Site shall mean site of Contract work as shown on the Drawings and any other land allotted by the Director IITM Pune for specific use during this Contract period.

Contract: Contract shall mean the notice inviting the Tender, Articles of Agreement, Contract conditions, special conditions, schedules, specifications in the form of Tender document including (not limited to) terms/ conditions. Drawings, specifications, price schedules attached here to and duly signed by Director IITM PUNE and Contractor including such deviations to Tender terms signed and accepted by both Director IITM PUNE and Contractor, as per Contract document and accepted correspondence/ corrections/ communications etc.

Specifications: Specifications shall mean any terms specifying Director IITM PUNE requirements pertaining to the Contract - technical/ commercial/ others annexed to the Contract including detailed specifications, drawings, general/ special conditions of Contract.

Contract Amount/ Value: Total amount/ value of the work under the scope of Contract.

Plant, Equipment, Work: This shall mean and include material, plant and equipment to be supplied and/ or erected by the Bidder or any other related work under the Contract.

Tests: Tests shall mean all the tests to be carried out during pre-commissioning/ on completion/ manufacturer's works as per this Contract and as per relevant IS specifications.

Engineer: Engineer shall mean the person approved by the Consultants, acting under the orders of Director IITM Pune/ Consultant. The Contractor shall offer the Engineer every facility and assistance. The Engineer will have power to give notice to the Contractor/ their representative regarding non-approval of work; and such work shall be suspended/ discontinued till written decision of the Consultant is obtained

Notice in Writing: Notice in writing shall mean a communication written by hand, typed or printed characters given to authorized employee of Contractor.

SECTION-D

GENERAL AND SPECIAL CONDITIONS OF CONTRACT

GENERAL CONDITIONS

1. ADDITIONAL WORK

Any additional work if required/ ordered by the Director IITM PUNE/ Consultant shall be taken up immediately and completed within the agreed time schedule.

2. WORKING DRAWINGS

Electrical layout drawings furnished by Director IITM Pune/ consultant 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 Consultant through the Project Engineer for interpretation or correction. Local conditions, which may affect the work, shall likewise be brought to the Consultants 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.

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

Contractor shall submit installation detail working drawings for Director IITM Pune/ Consultants 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.**
- **Lighting**
- **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/ Consultant for completing the project on time without cost over-run.**

3. 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 PUNE/ Consultants verdict shall be final and binding on the Contractor.

4. MAKES OF THE STANDARD BOUGHT-OUT EQUIPMENT

The makes of the bought-out/ standard products are specified in the Tender. In case some other equivalent makes are to be used, the Contractor shall specify makes of the equipment offered. These shall be reputed makes and shall be subject to the approval of Director IITM PUNE/ Consultant.

The Manufacturer's drawings and catalogues shall be submitted in 4 sets, within 4 weeks of date of award of the order or letter of intent. In any case this shall be before actual installation/ use of the equipment/ material at site. The operating

instructions & maintenance manuals shall be handed over immediately on commissioning.

5. DEFECTS / MODIFICATIONS

If in the opinion of Director IITM PUNE/ Consultant/ Statutory authorities the work carried out is defective, the Contractor shall rectify such defects without any additional cost to Director IITM PUNE; or carry out modifications to make the work complete in all respects and acceptable to the Director IITM PUNE/ Consultant/ Statutory authorities. To get satisfactory test readings, the Contractor shall carry out required modifications (which may include even replacement of defective items) without any additional cost of whatsoever nature to Director IITM PUNE. The work shall be guaranteed to yield the specified rating(s), design conditions within tolerance as per relevant IS specs. Any equipment, which in the opinion of the Director IITM PUNE/ Consultant/ Statutory Authorities does not meet specified requirements for which it is installed, may be rejected and Contractor shall replace it free of cost and within such time as may be reasonably allowed to him. The delay in the execution of the project on this account is not acceptable.

6. COMPLETION CERTIFICATE

The Contractor shall inform the Consultant, completion of erection for inspection and witnessing the site tests. Required tools/ instruments for such tests shall be arranged by the Contractor. The equipment shall be commissioned only after obtaining written acceptance of pre-commissioning tests (as per requirement) by the Director IITM Pune/ Consultant. At this stage the Consultant shall issue completion certificate to the Contractor. The Director IITM Pune / Consultant reserve the right to issue the completion certificate in parts. If due to Contractor's inefficiency the Contractors completion certificate is delayed, the Director IITM PUNE reserve their right to put the equipment to use. The maintenance period or defects liability period shall start from the date of completion to the satisfaction of the Director IITM PUNE as mentioned in the completion certificate. Before issue of completion certificate, Contractor shall supply AS-BUILT drawings and operation and maintenance manuals as per relevant clause.

7. COMPLETION CERTIFICATE UNDER DEVIATION

The Director IITM Pune/ Consultant may consider issuing completion certificate for the Contract along with the list of deviations for which the Contractor shall give an undertaking that the deviations shall be attended and rectified within two months from the date of completion certificate. The right of issuing such a certificate lies exclusively with the Director IITM Pune depending on nature of deviations.

8. LIQUIDATED DAMAGES FOR DELAY IN DELIVERY

Liquidated Damages shall be 1% of total contract value per week or part thereof subject to a maximum of 5% of the total contract value for the Delay beyond the agreed completion dates for various stages / phases. If during the course of the contract it is clear to the Purchaser / Consultant that the delivery is delayed by more than 5 weeks due to reasons totally attributable to the Supplier, the Purchaser shall have right to termination of the contract.

9. DEFECTS LIABILITY PERIOD & FINAL ACCEPTANCE CERTIFICATE

Defects liability period shall commence on the date of completion mentioned in the completion certificate (with or without deviation list) and shall not finish for at least *Two years*. On completion of the defects liability period, the Director IITM Pune/ Consultant shall carry out final inspection of work and issue a list of defects/ deviations, if any. The Contractor shall attend to and rectify these defects/ deviations immediately. During the defects liability period, if there is

any defect observed in the work carried out by the Contractor; the contractor shall rectify such defects immediately. At the end of the defects liability period and after rectification of all deviations, the Consultant shall issue final acceptance certificate. The Director IITM PUNE will release the retention amount or bank guarantee within 15 days; of presentation of final acceptance certificate by the Contractor.

If after defect rectification, the item is not acceptable to Director IITM PUNE/ Consultant, the Contractor shall replace the item by right quality item, free of cost. "The nature and quantum of defect, it's reporting to the Contractor, Contractor's response" thereof shall be recorded in writing by the Director IITM Pune and acknowledged by the Contractor/ Consultant as the case may be.

The Contractors shall handover the running equipment to the Director IITM Pune, for use and routine maintenance. However the Contractor is responsible for quality of work for defect liability period and quality of supplied equipment. The erection shall be as per Contract specifications and relevant IS Specifications.

The Contractor shall obtain, well in time, before/ during and after completion of erection, approval from MSEB and electrical inspector, factory inspector, other statutory authorities as and when required. Charges for co-ordination/ liaison to are considered separately.

10. PERFORMANCE GUARANTEE

If the performance of the equipment fail to prove the guarantee set forth in the specification, Supplier shall investigate the causes and provide free of cost to Purchaser / Consultant equipment within one month period to prove the guarantees.

If Supplier fails to prove the guarantee within the one month period, Purchaser shall have the option to take over the equipment and rectify, if possible, the equipment to fulfil the guarantees and or to make necessary additions to make up the deficiency at Supplier's risk and cost. All expenditure incurred by the Purchaser in this regard shall be to Supplier's Account.

The manufacturer's guarantee for all brought out equipment shall be made available to the Purchaser and shall be valid for the entire defects liability period. If the manufacturer does not issue such guarantees, the Supplier shall guarantee the brought out items for the entire defects liability period along with this guarantee for the equipment.

11. WARRANTY /GUARANTEE

Equipment shall be guaranteed for trouble free operation for a period of 18 months from arrival at site or 12 months from the date of commissioning whichever is earlier. Any defects discovered during this period shall be rectified free of cost.

12. WORKMANSHIP

Good workmanship and neat appearance are pre-requisites of the Contract. Work shall be carried out in accordance with statutory rules and regulations in force and confirm to MSEB standards, electrical inspector's requirements, IE rules and relevant IS specifications and to the satisfaction of Director IITM Pune/ Consultants.

13. EXTENSION

Upon it becoming reasonably apparent that the progress of the work is delayed, the Contractor shall forthwith (within a maximum period of seven days) give written notice of the cause of the delay to the Director IITM Pune / Consultants and if, in the opinion of the Consultant, the completion of the work is likely to be

or has been delayed beyond the "Date of completion" stated in the agreement hereto or beyond any extended time previously fixed under this clause.

a) By force majeure,

b) Reason of any exceptionally inclement weather,

c) Reason of loss or damage occasioned by any one or more of the contingencies referred to in this document

d) Reason of social commotion, local combination of workmen strike or lockout affecting any of the trades employed upon the works or any of the traders engaged in the preparation manufacture or transportation

e) Any of the goods or materials required for the work,

f) Reason of Consultant's / and or the Director IITM Pune instructions issued

g) Reason of the Contractor not having receiving in due time necessary instructions, drawings, details or levels from the Director IITM Pune / Consultant for which he specifically applied in writing on a date which having regard to the date of completion stated in the appendix hereto or

h) Any extension of time then fixed was neither unreasonably distant from nor unreasonably close to the date on which it was necessary for him to receive the same

I) Delay on the part of nominated Sub-Contractors or nominated suppliers which the Contractor has taken all practicable to avoid or reduce, or

j) Delay on the part of artists, tradesmen or others engaged by the Director IITM Pune in executing work not forming part of this contract, or

k) Reason of the opening up for inspection of any work covered up or of the testing of any of the works, materials or goods in accordance with clause 31.7 above (including making good in consequence of such opening up or testing) unless the inspection of test showed that the work materials or goods were not in accordance with this Contract, or

l) Reason of the Contractors' inability for reason beyond his control and which he could not reasonably have foreseen at the date of this Contract to secure such labour, goods or materials as are essential to the proper carrying out works, then the Consultant shall estimate the length of the delay beyond date or time aforesaid make in writing a fair and reasonable extension of time for completion of works, provided always that the contractor shall use constantly

his best endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Director IITM Pune / Consultant to proceed with the work.
The Contractor will forfeit his claim for extension if he does not report the cause of the delay in completion date within seven days of the date of occurrence.

14. 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.

15. 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/Consultants 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.

16. AS BUILT DRAWINGS

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 -

1. Detailed drawing showing layouts cables routing, earthing, lighting system, etc. as installed.
2. Manufacturers' operation and maintenance instructions manuals for supplied items.
3. Test results after Consultants acceptance.
4. Contractor's instructions for routine maintenance of the work.
5. Any other drawings/ details deemed necessary by the Director IITM PUNE/ consultant for satisfactory maintenance of the work.
6. List of recommended spares for 2 years operation.
7. Relay co-ordination details (if any)
8. Quality assurance plan
9. Catalogues of major equipments
10. Commissioning reports and settling parameters
11. Warranty certificates by OEM
12. Release orders by authorities
13. Commissioning documents with MSEB.
14. Acknowledgement/ Memos etc.
15. Approvals and NOCs in originals

17. CARE OF WORKS

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. 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.

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. Any delay occurring on account of any of the above shall be to the account of Contractor. Contractor may employ watchman for safe custody of materials. Security and safety of all works related to this Contract is Contractor's sole responsibility.

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

18. PENALTY

The penalty shall be 1% of total Contract value per week or part thereof subject to a maximum of 10% of the total Contract value for the delay beyond the agreed completion dates for various stages / phases. If during the course of the Contract it is clear to the Director IITM Pune / Consultant that the project is delayed by more than 5 weeks due to reasons totally attributable to the Contractor, the Director IITM Pune shall have right to terminate the Contract or get part or whole of the remaining work executed by some other agency at the

Contractor's risk and cost, besides applying the penalty for delay caused to the project.

19. FORCE MAJEURE CLAUSE

This includes delays due to any war, hostilities, act of public enemy, civil commotion, strikes, lockouts, rebellion, revolution, insurrection or military or unsurpassed power, sabotage, fire, floods, explosions, epidemics, quarantine restrictions, earthquakes, damage by air craft and acts of god or any case for which Director IITM PUNE are responsible for the delay in execution/ completion of work by contractor; neither party shall, by reasons of such eventuality, be entitled to terminate this contract nor shall have any claims for damages against the other in respect of such non performance and deliveries under this contract shall be refunded as soon as practicable after such eventuality has come to an end or exist. The above mentioned Force Majored events shall not include constraints which could prudently be foreseen like shortage of power, non availability of raw materials, difficulties in making transport arrangements etc.

20. INSURANCE OF WORKS/ LABOURS

The contractor must take comprehensive insurance policy to cover his works, labours against all risks and include the cost of his policy in the tender price.

The Contractor shall at his own expense, without limiting his liabilities and obligations under any provisions of the Contract, effect and maintain until the completion of the Contract such insurance policies as are required under the Employee's State Insurance Act (ESI), the Factories' Act and any other Labour Law as may be applicable.

The Contractor shall procure such insurance policies with an insurance company as approved by the Director IITM Pune, against all risks in respect of which the Contractor is required under this clause to indemnify the Director IITM Pune, in particular, the Contractor shall effect and maintain an insurance policy of at least Rs.5.00 lakhs for per person engaged for the execution and completion of Work, Rs.5.00 lakhs per accident for injury or death and at least Rs.5.00 lakhs per accident for any damage caused to any third party property and the Contractor shall adequately indemnify the Director IITM Pune against all such third party accident/damage, losses or claims which may arise in respect of the Work or in consequence thereof.

The Contractor shall also maintain adequate insurance/medical policies against all claims which may be made upon the Director IITM Pune whether under the workmen's compensation act or any other statute in force during the currency of the Contract. All such insurance /medical policies shall be in the joint names of the Director IITM Pune and the Contractor and shall be deposited with the Director IITM Pune.

The Contractor shall be responsible for any such damage, loss of person or property or any other claim arising out and incidental to the negligence or failure of the Contractor or Contractor's personnel to execute the Work in accordance with the Contract, and for all such damages, losses or claims for which the insurance policies as stated above have not been procured by the Contractor.

21. FIRE INSURANCE

Unless otherwise instructed by the Employer, the Contractor shall on signing the Contract, insure the Work(s) and the materials to be used for the execution and completion of the Work and keep them insured until the virtual completion of the Contract, against any loss or damage arising due to fire and/or earth-quake

Such insurance policy shall be with an insurance company as approved by the Employer and shall be in the joint names of the Employer and the Contractor and for such amount and the consultants fees and for any further sum if called

upon to do so by the employer the premium of such further sum being allowed to the contractor as an authorized extra. Such policy shall be adequate to cover the property of the Employer lying on the Site and the Consultant's fees in connection with the Consultant's services generally in the reinstatement and shall not cover any property of the Contractor or of any Sub-contractor or employees. The Contractor shall deposit such policies and receipts for the premium with the Employer within twenty-one days from the date of signing the Contract unless otherwise instructed by the Employer. In the event of any default of the Contractor in insuring, as provided above, the Employer may so insure and may deduct the premiums paid from any money due or which may become due to the Contractor. The Contractor shall, as soon as the claim under the policy is settled, or the work is reinstated by the insurance office should they elect to do so, proceed with all due diligence of the completed Work(s) to ensure that the Work is fully replaced and restored in the same manner as though the fire or any other event which had caused such destruction had not occurred and the Work in all respects complies with conditions and specifications of the Contract. The Contractor, in case of rebuilding, replacing or reinstatement after fire, shall be entitled to such extension of time for completion as the Employer may deem fit.

22. RISK PURCHASE CLAUSE

If in the opinion of the Director IITM Pune/ Consultant, the contractor fails to perform and discharge his obligations at any time during tenure of the contract including maintenance period, the Director IITM PUNE shall give 7 days' notice in writing to the contractor to improve his performance. If the contractor fails the Director IITM PUNE reserve the right to cancel the whole or part of the order and get the same carried out by other agencies at the contractors' risk, cost and responsibilities and recover the costs from the contractors' outstanding bills or security deposit or retention amount.

23. LABOUR LAWS

The contractor shall abide by the provisions of state/ central govt. / local labour laws and discharge his obligations towards any liability arising out of such laws in respect of his workers/ sub contractors workers. In case, the contractor fails to comply with the law requirements, the Director IITM PUNE will have to intervene and settle the demands/ disputes of the contractor or his sub contractors labour and debit the cost to the contractors' account. The contractor shall maintain all such records for the attendance of his labour/ other people as may be required. In no case, the same would be mixed up with records of the Director IITM Pune/ his other contractors.

24. SETTLEMENT OF DISPUTE / AMBIGUITIES

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

25. BENEFICIERY FOR INSURANCE POLICIES

Insurance policies mentioned in the respective clauses shall be taken within 10 days of award of the order/ LOI. Director IITM PUNE shall be the sole beneficiaries for these policies. Copies of these policies shall be produced when asked. If contractor fails to take out these policies within the stipulated period, Director IITM PUNE reserve their right to take out these policies on contractor's behalf and debit the cost to contractors' account

26. COMPLIANCE TO STATUTORY RULES / REGULATIONS / ACTS

The contractor will have to comply with all the rules/ regulations/ acts prescribed under the Factories Act, Provident Fund Act, ESI Act, Shops and Establishment Act, Workmen's Compensation Act and such other Acts and

labour laws as may be applicable and any liability arising out of non observance of the regulations and Acts in respect of his employees, in respect of this contract work, will have to be fully assumed and met by the contractor. The contractor should ensure that he satisfies all the above regulations acts etc.

27. REGULATIONS

The contractor and his employees shall observe all prevailing rules and regulations of working in IITM, Pune and modified/ upgraded/ amended from time to time.

26. SITE SUPERVISIONS AND SITE INSTRUCTION BOOK

The contractor shall deploy qualified and responsible engineer at site for site supervision and this engineers shall be available at site during working hours to take instructions and answer queries.

29. MEETINGS

Senior representative of the contractor along with the site engineer shall attend scheduled site meetings and make himself available for any other meetings with the consultants/ Director IITM PUNE as and when required at site. The contractor shall co-ordinate his work with those of other agencies and the consultants/ Director IITM PUNE shall decide the priorities.

30. MAINTENANCE OF RECORDS

The contractor shall maintain at site proper record of the contracts agreement, drawings, site instructions or any other records as requested by consultants/ Director IITM PUNE and shall make these available to consultants/ Director IITM PUNE as and when required during site visits.

Safety instructions are discussed in detail in section 16.

31. HOUSE KEEPING

The contractor shall provide proper housekeeping, keep working place neat and clean and store materials neatly and properly at the closure of each day's work. Protecting electrical equipment from other contractor's activities (e.g. Painting, etc.) shall be contractor's responsibility with intimation to safety officers.

32. ARBITRATION

All disputes, claims, controversy and differences of any kind whatsoever arising out of or in connection with the Contract or the execution of the Work(s) (whether during the progress of the Work(s) or after their completion and whether before or after the determination, abandonment or breach of the Contract) shall be referred to and settled by the Consultant who shall state his decision in writing. Such decision may be in the form of a final certificate or otherwise and shall be issued by the Consultant within 30 days of the date of last hearing with respect to such dispute. The decision of the Consultant with respect to any of the excepted matters shall be final and without appeal. But if either the Employer or the Contractor is dissatisfied with the decision of the Consultant on any matter, question or dispute of any kind (except any of the

excepted matters) or as to the withholding by the Consultant of any certificate to which the Contractor may claim to be entitled under the Contract, then and in any such case either party (the Employer or the Contractor) may within twenty-eight days after receiving notice to such decision give a written notice to the other party requiring that such matters in dispute be arbitrated upon. Such written notice shall specify the matters which are in dispute and such dispute or difference of which such written notice has been given and no other shall be and is hereby referred to the arbitrator being a member of the Institution of Engineers to be agreed upon and appointed by both the parties or in case of disagreement as to the appointment of a single arbitrator, to the

arbitration of two arbitrators being both member of Institution of Engineers one to be appointed by each party, which arbitrators shall before taking upon themselves the burden of reference appoint an umpire. The arbitrator, the arbitrators or the umpire shall have power to open up, review and revise any certificate, opinion, decision, requisition or notice save in regard to the excepted matters and to determine all matters in dispute which shall be submitted to him or them and of which notice shall have been given as aforesaid. The failure to timely appoint an arbitrator by any party shall entitle the other party to request the Institution of Engineers to appoint such arbitrator and the non-appointing party shall not be entitled to raise any objections in this regard.

Upon every or any such reference the cost of incurred and incidental to the reference and award respectively be in the direction of the arbitration, or arbitrators or the umpire who may determine the amount thereof, or direct the same to be taxed as between Attorney and Client or as to between party and party, and shall direct by whom and to whom and in what manner the same shall be borne and paid. The submission shall be deemed to be a submission to arbitration within the meaning of the Arbitration and Conciliation Act, 1996 or any statutory amendments to the Act. The award of the arbitrator or arbitrators or umpire shall be final and binding on the parties. Such reference except as to the withholding by the consultants of any certificates to which the contractor claims to be entitled, shall not be opened or entered upon until after the completion or alleged completion of the works or until after the practical cessation of the works arising from any cause unless with the written consent of the employer and the contractor. Provided always that the employer shall not withhold the payment of the interim certificate nor the contractor in any way delay the carrying out of the works by reason of any such matter, question or dispute being referred to arbitration be shall proceed with the works with the works with all due diligence and shall until the decision of the arbitrator or arbitrators or the umpire be given, abide by the decision of the consultants and no award of arbitrator or the arbitrators or the umpire shall relieve the contractor of his obligations to adhere strictly to the consultants' instructions with regard to the actual carrying out of the works.

The Employer and the Contractor hereby also agree that arbitration under this clause shall be a condition precedent to any other right of action under the Contract. All the disputes arising out of or in any way connected with the Agreement or Contract in respect of the above work shall be deemed to have arisen in Pune and only the courts in Pune shall have jurisdiction to determine the disputes.

33. TAC APPROVAL

Installation shall be subject to approval of Tariff Advisory Committee (TAC) of Fire Insurance Association of India. Hence contractor shall use all materials approved by TAC and it would be contractor's sole responsibility to fill in insurance forms, prepare necessary drawings and submit the same to Fire Insurance Authorities and obtain their approval for the electrical installation. Materials under Director IITM PUNE' scope of supply shall be procured from suppliers approved by TAC.

34. SAMPLE APPROVAL

Even though the approved makes are mentioned in the tender, it is necessary to get approval for samples of supply items by project consultant as well as by Director IITM Pune. With such promptness as to cause no delay in his work or in that of any other sub-contractor. This shall be delivered free of cost. Work shall

be carried out in accordance with approved samples. Sample prior to approval to Director IITM Pune / consultant needs to be approved by MSETCL/MSEDCL.

35. ACCESS FOR DIRECTOR IITM PUNE / CONSULTANT TO THE WORK

The Director IITM Pune / Consultant and their representatives shall have access to the works and the workshops or other place of the Contractor where work is being carried out for the Contract and when work is to be so prepared in workshops or other places of a Sub-Contractor (whether or not a nominated Sub-Contractor.) at all reasonable times. The Contractor shall have a term in the Sub-Contract so as to secure a similar right of access to those workshops or placed for the Director IITM Pune / Consultant and his representatives and shall do all things reasonably necessary to make the right effective.

36. CONSULTANT'S STATUS AND DECISIONS

The Consultant shall be the Director IITM PUNE representative during the construction period. The Consultant shall periodically visit the site to familiarize himself generally with the progress and the quality of the work and to determine in general if the work is proceeding in accordance with the Contract Document. He shall not be required to make exhaustive or continuous on site inspection to check the quality or quantity of the work and he shall not be responsible for the Contractors' failure to carry out the construction work in accordance with the Contract Document. During such visits and on the basis of his observations while at the site he shall keep the Director IITM Pune informed of the progress of the work, shall endeavor to guard the Director IITM Pune against defects and deficiencies in the work of the Contractor and he shall condemn work which fails to conform to the Contract Document. Consultant shall have authority to act on behalf of the Director IITM Pune only to the extent expressly provided in the Contract Document or otherwise in writing which shall be shown to the Contractor. He shall have authority to stop the work, whenever such stoppage may be necessary in his reasonable opinion, to ensure the proper execution of the Contract. The Consultant shall be in the first instance the interpreter of the conditions of this contract and the judge of its performance. He shall side neither with the Director IITM Pune nor with the Contractor but shall use his powers under the Contract to enforce its faithful performance by both. In case of the termination of the appointment of the Consultant, the Director IITM Pune shall appoint a capable and reputable Consultant against whom the Contractor shall make no reasonable objection and whose status under the Contract shall be that of the former Consultant. Any dispute in connection with such appointment shall be subject to Arbitration.

Decision

The Consultant shall within a reasonable time make decisions on all claims of the Director IITM Pune or the Contractor and all other matters relating to the execution and progress of the work of the interpretation of the Contract Document. The Consultant may in his absolute discretion and from time to time issue further drawings, details and / or written instructions, written directions and written explanations in regard to:

Variation or modifications of the design.

The quality or quantity of works or the additions or omissions or substitution of any work.

Any discrepancy in or divergence between the drawings and / or specifications.

The removal and / or re-examination of any works executed by the Contractor.

The dismissal from the works of any persons employed thereon.

The opening up for inspection of any work covered up.

The amending and making good of any defects under defects liability period.

The removal from the site of any material therefore.

Assignment and sub letting.

Delay and extension time.

The postponement of any work to be executed under the provision of this Contract.

Dismissal

The Contractor shall on the request of the Director IITM Pune / Consultant immediately dismiss from the works any person employed thereof by him who may in the opinion of the Director IITM Pune / Consultants be incompetent or misconducts himself and such person shall not be again employed on the work without the permission of the Director IITM Pune / Consultant

SPECIAL CONDITIONS OF CONTRACT

Temporary/ Construction Power Supply: - Contractor shall arrange *at his own cost* arrangement for temporary power and distribution of the power to his equipments. Contractor shall properly document inward of such equipments and shall take permission from client while taking out. Contractor shall remove all wires, sundry materials, etc. after completion of works and clear the site. However power supply for lighting of site can be availed from Director IITM PUNE existing connection.

Drinking Water supply: - To be arranged by contractor.

Material storage on site: Contractor shall create a lockable facility on the site at his own cost & shall provided his security service round the clock for the materials under his custody. The client shall not remain responsible for any theft, misuse by other agencies or damage due to improper stacking, loading etc in any case.

Completion Period – Completion period shall not extend 120 days from the date of LOI.

Validity of bid – Bids shall be valid up to end of the project or for a period of twelve months maximum from the date of submission of bids. Other escalations shall not be entertained during the execution.

Declaration: Contractor shall have to submit declaration to the client that "There is no Legal Case pending against Bidder, the process of which may affect Progress/ execution of contractual work to them".

Bidders shall note that the quantities mentioned in the BOQ are tentative; contractor shall not directly buy the material without the actual measurement on site. Wastages or surplus material claims thereafter shall not be entertained in any case & only erected quantities shall be paid after certifications.

COMMERCIAL CONDITIONS OF CONTRACT

The prices quoted shall include all taxes and duties, Octroi, and any other taxes that may be levied on supplied materials and installation work as per prevailing tax structure at the time of delivery of items.

Payment Terms for Supply and Erection of items:

Agreed PAYMENT Terms with Electrical Contractor-

1. **60% of supply value against supply of material at site.**
2. **15% of supply value & 75% of labour value on installation.**
3. **20% of supply & installation value against testing & commissioning.**
4. **Balance 5% payment can be release on submission of Bank guarantee from Indian Nationalizes Bank of equal amount valid for 12 month from the date of virtual completion certificate.**

SECTION-E

SAFETY REGULATIONS

The contractor shall at his own expense, arrange for the safety provisions as per the codes of Indian Standard Institution, Indian Electricity Act / Rule and such other Rules, Regulations and Laws as may be applicable in respect of all labour, directly or indirectly employed in the work for performance of the Contractor's part of this agreement. While the Indian Electricity Rules 1956, as amended up to date, are to be followed in entirety, any installation or portion of the installation that does not comply with these Rules, should be rectified immediately.

The contractor shall be responsible for and indemnify the buyer against all injury to persons – both his own workmen and others and for all damage to structural and / or decorative part of the buyer's property during erection and commissioning of the equipment. The contractor shall repair / reinstate all such damage at his own cost.

It shall be ensured that the control switches and distribution boards are duly marked, the distribution diagrams of substations are prominently displayed, and the substation premises, main switch rooms and D.B. enclosures are kept clean. Particular care should be taken to prevent the substation being used as store for inflammable materials, broken furniture, waste materials etc.

No inflammable materials shall be stored in places other than the rooms specially constructed for this purpose in accordance with the provisions of the Indian Explosives Act. If such storage is unavoidable, it should be allowed only for short period and in addition, special precautions such as cutting off supply such places at normal times, storing materials away from wiring and switch boards, giving electric supply for a temporary period with due permission of engineer- in charge shall be taken.

Protective and safety equipment such as rubber gloves, earthing rods, line men's belt, portable respiration apparatus, necessary number of caution boards such as " Man on Line", "Don't switch on" etc should be provided in easily identifiable locations. Where electric welding or such other nature of work is undertaken, goggles shall be provided.

Rubber or insulating mats should be available in front of the main switchboards or any other control equipments of medium voltage or above.

Standard first Aid boxes containing materials as prescribed by the St John Ambulance or Indian red cross should be provided in easily identifiable locations and should be easily available.

Periodical examination of the first aid facilities and protective and safety equipment provided should be undertaken and proper records shall be maintained for their adequacy and effectiveness.

Charts (one in English and one in regional language – Marathi) displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently displayed at appropriate places.

A chart containing the names, addresses and telephone numbers of nearest authorized medical practitioners, hospitals, fire brigade and also officers in charge shall be displayed prominently along with the first Aid box.

Steps to train supervisory staff and authorized persons of the engineering staff in the first Aid practices, including various methods of artificial respiration with the help of local authorities such as fire brigade, St. John's Ambulance Brigade, Indian Red Cross or other recognized

institutions equipped to impart such training shall be taken, as prompt rendering of artificial respiration can save life at the time of electric shock.

Electrical wiring and control switches should be periodically inspected and any defective wiring switches which will expose live parts should be replaced immediately to make installation safe.

No work on live L.T. bus bars or pedestal switch boards should handled by a person below the rank of a wire man and such a work should preferably be done in the presence of the Engineer in charge of the work.

When working on or near live installation, suitable insulated tools should be used, and special care should be taken to see that these tools accidentally do not drop on live terminals causing shock or dead short.

The electrical switchgear and distribution boards should be clearly marked to indicate the area being controlled by them.

Before starting any work the existing installation, it should be ensured that the electric supply to that portion in which the work is undertaken is preferably cut off. Precautions like displaying "Men at Work" caution boards on the controlling switches, removing fuse carrier from these switches and these fuse carriers being kept with the person working on the installation, etc, should be taken against accidental energization. "Permit to Work" should be obtained from the Engineer-in-charge. No work on H.T. main should be undertaken unless it is made dead and discharged to earth with an earthing lead of appropriate size. The discharge operation shall be repeated several times and the installation connected to earth positively before any work is taken up.

Before energizing any installation after the work is completed, it should be ensured that all the tools have been removed and accounted and no person is present inside any enclosure of the switchboard. Any earthing connection made for carrying out the work should be removed. "Permit to work" should be received back duly signed by the person to whom it was issued in token of having completed the work and the installation being ready for energisation and "Men at Work" caution Boards removed.

In case of electrical accidents and shock, the electrical installation on which the accident occurred should be switched off immediately and the affected person should be immediately removed from live installation by pulling him with the help of coat, shirt, and wooden material or with any other dry cloth. He should be removed from the place of accident to a nearby safe place and artificial respiration continuously given as contained in BIS code and standard prescribed by St John Ambulance Brigade or Fire Brigade.

While artificial respiration on the affected person is started immediately, help of Fire Brigade and Medical Practitioner should be called for an artificial respiration should be continued uninterrupted until such help arrived.

These instructions should be explained in Hindi / local language to those staff who does not understand English.

The contractor shall ensure that all portable power tools used by the workman are rated 230 volts, double insulated and have to taken through 100 mA Earth Leakage Circuit Breaker (ELCB). Also all temporary lighting shall be supplied through 30 mA ELCB. Inserting wire into the sockets without the plug tops is not allowed. The length of the extension cord for portable tools should not be more than 5 feet. Temporary cables and flexible wires of short length should be bunched up and supported at inaccessible height. Temporary lamps should be mounted at inaccessible height. If lamps are incandescent, they should be protected by wire-mesh.

All power supply / Distribution Boards shall have canopy for protection against weather if located outdoors.

While carrying out work in Vessels / AC ducts or any other confined place, hand lamps with metallic guard suitable for 24 Volts AC supply shall be used All non-current carrying metallic parts of electrical system and equipment shall be earthed with two separate earthing wires of adequate capacity.

GENERAL RESPONSIBILITY

The contractor shall obtain a "Work Permit" from the Site Engineer / Client before starting any work at site. The work permits are issued to prevent any one working in unauthorized areas and they are valid for specific period.

The contractor shall produce test certificates from Government approved certifying authorities for all the lifting gear & hoists (slings, chains, hooks, chain pulley blocks, winches, cranes etc) before starting the work. The contractor's supervisor for subsequent spot checks shall retain the certificates.

The gas cylinders should be used in safe manner. They should not be dropped from heights. Acetylene cylinder should be kept upright position. Oxygen cylinders should not be kept near inflammable materials like oil etc.

The contractor is to remove all waste materials from and around the work site and leave the work spot spick and span.

HOT WORK

Before carrying out any hot work (gas cutting, welding etc) the contractor shall contact the site-in -charge to ascertain about the safety of the area for welding work.

For welding work DC Generator sets are to be used instead of AC transformer sets.

The contractor shall produce certificates for his welding sets checked by the site in charge of consultant before starting the work. The certificates shall have to be renewed every two months. A copy of the current certificate shall be displayed on the welding sets.

Only cables in good condition and insulated holders are to be used. The length of the supply cable shall not exceed 25 feet and the welding set body shall be properly earthed. Under no circumstance building structure pipeline should be used as a return path of the current.

A charged fire extinguisher of CO2 type is to be carried with each welding set.

The welder is to wear good quality insulated welding gloves, shoes & goggles while at work.

Tarpaulins are not be used in the vicinity of welding / gas cutting jobs.

EXCAVATION

In the event of an excavation being made, it is the responsibility of the contractor to see that any opening, sump or pit caused by them is securely fenced as required by the Factory Act.

WORKING AT HEIGHT

For carrying out work at heights exceeding 6 feet or over and near the opening in floors, roofs, etc the following precaution to be taken.

The written permission of the Departmental Manager is to be taken before carrying out any work. Adequate safety precautions like use of safety belts, crawling ladders etc are to be taken.

All personnel engaged on overhead work shall be men experienced in such work.

Whenever possible timber staging or platform shall be erected with planks of minimum thickness 2 inches and minimum width 12 inches when the nature of work demands staging of a greater width than plank provided then additional planks shall be added and lashed securely.

Staging shall be provided with simple safety rails or ropes throughout its length, at waist height and on each open side.

Staging supports shall be of standard steel scaffolding safely secured and supported on firm level footings or slung from overhead beams. The supports shall be situated at a maximum distance of 8 feet apart and staging shall be secured to each support.

In case the site or nature of work is unsuitable for erection of proper staging all workers shall wear safety belts around their waists and secure their lifelines to strong scaffolding or structural members.

Wherever it is not possible to put up staging and / or use safety belts, safety nets or sheets shall be slung beneath the place of work.

When working in open process vessels or tanks, safety belts or safety nets shall always be used whether or not staging and scaffolding is provided.

Safe access to all points of work should be provided in the form of suitable ladders, stairways etc.

Contractor's employee of at least status of a foreman shall examine all arrangements before starting such work is commenced and shall satisfy himself that all reasonable safety precautions have been taken.

FIRE INSTRUCTIONS

Before carrying out any hot work (gas cutting, welding etc) the contractor shall contact the site-in -charge to ascertain about the safety of the area for welding work.

Smoking is strictly prohibited in factory premises. Severe action will be taken if any of the contractor's workmen is found smoking at the work site area.

In case fire is discovered, dispatch additional force & site Engineer. Wherever possible switch off any electrical and gas apparatus near the fire.

Check the nature of fire, pick up appropriate fire extinguisher and try to put out fire. For Electrical fire use carbon dioxide fire extinguisher.

PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment should be worn wherever necessary.

REVIEW MEETINGS

Periodic safety review meeting shall be conducted to review safety and for better coordination with other agencies.

Periodically safety review will be held with Site Engineer and issues will be discussed and action points shall be monitored and recorded in a separate safety Register / File.

SAFETY AUDITS

Periodic safety audit shall be carried out by CONSULTANT. The interval between the safety audits shall be discussed with Site Engineer / safety Officer.

WORK AFTER NORMAL WORKING HOURS

Extra care need to be taken for jobs being carried out after normal working hours with due revalidated work permit.

ACCIDENTS

In case of injury or serious illness, the department should be informed immediately. All injuries are to be reported by filling in the "injury report" form, which will be available with the respective department / site engineer.

These safety conditions should not be regarded as exhaustive. These have been issued for the guidance of the contractor and will not in any way absolve the contractor from any obligations or liabilities that might incur or transfer such obligations on liabilities to the company.

SECTION-F
TECHNICAL SPECIFICATIONS

1. **This specification covers in brief the requirements for the installation, related LT power & control Cable works, earthing, Transformer installation and the downstream installation. It is not the intent to specify herein all the details of material, equipment, installation, testing and commissioning; however the same shall be of high standard of engineering and shall comply to all currently applicable Standards, Regulations and Safety Codes, Maharashtra State Electricity state Board practices. Also it is not possible to specify the quantity of every item, but it is Bidders' responsibility to execute the job with recommended engineering practices in best workable manner. Material specification for major equipment such as HT Panel, LT Panels, Transformer, DG, UPS, LT Panels, Cables etc. shall be issued separately provided these are part of contractor's scope of supply. The same shall be confirmed by contractor in writing with client/ consultant prior to material procurement.**

2. **Necessary clearances such as- horizontal clearances from structures/live conductors/building, vertical Clearances from ground, span, sag etc. as per I.E. rules and other statutory Requirements shall be followed. The drawing furnished along with tender is indicative and contractor to prepare working details.**

3. **Necessary correction in 'tender Bill Of Quantities' and rates thereof shall be carried out as the final arrangement is decided, in such cases rates shall be derived from unit rates quoted or as per 'rate analysis' submitted by contractor and evaluated by CONSULTANT / DIRECTOR IITM PUNE.**

4. **LT Switchgear Panels, Power and Lighting DB and Control Panel.**

5. **This shall be applicable to switchgear panels, power and light distribution boards, instrument distribution boards, DCDB, control panel, etc. Manufacturer's instructions, drawings and instructions of the Engineer-in-Charge should be studied and strictly followed during handling, erection, testing and commissioning of the switchgear. The panels should be handled with care, avoiding impact to the equipment, by the experienced riggers under the guidance of a competent supervisor. Dragging of the panels should be avoided and use of a crane and trailer should be made for the handling purpose while transporting to various sites. The panels should be properly supported on the truck or trailer by means of ropes to avoid any chances of damage or tilting due to heavy vibrations. The panels should be lifted by making use of lifting eye-bolts only, fully tightened after ensuring that panel supports, nuts and bolts are all intact and tightened. When lifting panels, utmost care should be taken to avoid any damage to insulators, bushings, metering and protective equipment. The panels should be preferably kept inside the cases till foundations are ready.**

6. **The panels should be taken out from the packed cases and moved one by one to the proper place. All the panels should be assembled, aligned and levelled and it should be ensured that panel to panel coupling bolts, busbar links fit properly without any strain on any part. It should also be checked-up that lowering, lifting, racking in and out operation of the breaker and all other motions are free from any obstruction. The fixing bolts should be grouted only after satisfying all these requirements. All Switchgear of any other equipment supplied & installed by contractor shall be tagged with engraved name-plate indicating device no & the source of supply panel.**

7. **The panel erection will consist of the following:**

   Placing the panels on the foundation, aligning and grouting / tak welding to supporting structure wherever possible. Levelling shall be within ± 1 mm with respect to the level specified. The panels shall be made vermin and dustproof with M-Seal for Interpanel joints as directed by CONSULTANT/Client. Checking the equipment for any apparent damages and

informing the Director IITM Pune. Measuring the insulation resistance value and improving the same, if required by approved methods.

Checking the control circuit for operation, interlock, indication with only control supply 'ON' and all control connections made.

Checking the name-plate details of the feeders as per drawings.

Checking the bimetal relay ranges for the motors and setting the relay at full load current stated on the motor name-plate.

Dressing and clamping of cables inside the equipment.

Cleaning the equipment with vacuum cleaner before energising.

Pre-commissioning tests like continuity checking, megger, interlock checking, direction of rotation of motor, operation of motors from various control points.

Painting the cable numbers on the respective compartments (near terminal block)

Tightening the busbar / link connection and checking connections at terminal block. Draw out modules shall be taken out if required.

Pasting the vendor wiring diagram reference on compartment door (inside).

Checking the mechanical operation of all switches, circuit breaker and similar items and the door interlocking arrangement.

Connecting the earth busbar of the equipment to the main earthing ring and painting the same green for easy identification.

Checking the measuring and indicating instruments for operation.

Plugging the unused cut-outs for cable glands in the equipment after completing the cable connections.

Touch-up painting of panels, wherever required.

Checking of all Components in Feeders with respect to vendor SLD and Bill of Material.

Prior to Panel hand-over, all feeder Nos. & description shall be provided on new engraved name plates in place of old ones.

CABLES

Cables shall comply with the latest editions of following standard, as applicable,

BIS : 1554 Part 1 PVC insulated electric cables (Heavy duty)

BIS: 7098 Part 2 Cross- Linked Polyethylene Insulated PVC sheathed cables

BIS : 8130 Conductors for insulated electric cables and flexible cables

1.1 KV grade cables: All LT power cables shall be 660/1100V grade, with aluminium conductor for size 10 Sq.MM and above. Power cables of sizes up to 6 Sq.mm. shall be with copper conductors

Construction

- Conductor – Shall be solid up to and including 6 Sq.mm. and stranded above 6 Sq.mm.Conductor shall be as below –
  a) Copper conductor – Stranded, class2, as per IS 8130

- AL conductor - Stranded, grade H4, class 2 as per IS 8130
- Insulation- Conductor insulation shall be of extruded PVC compound type
- Inner Sheath –extruded, black, PVC compound type ST-1
- Armour - made up of Al. strip / or single G.I. strip / G.I. wire
- Outer sheath- extruded, black, PVC compound type ST-1
-

33kV Earthed Grade XLPE cables

Cables shall have following construction:-

- Conductor – AL conductor - Stranded ,grade H4,class 2 as per IS 8130
- Conductor Screen – Extruded semi conducting compound in combination with non- magnetic metallic tape and XLPE compound insulated
- Inner Sheath – Extruded black PVC compound type ST-2
- Outer Sheath – Extruded black PVC compound type ST-2
- Armour - Steel strip Al / G.I.
- Cores shall be identified by Printed numerals of Phase.
- Voltage rating will be 22kV Earthed.

Tests

- All routine tests as per relevant IS shall be carried out on each size of cable required for the project.
- The manufacturer will furnish type test certificate.
- In addition to above mentioned test the cables shall be subjected to following tests:-
  Water tightness test.
  Saline bath test (in accordance with CEGB recommendations 628)
- Inspection of cables will be held at the manufacturer's works at following stages:
  During manufacturing process while applying insulation.

  Final inspection for carrying out tests.
- The copies of routine and type tests shall be submitted at least one week prior to final inspection.

Cable Drums

- Cables shall be supplied in non-returnable drums of sturdy construction. All ferrous and other metal of drums shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage.
- The length of cable on each drum shall be determined by the manufacturer considering the transport limitations from manufacturer's works to the site.
- The cut ends shall be sealed by means of non-hygroscopic sealing materials.
- The cable drum shall be marked with following information :-
  a) Trade name

b) Cross sectional area of the cable with no of cores.
c) Voltage grade and type of cable.
d) Lengths of cable, weight of cable drum including cable.
e) Direction of rotation of drum by arrow marking.
f) IS certification mark.

- Manufacturer shall indicate the maximum length for each size of cable, which can be furnished on one drum. However, before packing the cables on drums, the successful manufacturer shall obtain purchasers' approval for the drum length.

Cable Accessories

- Manufacturer shall include in his offer, the equipment and materials required for making cable splice and cable terminals. Full details of the splicing and terminating procedures shall be given by the manufacturer.
- The total creepage distance of the outdoor porcelain insulators of cable sealing ends shall be suitable for heavily polluted saline atmosphere and shall in any case not be less than 25 mm per KV of highest line to line voltage. The protected creepage distance shall be half of the total creepage distance. The insulators shall be washable under live conditions by hot line washing equipment.

Information to be given by manufacturer

In addition to the standard information, the manufacturer shall provide the following information with the offer.

Detailed drawings with dimensions of the cable and all accessories including

Cross sectional view of cable, indicating the material used in each type of construction.

Splices, straight joints and trifurcating boxes.

Terminations, showing mounting arrangement

Complete specifications of covering used to protect sheath and reinforcing tapes from corrosion.

Describing information regarding cable and accessories and test of installations of similar cables now in service with description, cable performance, and outages suffered and cause of outages.

Recommended method for locating conductor faults, apparatus required for locating the faults and their price.

Transporting the cables from stores to place of installation. The drums under the custody of the contractor shall be neatly arranged in the yard near his site office. The drum shall not be rolled for transportation more than 10m Truck / Trailer shall be used for transportation for distance more than 10m.

The cables shall be rolled out for equipment and cutting shall be as per site requirement. Cable jacks and cable rollers shall be used during laying of cable.

Electrical Contractor shall cut all cable length by actual measurement at site as per final route determined. Cable lengths indicated in Cable Schedules shall be used only to get an idea of length involved.

The cables shall be tested for insulation value before laying. Drum Schedule to be prepared by contractor.

The Cables shall be laid in trenches, trays, along walls or structural support as per the requirement. The cables shall be neatly laid and clamped. The crossing of cables shall be avoided. The arrangement of cables on the tray / trench shall be decided based on the cable schedule and layout drawings and shall be approved by the CONSULTANT/Client.

Clamping of cable shall be done by 18 SWG thick aluminium clamps at an interval of 0.5 mtr. for vertical run and 1 mtr. for horizontal run. When cables are cleated on wall / structures, the spacer and saddle shall be used at 300 mm interval or less depending on the location and shall be approved by CONSULTANT/Client.

The cable terminations shall be done as per standard practice and crimping type of terminations shall be considered.

The glanding shall be done with suitable arrangement for earthing the gland. Wires / sleeves required for effectively earthing the glands shall be included in the termination materials.

The unused cores of the multicore cables shall be properly taped.

The tag carrying the cable number shall be at interval of 20 mtr. for underground cable and 30 mtr for above ground cable and at all bends and route changes of the cable run. Material of tag will be aluminium for above ground cables and of lead for buried cables. Sample of tags shall be approved by CONSULTANT/Client.

The cable numbers shall be painted near the terminal blocks in MCC / Distribution Boards / Switchboards.

For main power cables loops shall be provided near terminations.

All cables coming from floor / trench shall be taken through a G.I. Pipe. The length of the pipe shall be decided by the contractor and approved by the CONSULTANT/Client.

The glands supplied by the contractor shall be suitable for cable sizes mentioned and if necessary reducers shall be provided by the contractor. The contractor shall indicate the requirement of reducers and supply the same after approval of rates by Director IITM Pune.

The contractor shall supply and install the ferrules for multicore cable connections. The ferrule markings shall be identical to the wires connected to the terminals.

The Lugs used shall be tinned Copper for Copper Cable and Aluminium Lugs for Aluminium Cable, crimping type of reputed make. The Lugs used for multistrand control cable shall be PVC sleeved crimping type copper lugs.

The connections between the junction boxes/control panels to components like pressure switches, limit switches shall be through flexible conduits. The length of each of the flexible conduit shall not exceed 120 cm.

The cables coming from switchboards to the cable tray shall be taken through branch trays and the cables shall be clamped neatly. The arrangement shall be approved by CONSULTANT/Client.

Main cable runs are to be routed as shown on the contract drawings. Any modifications found necessary due to site conditions must be approved by CONSULTANT. Details of routes not shown on these drawings are to be determined on site by discussion with CONSULTANT/Client.

PVC insulated and / or served cables shall not run parallel within 100 mm of, or be installed above and in line with, any heated pipes or duct. Where crossing above heated pipes or ducts is unavoidable the cable must be kept at least 150 mm from the outer surface of such pipes or ducts or the insulation thereof.

On main horizontal cable runs where cables are supported, suitable mild steel saddles, cleats or clips shall be used. Between these fixing points cables shall be laid neatly in position on the intervening racks. On vertical cable runs and horizontal runs other than the main horizontal runs, cables shall be fixed at one metre intervals. Where different sized cables are together the maximum fixing intervals are to be those required for the smallest cable, unless the smaller cables are bunched with larger cables and supported by them throughout the complete multi-cable run.

NOTE: Where the contract drawings indicate that the cables are to be run or fixed other than in accordance with this specification, the drawings shall be deemed to be correct.

Cable run in RCC trenches are to be run on the floor along the sides on suitable brackets and located 75 mm minimum from floor of trench. Cable ducts in the ground shall be sealed against the ingress of water, foreign matter and vermin, at both ends by means of non-setting compound and / or suitable wood plugs fitted over the cable and into the duct. Where ducts are not in use they shall be sealed in a similar manner.

Cables laid direct in the ground shall be laid on a bedding of 150 mm of sand and covered by 150 mm layer of sand, on top of sand tiles / bricks covering to be done. The depth of laying shall be such as to provide 750 mm minimum cover for low voltage cables and 1000 mm cover for high voltage cables.

All non used open entries in equipment and open ends of conduit are to be sealed by means of conduit plugs (or blanking plates if entries are not of standard conduit sizes) at all time.

<u>NOTE</u>: This is particularly important where equipment is located in position, but electrical installation is incomplete.

Where cables pass through floors, they shall be protected by metal / PVC pipes or other suitable means. Holes in floors, walls, etc. will be made and reinstalled by the contractor unless otherwise stated.

All cables laid underground shall be protected with good quality brick and interlocked concrete tiles marked "Electric" or "Telephone" cables.

Cable joints shall be mechanically and electrically sound and except for buried cables they shall be accessible for inspection. Underground joints shall be specially protected with a double layer of bricks and cast iron joint markers (marked 'Cable-Joint'), shall be installed to indicate the position of the joint.

Where corrosion of armour or gland might occur, it shall be effectively protected by suitable means.

The contractor shall test all cables for proper insulation before they are transported for laying and shall furnish a certificate of acceptance to this effect. Any damage to the cable subsequently shall be made good by the contractor at his own cost. After the test of insulation, the cut ends of cables shall be sealed properly with waterproof material to prevent ingress of moisture.

Cable Marking

All Cables shall be externally marked at either end with the respective identification numbers by means of non-deteriorating material. Cable Markers shall be approved by CONSULTANT/Client.

Where conductors are left to be terminated by another party or left to be connected later, they must be individually identified.

Heat Shrinkable Type H T Cable Termination Kits

Cable termination kits shall be outdoor or indoor type as specified in the BOQ.

These kits shall be of PVC heat shrinkable type only. Compound Filling type termination kits are not acceptable.

Cable termination kits shall be suitable for XLPE cable of given size.

Voltage grade Of the kit shall be considered as EARTHED type that is 33 kV (E)As per cable voltage grade.

Cable Glands

When preparing cables prior to fitting glands, the gland manufacturer's instruction for cable preparation shall be observed. In all cases where armoured cables are used care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.

Where compound boxes are used for terminating cables, the compound must penetrate fully and leave no air holes. Where hot pouring of compound is employed, 'topping up' must be carried out as soon as possible after the first filling. The pouring temperature of the compound must not be high enough to damage the cable insulation.

All terminations of paper insulated cable shall incorporate damp barriers in each conductor. The insulation shall be removed to leave approximately 15 mm to 20 mm of the conductor exposed, and the conductor shall be soldered at this point.

The preferred method of terminating conductors is by means of solder less compressed connectors. Deviations from the above shall be subject to approval of CONSULTANT/Client.

Connectors shall be of the correct size for the conductor concerned and as manufactured by Dowell's or approved equivalent.

All connectors shall be marked with the size reference for identification with the correct compression tool. This reference shall be located on the palm of the connector and shall be remote from the contact faces where possible.

The palm of the connector shall be of such shape and size that standard washers to relevant IS applicable to the size of stud for which the connector is designed shall lie flat on both faces of the connector palm when the holes in the washers and the palm are co-incident.

Compression tools shall be designed and supplied for specific use with the connectors used, and shall be regularly services by the maker.

LT PANELS

Construction

- The switchboard shall be totally enclosed, metal clad, sheet steel fabricated, compartmentalized, dead front type, dust and vermin-proof, freestanding, floor mounting type. It shall be of unit construction suitable for splitting into sections for shipping to site and to be correctly re-erected on prepared foundations without skilled supervision. The individual shipping section length shall not preferably exceed 2 metres. Provisions shall be made for addition of future units on either ends of a switchgear line-up after its installation on site. End busbar fishplates shall be provided.

- The switchgear shall be easily extensible on either side by the addition of vertical sections. It shall be possible to extend the switchgear, irrespective of the type of end panel and the design shall be such as to permit addition of extension panels of a type other than the type of end panel. Any adapter panels required shall be included in the basic price and indicated clearly in the technical particulars furnished.

- The switchboard shall be fabricated preferably from cold rolled sheet steel of minimum thickness 14/16 gauge.

- The height of the switchboard shall be constant throughout its length, but not exceeding 2400 mm.

- Adequate lifting facilities such as hooks for ease of handling on site shall be provided. These hooks when removed shall not leave any openings in the switchgear.

- Front access shall be available to all components in each cubicle, which require adjustment, maintenance or replacement. Checking and removal of components shall be possible without disturbing adjacent equipment. All auxiliary equipment shall be easily accessible. Setting of relays shall be possible without de-energizing other equipment.

- Rear access shall be available to all cable glands and multicore terminal blocks by means of sheet steel hinged doors, designed to give the maximum possible access to the cable terminations. The cable alley door shall be provided with bolts, which can be opened with special keys by authorized persons.

- Each unit of switchgear shall have necessary interior barriers to form separate compartments for buses, switching devices entering cable connection etc. All barriers shall be manufactured from non-inflammable material, preferably of sheet steel.

- **Each compartment shall be constructed and segregated to confine any damage caused by an internal fault to that compartment.**

- **Adequate barriers shall permit personnel to work safely within an empty switching device compartment or one from which the switching device assembly has been temporarily removed with bus energized.**

- **The arrangement of feeders in the switchboard shall take into consideration the number and size of cables required for the feeders.**

- **The arrangement of the feeders shall ensure that operating handle of the switch / breaker shall be above 300 mm but below 1800 mm from ground level.**

- **Removable type undrilled gland plates shall be provided on bottom of the panel. Gland plates shall be 3 mm thick sheet steel.**

- **Suitable provision shall be made for clamping cables inside the switchboard.**

- **The cable terminations inside the cable alley shall be completely shrouded so that it shall be possible to work on any one of the terminations by switching OFF the corresponding feeder switch only.**

- **All bezels, handles, screws, bolts, washers, hinges and other embellishments shall be of the best quality electro galvanized or passivated to withstand attack from corrosive atmosphere.**

- **The fabricated parts shall undergo a treatment of degreasing, pickling and two coats of primer before being given the stoved enamel finish. The final finish shall be of colour shade 631 as per IS-5 or RAL-7032. Two coats of final paint shall be applied. Proper care shall be taken to grind the welded joints to give a smooth appearance after painting.**

- **The external finish of the board shall be of the highest standard.**

- **The external and internal surface of the board shall be stove enamelled finish unless otherwise specified.**

- **Adequate packaging against damage and deterioration shall be provided for transportation to site and subsequent storage prior to re-assembly.**

- **Horizontal busbar chambers shall be at the top of the board. Busbars shall be completely shrouded to prevent metal pieces falling on the busbar during maintenance.**

- **The busbars shall be of aluminium with continuous rating as given in the SLD. All busbars and their main current carrying connections shall have preferably the same sectional area throughout their length. The busbars shall be colour coded.**

- **The busbar sizes shall be determined taking into consideration the continuous rating without exceeding the final temperature of 45o C over maximum ambient temperature and the fault level specified. The busbars shall be supported by insulators on non-carbonizing material resistant to acid and alkali and having non-hygroscopic characteristics and braced to withstand the fault level specified.**

- **Auxiliary busbars each of minimum size 18 sq mm copper shall be provided for following applications. Exact number of busbars shall depend on various control, metering and auxiliary power distribution requirements specified in specific requirements.**

  1. **Panel / Motor space heater supply.**
  2. **AC / DC control supply for breaker tripping closing and indication circuits.**
  3. **AC / DC control supply for breaker spring charging motors.**
  4. **AC control supply for motor starter control and indication circuits.**
  5. **AC potential supply for KWH meters.**

- **Earthing - Two earth terminals shall be provided on each switch cubicle, at the back, near the floor. An earth bar of at least 50 x 6 mm copper shall be fixed to these terminals. The earth bar shall be electrically continuous and shall run the full extent of each board. Each unit shall be constructed to ensure satisfactory electrical continuity between all metal parts not intended to be alive and earth terminals of the unit. Suitable holes with bolts and lugs shall be provided at each end of earth bar of switchgear for connection to a main earthing grid of 50 x 6 mm GI bus. The earth bar shall be accessible in each cable entering compartment either directly or through a branch extension to ground the cable armour and shields.**

- **Busbars and connections shall be secured in such a manner that the insulators are not subjected to bending forces under short circuit conditions. The vertical dropper shall be sized to carry continuously at least the rated current of the connected switching devices. When multiple switching devices are combined in tiers for a vertical unit, the droppers shall be able to carry the total current resulting from the combination of all switching devices. The vertical busbars shall be completely shrouded with the cut-out for connection tappings.**

- **In case of copper to aluminium connections, proper treatment shall be given to minimize the bimetallic effect. That is, all joint surfaces at aluminium to copper joints shall be silver / tin plated, alternatively Cu-Al. washers (bimetallic washers) may be used.**

- **Any unused circuit breaker compartment shall be fully equipped and provided with compartment door, vertical bus bars and control terminals / wiring, etc., such that the same could be used for housing outgoing breakers in future without any modifications to the panel. All quotations must indicate the number of circuit breakers, which could be provided in unused space for each switchboard line up. Unit price for providing such outgoing circuit breakers shall be quoted which could be considered during placement of order.**

- **The arrangement of feeders in the switchboard shall take into consideration the number and size of cables required for the feeders.**

- **Incomer and Bus Coupler ACB shall be limited to one per panel.**

- **Nameplate or polyester adhesive stickers shall be provided for each equipment (lamps, push buttons, switches, relays, auxiliary contactors,**

etc.) mounted on the switchboard. Special warning plates one each on each front of a shipping section shall be provided on removable covers of doors giving access to cable terminals and busbars. Special warning labels shall be provided inside the switchboard also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.

- **Engraved nameplates shall preferably be of 3 ply (Black-White Black) lamicoid sheets or anodized aluminium. Nameplates shall be fastened by screws and not by adhesives.**
- **ACB feeders for outgoing shall be limited three per panel subject to Director IITM Pune approval on GA diagram.**
- **SFU feeders for outgoing shall be limited to three per panel.**
- **The feeders shall be arranged in the ascending order of alphabets followed by ascending order of equipment, e.g. A33801, M3402, and P211.**
- **Manufacturer shall furnish the general arrangement drawing of switchboard along with the quotation. The General Arrangement drawing of switchboard shall be subject to Director IITM Pune approval.**

Circuit Breakers

The circuit breaker shall be triple pole, air break, and draw out type with solid manually detachable type neutral. Unless otherwise stated elsewhere, the circuit breakers shall be draw out type.

The charging mechanism of the circuit breaker shall be manual / motor operated spring charged independent type. The close / trip control switch to be interlocked to trip before close. The closing and tripping circuits shall be self-opening on completion of their respective functions irrespective of the position of the control switch. Manual closing devices shall also be provided.

- **The circuit breaker shall be electrically and mechanically trip free.**
- **For all electrical circuit breakers anti-pumping device shall be incorporated.**
- **The breaker shall be provided with minimum 6NO + 6NC auxiliary contacts. 20% auxiliary contacts (Min. 3 NO + 3 NC) shall be provided for Director IITM Pune exclusive use. All spare contacts shall be wired upto terminal blocks. Auxiliary contactor or relay shall be used to multiply contacts.**
- **The auxiliary contact for the shunt trip shall be of advanced nature such that the auxiliary contact close before main contacts.**
- **The main and secondary isolating contacts of the circuit breaker shall be of self-aligning type.**
- **The main isolating contact shall have continuous rating equal to the rating of the breaker.**
- **The secondary isolating contact shall be of wiping contact type.**

- **The fixed portion of the circuit breaker shall have rail arrangement over which the chassis can move smoothly.**
- **It shall be possible to bring the circuit breaker to isolated position with the help of external lever without opening the compartment door.**
- **The breaker shall have 3 distinct positions, such as "SERVICE", "TEST" and "ISOLATED".**
- **Proper mechanical indication shall be provided to locate these three positions without opening the compartment door.**
- **It shall be possible to further withdraw the breaker from isolated position for inspection of the circuit breaker "withdrawn" position.**
- **A stop block shall be provided on the slide rails to prevent the forward movement of the circuit breaker when it reaches the isolated position so that any accidental fall can be avoided. Provision shall be provided to padlock the breaker in all the three positions.**
- **The following interlocks shall be provided on the circuit breaker:**

  1. **It shall not be possible to withdraw the circuit breaker from the service position with the contacts of the breaker closed.**
  2. **It shall not be possible to close the circuit breaker unless any one of the three positions is located, the service position, a definitely located test position, or isolated position.**
  3. **It shall not be possible to open the compartment door when the circuit breaker is ON.**
  4. **It shall not be possible to push breaker in if either set of safety shutter is not free and not in its normal closed position.**
  5. **The circuit breaker can be padlocked in OFF position.**
  6. **The castle interlocking shall be provided as per the SLD.**

- **The circuit breaker shall be provided with mechanical ON/OFF, TRIP and SPRING CHARGED indication, mechanical trip push button, operating handle or `close' push button, in case of electrically operated circuit breaker and padlocking facility wherever specified.**
- **In case of electrically operated breaker, emergency operating handle shall be provided.**
- **It shall be possible to close the circuit breaker with the emergency operating handle without opening the compartment door.**
- **Wherever cutouts are provided for the control box, proper gaskets shall be provided. Provision shall be made for closing the cutout provided for the control boxes when the C.B. is taken out of the compartment.**
- **The circuit breaker shall be provided with automatic safety shutters, so that before the breaker reaches `isolated' position the main isolating contacts are completely shrouded.**

- **The circuit breaker compartment shall be so designed that hot gases produced shall be lead away from the operator.**
- **The protective relays and instruments shall be mounted as near to the circuit breaker as possible. Separate compartment for the instruments and relays shall be provided.**
- **When the circuit breaker compartment door is open, it must not be possible to touch the live parts.**
- **All removable covers protecting live parts shall be clearly labelled with warning notices reading "LIVE PARTS. ISOLATE ELSEWHERE BEFORE REMOVING COVER'.**
- **It shall be possible to readily remove the arc chutes for routine inspection of the contacts with the circuit breaker in the "withdrawn" position.**
- **All circuit breakers of same rating shall be identical in all respects and shall be interchangeable.**
- **All the non-conducting metal parts of the circuit breaker trolley shall be bonded together and shall make perfect electrical connection to earth through substantial sliding contacts, at service and test positions. Such sliding contacts shall be arranged to make before power plug in and interrupt after power draw out.**

Switches –

- **The switches shall be quick-make, quick-break heavy-duty type.**
- **The switches shall be able to make and break 300% of the rated current at 0.3 P.F. as required by IS-4047.**
- **The operating handle shall be mounted on the door of the compartment housing the switches. The switches shall be provided with an interlocking arrangement such that when the switch is ON it shall not be possible to open the compartment door.**
- **It shall also be ensured that closing of the switch when the compartment door is open shall not be possible.**
- **To facilitate closing of switch with door open during maintenance / testing, interlock defeat mechanism shall be provided.**
- **The castell interlock shall be provided, wherever specified in the SLD.**
- **In case of switch fuse feeders, the switch rating shall be equal or greater than the fuse rating.**
- **The switch shall be provided with padlocking facility in OFF position.**
- **All removable covers protecting live parts shall be clearly labelled with warning notices reading "LIVE PARTS. ISOLATE ELSEWHERE BEFORE REMOVING COVER".**
- **Rating of the switches shall be as given in the SLD.**

HRC Fuses

- **Fuses provided shall have rupturing capacity greater than the fault level specified.**
- **Fuses shall be of link type and shall conform to the relevant Indian Standards. They shall be of class 3 AC duty.**
- **Fuses for motor feeders shall be decided taking into consideration bimetal relay characteristics provided.**
- **Rating of the fuses shall be as given in the SLD.**
- **Delayed action fuses shall be preferred for motor feeders.**
- **Indication shall be provided in the fuses to indicate the fuse has operated. Operating indicator shall be visible without removal of fuses from service. Removal of fuses, however, must be possible, although full voltage may exist at the terminals. Fuses shall be pressure fitted type.**
- **Fuse handle shall be supplied along with switchboard.**
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Contactors

The air break contactors shall be of triple pole type. Contactor shall have at least 2NO + 2NC contacts for Director IITM Pune use. The auxiliary contacts shall be wired to the terminals. The contactor coil shall be suitable for control voltage of 230V AC. The coils shall have grade 'E' insulation and shall be suitable for use in the ambient temperature. The design of the contactor shall ensure easy access to auxiliary contacts and coil. Mechanical ON-OFF indication shall be provided for the contactors. Wherever mechanical indications are not provided, indicating lamps shall be provided for ON indication of the contactor. The contactor shall pick up at 85% of the control voltage and shall not drop out for voltage upto 45%. The control voltage for motor starter circuit shall be 240V, single phase, 50 Hz, unless otherwise specified.

Relays

- **The relays shall conform to the requirements of IS-3231 and IS-4483.**
- **All relays specified shall be flush mounted in dust proof cases and shall match the appearance of the instruments mounted on the same panel.**
- **Protective relays shall be of the easy withdrawable type. Trip circuits shall be automatically broken and current transformer secondary circuits shorted, when a relay is withdrawn from its case. A marking strip shall be provided in front of each terminal block and a diagram plate at the back of each case to identify connections.**

- **Relays contacts shall withstand repeated operation and shall make or break the maximum currents in their circuits without deterioration. All spare contacts shall also be wired upto the external terminals.**

- **Relay coils shall carry their normal currents indefinitely and such currents as can occur under fault conditions. Relay mechanisms shall not be affected by vibration or magnetic fields, which may occur in normal operation.**

- **All relays in tripping circuits shall have mechanically operated flag indications. Indicators shall be capable of being reset without opening the relay case. It shall not be possible to operate any relay by hand or to alter its setting without opening the case. For relays with combined functions such as inverse time and instantaneous trip, separate indications of each function as specified shall be provided.**

- **Master tripping relay (Lock-out Relay) shall be of the hand reset type and shall have a reasonable number of spare contacts, both normally open and normally closed, in addition to those required by the protection and tripping scheme.**

- **Provision shall be made for insertion of test plug at the front for testing and calibration using external source of power without disconnecting permanent wiring. Test plugs shall permit the shorting of any current transformer circuit.**

- **Relay covers shall be of non-ignitable materials. Relays on which the function of a contact may be changed from NC to NO and vice-versa by simply changing the contact arrangement are preferred.**

- **All relays pertaining to a feeder shall be accommodated in the same vertical section.**

Bimetal Relay

Bimetal relays shall be heavy duty, (wherever mentioned) ambient temperature compensated type. The selection of bimetal relays shall be based on the absorbed horsepower of motor given in the data sheet. Proper co-ordination shall be ensured between bimetal relay and the back-up HRC fuse provided. The bimetal relay shall be of hand reset type preferably with facility to change to self-reset at site, if necessary. The bimetal relay shall be provided with changeover contact for alarm indication. It shall be possible to reset the relay only after opening the compartment door, if so specified. BMRs shall be with built in single phasing protection. Equipment like fans, blowers, etc., shall be provided with suitable saturable CT operated BMR. For saturable CT operated BMR, Single Phasing Protection Relay shall be separate, if specified.

- **SINGLE PHASING PREVENTER RELAY (SPPR)**

1. If specified Single Phasing Protections shall be provided in all motor starter modules with contactor rating of 200 Amps and above. The Single Phasing Protection shall be of the current operated type and shall operate on the principle of sensing negative sequence of current.

2. In case of single phasing, the Single Phasing Protection shall operate after a time delay of 2 to 3 sec. The relay shall be of the hand reset type and visual indication of the relay operation shall be available.

3. The Single Phasing Protection shall be suitable for protection of the non-reversible and reversible motors.

4. Current transformer operated Single Phasing Protection Relay shall be provided for feeders, if specified.

5. Thermal overload relays shall be provided with minimum 1NO + 1NC contacts with a rating of 5 Amps at 240V, 1 phase, 50 Hz AC and 1.3 Amps at 110 V DC (inductive load).

Indicating Instruments & Meters

- All indicating instruments and meters shall be capable of carrying continuously their full load currents and full voltage across their pressure coils. They shall not be damaged by the passage of fault currents or the existence of over pressure on the primary side of their instrument transformers for the maximum permitted duration of fault conditions, which may occur during normal operation. All instruments and meters shall be back connected.

- For incoming feeders, measuring instruments shall be of 96 x 96 mm square pattern, flush mounting type, 72 x 72 mm instruments shall be used for outgoing feeders. Instruments shall be provided wherever indicated in specific requirements. All auxiliary equipment such as shunts, transducers, CTs, VTs that are required shall be included in the supply of the switchboard.

- All AC ammeters, voltmeters, KW meters shall be of moving iron type for AC and permanent magnet type for DC. Accuracy class shall be 1.0 for KW / KWH meters and 1.5 for ammeters and voltmeters as per IS: 1248. The range shall be as indicated in the SLD. Ammeters for motor feeders shall have non-linear compressed scale at the end to indicate motor starting current. Voltmeter shall be suitable for direct line connection.

- KWH meters and KVARH meters shall be of registering type and shall be installed inside unit but readable without opening doors. KWH meters shall be with maximum demand indicator in KVA.

- KW, KWH and power factor meters shall be suitable for 3 phases, 4 wire unbalanced system with voltage coil suitable for 230V AC. The current coils shall also be suitable as given in SLD.

- Instruments shall be mounted above 900 mm but below 2000 mm from the base channel of the switchboard.

- They shall be provided with zero adjusting devices for external operation.

- Indicating instruments and protective relay for respective feeder shall be located either in the same panel or in adjoining panel and shall be grouped together.

Current Transformer

- The Current Transformers shall be Resin cast bar primary / wound primary type. The burden ratio shall be minimum as indicated in Specific Requirements. However, current transformers shall have sufficient capacity to operate with the burden imposed by the devices shown on drawings with their accuracy classification. Separate cores shall be used for metering and protection

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- Current transformers for instruments shall have an accuracy class 1.0 and accuracy limit factor less than 5.0. However, accuracy class 3.0 is acceptable for ammeters only. If a metering load is fed from a protection CT, suitable 1/1 or 5/5 ratio saturable interposing CTs shall be used.

- The current transformers shall be capable to withstand dynamic and thermal stresses originated by the fault current.

- The CTs shall be suitably insulated and the mounting of the CTs shall facilitate easy maintenance.

- The CTs shall be mounted in stationary part of switchgear.

- The secondary of the CTs for metering when wired to terminals, shorting links shall be provided. Shorting links shall be of removable type of Wago make.

- For proper relaying, one side of current transformer secondary shall be grounded in the compartment with the meters or relays, which they serve, and each CT group shall be grounded with a separate identified lead, which may be disconnected for testing.

Potential Transformer

- The potential transformers wherever provided shall be epoxy cast resin type and shall have class of burden minimum as given in the SLD. However, potential transformers shall have sufficient capacity to operate with the burden imposed by the devices shown on the drawing with their accuracy classification.

- The voltage transformers shall have an accuracy class 3.0 from 50% to 110% of normal voltage and class 1.0 from 80% to 120% of normal voltage with burdens varying between 25% to 100% of the rated value at 0.8 PF lagging.

- The primary of the voltage transformers shall be rated for 415 volts and the secondary for 110 volts.

- The PT shall be provided with HRC fuse on the primary side and secondary side.

- The PT shall be mounted in a separate compartment complete with its accessories.

- For proper relaying, one side of PT secondary shall be grounded at the transformer and the ground connection shall be identified and removable for testing.

- Test terminals shall be provided for PT circuits.

Timer

- For reacceleration duty, timers unless otherwise stated, shall be pneumatic type and shall have adjustable time setting of 0 - 60 secs. The time settings, where specified shall be accurately set before dispatch of the switchboard.

- Timers for auto-transfer schemes shall be of static type with timing ranges suitable for the scheme employed.

Indicating Lamps

- Indicating lamps shall be filament type with series resistance. The domes of the fittings shall be heat resistant.

- The lamp shall be suitable for the voltage supply as given in SLD.

- It shall be possible to replace the indicating lamp without opening the compartment door.

- Screwed type lamps are preferred to bayonet cap lamps.

Control Switches

All circuit breaker operating switches shall be of the pistol grip type, spring return to neutral and lockable in that position.

They shall be arranged to close the breaker by being turned clockwise and to trip it by being turned anti-clockwise. The trip, neutral and close positions shall be clearly indicated. The movement shall be such that the switch cannot be operated inadvertently and that it is mechanically interlocked to trip before close. The operating switch shall be located preferably on the centre line at about 1.5 M from the floor level

Wiring Termination & Ferruling

All control conductors insulating material shall be of the PVC type.

Control, signaling, protection and metering wiring shall be by PVC insulated, 1.1 KV grade copper conductor wires of minimum 1.5 sq mm section, for CT secondary circuit wires of 2.5 sq mm copper conductor minimum shall be used.
Flexible conductor ends shall be fitted with suitable crimped thimble for efficient termination.
All control wires shall be properly bunched, cleated and supported on panel frames.
Where it is necessary to use a large number of conductors in one run, they shall be divided into two or more cable runs in enclosed channels.

Conductors shall only be carried over or bent around sharp corners or edges where this is unavoidable, in which case a suitable insulating strip shall be fixed to the sharp edge.

Sharp bends shall be avoided.

Conductors carried across a hinged portion of a chassis or door shall be flexible stranded copper conductors and the same shall be soldered crimped at ends before connections are made.

Suitable means of protection against abrasion shall be provided.

Sufficient slack shall be left at conductor ends to allow components to which the conductors are attached to be removed for inspection and servicing.

Conductors passing through holes in chassis or screens shall be fully protected by correctly fitted grommets or bushes.

Control and main wiring shall be kept separate as far as practically possible.

Colour coding for wiring shall be used and shall be indicated on the drawing.

Terminal strips for connecting entering control cables shall be Wago make plug in type of adequate size, shall be located conveniently for easy accessibility, without danger of contact with live part, ease of connection, and shall be separated by barriers from power circuits. At least 10% spare terminals shall be provided in terminal strips. Sufficient terminals shall be provided on each terminal strip to ensure that not more than one outgoing wire is connected per terminal.

The wire shall be identified by numbered ferrules at each end all in accordance with the connection diagram. All ferrules shall be made of non-deteriorating materials. The ferrules shall be universal triangular type so that they cannot move freely on the wire.

Glands

It shall be preferable to have all the glands on the removable bottom gland plate. Gland plate shall be 3 mm thick M.S. sheet. Suitable provision for cable clamping shall be given alley for bringing cables to the respective compartments.

Panel Space Heaters

Wherever specified in specific requirements all switchgear shall be provided with space heaters in each vertical units to prevent condensation and the same shall be equipped with differential thermostat to automatically cut in and cut off the heater, so as to maintain interior temperature 5 DEG C above the ambient and shall also have manual disconnect switch and fuse for protection.

Label Details

Labels of 3-ply laminate shall have black lettering on yellow background provided for following:

Main nameplate for the PCC as per description given in SLD in centre on top side on front of the PCC.Name plates for all incomers and outgoing feeders indicating description, rating, equipment no., feeder no., etc.

1. **Nameplates for all door mounted components.**
2. **Name plates for panel numbers on front and rear.**
3. **Warning labels for interlocks.**

- **Danger labels shall be provided for interlocks.**

1. **Danger labels for the PCC as per statutory regulations.**
2. **Danger labels for busbar chamber.**
3. **Danger labels for cable alley housing live terminals.**

- **All components shall be provided with components identification stickers.**

- **Every component shall be provided with label on inside of the door indicating following information.**

- **Switch / Breaker Rating**
- **Fuse Rating**
- **BMR Rating**
- **Contactor Rating**
- **CT Rating**
- **Rating of other major components**

All nameplates shall be fastened by means of screws to the panel.

Limit of Supply

The supply of switchgear shall include the switchgear itself complete with all normal components and devices required for full and proper operation of the equipment even though such components or devices may not be shown in detail on drawings.
Switchgear shall be in working order provided with the following auxiliary components necessary for normal and safe maintenance and operation.

- **Special tools - Complete set of special tools shall include all necessary devices for lifting, installing, withdrawing, testing and maintaining the circuit breakers, contactors, fuses, relays and other components of the switchgear.**
- **2 Nos. handles for removing fuses shall be delivered with each switchgear.**
- **6 Nos. lamp grips for removing and replacing of indicating lamps.**
- **1 No. test plug for Relays.**

Commissioning and Start Up Supervision

Commissioning and start-up supervision shall be provided by the manufacturer at site, and charges for the same shall be quoted separately

Switchgear and Equipment Certification

Manufacturer shall state in its bid whether proposed circuit breakers and switchgears have been tested by an independent recognized testing organization. Copy of such test certificates shall be attached to the bid.

Packing

The switchboard shall be shipped to site packed in wooden crates. They shall be wrapped in polyethylene sheets before being placed in crates to prevent damage to the finish. Crates shall have skid bottoms for handling.

- The packing cases shall be marked as per the details given in the purchase order.
- Each case shall have the reference to the vendor general arrangement drawing and shall normally indicate the sections of the switchgear.
- The packing cases shall contain one set of all the drawings for easy inspection at site.

Statutory Regulation

The switchgear shall be manufactured as per the requirements of Indian Electricity Rules. The switchgear shall be acceptable to the local statutory authorities such as Electrical Inspectorate and Fire Insurance Council. The switchgear shall have approval of Tariff Advisory Committee and relevant certificates shall be furnished in six sets for records.

Spares

Manufacturer shall quote for recommended spares for 2 years and for spare fuses

Testing

a) 415V switchgear shall be tested as per relevant Indian Standards and will include the following:
b) Visual and dimensional inspection as per general arrangement drawing.
c) Checking for provision of feeders as per general arrangement drawing.
d) Checking for provision of components as per bill of material.
e) Operation test.
f) IR measurement before and after HV test.

- HV test.

The testing will be witnessed by Client's Engineer. Six copies of Test Certificates shall be furnished to Director IITM Pune for approval before dispatch.

Bus Bar

The busbars shall be of electrical grade aluminium flats / channels adequately sized to carry maximum current of maximum site temperature specified. The final temperature of busbars and connectors at joints between connector and busbar should not exceed 100o C when carrying rated currents. Also the final busbar temperature shall not exceed 250o C when short circuit current for specified duration flows through.

- Busbar size per phase shall be suitable for maximum specified continuous rating at maximum specified site hygroscopic temperature.
- Bimetallic strips covering full joint surface shall be provided wherever copper to aluminium connections are envisaged. Busbar clamps shall be provided to maintain the busbars in position. These

clamps shall be made out of fully heat treated magnesium silicate aluminium alloy to IS: 5082. The clamp design shall be such that it holds the busbar firmly and also allow sliding movement of busbars without generating internal stresses to accommodate expansion during operation at rated current. For fixing the busbars to the busbar supports, cadmium plated bolts, nuts and washers shall be employed

- Wherever required for long run of bus duct, expansion joints with flexible strips shall be provided to allow for expansion and contraction due to temperature variations arising out of normal continuous current flow and short circuit current flow for specified duration. Minimum one expansion joint shall be provided for each 3000 mm long straight length of bus duct.

Termination at the End of Bus Duct

- The bus duct shall be provided with flexibles at both ends for connecting it with transformer at one end and 415V switchgear at other end.
- The flexibles shall be made of thin copper strips. The ends of the flexibles shall be clamped by copper plate. The ends of flexibles shall be tin plated

Earth Bus

One earth bus of 50 mm x 8 mm aluminium shall run on the external side of the bus duct through the whole length of the bus duct and shall be positively connected to the body of the bus duct. At both ends of the earth bus provision shall be made to connect it to main / earthing system

LT CABLES

Construction

All LT power cables shall be 660/1100V grade, with aluminium conductor for size 70Sq.MM and above. Power cables of sizes up to 50 Sq.mm. shall be with copper conductors
The cables shall be suitable for laying in trays, trenches, ducts, conduits and underground, buried installation with uncontrolled backfill and possibility of flooding by water. For all cables, cable manufacturer shall provide information on correct voltage drop values when the current is less than the full current rating of the cable

1. PVC Cables

All power / control cables for use on medium voltage systems shall be heavy-duty type, 1100V grade with aluminium / copper conductor, PVC insulated, inner-sheathed, armoured and overall PVC sheathed.

- **The construction of the conductors shall be solid for aluminium / copper cables upto 6 sq.mm. For 10 sq.mm and above shall be stranded only. Conductors of nominal area less than 25 sq. mm shall be circular only. Conductors of nominal area 25 sq.mm and above may be circular or shaped.**

- **The core insulation shall be with PVC compound applied over the conductor by extrusion and shall conform to the requirements of Type 'A' compound of IS: 5831. Control cables having 6 cores and above shall be identified with prominent and indelible Arabic numerals on the outer surface of the insulation**

- **The inner sheath shall be applied over the laid-up cores by extrusion/wrapping and shall be on PVC / un-vulcanised rubber. If PVC compound is used it shall conform to the requirements of Type ST1 PVC compound of IS: 5831**

- **For multicore cables, if the armouring is specified, the same shall be by single round galvanised steel wires where the calculated diameter below armouring does not exceed 13 mm and galvanised steel wires / strips where this dimension is greater than 13 mm. Requirement and methods of tests for armour material and uniformity of galvanization shall be as per IS: 3975 and IS: 2633. If armouring is specified for single core cables, the same shall be with hard drawn aluminium round wire of 2.5 mm diameter.**

- **The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound conforming to the requirements of type ST1 compound of IS: 5831. To protect the cables against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath.**

2. XLPE Cables

- **Power cables shall be with Aluminium / Copper Conductor, XLPE insulated, armoured and overall PVC sheathed. All cables rated above 3.3 KV shall be provided with both conductor screening and insulation screening. The conductors shall be provided with non-metallic extruded semi conducting shielding. The insulation screening shall consist of non-metallic extruded semi-conducting compound in combination with a non-magnetic metallic screening of copper. The insulation screen shall be strippable without application of heat. The copper screen shall be capable of carrying the single line to ground fault current for duration of 1 second. For cables rated above 3.3 KV the conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by Triple Extrusion process to ensure perfect bonding between the layers. The core identification shall be coloured strips or by printed numerals.**

- **The construction of the conductors shall be stranded and compacted circular for all cables.**

- **The core insulation shall be with cross-linked polyethylene unfilled insulating compound. It shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions**

- **The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of Type ST 2 compound of IS: 5831.**

- **For multicore cables, the armouring shall be by galvanised steel wires / strips. If armouring is specified for single core cables the same shall be with hard drawn aluminium round wire of 2.5 mm diameter.**
- **The outer sheath for the cables shall be supplied by extrusion over the armouring and shall be of PVC compound confirming to the requirements of Type ST 2 compound of IS: 5831. To protect the cable against rodent and termite attack, suitable chemicals shall be added into the PVC compound of the outer sheath.**

Standards

The Cables shall conform to the requirements of the following, but not limited, to latest revision of relevant Indian Standards or equivalent British or any other International Standard Specification.

IS: 1554 - PVC insulated (heavy duty) electric (Part I) Cables - Part I for working voltages upto and including 1100V.

IS: 1753 - Aluminium conductors for insulated cables.

IS: 3961 - Recommended current ratings for (Part II) cables: Part-II PVC insulated and PVC sheathed heavy-duty cables.

IS: 3975 - Mild steel wires, formed wires and tapes for armouring of cables.

IS: 5831 - PVC insulation and sheath of electrical cables.

IS: 7098 - Cross-linked Polyethylene insulated (Part-II) PVC sheathed cables: Part-II for working voltages from 3.3 KV upto & including 33 KV.

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

IS: 9968 - Elastomer - insulated cables, for (Part I) working voltage upto and including 1100V.

Testing & Inspection

All the cables shall be tested and examined at the manufacturer's works. All the materials employed in the manufacture of the cables shall be subjected, both before and after manufacture of the cable, to examination, and testing by vendor.
All routine and acceptance tests in accordance with the relevant standards shall be conducted in presence of the Client.
Vendor shall furnish Test Certificates for all cables before dispatch for approval.
Vendor to confirm the availability of facilities at their works for the following tests and the standards to which they will conform to.

Accelerated water absorption test for insulation.

Dielectric retention test.

- Oxygen index test.
- Test for rodent and termite repulsion property.

Packing & Forwarding

1. The cables shall be supplied duly wound on non-returnable wooden drums. The drums shall be fully sealed to protect the cable from mechanical damage during transit. The wood used for construction of the drum shall be properly seasoned and free from defects. Wood preservatives shall be applied to the entire drum.
2. All cables shall be supplied in one length. If cable length exceeds standard drum length then the balance quantity shall be supplied in one length. If required by the Client, the vendor shall supply the cable in lengths as specified / informed to vendor during delivery.
3. On flange of the drum necessary information such as manufacturer's name, type / size / voltage grade and length of cable, drum No, year of manufacture shall be printed. An arrow shall be printed on the rim of the flange to show the direction of rotation of the drum.
4. Cables shall be supplied in drum lengths as follows:
   Medium voltage power cables upto and including 6 sq.mm. - 1000 M.
   Medium Voltage power cables from 10 sq.mm. Upto and including 300 sq.mm - 500 M.
   A tolerance of plus 5% shall be permissible for each drum.
5. The length of cable on each drum shall be determined by the manufacturer considering the transport limitations from manufacturer's works to the site.

Laying of Cables

Transporting the cables from stores to place of installation. The drums under the custody of the contractor shall be neatly arranged in the yard near his site office. The drum shall not be rolled for transportation more than 10m Truck / Trailer shall be used for transportation for distance more than 10m.

- The cables shall be rolled out for equipment and cutting shall be as per site requirement. Cable jacks and cable rollers shall be used during laying of cable.
- Electrical Contractor shall cut all cable length by actual measurement at site as per final route determined. Cable lengths indicated in Cable Schedules shall be used only to get an idea of length involved.
- The cables shall be tested for insulation value before laying. Drum Schedule to be prepared by contractor.
- The Cables shall be laid in trenches, trays, along walls or structural support as per the requirement. The cables shall be neatly laid and clamped. The crossing of cables shall be avoided. The arrangement of cables on the tray / trench shall be decided based on the cable schedule and layout drawings and shall be approved by the CONSULTANT/Client.

- **Clamping of cable shall be done by 18 SWG thick aluminium clamps at an interval of 0.5 mtr. for vertical run and 1 mtr. for horizontal run. When cables are cleated on wall / structures, the spacer and saddle shall be used at 300 mm interval or less depending on the location and shall be approved by CONSULTANT/Client.**

- **The cable terminations shall be done as per standard practice and crimping type of terminations shall be considered.**

- **The glanding shall be done with suitable arrangement for earthing the gland. Wires / sleeves required for effectively earthing the glands shall be included in the termination materials.**

- **The unused cores of the multicore cables shall be properly taped.**

- **The tag carrying the cable number shall be at interval of 20 mtr for underground cable and 30 mtr for above ground cable and at all bends and route changes of the cable run. Material of tag will be aluminium for above ground cables and of lead for buried cables. Sample of tags shall be approved by CONSULTANT/Client.**

- **The cable numbers shall be painted near the terminal blocks in MCC / Distribution Boards / Switchboards.**

- **For main power cables loops shall be provided near terminations.**

- **All cables coming from floor / trench shall be taken through a G.I. Pipe. The length of the pipe shall be decided by the contractor and approved by the CONSULTANT/Client.**

- **The glands supplied by the contractor shall be suitable for cable sizes mentioned and if necessary reducers shall be provided by the contractor. The contractor shall indicate the requirement of reducers and supply the same after approval of rates by Director IITM Pune.**

- **The contractor shall supply and install the ferrules for multicore cable connections. The ferrule markings shall be identical to the wires connected to the terminals.**

- **The Lugs used shall be tinned Copper for Copper Cable and Aluminium Lugs for Aluminium Cable, crimping type of reputed make. The Lugs used for multistrand control cable shall be PVC sleeved crimping type copper lugs.**

- **The connections between the junction boxes/control panels to components like pressure switches, limit switches shall be through flexible conduits. The length of each of the flexible conduit shall not exceed 120 cm.**

- **The cables coming from switchboards to the cable tray shall be taken through branch trays and the cables shall be clamped neatly. The arrangement shall be approved by CONSULTANT/Client.**

- **Main cable runs are to be routed as shown on the contract drawings. Any modifications found necessary due to site conditions must be approved by CONSULTANT. Details of routes not shown on these**

drawings are to be determined on site by discussion with CONSULTANT/Client.

- **PVC insulated and / or served cables shall not run parallel within 100 mm of, or be installed above and in line with, any heated pipes or duct. Where crossing above heated pipes or ducts is unavoidable the cable must be kept at least 150 mm from the outer surface of such pipes or ducts or the insulation thereof.**

- **On main horizontal cable runs where cables are supported, suitable mild steel saddles, cleats or clips shall be used. Between these fixing points cables shall be laid neatly in position on the intervening racks. On vertical cable runs and horizontal runs other than the main horizontal runs, cables shall be fixed at one meter intervals. Where different sized cables are together the maximum fixing intervals are to be those required for the smallest cable, unless the smaller cables are bunched with larger cables and supported by them throughout the complete multi-cable run.**

  NOTE: Where the contract drawings indicate that the cables are to be run or fixed other than in accordance with this specification, the drawings shall be deemed to be correct.

- **Cable run in RCC trenches are to be run on the floor along the sides on suitable brackets and located 75 mm minimum from floor of trench. Cable ducts in the ground shall be sealed against the ingress of water, foreign matter and vermin, at both ends by means of non-setting compound and / or suitable wood plugs fitted over the cable and into the duct. Where ducts are not in use they shall be sealed in a similar manner.**

- **Cables laid direct in the ground shall be laid on a bedding of 150 mm of sand and covered by 150 mm layer of sand, on top of sand tiles / bricks covering to be done. The depth of laying shall be such as to provide 750 mm minimum cover for low voltage cables and 1000 mm cover for high voltage cables.**

- **All non used open entries in equipment and open ends of conduit are to be sealed by means of conduit plugs (or blanking plates if entries are not of standard conduit sizes) at all time.**

  NOTE: This is particularly important where equipment is located in position, but electrical installation is incomplete.

  Where cables pass through floors, they shall be protected by metal / PVC pipes or other suitable means. Holes in floors, walls, etc. will be made and reinstalled by the contractor unless otherwise stated.

- **All cables laid underground shall be protected with good quality brick and interlocked concrete tiles marked "Electric" or "Telephone" cables.**

- **Cable joints shall be mechanically and electrically sound and except for buried cables they shall be accessible for inspection. Underground joints shall be specially protected with a double layer of bricks and cast iron joint markers (marked 'Cable-Joint'), shall be installed to indicate the position of the joint.**

- **Where corrosion of armour or gland might occur, it shall be effectively protected by suitable means**

- **The contractor shall test all cables for proper insulation before they are transported for laying and shall furnish a certificate of acceptance to this effect. Any damage to the cable subsequently shall be made good by the contractor at his own cost. After the test of insulation, the cut ends of cables shall be sealed properly with waterproof material to prevent ingress of moisture.**

- **Cable Marking**

  All Cables shall be externally marked at either end with the respective identification numbers by means of non-deteriorating material. Cable Markers shall be approved by CONSULTANT/Client.

  Where conductors are left to be terminated by another party or left to be connected later, they must be individually identified

CABLE GLANDS

- **When preparing cables prior to fitting glands, the gland manufacturer's instruction for cable preparation shall be observed. In all cases where armoured cables are used care shall be taken to ensure that the lay of the armour is maintained after the gland is completely fitted.**

- **Where compound boxes are used for terminating cables, the compound must penetrate fully and leave no air holes. Where hot pouring of compound is employed, 'topping up' must be carried out as soon as possible after the first filling. The pouring temperature of the compound must not be high enough to damage the cable insulation.**

- **All terminations of paper insulated cable shall incorporate damp barriers in each conductor. The insulation shall be removed to leave approximately 15 mm to 20 mm of the conductor exposed, and the conductor shall be soldered at this point.**

- **The preferred method of terminating conductors is by means of solder less compressed connectors. Deviations from the above shall be subject to approval of CONSULTANT/Client**

- **Connectors shall be of the correct size for the conductor concerned and as manufactured by Dowels or approved equivalent**

- **All connectors shall be marked with the size reference for identification with the correct compression tool. This reference shall be located on the palm of the connector and shall be remote from the contact faces where possible.**

- **The palm of the connector shall be of such shape and size that standard washers to relevant IS applicable to the size of stud for which the connector is designed shall lie flat on both faces of the connector palm when the holes in the washers and the palm are co-incident.**

- Compression tools shall be designed and supplied for specific use with the connectors used, and shall be regularly services by the maker.

DISTRIBUTION BOARDS (Wall Mounted)

The Board shall be installed on column / structure, as required with necessary frame work at an approximate elevation of 1200 mm from finished floor level.

Balance activity, same as mentioned

LIGHTING SYSTEM

The lighting fixtures in the open areas shall be fed from lighting panel and controlled from local switch. Lighting wiring between JB and lighting fixtures shall be done by PVC insulated 3-core (phase neutral and earth) unarmored cable. Lighting fittings in building shall be fed from lighting panels. Wiring in the building shall be done by means of 3-core Copper Conductor PVC insulated or copper conductor wires in conduit of 1' size / metsec channel, as specified. All joints of conductors in Switch boards / JB's / Fittings shall be made only by means of approved Mechanical connectors (nylon / PVC connectors). Bare or twist joints are not permitted anywhere in the wiring system. Cost towards mechanical connectors is deemed to have been included in wiring.

Methods, type, size, etc. mentioned in the BOQ shall supersede the above requirements.

Socket outlets in production areas shall be approximately 1200 mm above finished grade and 300 mm above FFL in office area. Lighting and power panel shall be mounted such that top of the panel is not more than 2000 mm above finished grade.

Fixtures shall be firmly supported from the structures, support clamps, etc. They may be bolted or welded to the steel work or metal inserts. In case of concrete structures, where metal inserts are not available, fixtures will be fixed to or supported from concrete surfaces with the help of anchor fastener. In such cases special care shall be taken to see that anchoring is firm.

The lighting layouts furnished by Director IITM Pune shall indicate approximate locations of lighting fixtures. The electrical contractor shall determine, with approval of the Engineer-in-Charge or his authorized representative, the exact locations of each fixture in order to avoid interference with mechanical equipment or any structure and also with a view to obtain as uniform illumination as practicable, and to avoid objectionable shadows. Conduit / cable run shown on drawing are only indicative. These shall be laid out by the contractor to suit field conditions as per directions of the Engineer-in-Charge.

All hardware shall be galvanized or zinc passivated. Circuit cable shall be group cleated to structure by using galvanized strip clamps or run in cable trays wherever they are available. Spacers and cleats shall be of suitable size to accommodate the cables and shall be approved by Engineer-in-Charge before fixing at site. For isolated structures lighting cable may be taken in underground G.I. Pipes. G.I. Saddle to be used will be 22 gauge

thick ribbed types and GI Spacer will be of 3 mm thick made out of 25 x 3 mm M.S. Flat.

Main runs of wiring from lighting panels and tapings to individual fixtures shall be in sizes specified on the SLD. Wiring for all outlet sockets shall be done with 3 cores of equal sizes for phase, neutral, & earth.

The cost for cable clamps, metal spacers, anchor bolts, etc. shall be deemed to have been included in the installation of cables

Contractor shall keep a close watch on the lighting MTO sheets issued to him. Any discrepancy noticed between the figure given in MTO and the actual requirement at site, shall be immediately brought to the notice of Engineer-in-Charge by the Contractor.

All fluorescent fixtures shall be with high power factor, low harmonic (THD< 10%), warm start electronic ballast. All other Ballasts shall be low loss Cu. Ballasts.

Fluorescent lamps unless otherwise specified shall be tri-phosphor colour 86 (cool day light).

CFL lamps shall be “Bright white” unless otherwise specified.

MID / High bay fixtures and streetlights shall be integral and floodlights shall be non-integral unless otherwise specified.

All housings shall be cast aluminum only. Sheet metal housing is not acceptable for outdoors luminaries. All outdoor luminaries shall be rated at IP 65.

Fixtures construction shall be suitable for maintenance from bottom unless otherwise specified and shall be screw less press fit as far as possible. Lamp replacement shall be possible without removing fixtures.

Tie arrangement shall be provided for covers, louvers etc which need to be removed for lamp / ballast replacement.

CONDUIT SYSTEM

Surface or concealed conduit system of wiring shall be adopted as specified in the drawings. Suitable pull boxes or inspection type fittings will be used to facilitate drawing of wires. Conduit wiring shall be as per IS-732. Wherever specified, conduits and conduit accessories shall be galvanized and shall conform to IS-2667, 1988.

Only threaded type conduit fitting shall be used. Pin Grip type clamp type fittings are not acceptable. Conduit ends shall be free from sharp edges or burrs. The ends of all conduits shall be reamed and neatly bushed with Bakelite bushings.

In order to minimize condensation of sweating inside the conduit system, all outlets shall be properly drained and ventilated in such manner so as to prevent entry of insects.

The outer surface of the conduit pipes, including all accessories forming part of the conduit system shall be adequately protected against rust, particularly when such system is exposed to weather. In all cases bare threaded portion of conduit pipe shall not be allowed unless such bare

threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.

Conduit connection to outlet boxes shall be by means of screwed hubs or check nuts on either side.

Conduit pipes shall be fixed by 22 gauge ribbed G.I. saddles on 25 x 3 mm G.I. saddle bars in an approved manner at intervals of not more than 50 cms. Saddle shall be fixed on either side of couplers, bends or similar fittings, at a distance of 30 mm from the centre of such fittings. The cost of saddle bars, saddles, clamps, etc. shall be deemed to have been included in the installation of conduits.

Where concealed wiring is to be adopted, conduits shall be laid in time before concreting of the slab. The contractor shall co-ordinate his work with other agencies involved in the civil works in such a way, that the work of these other agencies is not hampered or delayed because of any section on his part. Vertical conduit runs shall be made either through columns or chases prepared in the walls. Contractor shall fill these chases or any other openings made by him after completing the work and neatly finish the surface. During installation, care shall be taken to see that adequate covers are provided to prevent rusting of conduits.

If required, conduit runs may be concealed in the floor for low level receptacles and exhaust fans. As built conduit layout drawing shall be submitted by contractor.

Wiring for exhaust fans shall be terminated in ceiling roses / receptacles and the connection from ceiling rose / receptacles to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires.

Maximum permissible number of wires that can be passed through a conduit of particular size shall be as per Table indicated below.

After erection, the entire conduit systems shall be tested throughout for mechanical and electrical continuity and shall be permanently connected to earth by means of approved type earthing clamps, in accordance with Indian Electricity Rules.

Installation is inclusive of supply and fixing of all accessories like:
Elbows, grommeters, bends, T-offs, etc.

2" Deep 65 mm dia round conduit junction box (18 SWG) with acrylic cover and 30A rated completely shrouded PVC connectors in JB. The terminals shall be kept loose in Junction Box for easy maintenance and connection.

CABLE TRAYS

All cable Trays upto 300mm shall be perforated type & above 300mm ladder type trays shall be used.

The Trays shall be pre-fabricated hot-dipped galvanized. Cold galvanizing at site is acceptable only for touch-ups.

The Trays shall have suitable provision for clamping at an interval of 500 mm.

The Earthing Strip for the earthing ring shall be run along the side of the Tray.

The connection between individual equipment to the ring shall be by bracing or with lugs.

The bending of trays shall be smooth and the curvature sufficient for each bending of cables in it. Pre-fabricated accessories such as Tees, bends, risers, couplers, reducers, etc. shall be used at all junction & branches. Cutting & welding of trays at site is not permissible. Similarly, the trays shall not be welded on the supports but bolted only.

Electrical Cable Tray routing shall be co-ordinated by Electrical Contractor at site to check fouling with pipes, equipment, light fittings, HVAC, etc. before fixing the trays.

EARTHING

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 CONSULTANT/Client 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 CONSULTANT/Client.

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 CONSULTANT/Client.

Unless otherwise approved by Director IITM Pune/ Consultant, 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 10^6 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 CONSULTANT/Client.

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.

Capacitor

The capacitor units shall be inspected and insulation value shall be checked and recorded

The aluminium link connections shall be checked and tightened.

The units shall be installed on framework near switchgear.

Before energizing the Capacitors, it shall be ensured by Contractor that Discharge Resistor is fitted across the Capacitor

The units shall be earthed with two distinctive earth strips.

UPS

This shall conform to the requirements of the following but not limited to, latest revision of all relevant Indian Standards or International Standards.

(a)	**IS: 3700**	**:**	**Essential ratings and characteristics of semi-conductor devices.**
(b)	**IS: 3715**	**:**	**Letter symbols for semi-conductor devices.**
(c)	**IS: 4411**	**:**	**Code of designation of semi-conductor devices.**
(d)	**IS: 5001**	**:**	**Guide for preparation of drawings for semi-conductor devices.**
(e)	**IS: 5469**	**:**	**Code of practice for the use of semi-conductor junction devices.**

DESCRIPTION & SYSTEM OPERATION

- **The UPS shall consist of Rectifier / Charger, Battery, Inverter, Static Transfer Switch, Maintenance Bypass Switch, Synchronizing Equipment, Protective Device and other Accessories. An Isolation Transformer shall be provided on input side.**
- **The UPS shall provide continuous electric power within specified tolerance, without interruption, to the critical loads.**
- **Normally electric energy from normal plant power source shall be supplied to UPS System.**
- **The solid-state rectifier / charger shall convert incoming AC power to DC power. The rectifier / charger output shall be fed to solid-state inverter. The inverter shall convert the DC power into AC power, which shall supply the load. Upon failure of AC power, input power for inverter shall automatically be supplied from the battery with no interruption / disturbance in inverter output in excess of limits specified herein (in these specifications). At the same time, UPS shall energize an alarm circuit.**
- **The duration for which Battery shall supply A/C power to O/P shall be minimum 30 minutes.**
- **When A/C power is restored, the input power for the inverter and for recharging the battery shall automatically be supplied from rectifier / charger output without interruption/ disturbance in inverter output in excess of limits specified herein (in these specifications).**
- **If the battery is exhausted before A/C power is restored, the UPS shall shut down automatically.**

- **The solid-state circuitry used for both Rectifier & Inverter shall be IGBT technology.**

- **Intelligent RS-232 Communication shall be possible which will Provide UPS status indications, electrical parameters such as Input & Output Voltage, Load levels etc and unattended shutdown.**

- **User-friendly LCD Display to indicate all important UPS parameters such as Input Voltage, Output Voltage, Battery Level and Load Level shall be provided.**

- **The UPS Module Cabinet shall consist of a rectifier / charger, a three-phase inverter, static transfer switch, maintenance bypass switch, and associated transformers, logic, synchronizing equipment, protective devices, and accessories as required for proper operation.**

- **The rectifier / charger unit shall be solid state and shall provide direct current to the inverter unit and for battery charging.**

- **A dry type power transformer shall be used for the rectifier unit if specified in the attached SLD.**

- **It shall be copper wiring exclusively and have one 5% tap below rated voltage. The transformer's hottest spot winding temperature shall not exceed the temperature limit of the transformer insulation class of material when operating full load at maximum ambient temperature of the transformer location within the rectifier / charger unit.**

- **An input AC filter shall be incorporated into the rectifier / charger unit. The filter is not to be add-on in front of the rectifier / charger. This filter is to reduce the current harmonics feedback into the input AC line to no more than 10%. The filter is to also improve the input power factor so that it is no more lagging than 0.95.**

- **The rectifier / charger unit shall provide for input current limiting whereby the maximum input current shall be limited to 125% of the full input current rating. This current limit shall be in effect, no matter whether the load is connected to the UPS module or the static transfer switch. That is, if the static transfer switch is supplying full rated load, then the rectifier / charger must limit the battery recharging to 25%.**

- **Furthermore, if the load is connected to the maintenance bypass line, the rectifier / charger input current must automatically reduce to 25%.**

- **The rectifier / charger unit shall provide features whereby when the AC power is returned after the UPS has been operating on battery power or has been de-energized, the total initial power requirement at the input terminals will not exceed 20% of rated load, and the power will gradually increase to 100% of full rating over the 15 second time interval. The unit shall be provided with an internal switch so that walk-in time can be changed from 2 seconds to 15 seconds.**

- **IGBTs in the rectifier / charger shall be fused with fast acting fuses, so that loss of any one power semiconductor will not cause cascading failures. All fuses shall be provided with a blown fuse indicator with an alarm indicator on the control panel.**

- **The rectifier / charger unit shall have an output filter to minimize ripple voltage into the battery. Under no conditions shall ripple voltage into the battery exceed 2% RMS. The filter shall be adequate to insure that the DC output of the rectifier/ charger will meet the input requirements of the inverter.**

- **The rectifier unit shall be designed to boost charge the completely discharged batteries in 10 to 14 hours. The changeover between boost charger mode and float charge mode shall be affected manually. Necessary alarms to indicate battery discharged and D.C. over voltage conditions shall be provided. Selector switch shall be provided for selecting the float charge or boost charge mode.**

- **There shall be DC overvoltage protection so that if the DC voltage rises to the pre-set limit, the UPS module is to shut down automatically and the load is to be transferred to the static bypass line uninterrupted.**

- **To prevent battery damage from over-discharging at light load, the rectifier / charger is to automatically raise the shutdown voltage set point as the load is reduced. The shutdown set point is to increase linearly from minimum to 1.75 volts per cell as the discharge time increases from 15 minutes to one hour.**

Inverter Unit

- **Advanced PWM Inverter with Precision Control Circuitry using High Performance IGBT Power Stage. The output shall be Pure Sine-wave output with less than 3% THD. Exceptional reliability, superior performance, Quite operation with very high reliability and efficiency shall be the key characteristics**

- **The inverter unit shall be a solid state device capable of accepting the output of the rectifier / charger or the unregulated voltage of the battery and provide regulated rated AC output within specified limits.**

- **The output frequency of the inverter shall be controlled by an oscillator. The oscillator shall be temperature compensated and be adjustable +5% of rated frequency. The oscillator shall hold the inverter output frequency to +0.1% for both steady state and transient conditions. Drift shall not exceed +0.1% during a 24 hour period. Total frequency deviation, including short time fluctuations and drift, shall not exceed +0.1% from the rated frequency.**

- **The inverter output shall stay synchronized with the static bypass line provided the static bypass line remains within +3 Hz of the nominal frequency. If the line frequency goes outside these limits, the inverter is to break sync with the line and run on its internal frequency. When the line frequency returns, within limits, the inverter output is to automatically re-synchronize with the line. The rate of change of frequency is not to exceed 0.1 Hz per second. The**

unit shall be provided with an internal switch so that the synchronizing frequency range can be changed from +3 Hz to +1 Hz or to +0.5 Hz.

- **The inverter shall be able to sustain an overload across its output terminals up to 150% load, while supplying any load within its rating, without reducing the output voltage. Loads greater than 150% shall be transferred to the static bypass line.**

- **The inverter, with the static bypass line disabled, shall current limit at 150% rated current at reduced voltage for any loading over 150% rated load. The inverter shall be capable of at least 300% current for short circuit conditions. If the short circuit is sustained, the inverter shall shut down and disconnect automatically from the critical load bus.**

- **The inverter unit shall be designed to operate from the rectifier output without use of battery smoothing effect. With the battery connected to the UPS system, a filter shall be provided at the input of inverter unit to reduce the A.C. Feedback from the inverter to the battery to a maximum of 2% of the battery AH capacity.**

- **The inverter unit shall be designed to operate with 93V to 145V DC or 186V to 290V DC at the terminals of inverter input filter. The output inverter voltage shall be stabilized to within +2% of the nominal output voltage with a load variation of 0 - 100% at 0.6 power factor (lagging).**

- **During step loading of 100%. The system voltage dip shall not exceed 15% and output voltage shall recover to within + 3% of the nominal output voltage within 10 cycles (200 m sec.)**

- **The inverter voltage regulator is to regulate each phase so that an unbalance loading will not cause the output voltage to go outside the specified voltage unbalance or phase displacement.**

- **An output AC filter shall be incorporated in the inverter unit. The filter shall reduce the inverter output voltage harmonics to 5% RMS total and single harmonics to 3% RMS for linear loads.**

- **Power semi-conductors in the inverter unit shall be fused with fast acting fuses, so that loss of any one power semiconductor will not cause cascading failures. All fuses shall be provided with a blown fuse indicator with an alarm indicator on the control panel.**

Static Transfer Switch

- **The Static Transfer Switch, using solid state devices, shall be provided to transfer the load between the UPS module and the static bypass line uninterrupted. Automatic static load transfers are to be initiated when a system overload is greater than specified here, a branch load circuit faults or a fault within the UPS module occurs.**

- **If the static transfer was caused by an overload or branch fault and this condition was rectified, then the static transfer switch is to automatically re-transfer the load to the UPS module.**

- **The static transfer switch shall be sized to provide 125% rated load continuously. The switch shall also have an overload rating of 2000% rated load for two cycles.**

- **Any time the load is on the static bypass line, the control panel shall indicate so. The audible alarm is to sound only after a ten-second delay. If the transfer was due to a momentary overload and automatically re-transferred back to the UPS module after the overload was removed, the alarm and indicator are to automatically reset.**

Maintenance by Pass Switch

- **A manually operated maintenance bypass switch is to be incorporated into the UPS module cabinet that will connect the load to the input AC power source bypassing the rectifier / charger, inverter, and static transfer switch.**

- **All energized terminals shall be shielded to ensure that maintenance personnel do not inadvertently come in contact with energized parts or terminals. A means to de-energize the static switch shall be provided when the UPS is in the maintenance bypass mode of operation.**

- **While the load is on the maintenance bypass line, it shall be possible to check out the operation of the rectifier / charger, inverter, and static transfer switch. It shall also be possible to check the battery operation.**

Battery

A Battery system shall be furnished for the UPS with sufficient capacity to maintain UPS output at the specified load for a duration of minimum 30 minutes. The type of battery shall Maintenance-free, Valve-regulated type. A minimum of 10 years warranty for performance of declared parameters within permissible limits shall be provided.

Cabinet

All the cells making up the Battery shall be installed in a free-standing cabinet, that is, of the same constructions as the UPS module cabinet. The cabinets shall be of the same height and depth.

Each cell is to be held in place to prevent movement during seismic motion. Connectors are to be used so that the battery can be disconnected in no more than 42 volt sections.

Battery Disconnect Circuit Breaker

The UPS Module shall have a Battery Circuit Breaker. This circuit breaker is to be mounted in the battery cabinet. When open, there shall be no battery voltage present in the UPS module cabinet. The UPS module shall be automatically disconnected when the battery reaches the minimum discharge voltage level or when signaled by other control functions.

MIMIC Panel

The Mimic Panel is to depict a single line diagram of the UPS. Indicating Lights shall be integrated with the single line diagram to illustrate the status of the UPS power paths. The functions whose status is to be displayed shall include, but not be limited to, the following:

a) Input power available

b) Output power available

c) Normal operation

d) Bypass operation

INSTRUMENT INDICATION & ANNUNCIATION

Following Instruments shall be provided on the system

Charger Panel

a) AC Line Voltage (with a selector switch)

b) AC Line Current (with a selector switch)

c) Charger Output Voltage (each)

d) Charger Output Current

e) Battery Current (charging / discharging current)

Inverter Panel

a) DC Input Current

b) Standby Transformer Secondary Voltage

c) UPS Output Voltage

d) UPS Current

e) Power Factor Meter

f) Frequency Meter

Following indications lamps shall be provided.

Charger Panel

a) AC mains ON (3 Lamps)

b) Battery on Float

c) Battery on Boost

Inverter Panel

a) Battery Output ON

b) Inverter - I Feeding

c) Inverter - II Feeding (Only for redundant system)

d) Standby Supply ON

e) Load on Bypass

f) Mains Synchronized

Audio-Visual Alarm shall be provided for the following complete with 'ACCEPT', 'RESET' and 'TEST' facilities.

Charger Panel

a) Mains Under voltage / Single Phasing

b) Charger Failure / SCR Fuse Failure

c) Reverse Polarity on DC Bus

d) Cooling Fan Tripped (common for all fans)

e) Battery Discharged

f) DC Over-Voltage

g) Battery Earth Fault

Inverter Panel

a) DC Input Failure

b) Inverter - I Output Trouble

Construction

- Rectifier / Charger and Inverter sections shall be housed in separate panels and shall be complete with all interconnections. The panels shall be fabricated with 1.6/2 mm thick cold rolled sheet steel and structural steel. The panels shall be free-standing. Vermin proof fitted with suitable louvers for ventilation and cooling fan. Hinged doors shall be provided at the front and back where required, with dust tight gaskets. Interpanel sheet steel barriers shall be used. The enclosure shall be IP-51 (NEMA-IA).

- Power cables shall be with aluminium / copper conductor as specified in SLD. Control cables shall be with copper conductors. All Cable connections shall be from bottom and from the front of the panel. At the bottom of the panels, a removable bolted gland plate shall be provided with double compression type cable glands fitted to it for external cable connections. Clamp type terminals shall be used for connection of all wires upto 10 mm2 and terminals for larger size shall be bolted type suitable for cable lugs.

- Busbars shall be colour coded and live parts shall be properly shrouded to ensure complete safety to personnel intending routine inspection by opening the panel doors. All equipment inside the panel and on door shall have suitable nameplates and device number as per the schematic diagram.

- All fuses shall be link type with HRC links and mounted inside the panel. All power and control switches shall be mounted on the door

operable externally and shall be rotary type. Space heaters and 100W incandescent lamps shall be provided in each panel. All instruments shall be switchboard type, back connected, 96 x 96 mm square of reputed make. Scale shall have a red mark indicating maximum permissible operating rating. Test terminals shall be provided on a separate rail for measuring and testing of equipment to check the performance.

- A suitably sized earth bus shall be provided at the bottom of the panels with provision for earth connection at both ends to purchaser's main earth grid. Suitable earthing of potential-free metallic parts of various equipment shall be done to ensure safety.

- All metal parts shall be treated so as to ensure efficient anti-corrosive protection. Hardware shall be zinc passivated or electro galvanised. Panel enclosure and structure supports shall be thoroughly cleaned and degreased to remove mill scale and rust, etc. External surface shall be prepared for final painting with Manufacturer's standard colour code.

Equipments Details

All materials and parts comprising the UPS shall be new, of current manufacture, of a high grade and free from all defects and imperfections and shall not have been in prior service, except as required during factory testing.

All active electronic devices shall be solid state. All semiconductor devices shall be hermetically sealed. All relays shall be dust tight.

The maximum working voltage, current and di/dt of all solid state power components and electronic devices, shall not exceed 75% of the ratings established by their manufacturer. The operating temperature of solid state component cases shall not be greater than 75% of their ratings. Electrolytic capacitors shall be computer grade and be operated at no more than 90% of their voltage rating.

Wiring

Access holes with cover plates are to be provided on top and bottom of the UPS and battery cabinets for inter-cabinet wiring and customer installation wiring.

Wiring practices, materials and coding shall be in accordance with the requirements of the National Electrical Code, OSHA and applicable local codes and standards.

All bolted connections of bus bars, lugs and cables shall be in accordance with requirements of the National Electric Code and other applicable standards. All electrical power connections are to be torqued to the required value and marked.

Ventilation

Adequate ventilation shall be provided to insure that all components are operated within their environmental ratings. All fans are to be equipped with wind vane sensors connected to an alarm on the module control panel.

Temperature sensors shall be provided to monitor temperature of critical components. Upon detection of temperatures in excess of component manufacturer's recommended ambient working temperature, the sensors shall cause audible and visual alarms to be sounded on the module control panel.

Forced ventilation if provided by means of fans shall have 100% redundancy.

If redundancy is not provided then it shall be possible to run the system at rated load for half hour and at reduced load (about 75%) continuously without any damage to the system.

Spares

Vendor shall recommend and provide spare parts needed for start-up and two years operation. Recommended spares should take into account related factors like equipment reliability, effect of equipment downtime upon production and safety, cost of and availability of equipment service facilities.

All spare parts furnished by vendor shall be wrapped and packed so that they will be presented in original as new condition under the normal conditions of storage to be anticipated and shall be properly taped and coded so that later identification as to intended equipment usage will be facilitated. They shall be packaged separately, clearly marked as spare parts and shipped at the same time as the equipment. Packing list shall be furnished so that the parts can be handled without uncrating, if desired.

Inspection and Testing

The Battery shall be subject to inspection by Client's representative. Manufacturer shall furnish to inspectors all requested information concerning the supply.

Battery shall be tested as per relevant IS and test certificates shall be furnished before dispatch.

The UPS System will be tested in the presence of Client's representative.

The following tests shall apply:

Full load heat run for eight hours (unit rate to be furnished separately).

Current forcing test.

Recording of time for mains to inverter changeover and vice-versa.

Recording of 1/2 load change transient.

Recording of full load change transient.

Functional Tests.

Detailed inspection will be performed to ascertain that the data sheet and other contractual aspect are complied with the earthing system must be inspected for robustness and continuity.

Lightning Protection

The plant and structures shall be protected against lightning in accordance with requirements of IS-2309.

Air terminal rods shall be provided at the top most points of all buildings and structures. Roof conductors shall be run at not more than 18 meters from each other on top of the buildings and interconnected at intervals of not more than 18 meters. Hot dip galvanized 25 x 3 mm G.I. strips shall be used for horizontal air termination. Whenever specified in the BOQ or layout drawing, early streamer type lightning protection of reputed make & type subject to Director IITM Pune/ consultant approval shall be used. Installation procedures shall be approved by Director IITM Pune/ Consultant prior to the stand of work.

Down comers shall be installed at every 30 meters of the periphery of the buildings and structures and connected to separate earthing pits. Each down comer shall be provided with one earthing pit. Each down comer shall be provided with a test link for testing the installation. Portion at the conductor below ground shall be painted with bituminous paint.

The sizes and material of lightning conductors shall be as follows unless otherwise specified in Specific Requirements.

		Roof Conductors	down Comers
a)	Copper	25 x 3 mm	32 x 6 mm
b)	G I	25 x 3 mm	32 x 6 mm

The down comer shall be cleated to the wall or columns at intervals of 300 mm using G.I. clamps. All joints in the conductors shall be welded. Welding joints shall be painted with two coats of Bitumen.

Each air terminal rod shall have 150 mm dia GI or 75 mm dia copper sphere with 5 nos. 150 mm long conical GI / Copper spikes. The spikes shall be screwed and welded / brazed to the sphere. The whole assembly shall be fixed to a GI rod of not less than 50 mm nominal bore by means of flanged connections. The down comer shall be connected to the flange and welded / brazed. The top of the air terminal rod shall be two meters above top most point of structure.

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.

SECTION-G
APPROVED LIST OF MATERIAL

Contractor shall supply material of Reputed Make which is approved by Maharashtra state Transmission Company (MSETCL) and Maharashtra state Electricity Board (MSEDCL)

SR. NO	ITEM DESCRITION	RECOMMENDED MAKES	PROVIDED BY BIDDER
1	H T XLPE CABLES	Universal / RPG./ Lapp/ KEI /Polycab	
2	H T DO fuse	Atlas / Pactil/ Kiron	
3	A.C.S.R. conductor	Atlas / Sterlite / equivalent.	
4	Clamps, Termination Kits, Joints	Raychem/ M-SEAL	
5	HT GOD	Atlas/ Pactil/ Kiron	
6	LT Cables	Universal/Lapp/Finolex /RPG/KEI/Polycab	
7	H.T. cable terminations	Raychem/ M-SEAL	
8	33kv Lightning Arrestors	CG/GE/Elpro	
9	ACB	ABB / Schneider MG / Siemens / L&T	
10	MCCBs	ABB / Schneider MG / Siemens / L&T	
11	SDFs	ABB / Schneider MG / Siemens / L&T	
12	Timers, Temp Controllers etc	Solectron / L&T/ABB	
13	Contactors/Relays	ABB / Schneider MG / Siemens / L&T	
14	Capacitors Banks (APP/MD)	Subodhan / Epcos / ABB	
15	Lighting Fixtures	Wipro/ Philips /Thorn / Bajaj	
16	1/3 Phase/ Sockets	Legrand / L&T/ Hager/ABB	
17	DBs	Hager/Legrand/MG/ABB/ Siemens	
18	Load Managers	L&T Quasar / Socomec/Elmeasure/Rishabh	
19	SDF Unit	Siemens / ABB/ Merlin Gerin/L&T	
20	ELCB / RCCB	Legrand / Merlin Gerin/ Siemens/Hager/ABB	
21	Bustrunking / Rising main	Schneider / L & T	

22	Starters	Siemens/ ABB/Merlin Gerin	
23	Relays (OL & EF)	Alstom/ Siemens/ABB	
24	APFC Relay	Sycon/Beluk/Ducati(RMI)/ABB	
25	Energy meter	L&T/Enercon/Krycard/ AE/Socomec/Elmeasure	
26	Indicating meter(Digital)	Enercon /AE/ Socomec/Elmeasure	
27	Control fuses	EE/Siemens/ Merlin Gerin	
28	Indicating lamps (LED based)	ALTOS/Teknic/Raas, Siemens	
29	Push buttons	Siemens/BCH/ Teknic/	
30	Connectors	WAGO/Phoenix	
31	Current / Voltage transformers	Kappa/ SEGC/AE	
32	Glands	Commet/Braco/Dowels/ Siemens/Phoenix	
33	Lugs	Dowel/Jainson	
34	PVC conduit accessories	Precision/ Circle Arc/ Diamond.	
35	Wires	Finolex / Lapp /RPG/Universal	
36	Switches & socket	ABB/Legrand/ Crabtree / Anchor Roma/	
37	MS Conduit & accessories	BEC/VIMCO	
38	Lighting poles	Valmont/Wipro/Bombay poles/Bajaj	
39	High Mast	Philips / Wipro /Valmont	
40	Ceiling fans	Usha, Orient, Crompton,	
41	Exhaust Fan (heavy duty)	Almonard/GEC/ Crompton	
42	Exhaust fans (light duty)	Siracco	
43	Electronic ballasts	Wipro/CG/ Intelux/ Philips	
44	Light fitting accessories	ATCO/ Vossolloh/ Wipro, Philips/Thorn/ Clipsal	
45	Incandescent Lamps	Philips/ Osram	

46	Telephone tag block	Krone	
47	Lan/Data/Telephone cables / wires (Cat6)	Delton/ Finolex/ ITL/ Avaya	
48	TV cables(RG6)	Airtech/ Komscop/ Sumer/Finolex.	
49	Speaker	Philips, All Wave Radio, Rami	
50	Data Networking	Avaya	
51	Fire alarm / access	Eureka Forbes/Zicom/ Siemens/ Celberus	
52	Cable Trays	Ashlesha /Indiana OR Eqiv.	

SECTION-H

LIST OF IS STANDARD

IS 10028	**Code of practice for installation and maintenance of transformers.**
IS 1866	**Code of practice for Maintenance of mineral insulating oil.**
IS 335	**New insulating oil for transformers and switchgears.**
IS 2309	**Protection of buildings and allied structures against lightning.**
IS 3043	**Code of practice for earthing.**
IS 5216	**Safety procedure and practices in Electrical work.**
IS 3106	**Code of practice for selection, installation and maintenance of fuses (Voltage not exceeding 650 Volts)**
IS 1646	**Code of practice for fire safety of buildings (general) Electrical installation.**
IS 9921	**Alternating Current Disconnectors above 1000 V.**
IS 8623	**Factory built assemblies of switchgear, and control gear for voltages up to and including 650 V**
IS 2147	**Degree of protection provided by enclosure for low voltage switchgear and control gear.**
IS 2551	**Danger notice plates.**
IS 1248	**Electrical indicating instruments.**
IS 722	**AC Electric meters.**
IS 2705	**Current Transformers.**
IS 3156	**Voltage transformers.**

1. Various materials and electrical installation shall confirm to latest editions of the B.I.S./IEC as mentioned in materials and installation specifications column. Additionally and generally following Indian standards shall also be applicable. All other relevant Indian standards shall also be applicable whether specifically mentioned or not.

IS 8828	**Miniature air break circuit breakers for AC circuits.**
IS 10118	**Installation and maintenance of switchgear.**
IS 398 IEC 1089-1991	**ACSR conductors**
IS 7098	**Cross linked polyethylene insulated PVC sheathed cables up to 33 KV**
IS 12943	**Brass glands for PVC cables**
IEC 99-4	**Gapless Surge Arrestors**
IS-900	**Code of practice for Installation and Maintenance of Induction Motors**
IS-1255 - 1983	**Codes of practice for Installation and Maintenance of Power Cables up to and including 33 KV Rating.**
IS-732 - 1989	**Code of practice for Electrical Wiring Installation. (System Voltage not exceeding 660 Volt).**
IS-1913	**General and Safety Requirements for Luminaries.**
IS-1646	**Code of Practice for Fire Safety of Building (General) Electrical Installation.**
IS-2713	**Specification for Tubular Poles for Overhead Power lines.**
IS-6792	**Method for determination of Electric Strength of Insulating Oils.**
IS-2667	**Specification for Fittings for Rigid Steel Conduits for Electrical Wiring.**

SECTION-I

DEVIATIONS FROM GENERAL CONDITIONS

All deviations from General Conditions of Contract shall be filled in hereby the Tenderer

SECTION	CLAUSE NO.	DEVIATION

The Tenderer hereby certificates that the above mentioned are only deviations from general conditions of contract of enquiry.

DATE: **Signature & Seal of Tenderer**

SECTION-J

DEVIATIONS FROM TECHNICAL SPECIFICATIONS

All deviations from Technical Specifications shall be filled in hereby the Tenderer

SECTION	CLAUSE NO.	DEVIATION

The Tenderer hereby certificates that the above mentioned are only deviations from Technical Specifications of contract of enquiry.

DATE: **Signature & Seal of Tenderer**

SECTION-K

LIST OF DRAWINGS

1. Lighting Layout for Ground Floor
2. Lighting Layout for First floor
3. Power & Data Layout for Ground Floor
4. Power & Data Layout for Ground Floor
5. SLD for MDB, MLDB, UPS, AC & Raw power DB SLD
6. Lighting & Emergency Lighting SLD-1
7. Lighting & Emergency Lighting SLD-2
8. Lighting & Emergency Lighting SLD-3
9. Power, AC & UPS Power SLD
10. Street Lighting A & Earthing Layout for Site

SECTION-L

DETAILS OF CONTRACTOR

Organization Name:

Address:

Telephone / Mob Number:

Fax Number:

Web Site:

E-Mail id:

Year of Establishment:

Bankers:

Key Persons:

Organization Profile:

PART II - BILL OF QUANTITIES

Project : MULTI TRAINING FACILITY BUILDING AT IITM		
CLIENT:-Indian Institute of Tropical Metrorology		
WORK:-INTERNAL & EXTERNAL ELCTRICAL WORK OF MULTI TRAINING FACILITY BUILDING		
Description	**Supply**	**Installation**
	Amount (Rs)	**Amount (Rs)**
SECTION - I :		
LV Panels & Distribution Boards		
SECTION II :		
L.V. Cables.		
SECTION III :		
Earthing & Lightning Protection		
SECTION IV :		
Point Wiring & Fixtures		
SECTION V:		
UPS MAINS / SUBMAINS WIRING & TELEPHONE		
SECTION: VI		
External Lighting		
TOTAL AMOUNT -		
VAT@5%		
VAT@12.5%		
Service Tax@ 10.3%		
Other taxes if any		
FINAL VALUE (Supply + Installation) With Taxes		

Note:-							

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
	SECTION - I : LV Panels & Distribution Boards						
1.0	Supply, Installation, testing & commissioning of LV panel boards compartmental cubicle type freestanding with appropriate cable entries, front operating, front maintained wherever required complete with base frame etc. as required and as per IS 8623 specifications. Panel has to be fabricated out of 14 / 16 SWG CRCA sheet, and surface treated with phosphating seven tank process and duly powder coated with RAL 7032 or any approved color. (Refer Single Line Diagram vide drg. no.-SLD001 ------ for Switchgear and other details).						
1.1	MDB	Set	1.00				
1.2	SLDB (External Lighting)	Set	1.00				
2	Supply, installation, testing, tagging, (Circuit numbering) and commissioning of following double door readymade recessed type MCB, DB, fabricated out of CRCA sheet and painted with powdercoating process OR made out of scratch proof polycarbonate body, and concealed in wall or on surface with necessary frame complete as required.						
2.1	4 way TPN DB with 25A, TP RCBO 100 mA as incomer & 10A SP MCB as outgoings as per SLD **(LDB-1,2,5,6,7 ELDB-3,4,5,6)**.	Nos	9.00				
	4 way TPN DB with 40A, TP MCB as incomer & 20A SP MCB as outgoings as per SLD **(UPS DB)**.	Nos	1.00				
2.2	6 way TPN DB with 25A, TP MCB as incomer & 10A SP MCB as outgoings as per SLD(**LDB-3,4, ELDB-1,2**)	Nos	4.00				
2.3	4 way TPN DB with 63A, FP MCB as incomer & 20A SP MCB as outgoings as per SLD (**ACDB**)	Nos	1.00				
2.4	6 way TPN DB with 63A, TP MCB as incomer & 20A SP MCB as outgoings as per SLD (**RPDB-3**)	Nos	1.00				
2.5	8 way TPN DB with 63A, TP MCB as incomer & 20A SP MCB as outgoings as per SLD (**RPDB-1 & 2**) .	Nos	2.00				
2.6	8 way VTPN DB with 63A, TPN MCCB as incomer & 25A TP MCB as outgoings as per SLD (**MLDB**).	Nos	1.00				
2.7	8way VTPN DB with 100A, FP MCCB as incomer & 63A TP MCB as outgoings as per SLD (**AC & RAW POWER DB**).	Nos	1.00				
2.8	8 way VTPN DB with 40A, TPN MCCB as incomer & 25A TP MCB as outgoings as per SLD (**MAIN UPS DB**).	Nos	1.00				
3	Supply, fixing, testing, of good quality industrial sockets with MCB's or MCB isolators of different ratings in readymade **IP 55** metal enclosure. Box should be suitable to terminate cables / wires easily, complete as required.						
3.1	20A 1Ø, 2P+E, Socket with 20A SP MCB in a Readymade Box.	No.	UR				
3.2	20A, 3Ø, 3P+N+E, Socket outlet with 20A TPMCB in readymade metal enclosure.	No.	UR				
3.3	32A, 3Ø, 3P+N+E, Socket outlet with 32A TPMCB in readymade metal enclosure.	No.	UR				
4	Supply, fixing, testing, of good quality industrial interlocked switched sockets with MCB's of different ratings in readymade **IP 65** metal enclosure. Box should be suitable to terminate cables / wires easily, complete as required.						
4.1	20A 1Ø, 2P+E Socket with 20A SP MCB in a Readymade Box IP65 .	No.	10.00				
4.2	32A, 3Ø, 3P+N+E, Socket outlet with 32A TPMCB in readymade metal enclosure IP65.	No.	3.00				
4.3	63A, 3Ø, 3P+N+E, Socket outlet with 63A TPMCB in readymade metal enclosure IP65.	No.	UR				
	TOTAL : SECTION - I						
	SECTION II : L.V. Cables.						

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
1.0	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 task. **(Actual cable lengths shall be measured at site prior to procurement.)**						
1.1	3.5C x 400 Sq.mm. A2XFY cable.	Rmtr	UR				
1.2	3.5C x 300 Sq.mm. A2XFY cable.	Rmtr	700				
1.3	3.5C x 240 Sq.mm. A2XFY cable.	Rmtr	UR				
1.4	3.5C x 185 Sq.mm. A2XFY cable.	Rmtr	UR				
1.5	3.5C x 150 Sq.mm. A2XFY cable.	Rmtr	200				
1.6	3.5C x 120 Sq.mm. A2XFY cable.	Rmtr	UR				
1.7	3.5C x 95 Sq.mm. A2XFY cable.	Rmtr	UR				
1.8	3.5C x 70 Sq.mm. A2XFY cable	Rmtr	UR				
1.9	3.5C x 50 Sq.mm. A2XFY cable.	Rmtr	UR				
1.10	3.5C x 35 Sq.mm. A2XFY cable.	Rmtr	100				
1.11	3.5C x 25 Sq.mm. A2XFY cable.	Rmtr	UR				
1.12	4C x 25 Sq.mm. AYFY cable.	Rmtr	UR				
1.13	4C x 16 Sq.mm. AYFY cable.	Rmtr	250				
1.14	4C x 10 Sq.mm. AYFY cable.	Rmtr	UR				
1.15	4C x 16 Sq.mm. YWY cable.	Rmtr	UR				
1.16	4C x 10 Sq.mm. YWY cable.	Rmtr	UR				
1.17	4C x 6 Sq.mm. AYFY cable.	Rmtr	500				
1.18	4C x 6 Sq.mm. YWY cable.	Rmtr	UR				
1.19	4C x 4 Sq.mm. YWY cable.	Rmtr	800				
1.20	4C x 2.5 Sq.mm. YWY cable.	Rmtr	UR				
1.21	3C x 6 Sq.mm. YWY cable.	Rmtr	UR				
1.22	3C x 4 Sq.mm. YWY cable.	Rmtr	UR				
1.23	3C x 2.5 Sq.mm. YWY cable.	Rmtr	UR				
1.24	3C x 2.5 Sq.mm. AYFY cable.	Rmtr	UR				
1.25	1CX 10 Sq.mm. YY Including End Termination	Rmtr	300				
2.0	Supply & installation of End termination for cables as above with Brass, heavy duty, Single compression glands, Al/ Cu lugs, other consumable like insulation adhesive tape, crimping, gland hole drilling, ferrulling, marking, etc.						
2.1	3.5C x 400 Sq.mm. A2XFY cable.	Nos.	UR				
2.2	3.5C x 300 Sq.mm. A2XFY cable.	Nos.	4				
2.3	3.5C x 240 Sq.mm. A2XFY cable.	Nos.	UR				
2.4	3.5C x 185 Sq.mm. A2XFY cable.	Nos.	UR				
2.5	3.5C x 150 Sq.mm. A2XFY cable.	Nos.	4				
2.6	3.5C x 120 Sq.mm. A2XFY cable.	Nos.	UR				
2.7	3.5C x 95 Sq.mm. A2XFY cable.	Nos.	UR				
2.8	3.5C x 70 Sq.mm. A2XFY cable	Nos.	UR				
2.9	3.5C x 50 Sq.mm. A2XFY cable.	Nos.	UR				
2.10	3.5C x 35 Sq.mm. A2XFY cable.	Nos.	2				
2.11	3.5C x 25 Sq.mm. A2XFY cable.	Nos.	UR				
2.12	4C x 25 Sq.mm. AYFY cable.	Nos.	UR				
2.13	4C x 16 Sq.mm. AYFY cable.	Nos.	12				
2.14	4C x 10 Sq.mm. AYFY cable.	Nos.	UR				
2.15	4C x 16 Sq.mm. YWY cable.	Nos.	UR				
2.16	4C x 10 Sq.mm. YWY cable.	Nos.	UR				
2.17	4C x 6 Sq.mm. AYFY cable.	Nos.	50				
2.18	4C x 6 Sq.mm. YWY cable.	Nos.	UR				
2.19	4C x 4 Sq.mm. YWY cable.	Nos.	26				
2.20	4C x 2.5 Sq.mm. YWY cable.	Nos.	UR				
2.21	3C x 6 Sq.mm. YWY cable.	Nos.	UR				
2.22	3C x 4 Sq.mm. YWY cable.	Nos.	UR				
2.23	3C x 2.5 Sq.mm. YWY cable.	Nos.	UR				
2.24	3C x 2.5 Sq.mm. AYFY cable.	Nos.	UR				
2.27	1cx10sqmm YY Cable PG Gland	Nos.	20				
3.0	Supply & installation of readymade hot dip GI. perforated type tray, including readymade accessories e.g. vertical & horizontal bends, reducers,couplers,Tee's, right angles etc.(Ref Layout)						

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
3.1	50mm, 50x50 perforated tray. (16 SWG)	Rmtr	UR				
3.2	100mm, 50x50 perforated tray. (16 SWG)	Rmtr	50				
3.3	150mm, 50x50 perforated tray. (16 SWG)	Rmtr	120				
3.4	200mm, 50x50 perforated tray. (16 SWG)	Rmtr	UR				
3.5	300mm, 50x50 perforated tray. (16 SWG)	Rmtr	100				
3.6	450x50x50 MM. LADDER CABLE TRAY	Rmtr	50				
4.0	Supply and installation of readymade hot dip GI tray covers 16/18 SWG including readymade shape of Vertical & Horizontal Bend, Tee's, Right angles etc. to suit tray for all vertical runs.						
4.1	50mm perforated tray.	Rmtr	UR				
4.2	100mm perforated tray.	Rmtr	50				
5.0	Excavation of cable trenches upto a depth of 1200 mm maximum and refilling, reinstating the material after cable laying complete including providing crown and disposing, spreading material within 500 mtrs.						
5.1	Excavation in Soft Rock	M^3	400				
5.2	Excavation in Hard Rock	M^3	UR				
6.0	Supply, laying of following different types of pipes in trenches for road crossing for electrical, telephone cables etc. complete as required including excavation of trench in all types of strata except hard rock and refilling, leveling of trench, shifting of extra earth or debris to dump yard complete as required.						
6.1	200 mm dia. HDPE Pipes with concrete encasing.	Rmt.	UR				
6.2	300 mm dia. HDPE Pipes with concrete encasing.	Rmt.	200				
7.0	Supply and Fabrication of M.S. angle/ Channel/ Square tube of 3mm thick of 50x50mm size including base plates supports as per requirement (Duly approved by AEPPL and Client) for trays, frames etc. including necessary painting with 2 coats of primer and 2 coats of enamel black paint.	Kg.	2000				
	TOTAL : SECTION II						
	SECTION III : Earthing & Lightning Protection						
1.0	Supply & making following Earthing station as per IS 3043 by using GI plate / Cu. plate / Pipe earthing as electrode complete with watering pipe, 50 x 6 mm connecting GI strip up to chamber, soil treatment with charcoal & salt / bentonite powder brick inspection chamber of suitable size with 450 x 450 mm, CI cover, disconnecting link complete, including excavation of earth pit in all type of strata, refilling as detailed below.						
1.1	Earthing as above but using maintenance free earth electrode with chemical treatment 3mtr. long "Ashlok" CAT NO. T39 / Alltec / UES make or equivalent. Including boring of hole upto 6.5 mtrs. in all types of strata as required.	Nos.	10				
2.0	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 srips as per specification. (excavation required for this will be ensured separately.) Refer layout & tender spec for various applications						
2.1	50 x 6 mm. GI strip.	Rmtr	50				
2.2	32 x 6 mm. GI strip.	Rmtr	350				
2.3	25 x 3 mm. GI strip.	Rmtr	UR				
2.4	25 x 3 mm. Cu. strip. Supported on Porcelain insulator/ J bolt at every 1.5 mtr interval for building L.A.	Rmtr	160				
2.5	25 x 3 mm. Cu strip.	Rmtr	100				
2.6	14 SWG Cu. Wire.	Rmtr	UR				

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
2.7	8 SWG Cu. Wire.	Rmtr	UR				
2.8	8 SWG GI Wire.	Rmtr	500				
2.9	4 SWG Cu Wire.	Rmtr	UR				
2.10	10 SWG GI Wire.	Rmtr	UR				
2.11	10 SWG Cu Wire.	Rmtr	UR				
2.12	6.0 sqmm Cu. Cond. PVC insulated.	Rmtr	UR				
2.13	4.0 sqmm Cu. Cond. PVC insulated.	Rmtr	UR				
3.0	Supply, installation, testing & commissioning of Transducer type Building lightning arrester "EARLY STREAMER" to cover protection radius of 65.0 mtr. With 3 mtr rod height & with stem and fixing arrangement. (Indelec or Eqvt.). Required installation/ mounting details shall be submitted prior to installation.	Nos.	1				
4.0	Supply, installation, testing & commissioning of Transducer type Building lightning arrester "EARLY STREAMER" to cover protection radius of 45.0 mtr. With 3 mtr rod height & with stem and fixing arrangement. (Indelec or Eqvt.). Required installation/ mounting details shall be submitted prior to installation.	Nos.	UR				
5.0	Supply, installation, testing & commissioning of 5 Spikes Copper Building lightening arrester to be installed on top most point of building with stem and fixing arrangement etc. complete.	Nos.	UR				
6.0	Supply, installation, testing of disconnecting link box for lightning down conductor at 1 mtr. from GL with SMC insulator and Gunmetal 50 x 6 mm disconnecting link.	Nos.	1				
	TOTAL : SECTION III						
	SECTION IV : Point Wiring & Fixtures						
1.0	Surface / concealed point wiring for light / fan call bell / 5 A points with 2 x 2.5 + 1 x 1.5 Sq.mm. multistrand Cu. wires 1100 V gr. in suitable size FR PVC conduits / flexible conduits wherever required as submains and 2 x 1.5 + 1 x 1.5 Sq.mm. wires for each point complete (submains will not be measured separately) with necessary modular switch board, switch plates and Blanking plates & accessories as required etc. to complete the task.. Primary Point shall mean first point wired from switchboard and Secondary point shall mean successive points next to Primary point.						
	Note:- All conduits in area with false ceiling shall be concealed in wall below false ceiling						
1.1	Primary Light point wiring with necessary 5 A SP switch, ceiling rose / Holders complete. (Maximum 2/3 points controlled by one switch)	Pt.	150				
1.2	Secondary light point wiring with 2x1.5 + 1x1.5 sqmm Cu wires from primary point above including necessary accessories e.g. connectors.	Pt.	160				
1.3	5A 3 pin socket outlets independent (Modular).	Pt.	25				
1.4	Fan point with modular 5 A SP Switch, 5 step Electronic fan Regulator, switch box plate & fan hook box etc. modular fan box.	Pt.	UR				
1.5	5A 3 pin socket outlets independent (Modular).	Pt.	UR				
1.6	5A 3 pin socket outlets for AC/Raw/Power point	Pt.	60				
1.7	Exhaust fan / Wall fan points with modular socket near fan & 5A switch in main switch board of respective area	Pt.	20				

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
1.8	Point wiring as above but for 5A +15 A socket outlet with 2 x 2.5 Sq.mm. + 1 x 1.5 Sq.mm. wires from DB including socket outlet & switch etc.complete.	Pt.	70				
2.0	Supply, installation, testing and commissioning of lighting fixtures/ fans/Ex. fans etc. including necessary ballast, lamp, accessories, wiring connection, support arrangement like suspension chain, M.S. conduit drop with ball socket. down drops, etc. All FTL fixtures shall be with triphosphor source.						
2.1	1 x 26 Watt CFL Wall / Ceiling Light Equi to Wipro FWP 42126	Nos.	35				
2.2	2 x 18 Watt Down lighter Equi to Wipro WCP 27218	Nos.	80				
2.3	2x 18 Watt Down lighter Equi to Wipro WCP 28218	Nos.	130				
2.4	1 x 36 Watt T8 Fixture Eqiv to Wipro WRF 21236	Nos.	25				
2.5	1 x 70 W Recess Mounted Downlighter Eqiv to Wipro WCH55070	Nos.	20				
2.6	1 x 26 Watt Fantacy Step Light Equi to Wipro FSP 42126	Nos.	30				
2.7	1 x 18 Watt Indoor Decorative Fixture Equi to Wipro WRF 21118	Nos.	25				
2.8	4 x 14 Watt T5 Equi to Wipro WVF -53414.	Nos.	25				
2.9	2 x 18 Watt CFL Surface Mounted Mirror Optics Fixture Eqiv to Wipro WVP 41218	Nos.	16				
2.10	Supply, installation testing of 150mm exhaust fans with mounting frame & louvers.	Nos.	UR				
2.11	Supply, installation testing of wall mounted fans with mounting frame & louvers.	Nos.	UR				
3.0	Supply & installation of 2 mm thick FR PVC white/Black conduit of following sizes including all accessories e.g. deep junction box, bends etc. for concealing in slab / wall & spacer, saddles for open on slab / wall.						
3.1	32 mm dia. FRPVC.	Rmt	UR				
3.2	25 mm dia. FRPVC.	Rmt	UR				
	TOTAL : SECTION IV						
	SECTION V: UPS MAINS / SUBMAINS WIRING & TELEPHONE						
1.0	Supply, Installation, Testing, Commissioning of **10 kVA UPS** with batteries, battery stand, 3 phase I/p & 3 phase o/p with 30 Minutes battery back up.	No.	2				
2.0	Supply & Installation of power points with 2 x 4.0 + 1 x 2.5 Sqmm Cu wires as above but in FR PVC conduit.	Rmtr	500				
3.0	As above but 2 x 2.5 + 1 x 1.5 Sq.mm. wires. In FR PVC conduit.	Rmtr	1200				
4.0	Supply and installation of main for UPS power points in Auditorium area with 2 x 4 + 1 x 2.5 Sq.mm. wires including 25mm FR PVC Conduits.	Rmtr	200				
5	As above but 2 x 2.5 + 1 x 1.5 Sq.mm. wires.FR PVC conduit .	Rmtr	200				
6	Supply ,Installation,Testing & Commissioning of 24 port switch,Patch cord Panel & rquired accessories to complete the job.						
6.1	Supply, installation, testing & comissioing of 24 Port Switch with SFP port	Set	1				

Item No	Description	Unit	Qty	Supply		Installation	
				Rate	Amount	Rate	Amount
6.2	Supply, installation, testing & comissioing of Patch Panels for above switch	Set	1				
7	Supply ,Installation,Testing & Commissioning of Data,Telephone cable & rquired accessories to complete the job.						
7.1	Supply & laying of Cat-6 computer/data cables in provided blank concealed conduits / Floor Truff above.	Rmtr	1000				
7.2	RJ 45 socket for above cable		14				
7.3	Supply and laying of RJ11 cables in provided blank concealed conduits / Floor Truff above.	Rmtr	1000				
7.4	Telephone socket & RJ 11 jack for above cable	Set	14				
7.5	Data Cluster Consisting Of:-2No. RJ45 Network Point 1NO,RJ11 Telephone Point 2No,2No. 5A Modular Socket Points With 2No. Switch ON UPS POWER	Set	8				
7.6	Data Cluster Consisting Of:-1No. RJ45 Network Points, 1No. RJ11 Telephone Points 1No. 5A Modular Socket Points With 1No. Switch On UPS POWER	Set	6				
8.0	Supply and installation of 2 mm thickness Aluminium extruded raceway for under floor installation including necessary cutting of floor providing couplers and clamps for raceway fixing as details provided making good the surface of floor complete as per sizes provided.						
8.1	80mm x 38mm deep AL. raceways.	Rmt.	UR				
8.2	100mm x 38 mm deep AL. raceways.	Rmt.	UR				
8.3	125mm x 38 mm deep AL. raceways.	Rmt.	UR				
9.0	Supply and installation of good quality floor junction boxes of appropriate sizes for raceways with folded frames including counter sunk screw arrangements such that covers are in level with the floor level. The cover will be M.S, power coated & have 4 Nos. 25 / 32 mm Ø holes with rubber grommets at appropriate location.						
9.1	100mm X 100mm X 50mm deep16SWG junction box with 14 SWG cover.	Nos.	UR				
9.2	125mm X 125mm X 50 mm deep16SWG junction box with 14 SWG cover.	Nos.	UR				
9.3	225mm X 225mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
9.4	330mm X 330mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
9.5	450mm X 450mm X 50 mm deep 16SWG junction box with 14 SWG cover.	Nos.	UR				
	TOTAL : SECTION V						
	SECTION - VI						
	External Lighting						
1.0	Supply, Installation of Street Light poles complete with excavation, pile foundation of size 1200 x 600 x 600 mm foundation with couping, muffing & RCC reinforcement, 2Nos. of 40mm dia GI pipes bend to shape 1.5m long for cable entry/exit, cable loop box with 15A 4 way connector, 10A SP MCB per lamp, spring type earthing of pole with 12 SWG wire Wipro/EQVT make.						
1.1	As Above but 6 Mtr. Poles with 1200mm suitable bracket long for mounting LED street light fixture.	Nos	8				
1.2	As Above but 12 Mtr. Poles with 1200mm suitable bracket long for mounting LED street light fixture.	Nos	3				
1.3	ORIO 4X6 W LED Fixture	Nos	8				
1.4	WFH52250 Floodlight 1x250W	Nos	3				
	TOTAL : SECTION VI						

ORIGINAL FRAME
SIZE- 594x420MM

REFERENCE DRAWING	REV.	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	TENDER DRAWING
	00	TANMAY 14.06.10	AMOL P 14.06.10	SHAILESH 14.06.10	
	01				
	02				
	03				
	04				ALTERATION

DRAWING TITLE	SLD FOR MDB, MLDB, UPS, AC & RAW POWER DB, SLDB
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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DRG. NO:- AEPPL\IITM\EL-SLD-001-R0
SCALE:- N.T.S. DATE:- 14.06.2011

LOAD DESCRIPTION	LDB-01	LDB-02	LDB-03	LDB-04	LDB-05	LDB-06	SPARE
LOCTAION	SERVICE ROOM	SERVICE ROOM	EXHIBITION AREA	EXHIBITION AREA	ELECTRICAL ROOM	1ST FLR. CORRIDOR	
CABLE SIZE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	

FROM MDB
1Rx4Cx16 sq.mm AYFY CABLE
2A SP MCB
63A TPN MCCB 35kA
SLDB (EXTERNAL LIGHTING DB)
LOCATION - ELECTRICAL ROOM
24 HR. REAL TIME SENSOR BASED UNIT
1Rx4Cx6 sq.mm. AYFY CABLE
SPARE
20A TP MCB
20A CONT.

FROM EXISTING MLTP
2Rx3.5Cx300 sq.mm A2XFY CABLE
630A TPN, MCCB 35kA, TM
ON OFFTRIP
2A SP MCB
630/5A CL1, CT
6300A TPN, 35kA AL. BUSBAR
400/5A CL1, CT
100/5A CL1, CT
63/5A CL1, CT
40/5A CL1, CT
100/5A CL1, CT
63/5A CL1, CT
LM
MAIN DISTRIBUTION BOARD (MDB)
LOC:- ELECTRICAL PANEL ROOM
CONN. LOAD:- 325 kW
CABLE ENTRY/EXIT:- TOP

LOAD DESCRIPTION	HVAC PANEL	AC & RAW POWER DB	MLDB	STREET LIGHTING DB	10 KVA UPS	SPARE	SPARE	SPARE
CONNECTED LOAD	220 kW	35 kW	20 kW	25 kW	10 kVA			
CABLE SIZE	2Rx3.5Cx150 sq.mm A2XFY CABLE	1Rx3.5Cx35 sq.mm A2XFY CABLE	1Rx4Cx16 sq.mm AYFY CABLE	1Rx4Cx16 sq.mm AYFY CABLE	5Rx1Cx10 sq.mm YY CABLE			

MLDB
LOC:- ELECTRICAL PANEL ROOM
8 WAY VTPN DB
FROM MDB
1Rx4Cx16 sq.mm AYFY CABLE
63A TPN MCCB 25kA, TM
25A TP MCB

MAIN UPS DB
LOC:- ELECTRICAL PANEL ROOM
8 WAY VTPN DB
FROM MDB
1Rx4Cx16 sq.mm AYFY CABLE
40A TPN MCCB 25kA, TM
25A TP MCB

LOAD DESCRIPTION	ELDB-01	ELDB-02	ELDB-03	ELDB-04	ELDB-05	ELDB-06	UPS DB	SPARE
LOCTAION	EXHIBITION AREA	EXHIBITION AREA	1ST FLR. CORRIDOR	EXHIBITION AREA	EXHIBITION AREA	EXHIBITION AREA	EXHIBITION AREA	
CABLE SIZE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	1Rx4Cx4 Sq. mm. YWY CABLE	

AC & RAW POWER DB
LOC:- ELECTRICAL PANEL ROOM
8 WAY VTPN DB
FROM MDB
1Rx3.5Cx35 sq.mm A2XFY CABLE
100A TPN MCCB 25kA, TM
63A TP MCB

LOAD DESCRIPTION	RPDB-01	RPDB-02	RPDB-03	ACDB	SPARE
LOCTAION	EXHIBITION AREA	EXHIBITION AREA	1ST FLR. CORRIDOR	EXHIBITION AREA	
CABLE SIZE	1Rx4Cx16 Sq. mm. AYFY CABLE	1Rx4Cx16 Sq. mm. AYFY CABLE	1Rx4Cx16 Sq. mm. AYFY CABLE	1Rx4Cx16 Sq. mm. AYFY CABLE	

FROM MDB
5Rx1Cx10 sq.mm YY CABLE
10kVA UPS 3Φ I/C 3Φ O/G

DRG. NO:-
EL-SLD-001-R0
REV. NO:- 00
SHEET NO:- 1 OF 1

ORIGINAL FRAME
SIZE- 594x420MM

REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE
	00	TANMAY 14.06.10	AMOL P 14.06.10	SHAILESH 14.06.10
	01			
	02			
	03			
	04			

ALTERATION
TENDER DRAWING

DRAWING TITLE: POWER, AC & UPS POWER SINGLE LINE DIAGRAM
PROJECT: INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT: IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

DRG. NO:- AEPPL\IITM\EL-PWR-003-R0
SCALE:- N.T.S. DATE:- 14.06.2011

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DRG. NO.:-
EL-PWR-003-R0
REV. NO.:- 00
SHEET NO.:- 1 OF 1

RPDB-03
LOCATION:- CORRIDOR AREA
6 WAY TPN DB

FROM AC & RAW POWER DB
1RX4CX16 sq.mm
AYFY CABLE

63A, 4P MCB

R1 Y1 B1 R2 Y2 B2 R3 Y3 B3 R4 Y4 B4 R5 Y5 B5–B6

20A SP MCB

2X4+1X2.5 Sq.mm. Cu. WIRE

PS301, PS302 | PS304 | PS305, PS311 | PS312, SS305, SS306 | PS313, SS307, SS308 | PS314, PS315 | PS316, PS318 | PS317, PS319 | PS309, PS310 | PS307, SS303, SS304 | PS306, SS301, SS302 | PS306 | SS304, SS305, SS306, SS307 | SS308, SS309, SS310, SS311

ACDB
LOCATION:- EXHIBITION AREA
4 WAY TPN DB

FROM AC & RAW POWER DB
1RX4CX16 sq.mm
AYFY CABLE

63A, 4P MCB

R1 Y1 B1 R2 Y2 B2 R3 Y3 B3 R4–B4

20A SP MCB

1RX4CX4 Sq. mm. YY CABLE

PP101 | PP102 | PP103 | PP104 | PP201 | PP202 | PP203 | PP204 | PP205

RPDB-02
LOCATION:- EXHIBITION AREA
8 WAY TPN DB

FROM AC & RAW POWER DB
1RX4CX16 sq.mm
AYFY CABLE

63A, 4P MCB

R1 Y1 B1 R2 Y2 B2 R3 Y3 B3 R4 Y4 R5 B4 Y5 R6 B5 Y6 B6 R7–B8

20A SP MCB

2X4+1X2.5 Sq.mm. Cu. WIRE

PS201, PS202 | PS203, PS204 | PS205, PS206 | PS207, PS208 | PS209, PS210 | PS211, PS212 | PS213, PS213A | PS214, PS215 | PS216, PS217 | PS218, PS219 | PS220 | PS221 | PS222, PS223 | PS224, PS225 | PS226, SS205, SS206 | PS227, PS228 | SS201, SS202, SS203, SS204 | SP203, SP204

UPS DB
LOCATION:- EXHIBITION AREA
4 WAY TPN DB

FROM MAIN UPS DB
1RX4CX4 sq.mm
YWY CABLE

40A, TP MCB

R1 Y1 B1 R2 Y2 B2–B4

20A SP MCB

2X4+1X2.5 Sq.mm. Cu. WIRE

DP01, DP02 | DP03, DP04 | DP05, DP06 | DP07, DP08 | DP09, DP10

RPDB-01
LOCATION:- EXHIBITION AREA
8 WAY TPN DB

FROM AC & RAW POWER DB
1RX4CX16 sq.mm
AYFY CABLE

63A, 4P MCB

R1 Y1 B1 R2 Y2 B2 R3 Y3 B3 R4 Y4 R5 B4 Y5 R6 B5 Y6 B6–B8

20A SP MCB

2X4+1X2.5 Sq.mm. Cu. WIRE

PS101, SS102 | PS102, PS103 | PS104, PS105 | PS106, PS107 | PS108, PS109 | PS110, PS111 | PS112, PS113 | PS114, PS115 | PS116, PS117 | PS118, PS119 | PS120, SS107, SS108 | PS121, PS122 | SS103, SS104, SS105, SS106 | SP102, SP103 | PS123, PS124 | PS125, PS126 | PS127

REFERENCE DRAWING					
REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	TENDER DRAWING	ALTERATION
00	TANMAY 14.06.10	AMOL P 14.06.10	SHAILESH 14.06.10		
01					
02					
03					
04					

DRAWING TITLE	LIGHTING & EMERGENCY LIGHTING SLD					DRG. NO:- AEPPL\ITM\EL-SLD-003-R0	
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE						
CLIENT	IITM PUNE						
REV.	DATE	STATUS					
R0	14.06.10	ISSUED FOR TENDER					

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Web : www.archivistaindia.com

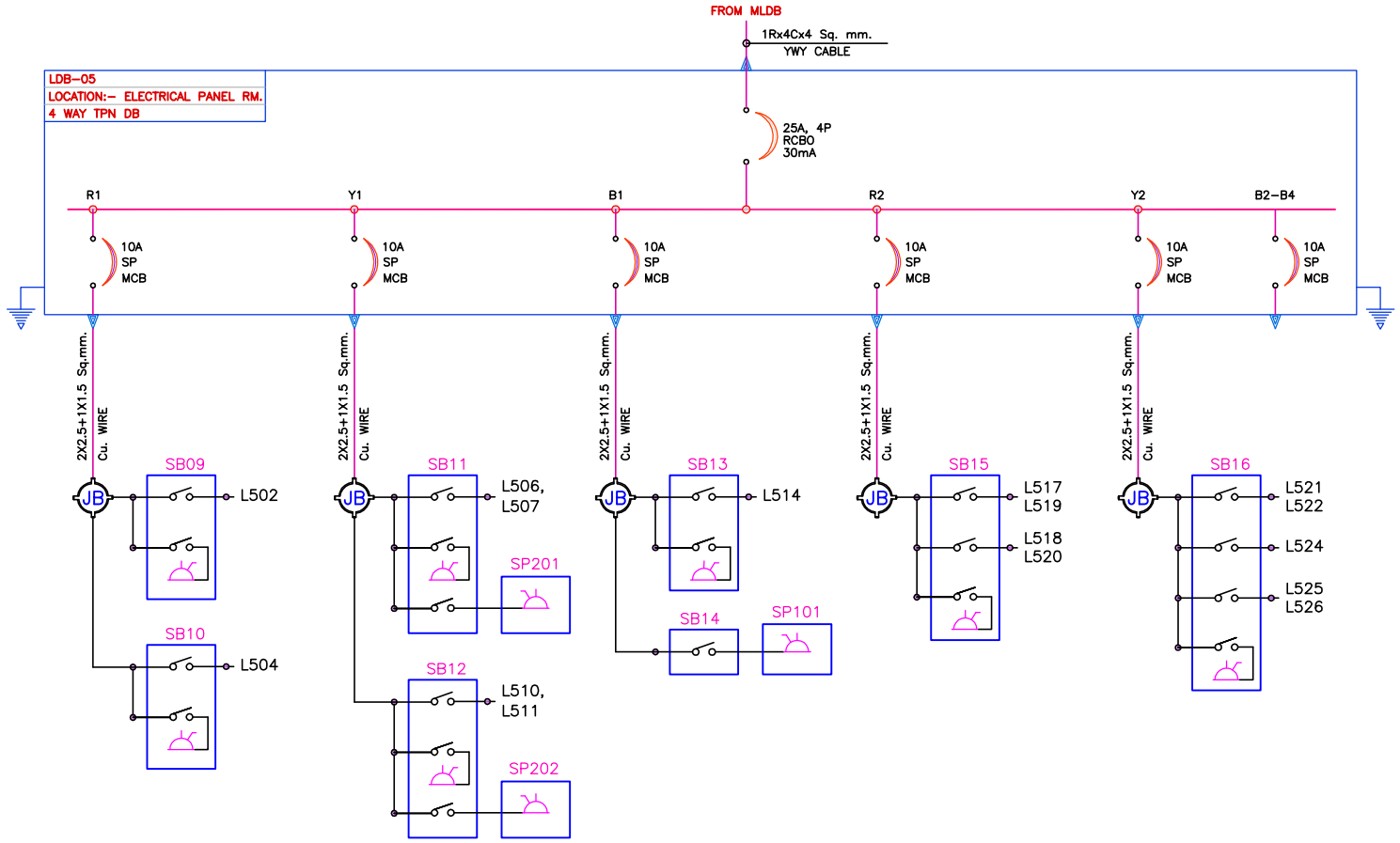
SCALE:- N.T.S. DATE:- 14.06.2011

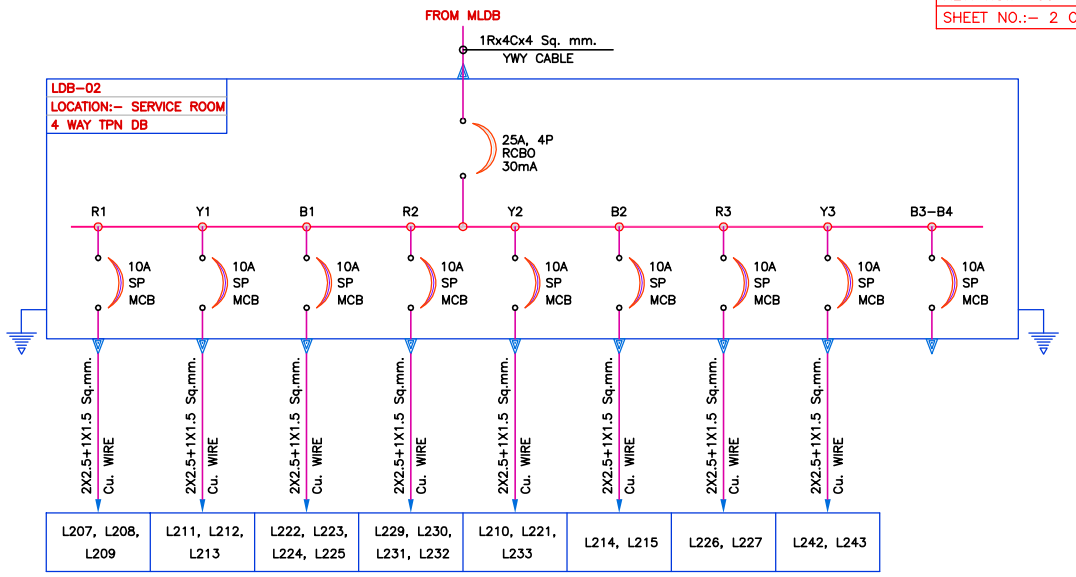
ORIGINAL FRAME
SIZE- 594x420MM

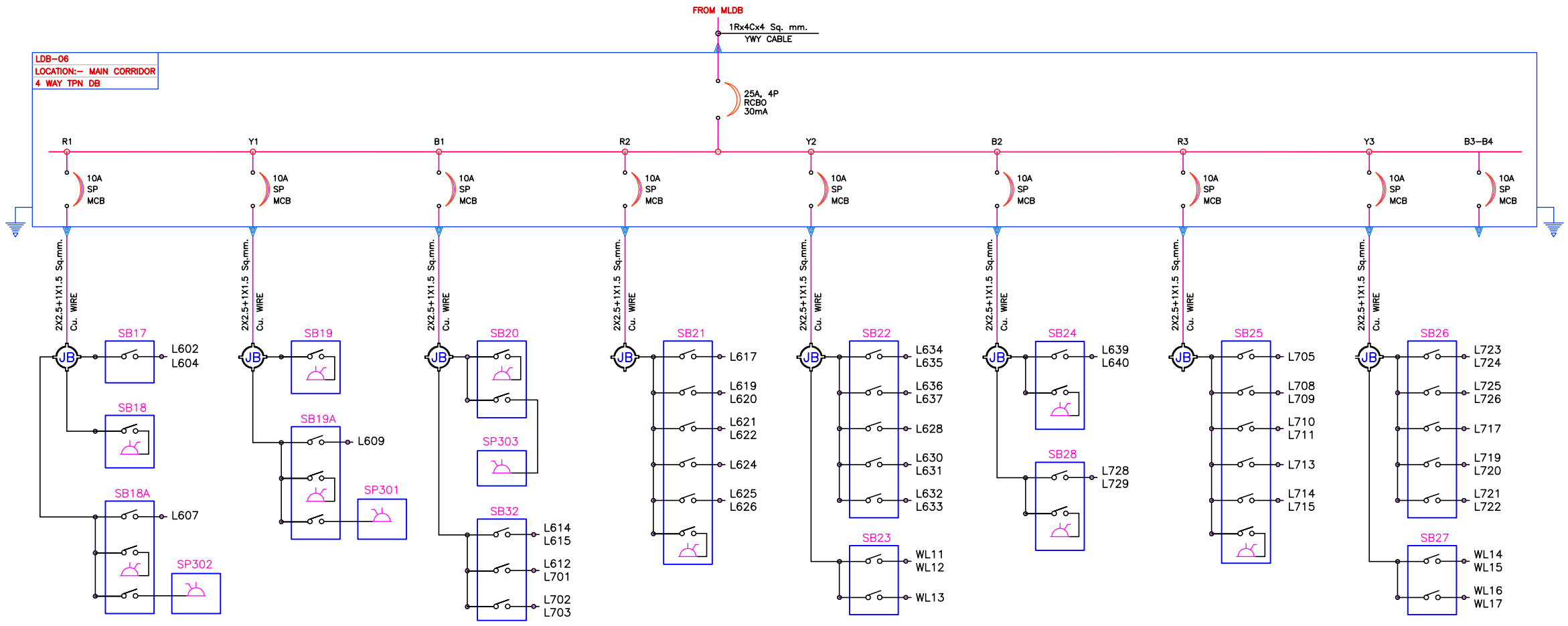
FROM MLDB
1Rx4Cx4 Sq. mm. YWY CABLE
25A, 4P RCBO 30mA
LDB-04
LOCATION:- EXHIBITION ZONE
6 WAY TPN DB
R1 MCB 10A SP
R2 MCB 10A SP
B1 MCB 10A SP
Y1 MCB 10A SP
L401
SB08
SP205
SB08A
L409 L410 L411
SB07
L415, L418, L422
L417, L421, L423
L416, L420, L424
L443, L444, L445, L446, L447
L425, L426, L430
L428, L429, L433
L431, L434, L432
L436, L438, L441
L437, L440, L442
L356, L357, L358
L448, WL06, WL07, WL08, WL10
2X2.5+1X1.5 Sq.mm. Cu. WIRE
R1 MCB 10A SP
Y2 MCB 10A SP
B2 MCB 10A SP
R2 MCB 10A SP
Y3 MCB 10A SP
B3 MCB 10A SP
R3 MCB 10A SP
Y4 MCB 10A SP
B4 MCB 10A SP
R4 MCB 10A SP
Y5 MCB 10A SP
R5 MCB 10A SP
B5-B6 MCB 10A SP
SP104
SB04
L307 L309 L310 L311
SB03
L312, L314, L316, L319
L315, L318, L321, L320
L322, L326, L328
L323, L324, L329
L327, L330, L331, L332
L334, L335, L336
L328, L339, L340
L341, L342, L343, L344
L354, L355
L356, L357, L358
L360, WL01, WL02, WL03, WL05
L346, L347, L349, L350, L351, L353
SB05
L107, L108, L109
L111, L112, L113
L125, L126, L127, L128
L129, L130, L131, L132
L110, L124, L133
L114, L115
L118, L119
L142, L143
SB31
L807 L810 L812 L813 L814 L815
SB30
L801 L804 L803 L806 L808 L809
*CAFETERIA AREA
LDB-03
LOCATION:- EXHIBITION ZONE
6 WAY TPN DB
LDB-01
LOCATION:- SERVICE ROOM
4 WAY TPN DB

DRG. NO.:-
EL-SLD-003-R0
REV. NO.:- 00
SHEET NO.:- 1 OF 3

DRG. NO.:- EL-SLD-003-R0
REV. NO.:- 00
SHEET NO.:- 2 OF 3







REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	ALTERATION
	04				
	03				
	02				
	01				
	00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING

DRAWING TITLE	LIGHTING & EMERGENCY LIGHTING SLD
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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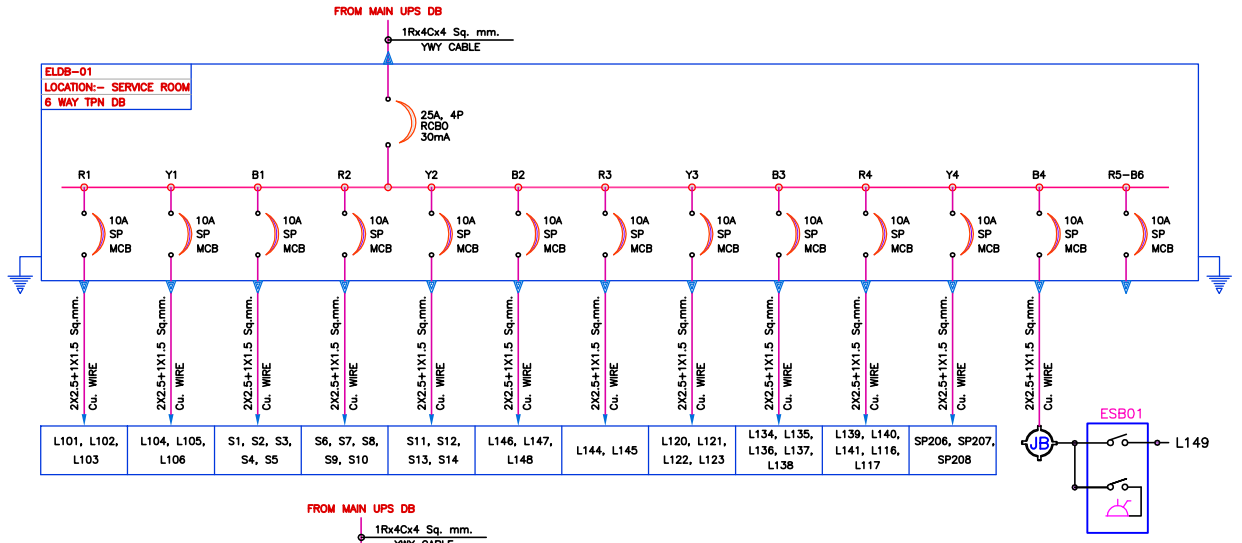
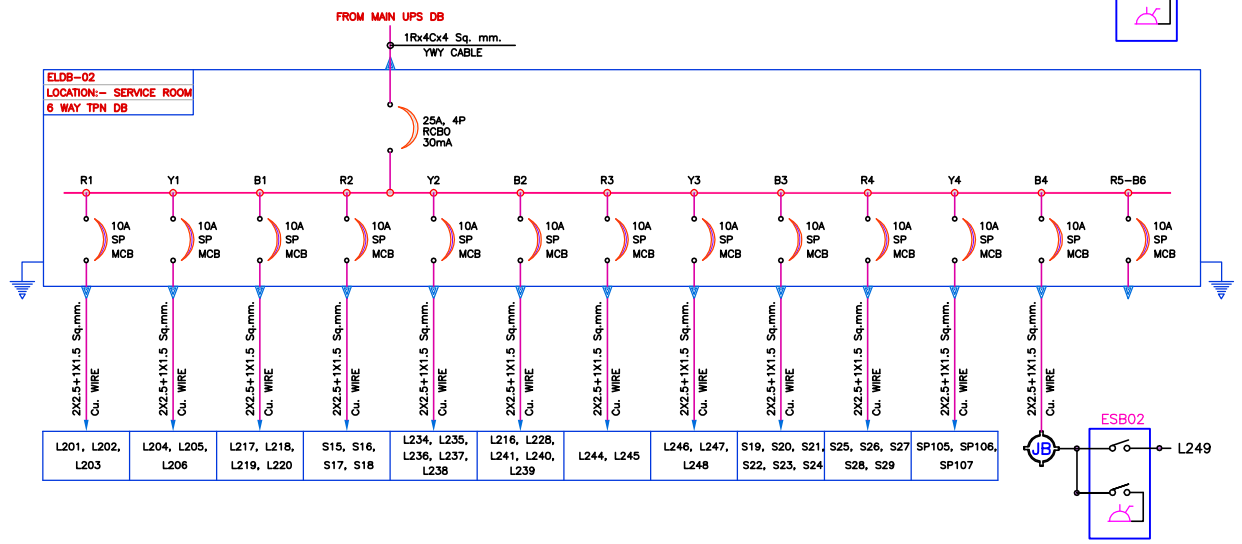
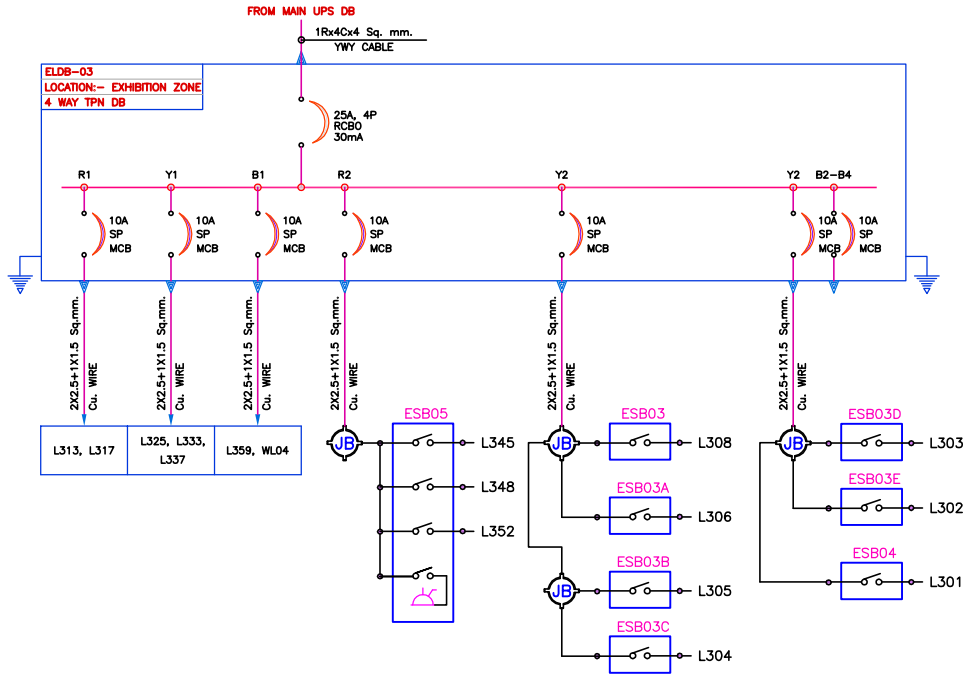
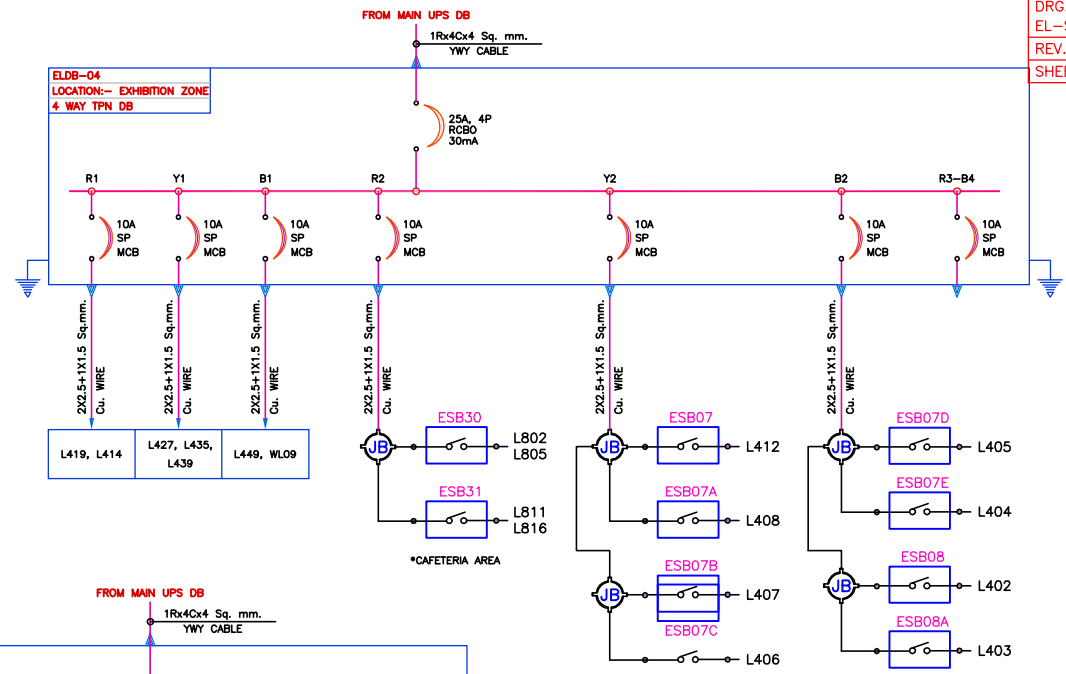
DRG. NO:- AEPPL\IITM\EL-SLD-003-R0 | SCALE:- N.T.S. | DATE:- 14.06.2011

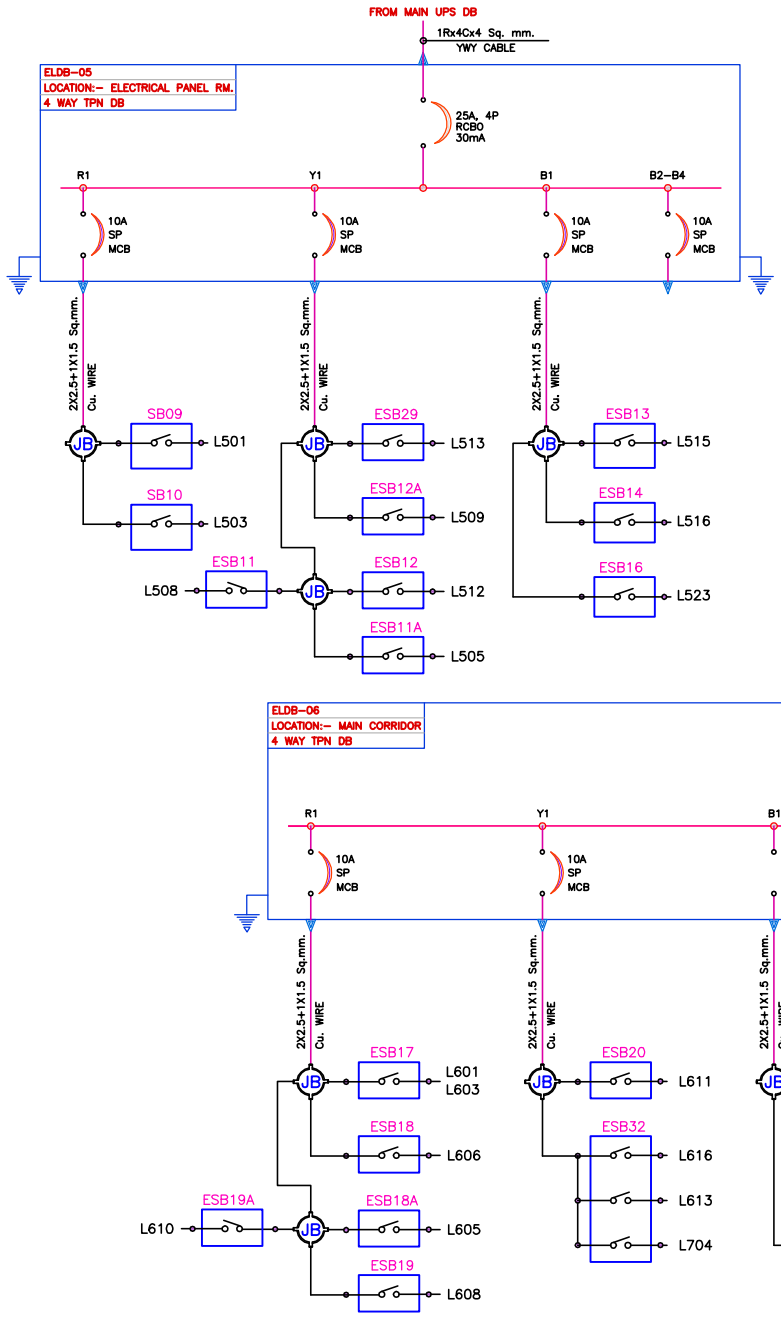
ORIGINAL FRAME SIZE- 594x420MM

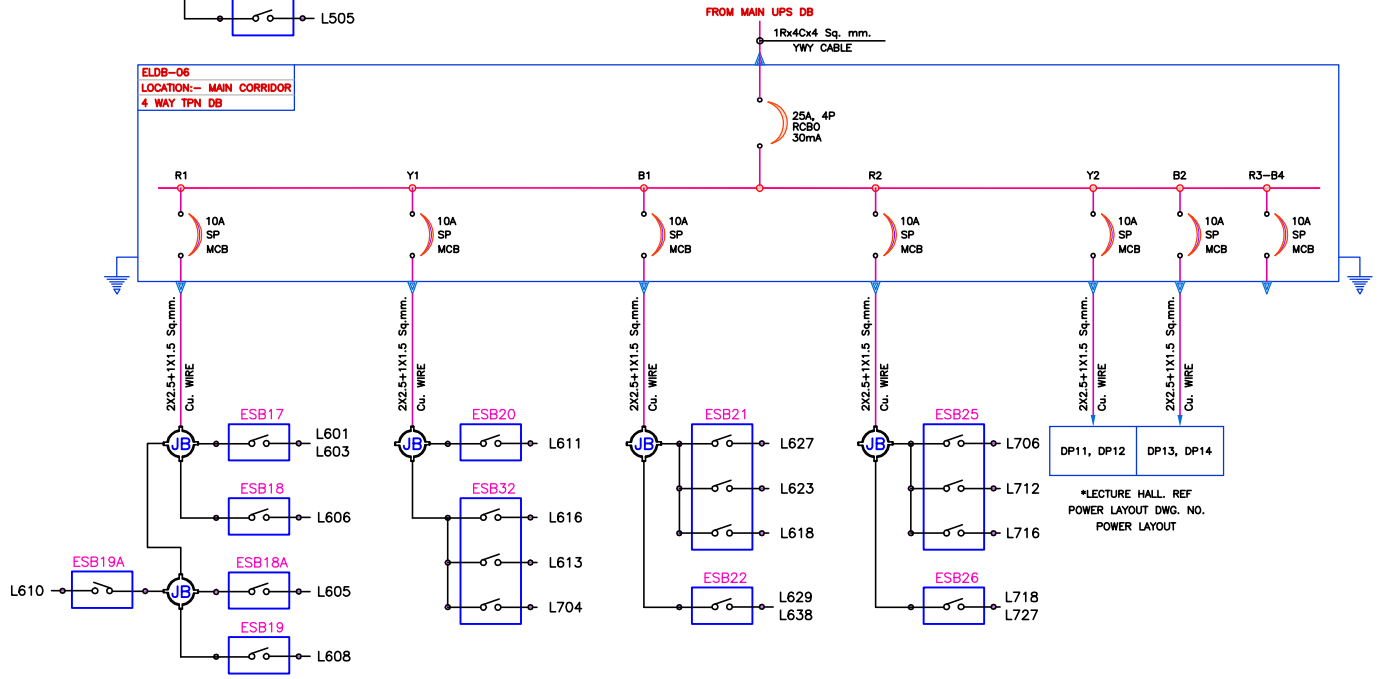












DRG. NO.:- EL-SLD-003-R0
REV. NO.:- 00
SHEET NO.:- 3 OF 3

ORIGINAL FRAME SIZE- 594x420MM

	04					
	03					
	02					
	01					
	00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING	
REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	ALTERATION	

DRAWING TITLE	LIGHTING & EMERGENCY LIGHTING SLD
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING; PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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ORIGINAL FRAME SIZE- 594x420MM

REFERENCE DRAWING			
REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE
00	TANMAY 14.06.10	AMOL P 14.06.10	SHAILESH 14.06.10
01			
02			
03			
04			

TENDER DRAWING

ALTERATION

DRAWING TITLE: POWER AND DATA LAYOUT FOR FIRST FLOOR
PROJECT: INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT: IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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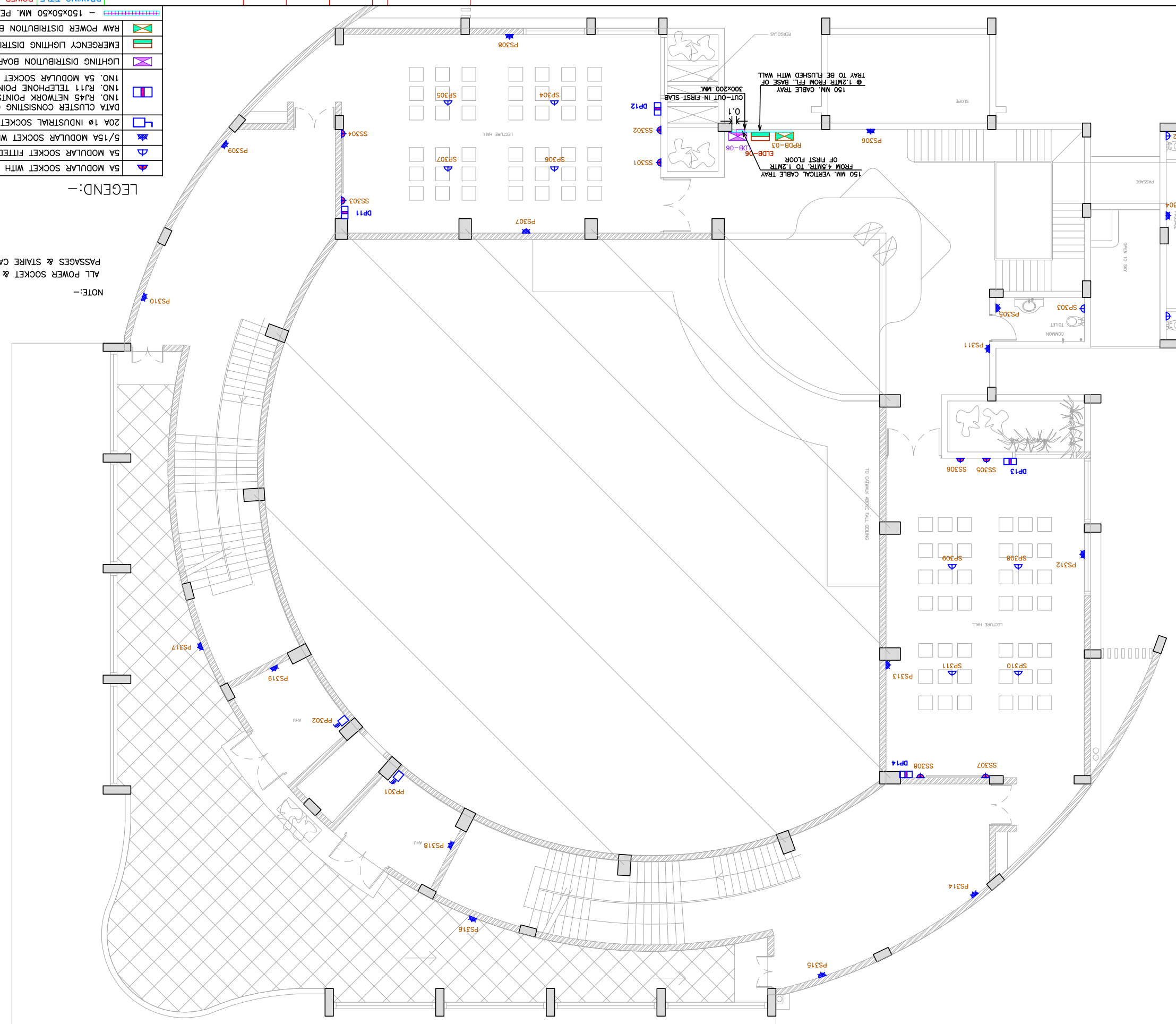
Web : www.archivistaindia.com

DRG. NO:- AEPPL\IITM\EL-PWR-002-R0
SCALE:- 1:100 (A2) DATE:- 14.06.2011

LEGEND:-

	5A MODULAR SOCKET WITH 5A SWITCH
	5A MODULAR SOCKET FITTED ON WALL/CEILING FOR EXHAUST/AC UNIT
	5/15A MODULAR SOCKET WITH 15A SWITCH
	20A 1ø INDUSTRIAL SOCKET WITH 20A MCB IP65
	DATA CLUSTER CONSISTING OF:- 1NO. RJ45 NETWORK POINTS 1NO. RJ11 TELEPHONE POINTS 1NO. 5A MODULAR SOCKET POINTS WITH 1NO. SWITCH ON UPS POWER
	LIGHTING DISTRIBUTION BOARD (LDB)
	EMERGENCY LIGHTING DISTRIBUTION BOARD (ELDB)
	RAW POWER DISTRIBUTION BOARD (RPDB)
	– 150x50x50 MM. PERFORATED CABLE TRAY

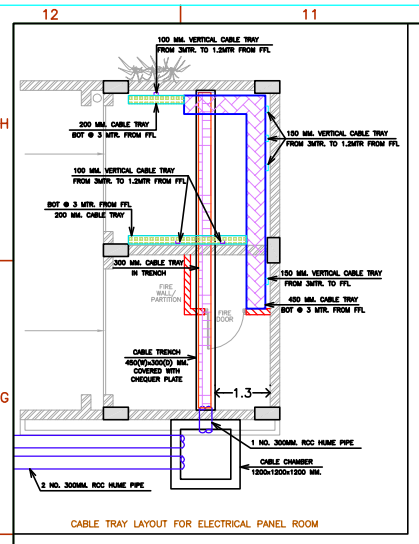
NOTE:-
ALL POWER SOCKET & SWITCH BOARD IN PASSAGES & STAIRE CASES AREA SHALL BE COVERED



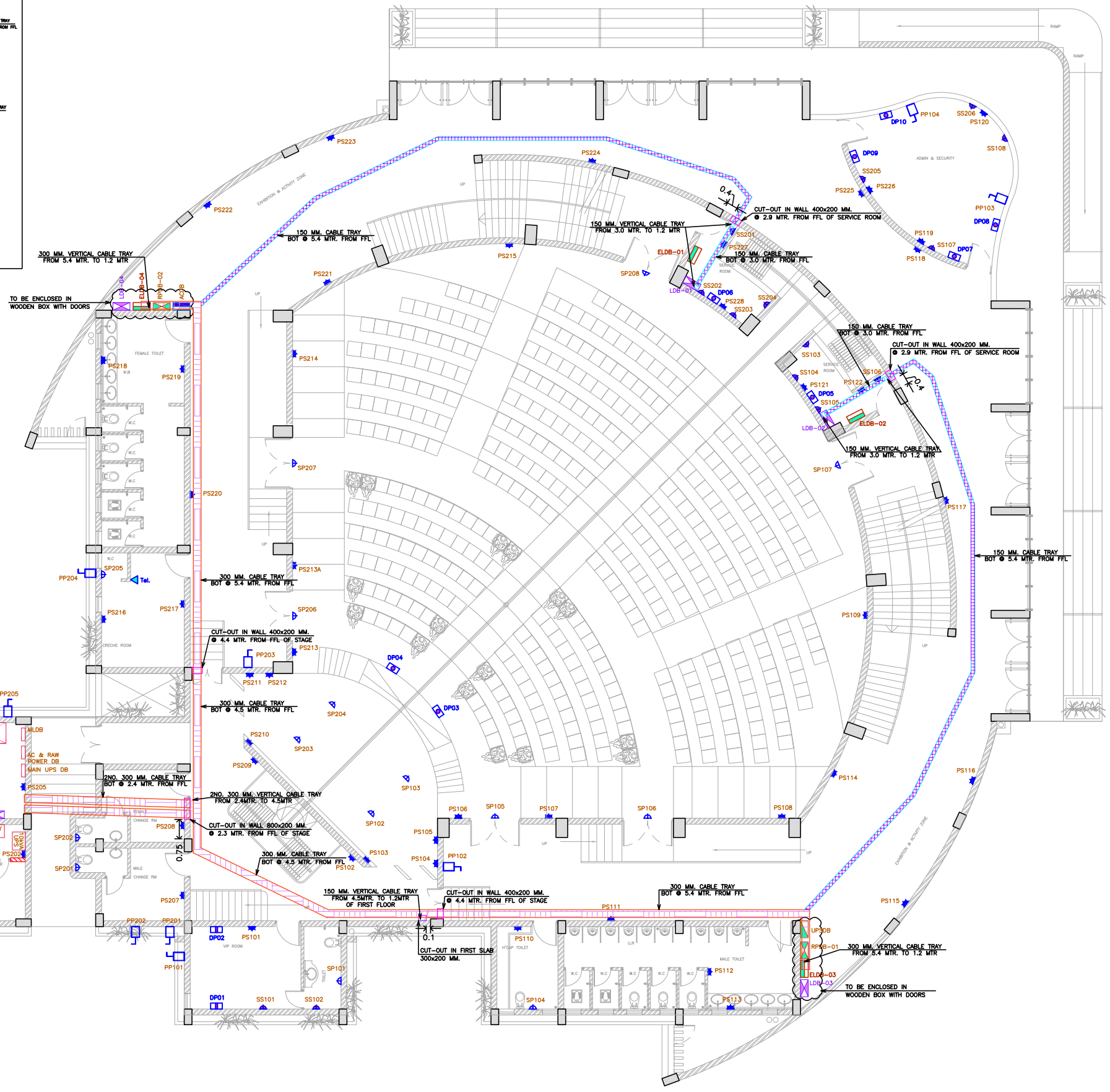
DRG. NO.:-	EL-PWR-002-R0
REV. NO.:-	00
SHEET NO.:-	1 OF 1

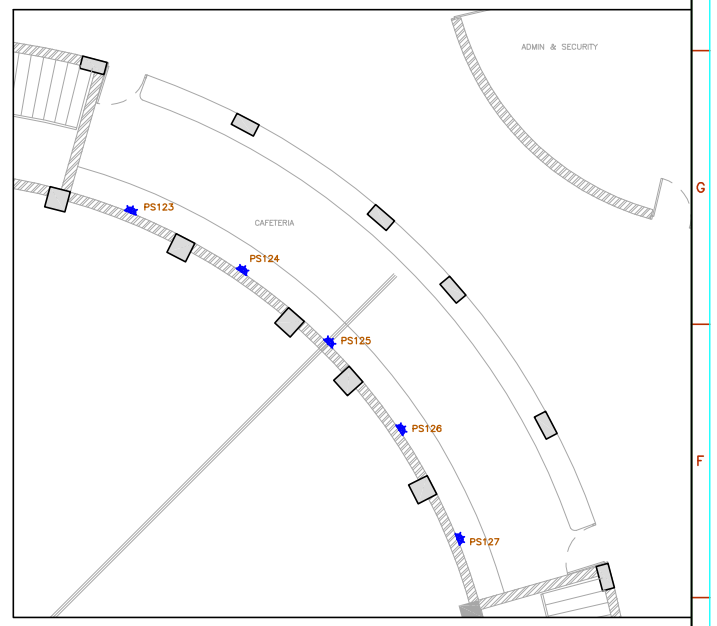
ORIGINAL FRAME SIZE– 594x420MM

DRG. NO.:– EL–PWR–001–R0
REV. NO.:– 00
SHEET NO.:– 1 OF 1



CABLE TRAY LAYOUT FOR ELECTRICAL PANEL ROOM





NOTE:–

ALL POWER SOCKET & SWITCH BOARD IN THE PASSAGES & STAIRE CASES AREA SHALL BE COVERED

LEGEND:–

	5A MODULAR SOCKET WITH 5A SWITCH
	5A MODULAR SOCKET FITTED ON WALL/CEILING FOR EXHAUST/AC UNIT/EXIT SIGN
	5/15A MODULAR SOCKET WITH 15A SWITCH
	20A 1Ø INDUSTRIAL SOCKET WITH 20A MCB IP65
	DATA CLUSTER CONSISTING OF:– 2NO. RJ45 NETWORK POINTS 1NO. RJ11 TELEPHONE POINTS 2NO. 5A MODULAR SOCKET POINTS WITH 2NO. SWITCH ON UPS POWER
	DATA CLUSTER CONSISTING OF:– 1NO. RJ45 NETWORK POINTS 1NO. RJ11 TELEPHONE POINTS 1NO. 5A MODULAR SOCKET POINTS WITH 1NO. SWITCH ON UPS POWER
	AC DISTRIBUTION BOARD (ACDB)
	UPS POWER DISTRIBUTION BOARD (UPSDB)
	LIGHTING DISTRIBUTION BOARD (LDB)
	EMERGENCY LIGHTING DISTRIBUTION BOARD (ELDB)
	RAW POWER DISTRIBUTION BOARD (RPDB)
	ELECTRICAL LT PANELS
	– 450x50x50 MM. LADDER CABLE TRAY
	– 300x50x50 MM. PERFORATED CABLE TRAY
	– 200x50x50 MM. PERFORATED CABLE TRAY
	– 150x50x50 MM. PERFORATED CABLE TRAY
	– 100x50x50 MM. PERFORATED CABLE TRAY

REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	ALTERATION
	04				
	03				
	02				
	01				
	00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING

DRAWING TITLE	POWER AND DATA LAYOUT FOR GROUND FLOOR
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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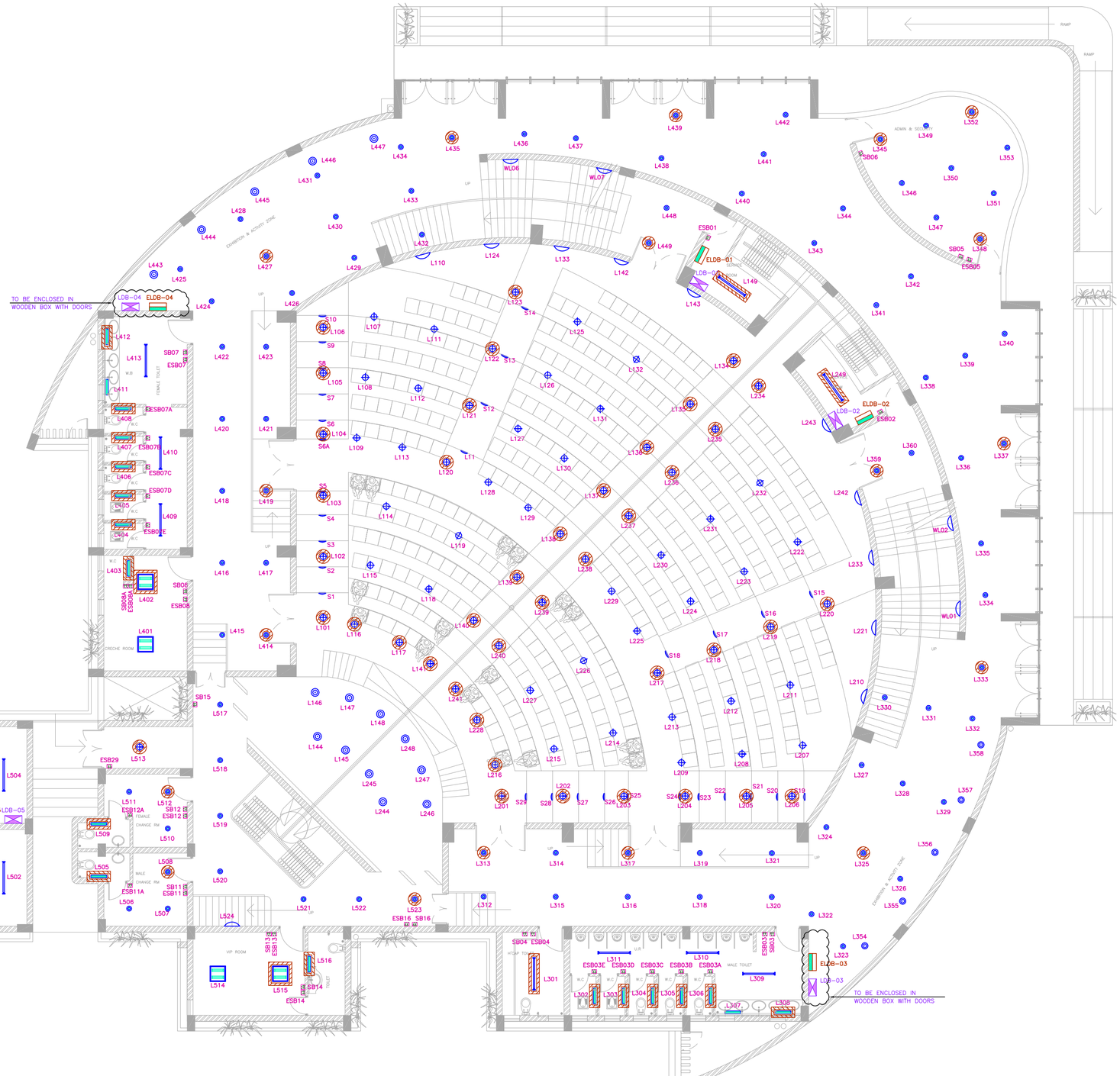
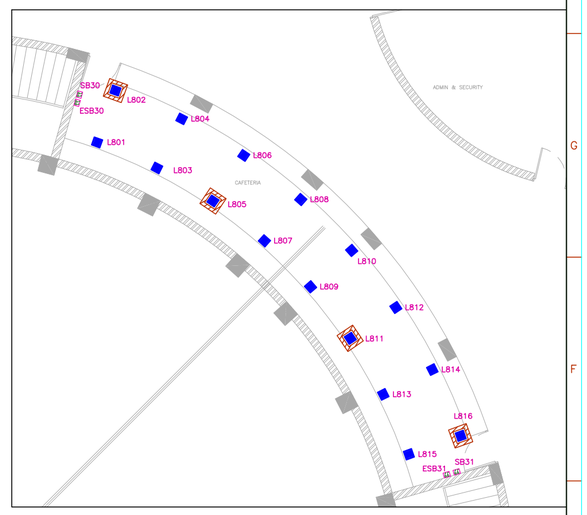
DRG. NO:– AEPPL\IITM\EL–PWR–001–R0 | SCALE:– 1:125 (A2) | DATE:– 14.06.2011

DRG. NO.:- EL-LTG-001-R0

REV. NO.:- 00

SHEET NO.:- 1 OF 1





LEGEND:-

	1x26 W CFL WALL/CEILING LIGHT WIPRO FWP 42126
	2x18 W DOWN LIGHTER (EQI. TO WIPRO WCP 27218)
	2x18 W DOWN LIGHTER (EQI. TO WIPRO WCP 28218)
	1x36 W T8 FIXTURE (EQI. TO WIPRO WRF 21136)
	1x26 W FANTASY STEP LIGHT (EQI. TO WIPRO FSP42126)
	1X18 W INDOOR DECORATIVE FIXTURE (EQI. TO WIPRO WRF21118)
	4x14 W T5 FIXTURE (EQI. TO WIPRO WVF 53414)
	1x70 W RECESS MOUNTED DOWNLIGHTER (EQI. TO WIPRO WCH55070)
	2x18 W CFL SURFACE MOUNTED MIRROR OPTIC FIXTURE (EQI. TO WIPRO WVP 41218)
	LIGHTING DISTRIBUTION BOARD (LDB)
	EMERGENCY LIGHTING DISTRIBUTION BOARD (ELDB)

ORIGINAL FRAME SIZE- 594x420MM

REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	
04				
03				
02				
01				
00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING
REFERENCE DRAWING				ALTERATION

DRAWING TITLE	LIGHTING LAYOUT FOR GROUND FLOOR
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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DRG. NO:- AEPPL\IITM\EL-LTG-001-R0 | SCALE:-1:125 (A2) | DATE:- 14.06.2011

DRG. NO.:- EL-LTG-002-R0
REV. NO.:- 00
SHEET NO.:- 1 OF 1

ORIGINAL FRAME SIZE- 594x420MM

LECTURE HALL
SLOPE
PERGOLAS
TO CATWALK ABOVE FALL CEILING
OPEN TO SKY
COMMON
PASSAGE
FEMALE
MALE
W.C.
AHU

LEGEND:-

	1x26 W CFL WALL/CEILING LIGHT WIPRO FWP 42126
	2x18 W DOWN LIGHTER (EQI. TO WIPRO WCP 28218)
	1x36 W T8 FIXTURE (EQI. TO WIPRO WRF 21136)
	1X18 W INDOOR DECORATIVE FIXTURE (EQI. TO WIPRO WRF21118)
	4x14 W T5 FIXTURE (EQI. TO WIPRO WVF 53414)
	LIGHTING DISTRIBUTION BOARD (LDB)
	EMERGENCY LIGHTING DISTRIBUTION BOARD (ELDB)

REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	
04				
03				
02				
01				
00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING
REFERENCE DRAWING				ALTERATION

DRAWING TITLE	LIGHTING LAYOUT FOR FIRST FLOOR
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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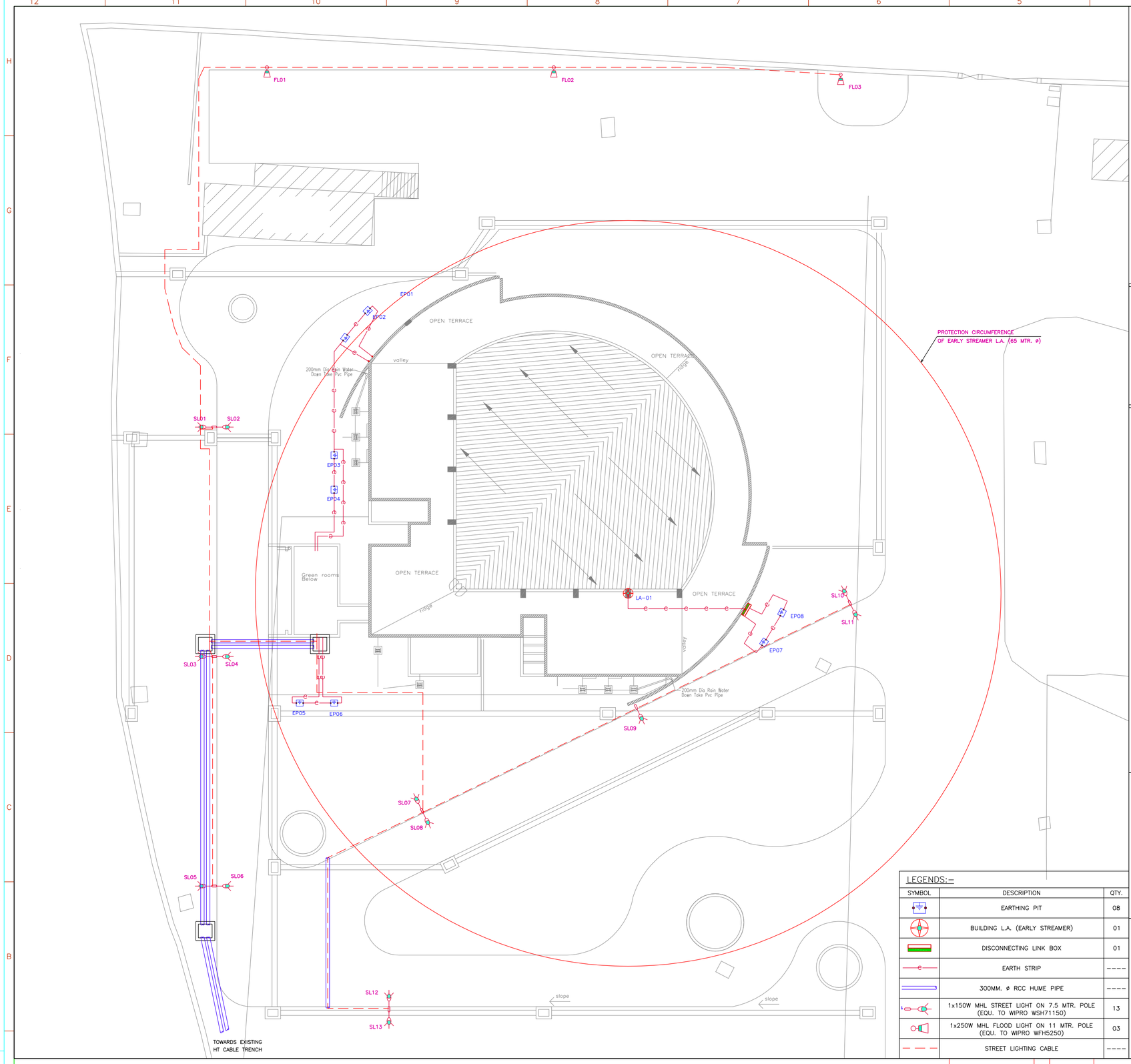
Web : www.archivistaindia.com

DRG. NO:- AEPPL\IITM\EL-LTG-002-R0 | SCALE:-1:125 (A2) | DATE:- 14.06.2011

ORIGINAL FRAME SIZE– 841x594MM

DRG. NO.:– EL–EXT–001–R0
REV. NO.:– 00
SHEET NO.:– 1 OF 1



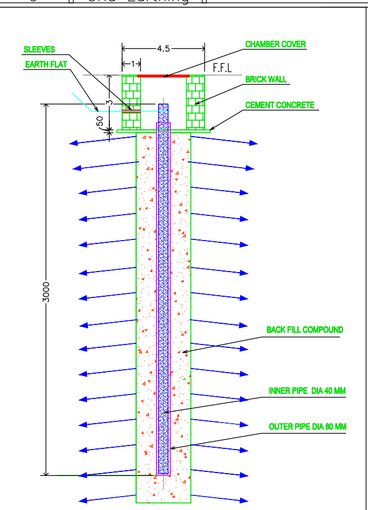
NOTES :

1) ALL DIMENSIONS ARE IN MM. HEIGHT IN METER UNLESS STATED OTHERWISE.
2) EARTHING SHALL BE CARRIED OUT AS PER IS : 3043.
3) EARTH PIT & MAIN EARTHING GRID LOCATION SHOWN IN THIS DRG. IS INDICATIVE ONLY. ACTUAL LOCATION SHALL BE DECIDED AT SITE CONSIDERING FOULING WITH EQUIPMENT FOUNDATIONS, COLUMNS & DRAINS, ETC.
4) 32x6 mm G.I. MAIN EARTH STRIP SHALL BE LAID MINIMUM 2.5 MTR. AWAY FROM THE BUILDING GRID UNLESS OTHERWISE SPECIFIED.
5) THE MAIN EARTHING GRID SHALL BE LAID AT A DEPTH OF 0.5 MTR MIN. BELOW THE GROUND LEVEL.
6) WHEREVER THE MAIN EARTHING GRID CROSSES THE ROAD/STORM WATER DRAIN, THE SAME SHALL BE LAID THROUGH RCC HUME PIPE AVAILABLE NEARBY (ALREADY LAID FOR ROAD CROSSING).
7) WHEREVER THE MAIN EARTHING GRID OR EARTHING LEAD IS OBSTRUCTED BY EQUIPMENT FOUNDATION, STEEL COLUMN, RCC TRENCHES THE ROUTING SHALL BE DIVERTED ACCORDINGLY AT SITE.
8) ALL THE EARTHING SHALL BE CARRIED OUT AS PER TABLE GIVEN BELOW.
9) THE CABLE SUPPORT STRUCTURES INSIDE THE PLANT SHALL BE CONNECTED TO EARTH AT SUITABLE INTERVAL USING 50 x 6 mm G.I. STRIP.
10) ALL CONNECTION AT THE EARTH GRID END SHALL BE WELDED TYPE & SURFACES SHALL BE CHIPPED, CLEANED THOROUGHLY & APPLIED WITH ANTICORROSIVE EPOXY BASED BLACK PAINT/BITUMINOUS COMPOUND.
11) LIGHTNING PROTECTION PROCEDURES SHALL BE AS PER IS 2309–1989.
12) ALL THE DOWN CONDUCTORS SHALL BE PROVIDED WITH TEST POINT (DISCONNECTING LINK BOX).
13) THE MINIMUM DISTANCE BETWEEN ANY TWO EARTH PIT SHALL BE MIN. 3.0 M. THE LENGTH OF EACH ELECTRODE.WHEN THIS IS NOT POSSIBLE DECISION SHALL BE TAKEN AT SITE AND/OR LOCATIONS SHALL BE SPREAD OUT IN ADJOINING AREA.
14) ALL HUME PIPES FOR ROAD CROSSING SHALL BE BY CIVIL AGENCY LOCATIONS ARE SHOWN IN ARCHITECTURAL LAYOUT.
15) THE ROUTE OF HORIZONTAL AIR TERMINATION CONDUCTORS 25x3mm GI STRIP SHOWN IN PLAN VIEW SHALL BE PROVIDED AT THE EDGE OF THE ROOF OR CEMENT PARAPETS CONSTRUCTED ON ASBESTOS ROOF.
16) DOWN CONDUCTOR (DN) 32x6mm GI STRIP SHALL BE FIXED ON THE COLUMNS/WALLS AND SHALL PREFERABLY TAKE SHORTEST POSSIBLE ROUTE UPTO EARTH ELECTRODES. BENDS IN DOWN CONDUCTOR SHOULD BE AVOIDED WHILE RUNNING ON COLUMNS/WALLS. ANY OBSTRUCTIONS SUCH AS A DOOR, CABLE TRAYS, ETC. SHALL AVOIDED BEFOREHAND.
17) TEST POINT FOR DOWN CONDUCTOR SHALL BE PROVIDED AT THE HEIGHT OF 1200mm ABOVE FINISHED GROUND LEVEL, TO FACILITATE MEASUREMENTS OF GROUND RESISTANCE AND TO CHECK CONTINUITY OF DOWN CONDUCTOR WHEN REQUIRED.
18) MINIMUM DISTANCE BETWEEN ANY TWO EARTH PITS WILL BE 3 MTRS. UNLESS OTHERWISE SPECIFIED.

Sr No	Earth Pit No	Equipment/Panel	Earth Strip Size	No of Runs
1	Earth Pit–1	HVAC /Chiller Panel	32X6 mm GI Strip	1
2	Earth Pit–2	HVAC /Chiller Panel	32X6 mm GI Strip	1
3	Earth Pit–3	MDB Panel	50x6 mm GI Strip	1
4	Earth Pit–4	MDB Panel	50x6 mm GI Strip	1
5	Earth Pit–5	10 KVA UPS	25X3 mm Cu Strip	1
6	Earth Pit–6	10 KVA UPS	25X3 mm Cu Strip	1
7	Earth Pit–7	LA –01	25X3 mm Cu Strip	1
8	Earth Pit–8	LA –01	25X3 mm Cu Strip	1
9	Grid Earthing		32X6 mm GI Strip	1

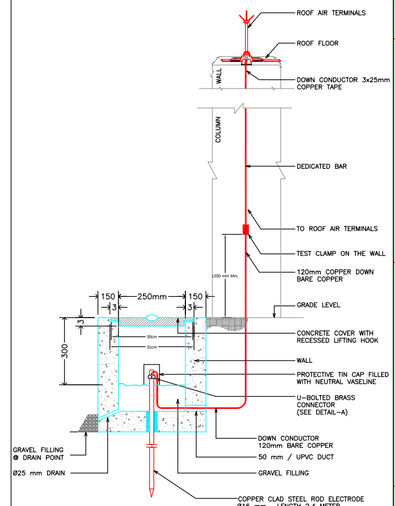
LEGENDS:–

SYMBOL	DESCRIPTION	QTY.
	EARTHING PIT	08
	BUILDING L.A. (EARLY STREAMER)	01
	DISCONNECTING LINK BOX	01
	EARTH STRIP	----
	300MM. ø RCC HUME PIPE	----
	1x150W MHL STREET LIGHT ON 7.5 MTR. POLE (EQU. TO WIPRO WSH71150)	13
	1x250W MHL FLOOD LIGHT ON 11 MTR. POLE (EQU. TO WIPRO WFH5250)	03
	STREET LIGHTING CABLE	----



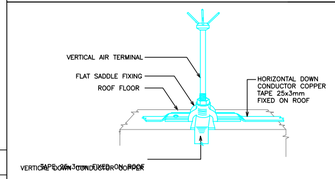
S.E.E. T-39 - 50KA, Dia 80mm.
"ASHLOK-SAFE EARTHING ELECTRODE"

N.T.S.

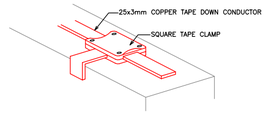


LIGHTNING PROTECTION FROM ROOF TO DOWN EARTH PIT (OUTDOOR)

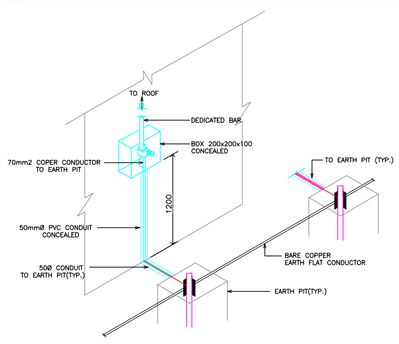
ALL DIMENSIONS ARE IN MM. N.T.S.



AIR TERMINAL DETAIL–C



TYPICAL CONNECTION TO ROOF DOWN CONDUCTOR



DOWN CONDUCTOR INSTALLATION DETAIL

REFERENCE DRAWING	REV	DRAWN BY & DATE	CHECKED BY & DATE	APP/AUTH BY & DATE	ALTERATION
	04				
	03				
	02				
	01				
	00	TANMAY 14.06.10	AMOL P. 14.06.10	SHAILESH 14.06.10	TENDER DRAWING

DRAWING TITLE	STREET LIGHTING, LA & EARTHING LAYOUT FOR SITE
PROJECT	INTERNAL & EXTERNAL ELECTRICAL WORK OF MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE
CLIENT	IITM PUNE

REV.	DATE	STATUS
R0	14.06.10	ISSUED FOR TENDER

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DRG. NO:– AEPPL\IITM\EL–EXT–001–R0 | SCALE:–1:175 (A1) | DATE:– 14.06.2011

Sub:-Minutes of the Pre-Bid Meeting held on 21.09.2011 at IITM Pune		
Name of The Work:-Internal & External Electrical work for Multi Training Facility Building at IITM, Pashan, Pune.		
Pre -Bid Date:-21.09.2011		
Tender Ref No:-EM/28/2011		
Sr No	Questions from Bidders	Clarifications
1	Reference Tender Document Page No.3 Cost of Tender Document/Tender Fee	Rs.1000/- as DD should be submit along with technical bid if downloaded from Web site, else refer Institute receipt No. for Rs.1000/- paid by cash for tender document. DD from nationalized or scheduled bank should be drawn in favour of Director,Indian Institute of Tropical Meteorology,Dr.Homi Bhabha Road,Pashan,Pune-411008
2	Reference Tender Document Page No. 3 & 8 EMD & DD whoes favour we have to prepare/drawn ?	EMD for amount of Rs 110000/-(Rupees One lacs & Ten Thousand Only) should be submit along with technical bid in the form of DD/BG from nationalized bank or scheduled bank in favour of Director,Indian Institute of Tropical Meteorology,Dr.Homi Bhabha Road,Pashan,Pune-411008
3	Reference Tender Document Page No.11(General Scope) Is their Any Free issue item by IITM at site?	No free issue item provide by IITM,as per BOQ contractor should arrange all material along with unloading at site
4	Reference Tender Document Page No.22 Clause No 33 TAC Approval reqiured?	Not Required
5	Reference Tender Document Page No.78(Approved List of Material) & BOQ Section V -Item no.1.0 UPS System makes not mention?	makes recommended for 10 KVA UPS are as follows:- Emerson,Socomec,Numeric,Aplab & APC.
6	Reference Tender Document Page no 83 Section K(List of Drawings) As per drawing no 6,7,8 & BOQ Section-I item no 2.1 & 2.2,the RCBO rating 30mA as mention on drawing needs to be corrected	For all LDB's & ELDB's,as mention on drawing shall be read 4 Pole, RCBO,100mA instead of 3Pole,RCBO,30mA.
7	Reference Tender Document Page no 83 Section K(List of Drawings) Lighting & Emergency Lighting SLD-3 for LDB-7 is not attached in drawing set?	should be download from IITM website.
8	Can you give all SLD in one drawing?	should be download from IITM website.
9	Reference Tender Document Page no 84 What is eligibility criteria for bidders?	Format for eligibility criteria should be download from IITM website.
10	Reference Tender Document BOQ Page.1 applicable taxes?	As per BOQ format

11	Reference Tender Document BOQ Page.2 Section I	
	Makes for Item no 1.1 & 1.2	CPRI Aproved Fabricated Panel for 50kA
12	Reference Tender Document BOQ Page.2 Section I(LV Panels & Distribution Boards) Item No 2.1 & 2.2	It should be download from IITM website.
	All LDB's & ELDB's serial no. not as per BOQ?	
13	Reference Tender Document BOQ Page.5 Section III (Earthing & Lightning Protection)	preferable Indelec
	item no.3:-make for Early streamer Lightning arrester not clear?	
14	Reference Tender Document BOQ Page no.5 Section IV(Point Wiring & Fixtures)	Use only FRLS flexible wires
	Shall we consider FR/FRLS flexible wire?	
15	Reference Tender Document BOQ Page no.5 Section IV(Point Wiring & Fixtures)	Consider 12-15 mtrs for primary point
	Item No.1.1:-Approximate length of primary point from Respective DB?	
16	Reference Tender Document BOQ Page no.5 Section IV(Point Wiring & Fixtures)	consider as per general practice(3 mtrs)
	Item No.1.2:-Approximate length of secondary point from primary point?	
17	Reference Tender Document BOQ Page no.7 Section VI(External Lighting)	Local Fabricated sewage street light pole 6 mts. consider,ORIO is wipro make LED Type lighting Fixture
	Item No.1.1 & 1.2:-which make shall we consider for 6mtr street light pole?what is ORIO?	
18	Wheather service tax be reimbursed?	NO
19	Shall we have to submit hard & soft copy(CD) of price bid?	one set hard copy and one set preferably on CD
20	Reference Tender Document BOQ Page no.6 Section V (UPS MAINS / SUBMAINS WIRING &TELEPHONE)	consider 2 pair with .5 mm dia cable for RJ-11 socket
	Item no. 7.3 There is specified to provide RJ-11 cable,Kindly specified two pair with 0.5 mm dia. Or any other as required?	
21	Reference Tender Document BOQ Page no.7 Section VI(External Lighting)	For item no 1.1 refer Sr No.17 & for item no 1.2 consider octagonal street light pole
	Item no 1.1 & 1.2:-There is specified to provide 6mtr & 12 mtr Pole.Please specified type of street light pole-sewage/octagonal?	
22	Reference Tender Document BOQ Page no.7 Section VI(External Lighting)	with reference to item no 1.4 i.e. WFH 52250 Flood light 1x250W,this not LED type flood light,consider Standard 1200mm bracket for mounting
	Item no 1.2 :-There is specified to provide 12 Mtr Pole with 1200 mm long suitable bracket for mounting LED street light, please provide Installation details / drawing for fixing of 1X250 W WFH 52250 light fitting (Item No. 1.4 Section - VI)	

	Reference Tender Document Page No.78(Approved List of Material) & BOQ Section V -Item no.1.0	
23	There is specified only one make"Avaya" in the list of approved make for data networking (Sr No. 50),Please note that now a day's this product is not manufactured/supplied by 'Avaya'.Kindly specified another 2 to 3 make for the same.?	makes recommended for Data networking are as follows:- Crone,ABB,D-Link

ORIGINAL FRAME SIZE- 594x420MM

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REFERENCE DRAWING						
REV	BY & DATE	DRAWN	CHECKED	APP/AUTH	BY & DATE	ALTERATION
00	TANMAY 22.09.11	AMOL P. 22.09.11	SHAILESH 22.09.11			TENDER DRAWING
01						
02						
03						
04						

DRAWING TITLE	SLD FOR MDB, MLDB, UPS, AC & RAW POWER DB, SLDB,LDB & ELDB
PROJECT	MULTI TRAINING FACILITY BUILDING, PASHAN, PUNE INTERNAL & EXTERNAL ELECTRICAL WORK OF
CLIENT	IITM PUNE
REV. / DATE / STATUS	R0 / 22.09.11 / ISSUED FOR TENDER

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DRG. NO:- AEPPL\IITM\EL-SLD-001-R0 | SCALE:-N.T.S. | DATE:- 16.06.2011

DRG. NO.:-EL-SLD-001-R0 | REV. NO.:- 00 | SHEET NO.:- 1 OF 1

Pre-Qualification of Electrical Work Contractors

1	**Company Name**	
2	**YEAR OF ESTABLISHMENT**	
3	**Address**	
4	**Telephone Nos**	
	Mobile no.	
	Fax Nos.	
	E-mail	
5	**Contact Person**	
	Name	
	Designation	
	Mobile #	
6	PREVIOUS EXPERIENCE WITH State Govt./Central Govt. work	
7	Name and Address of Parent Company if Part of Group or Larger Company	
8	State Relationship of Company with Parent Company	
9	BRIEF DESCRIPTION OF NATURE OF BUSINESS	
10	Govt Authorised Electrical Laision with MC and MS Number	
11	NAME OF COMPANY DIRECTORS	
12	**Organizational Capability (staff strength)**	
	Project Managers	
	Supervisors	
	Safety Engineers	
	Quality Engineers	
13	**Proposed Team for this Project**	
	Project Managers	
	Supervisors	
	Safety Engineers	
	Quantity Surveyors/Billing Engineer	
	Quality Engineers	
14	**Financial Capacity over last 5 years (Turnover & Profit)**	
	Financial year 2010-11	
	Financial year 2009-10	
	Financial year 2008-09	
15	**Tie up with Indian/ Foreign partners**	
16	**Provide following details of five major/best jobs completed of similar nature since last three years.** (You may be required to arrange for inspections of at least two such projects).	
a.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	

1	**Company Name**	
b.	Name of the project	
a.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	
b.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	
c.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	
d.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	
e.	Name of the project	
	Architect/consultant.	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
	Scope	
	Project proposed for inspection	
	Client contact details (Name with tele / fax and e-mail).	
17	**Work in hand (provide details in following format - Attach additional sheets if required)**	
1	Name of the project	
	Architect/consusltant	
	%age completed/status	
	Duration in months.	
	Completion year	
	Area	
	Project Cost	
2	Name of the project	
	Architect/consusltant	
	%age completed/status	
	Duration in months.	
	Completion time	
	Area	
	Project Cost	
18	**Infrastructure/ Equipment/ Machinery details:**	
	(Attach Seprate List)	

1	**Company Name**	
19	**Insurance Cover.**	
	Provide details of cover availed.	
20	**PF/ESI details :-**	
	Reg. No. PF	
	Reg. No. ESI	
	Reg. No. WCT.	
21	**PAN Details:**	
	PAN No:	
	Latest Income tax clearance certificate	
22	**Quality Assurance**	
	Provide details of methodology adopted.	
23	**EHS (Environment, Health & Safety) System Implementation**	
	Provide details of methodology adopted.	
24	**Major suppliers on previous projects**	
25	**Major suppliers proposed for this project**	
26	**Solvency certificate from Banker**	
27	**List any arbitration cases/ legal disputes on Current/ previous projects - Mention name of project, reason for dispute, party filing the suit and current status)**	
28	**Is the company ISO Certified?**	
29	**List any awards, recognitions on previously executed projects**	
30	**Any other documentation relevant to Pre-qualification**	