



**TENDER DOCUMENT
(e-Procurement)**

Tender No: IISc/Tender 1/2020-21

**For
"Supply, Installation, Testing and Commissioning of 2500kVA CSS at
CAF building in IISc, Bangalore"**

**Office of the Project Engineer cum Estate officer
Centre for Campus Management and Development Indian Institute of Science
Indian Institute of Science Bangalore – 560012**

Website : <https://IISc.ac.in/business-with-IISc/tenders/>

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1. Tender Notification

Tender No: IISc/Tender 1/2020-21

Scope of Work	Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore
Estimated Value of work	Rs 1,14,20,000
Period of Work Completion	4 (Four) Months
Name of the Client	Indian Institute of Science, Bangalore
Address of the Client	The Registrar Indian Institute of Science Bangalore – 560 012 Tel No. 080-2293 2765/2202/2203 e-Mail: office.ccmd@iisc.ac.in
Tender Fee	As per e-procurement portal
Submission of Tender Document	e-procurement portal- https://eprocure.gov.in/eprocure/app Helpline no: 0120-4001005
Earnest Money to be deposited with the Tender	Rs. 1,71,300
Last date and Time for online submission (uploading) of tender	26.05.2020 at 18.00 hrs.
Date and Time of opening of Tender (Technical Bid)	28.05.2020 at 15:30 hrs.
Date and Time of opening of Tender (Financial Bid)	Shall be intimated to technically qualified bidders.
Pre-bid meeting Date, Time & Venue	13.05.2020 at 16.00 hrs. Due to COVID 19 situation, the pre bid meeting will be held on Teams App (Video conference mode). The web link will be published in IISc website in tender page before the meeting date.

2. Notice Inviting Tender

The Registrar, Indian Institute of Science invites tenders in two bid (Technical and Financial) system from eligible Bidders, for **“Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore”**

- 2.1 Bidders shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of India or any State Government of Union of India. (authorized signatory should provide an undertaking). Tenders from Joint ventures are not acceptable.
- 2.2 All Bidders shall provide the required information accurately and enough as per details in Section 4: Eligibility Criteria
- 2.3 The Tenderer shall upload the valid certificate copies of PAN, GST, Contractor's Registration certificate in technical bid, **failing which the tender will be rejected**. If necessary, bidder shall produce all the original documents for verification.
- 2.4 If the rate quoted by the Contractor for each category of works is below the estimated value of the work, the contractor should pay the difference of amount in favour of The Registrar, IISc in the form of DD or Pay order or FDR (Fixed deposit receipt) or Bank Guarantee as an additional security deposit before entering into Agreement. The same will be refunded only after satisfactory completion of the work.
- 2.5 The work shall be carried out as per the directions of the Project Engineer cum Estate Officer.
- 2.6 Blacklisted contractors in State / Central Govt. Departments, Central / State PSUs, Autonomous Organizations/ Boards etc., are not eligible to quote, if found such tenders will be rejected. The contractors who are penalized due to delay in completion of the previous works will be rejected.
- 2.7 The successful Bidder shall execute an Agreement within 10 days from the date of Receipt of intimation from this office, The Tender Document will form the part and parcel of the agreement, failing which the tender will deem to be get cancelled.
- 2.8 The material shall be got approved by the Project Engineer cum Estate Officer, IISc before execution of the work.
- 2.9 Further details of the work can be obtained from this office.
- 2.10 The rates quoted should reflect all taxes separately. However, bid evaluation will be done inclusive of all Taxes / Cess. / Royalty etc. The statutory levies as per Govt. guidelines will be deducted. The IISc reserves the right to accept / reject any or all the tenders without assigning any reasons.
- 2.11 The work shall be commenced with all men and machinery within 10 days from the date of work order, failing which it would be presumed that the successful tenderer is not interested in the work and action will be taken to get the work executed through alternate agency at the risk and cost of the former Tenderer.
- 2.12 Conditional tenders will not be accepted and is liable for rejection.
- 2.13 Bidders who meet the above specified minimum qualifying criteria, shall be eligible.
- 2.14 Even though the Bidders meet the above criteria, they are subject to be disqualified if they have:
 - Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
 - Record of poor performance such as abandoning the works, not properly completed the contract, inordinate delays in completion, litigation history, or financial failures etc.

2.15 Site visit:

The Bidder at his own responsibility is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for the Works. The cost of visiting the Site shall be at the Bidder's own expense.

2.16 The Tender document can be downloaded from e-procurement website: <https://eprocure.gov.in/eprocure/app>. It may be noted that all subsequent notifications, changes and amendments on the project/document would be posted only on the same website.

2.17 Content of Tender documents

The bidders should go through the Tender Document and submit online response through e-procurement portal only.

2.18 Amendment of Tender documents

Before the deadline for submission of tenders, the IISc may modify the tender documents by issuing corrigendum / addendum.

Such corrigendum/ addendum thus issued shall be part of the tender documents and shall be published online in e-Procurement portal.

To give prospective Bidders reasonable time in which to take corrigendum/ addendum into account in preparing.

2.19 Documents comprising the Tender

The Technical Bid submitted by the Bidder shall contain the documents as follows:

- a) Earnest Money Deposit & Tender fee paid in any of the payment modes specified in e-Procurement platform.
- b) Qualification Information as per formats to comply the task created in the e-Procurement Portal under General Terms and Conditions and Technical parameters and Documents required from Bidder.
- c) Any other documents / materials required to be completed and submitted by Bidders in accordance with these instructions. The required documents shall be filled in without exception.

The financial bid submitted by the Bidder shall contain the documents as follows:

Priced Bill of Quantities; online through e-procurement portal, no hardcopy of commercial bid should be attached or disclosed.

2.20 Tender prices

The contract shall be for category of works / whole works based on the priced Bill of Quantities submitted by the Bidder.

All prevailing duties, taxes, and other levies like CESS/Royalty payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Bidder.

2.21 Tender validity

Tenders shall remain valid for a period not less than **180 days** after the deadline date for tender submission. A tender valid for a shorter period shall be rejected by the IISc. as non-responsive.

In exceptional circumstances, prior to expiry of the original time limit, the IISc. may request that the Bidders may extend the period of validity for a specified additional period. The request and the Bidders' responses shall be made in writing or by email. A Bidder may refuse the request without forfeiting his earnest money deposit. A Bidder agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 2.18 and 2.22 in all respects.

2.22 Earnest money deposit

The Bidder shall furnish, as part of his tender, earnest money deposit (EMD).

The Bidder can pay the Earnest Money Deposit (EMD) in the e-Procurement portal using any of the following payment modes:

- i) National Electronic Fund Transfer (NEFT) / Real Time Gross Settlement (RTGS)
- ii) Demand draft Beneficiary Details :

Account Holder Name – Registrar, IISc Bangalore

Account No: 31728098170

IFSC code: SBIN0002215

State Bank of India- IISC Branch

The bidder has to scan the receipt and attach it with Technical Bid Documents for our reference. EMD amount will have to be submitted by the bidder taking into account the following conditions:

- a) The entire EMD amount must be paid in a single transaction
- b) The earnest money deposit of unsuccessful Bidders will be returned after awarding the contract to the successful bidder.

The earnest money deposit may be forfeited:

- a) If the Bidder withdraws the Tender after tender opening during the period of tender validity,
- b) If the Bidder fails within the specified time limit to
 - i) Sign the Agreement; or
 - ii) Furnish the required Security deposit

2.23 Provisions for Micro , Small and Medium Enterprises (MSME) :

MSME vendor must confirm that UAM No has been uploaded on CPPP website as required by Ministry's circular no F.No21(17) / 2016 dated 06.04.18 for qualifying to be considered as MSME vendor under this tender. The MSME registration to specify manufacturing / service of the tender item(s).

Registered MSME vendors shall be exempted from need to furnish EMD, subject to their submission of registration details. Declaration of Udyog Aadhar Memorandum [UAM Number] number by the MSME vendors on Central Public Procurement Portal [CPPP] is mandatory to qualify for availing the benefits as per Public Procurement Policy for MSMEs.

Participating Micro and Small Enterprises quoting price within price band of L1+15%, will qualify to supply a portion of requirement by bringing down price to L1 price in a situation where L1 price is from someone other than a Micro and Small Enterprises.

2.24 Format and signing of Tender

Successful Bidder shall sign all the pages of the tender document as a token of acceptance of all the terms and conditions of the contract.

2.25 Submission of Tenders

Tenders must be submitted on-line in the e-Procurement portal by the Bidder before the notified date and time.

2.26 Deadline for submission of the Tenders

The Bidder shall submit a set of hard copies of all the documents in a sealed cover to IISc required as a pre-qualification bid (Technical bid) which were uploaded through e-procurement portal. In the event of any discrepancy between them, the original uploaded document in e-procurement shall govern.

The IISc may extend the deadline for submission of tenders by issuing an amendment, in which case all rights and obligations of the IISc and the Bidders previously subject to the original deadline will then be subject to the new deadline.

2.27 Late Tenders

In e-procurement system, Bidder shall not be able to submit the bid after the bid submission time and date as the icon or the task in the e-procurement portal will not be available. IISc will not be liable (or) responsible for any delay due to unavailability of the portal and the Internet link.

2.28 Modification and Withdrawal of Tenders

Bidder has all the time to modify and correct or upload any relevant document in the portal till last date and time for Bid submission, as published in the e-procurement portal.

The Bidder may withdraw his tender before the notified last date and time of tender submission. No Tender may be modified after the deadline for submission of Tenders.

Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Clause 2.21 above may result in the forfeiture of the earnest money deposit.

2.29 Tender Opening:

The IISc will open all the Tenders received in the presence of the Bidders or their representatives who choose to attend on the specified date, time and place specified. In the event of the specified date of Tender opening being declared a holiday for the IISc. The Tenders will be opened at the appointed time and location on the next working day.

The IISc. will evaluate and determine whether each tender meets the minimum qualification eligibility criteria.

Bidder to submit all the Original Documents, which are submitted in e-procurement portal, to the IISc. for verification at the time of opening of Tender. The IISc will record the Tender opening

2.30 Process to be confidential

Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced.

2.31 Clarification of Tenders

To assist in the examination, evaluation, the IISc. may, at his discretion, ask any Bidder for clarification of his Tender. The request for clarification and the response shall be in writing or by e-mail along with the section number, page number and subject of clarification, but no change in the price or substance of the Tender shall be sought, offered, or permitted.

Subject to clause 2.31, no Bidder shall contact the IISc. on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the IISc., he should do so in writing.

Any effort by the Bidder to influence the IISc in the Tender evaluation, or contract award decisions may result in the rejection of the Bidders' Tender.

2.32 Examination of Tenders and determination of responsiveness

Prior to the detailed evaluation of Tenders, the IISc. will determine whether each Tender (a) meets the eligibility criteria (b) is accompanied by the required earnest money deposit and; (c) is substantially responsive to the requirements of the Tender documents.

A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the IISc's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Tenders.

If a Tender is not substantially responsive, it will be rejected by the IISc., and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

2.33 Correction of errors

No corrections to uploaded bid is permitted by the portal. Tenders determined to be substantially responsive will be checked by IISc

2.34 Evaluation and comparison of Tenders

Opening of the Financial bid will be preceded by the evaluation of the Pre-qualification Offer (Technical bid), vis-a-vis the capability, capacity and credibility of the Bidder. Evaluation of the Prequalification Offer will be done by the Evaluation Committee constituted for the purpose. After evaluation is completed, all the Bidders who are qualified will be notified and will be intimated at the time of opening of the Financial bid. Financial bid will be opened in the presence of those who choose to be present or even in the absence of any Bidder.

The IISc will evaluate and compare the Tenders as per comparative statement downloaded from e-procurement portal.

In evaluating the Tenders, the IISc. will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:

- a) Making any correction for errors and
- b) Making appropriate adjustments to reflect discounts or other price modifications offered

The IISc reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the IISc shall not be taken into account in Tender evaluation.

2.35 Negotiations

The Bidder though technically qualified and whose financial offer is the lowest, fails to convince the Tender Evaluation Committee of his capability, capacity, credibility, his offer may be reviewed, and the Bidder intimated accordingly. In such case, the Bidder, who has quoted the lowest price, may be considered and his price may be negotiated as advised by the tender committee.

2.36 Award criteria

Subject to Clause 2.37, the IISc will award the Contract to the Bidder whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price. After technical evaluation the technically qualified bidders will be considered for opening of the financial bids provided that such Bidder has been determined to be eligible in accordance with the provisions of this tender document and subsequent technical clarifications offered by the responsive bidders.

2.37 Right to accept any Tender and to reject any or all Tenders

Notwithstanding Clause 2.36, the IISc reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the IISc's action.

2.38 Notification of award and signing of Agreement

The Bidder whose Tender has been accepted will be notified of the award by the IISc. prior to expiration of the Tender validity period by e-mail or confirmed by letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the IISc. will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of clause 2.39

The Agreement will incorporate all agreements between the IISc and the successful Bidder /Bidders. It will be kept ready for signature of the successful Bidder in the office of IISc. Following the notification of award along with the Letter of intent. The successful Bidder will sign the Agreement and deliver it to the IISc.

Upon the furnishing by the successful Bidder of the Security deposit, the IISc will issue formal work order.

The successful bidder is required to sign an agreement for the due fulfilment of the contract and start the work immediately on of the acceptance of his tender. A draft of the Articles of the Agreement is enclosed. The Earnest Money will be forfeited and at the absolute disposal of the Employer if the Contractor defaults from signing the Agreement of in starting the work.

2.39 Further Security deposit (FSD)

Further percentage on the running bills and final bill in addition to Earnest Money Deposit shall be levied from the contractor. When the FSD deducted from R.A Bills of the contractor @ 6.0% of the bill amount exceeds Rs.1.00 Lakh, the amount in excess of Rs. 1.00 Lakh may, at the request of the bidder, be released to him against the production of the bank guarantee issued from a Nationalized Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.

If the security deposit is provided by the successful bidder in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank

Failure of the successful Bidder to comply with the requirements of clause 2.38 shall constitute sufficient grounds for cancellation of the award and forfeiture of the earnest money deposit.

- 2.40 The rates to be quoted including all taxes with GST and inclusive of all statutory Levies like cess, royalty etc., and shall not be quoted above 125% and below 75% of the prevailing rates. Otherwise above 125% and below 75% of the amount will be treated as unbalanced amount which will be accounted for security deposit.

2.41 Corrupt or Fraudulent practices

The IISc requires that the Bidders observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, IISc.

- a) will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;
- b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a IISc contract if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing, a IISc contract.

2.42 Payment Terms

70% against the supply of material and 30% after installation, testing and commissioning, subject to the provisions of the tender document.

- 2.43 Work done as a sub- contractor under a prime contractor will not be considered for qualification. "Prime Contractor" means a firm that performs a construction work itself and that the work is directly entrusted to the firm by the owner/ government/ local body/ quasi government/ Government undertaking bodies.

3. Declaration of Tenderer

Name of Work: Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore.

- 3.1 I/We, declare that specifications, plans, designs and conditions of contract on which the rates have been quoted are completely studied by me/us before submitting this tender.
- 3.2 I/We declare that I/We have inspected the work spot and have made myself/ourselves thoroughly conversant and satisfied as regards the field conditions prevalent there, regarding the materials, labour and the particulars of various leads with which the materials required to be brought for the work.
- 3.3 I/We, declare that the rates quoted for items of works for which now tenders are called for are inclusive of leads with which I/We propose to bring the materials. I/We will not have any claims for higher leads, and my/our quoted rates are with all leads and lifts etc.,
- 3.4 I/We, declare that the rates tendered by me/us for this work have not been witnessed by any other contractor/s who has/have tendered for this work.
- 3.5 I/We, declare that I/We, have understood all the conditions mentioned above and also the specifications stipulated in tender condition either by going through myself/ourselves or by getting translated into my/our own mother tongue.

4. Eligibility Criteria

- 4.1 The bidder should have valid CLASS I (ELECTRICAL) Licence issued by State Electrical Licencing Authority.
- 4.2 The bidder should have achieved during last five years in any two consecutive years minimum annual financial turnover of at least 200% (two hundred percent) of the estimated cost of work, ending March 2019. The annual turnover of previous years will be adjusted to 2018–2019 price level based on annual inflation of 8% (eight percent);
- 4.3 The bidder should have satisfactorily completed as a Prime contractor during the last five years, ending March 2019 in State / Central Govt. Departments, Central / State PSUs, Autonomous Organizations/ Boards / reputed organizations.
- a) Three similar works each costing not less than 40% (forty percent) i.e. Rs. 45,68,000/- of the estimated cost or completed two similar works each costing not less than 60% (sixty percent) i.e. Rs. 68,52,000/- of the estimated cost or completed one similar work costing not less than 80% (eighty percent) i.e. 91,36,000/- of the estimated cost.
- b) Work completion certificate for having completed work of similar nature of contract certified from the competent authority not below the Rank of Executive Engineer or equivalent shall be uploaded. The work completion certificate shall mention the nature of work, items of work executed, the agreement number & date, the value of work, the date of commencement, the stipulated date of completion, the actual date of completion of the work and reason for delay (if any)
- 4.4 The information to be filled in by the bidder hereunder will be used for purposes of computing Tender capacity. This information will not be incorporated in the Contract.

Name of Agency as registered :
 Postal Address for communication :
 Principal Place of business :
 Name of the Owner :
 Nature of Company/individual/partnership/firm :
 Name of the authorized person with contact details :
 Constitution or legal status of Bidder :
 Place of Registration :

- 4.5 Total value of similar works executed, and payments received in the last five years (in Rs. Lakhs)

2014-15 _____
 2015-16 _____
 2016-17 _____
 2017-18 _____
 2018-19 _____

- 4.6 Information on works for which tenders have been submitted and on going works as on the date of this Tender.

(A) Existing commitments and on-going works:

Description Of work	Place & state	Contract Number And Date	Name & Address of the Customer	Value of contract Rs.Lakhs	Specified period of completion	Value of work remaining to be completed (Rs.Lakhs)	Anticipated date of completion
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1	2	3	4	5	6	7	8

[Details to be furnished with necessary work order signed from concerned Project Engineer not below the rank of Executive Engineer or Competent Authority. The Work order/Testimonials will be verified, if required]

(B) Works for which Tenders already submitted:

Description Of work	Place & state	Name & Address of the Customer	Estimated value of work Rs in lakhs	Stipulated period of completion	Date when decision is expected	Remark If any
1	2	3	4	5	6	7

4.7 Certificate from Chartered Account stating turn over for the last five years is also to be uploaded.

Sl.No	Year	Turn Over Amount	Remark
1	2014-15		
2	2015-16		
3	2016-17		
4	2017-18		
5	2018-19		

4.8 Evidence of access to financial resources to meet the qualification requirement specified in ITT: Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

BANKER'S CERTIFICATE

This is to certify that M/s. is a reputed company with a good financial standing. If the contract for this work, (name of the work) is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs.34,26,000/- (30% of the tender value) to meet the working capital requirements for executing the above contract

Sd/-

Name of the Bank, Senior Bank Manger
Address:.....

Name, address, and telephone, telex, and fax numbers of the Bidders' bankers who may provide references if contacted by the IISc.

5. Special Conditions

- 5.1.1 Establishment of Labor Camp is strictly prohibited in the premises of Indian Institute of Science Campus. Essential labor for round the clock work at site will be allowed with prior permission of Project Engineer cum Estate Officer.
- 5.1.2 Any damage to the existing service lines during execution of work shall be got rectified by the bidder at his own cost and risk.
- 5.1.3 Debris shall be disposed-off to an undisputed place of Bangalore outskirts as per the direction of the Engineer-in-Charge, whenever required.
- 5.1.4 Labor employed at the site will not be allowed to use cellphone while working at the site.
- 5.1.5 Supply of Electricity: - Electricity required for construction shall be arranged by the contractor himself. Electricity if supplied to the contractor by the Institute will be metered and amount will be recovered in the Bills as per actual at rates fixed by the Institute. Supply of electricity from the Institute is not mandatory. Non-supply of electricity by the Institute cannot be held as reason for shortfall in progress.
- 5.1.6 Water supply: The Contractor has to make his own arrangement for water supply. However, if water supply to the site at one convenient point is made available by the Institute, the charges for the consumption of water will be borne by the Contractor at 1.50% of the value of the work.
- 5.2 Schedule of Quantities (Bill of Quantities) is attached herewith. It should, however, be clearly understood that these quantities are liable to alterations by omission, addition or variation, at the discretion of the Architects/Project Engineer Cum Estate Officer
- 5.3 The drawings together with specifications and conditions of contract are enclosed. These should be studied carefully by the intending tenderers. In the absence of specifications for any item of work, material or ingredient in the specifications, CPWD / PWD specifications shall be followed and in the absence of specification for any item, materials are ingredient shall be fixed in all respects in accordance with the instructions and requirements of the Project Engineer Cum Estate Officer, the work will be the best of the kind.
- 5.4 The tenderer is expected to inspect the site and acquaint himself with the local conditions and will be deemed to have so done before submitting the tender.
- 5.5 The rates quoted shall be for finished work and shall include for all necessary incidental work. Sales or any other tax on materials in respect of this contract will be payable by the Contractor. The Contractors cannot presume any details regarding the contract.
- 5.6 It is entirely the responsibility of the Contractor to arrange for and provide all materials required for successful completion of the work except such special materials that may be supplied if any.
- 6 Tenders determined to be substantially responsive will be checked by IISc for any arithmetic errors. Errors will be corrected by the Employer as follows.
- 7 Where there is discrepancy between the rates in figures and in words, the lower of the two will be governed
- 8 Where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will be governed.
- 9 Where there is a discrepancy in entries of unit rate between the Original and Duplicate, the lower will govern.
- 9.1 The Contractor should make his own arrangements to cover the all-round construction area, by providing polyester net/polythene sheet/barricading to avoid inconvenience to other surrounding departments, as directed by the Project Engineer-cum-Estate Officer of the work.

- 9.2 The debris arise during the period of construction will have to be cleared then and there to keep the surroundings clean and tidy. Such debris shall, if not cleared, be cleared at his risk and cost.
- 9.3 The contractor shall vacate the campus premises with all his men/ materials immediately after completion of the project.

6. GENERAL CONDITIONS

6.1 DEFINITIONS OF TERMS

In constituting these conditions and specifications, the following expressions shall have the meaning, therein assigned to them unless there is something repugnant in the subject of context in consisting with such meanings.

6.2 Institute shall mean the “Indian Institute of Science, Bangalore”.

6.3 “Office” shall refer to the Office of the Project Engineer cum Estate officer.

6.4 “Contractors” shall mean the tenderer whether a firm, registered company, partnership or any individual whose tender has been accepted by Institute or by an Officer (duly authorized in this behalf) on behalf of the Institute and who has entered into agreement with Institute for due fulfillment of the contract and shall include the legal representatives, successors, heirs and assignees of the tenderer.

6.5 “Engineer” shall mean the “Project Engineer cum Estate officer”, Indian Institute of Science, Bangalore or such other officer as may be appointed to call as the Project Engineer cum Estate officer for the purpose of the contract and shall also mean and include other officers of equivalent rank directly in charge of the work or any part thereof under administrative control of the Director, IISc, Bangalore-12.

6.6 When the Engineer is named as final authority, it includes all the above mentioned officers and in such matters, the contractors shall have the right of appeal against the orders up to the Director, IISc, Bangalore, whose decision shall be final and legally binding on all the parties concerned.

6.7 The Project Engineer cum Estate officer named as final authority for any decision taken, shall mean only the Director, IISc, Bangalore or his duly authorized assistant.

6.8 The Engineer in charge shall mean the Project Engineer cum Estate officer directly in charge of the work or his duly authorized assistants.

6.9 Plant shall mean and include any or all plants, machinery, tools and other implements of all description necessary for the execution of the work in a safe and workmen like manner.

6.10 The expression “Works” where used in these conditions shall unless thereby something in the subject or contract repayment to such construction, be construed to mean the work or the works constructed to be executed under or virtue of the contract whether temporary or permanent and whether original, altered, substituted or additional.

6.11 “Contract and contract document” shall mean and include the notice inviting tenders, proceedings of the pre bid meeting, the stamped agreement, conditions of contract, specifications and Schedules ‘B’, drawings and all other connected documents with tender schedule.

6.12 “Specifications” shall mean the specifications annexed and where these are not specifically mentioned shall be as may be detailed and necessary due to particular nature of work as approved by the Project Engineer cum Estate officer.

- 6.13 "Site" shall mean and include all the area in which operations in respect of the work are carried out. This shall also include materials stacking yards and the area where temporary structures are put up for installing any machinery etc.
- 6.14 "Tests" shall mean such tests as are required to be carried out either by the contractor or by the Project Engineer cum Estate officer from time to time on completion as detailed in the specifications before the work is certified as being satisfactory and is taken over by the Project Engineer cum Estate officer.
- 6.15 "Month" shall mean a Calendar month.
- 6.16 "Prime contractor" mean a firm that performs construction work itself and that the work is directly entrusted to the firm by the owner / Government / local body / Quasi Government / Government under taking. Words used in singular shall also include the plural & vice-versa where the context so demands.

6.17 CONTRACTOR TO INSPECT SITE:

The contractor shall visit and examine the construction site and satisfy himself as to the nature of the existing roads or other means of communications, the character of the soil for the excavations, the extent and magnitude of the work and facilities for obtaining materials and shall obtain generally his own information on all matters affecting the execution of the work. No extra for charges made in consequence of any misunderstanding or incorrect information on any of these points or on the grounds of insufficient description will be allowed. All expenses incurred by the contractor in connection with obtaining information for submitting this tender including his visits to the site or efforts in compiling the tender shall be borne by the Tenderer and no claims for reimbursement thereof shall be entertained. .

6.18 ACCESS TO SITE:

The Contractor is to include in his rates for forming access to the site, with all temporary roads and gangways required for the works.

6.19 SETTING OUT:

The Contractor shall set out the building in accordance with the plans. All grid/centre lines shall be pegged out to the satisfaction of the Engineer. The Contractor shall be responsible for the correctness of the lining out and any inaccuracies are to be rectified at his own expense. He will be responsible for taking ground levels of the site before setting out and recording them without any extra charge.

The Contractor shall construct and maintain proper bench mark at the intersection of all main walls, columns, etc., in order that the lines and levels may be accurately checked at all times.

6.20 TREASURE TROVE:

Should any treasure, fossils, minerals, or works of art of antique interest be found during excavation or while carrying out the works, the Contractor shall give immediate notice to the Engineer of any such discovery and shall make over such finds to the Institute.

6.21 ACCESS FOR INSPECTION;

The Contractor is to provide at all times during the progress of the works and the maintenance period proper means of access, with ladders, gangways etc., and the necessary attendants to move and adapt as directed for the inspection of measurement of the works by the Engineer or their representatives.

6.22 ATTENDANCE UPON ALL TRADERS:

The Contractor shall be required to permit tradesmen/ Specialized agencies appointed by the employer to execute works like water supply, Sanitary, Electrical installation, lifts, air conditioning,

hardware and other specialized works. The contractor shall also permit the above mentioned agencies to use his scaffolding and retain the scaffolding till such works are completed. The rates quoted by the contractor shall be inclusive of the above facility.

6.23 GATEKEEPER AND WATCHMAN:

The Contractor from the time of being placed in possession of the site must make arrangements for watching, lighting and protecting the work, all materials, workmen and the public by round the clock on all days including Sundays and holidays at his own risk and cost.

6.24 STORAGE OF MATERIALS:

The Contractor shall provide for necessary sheds of adequate dimension for storage and protection of materials like cement, steel, lime, timber and such other materials including tools and equipment which are likely to deteriorate by the action of sun, wind, rain or other natural causes due to exposure in the open. The cement storage site shall be leak proof and shall hold at least 4 months requirement. All such sheds shall be cleared away and the whole area left in good order on completion of the contract to the satisfaction of the Engineer.

All materials which are stored on the site such as bricks, aggregates etc., shall be stacked in such a manner as to facilitate rapid and easy checking of quantities of such materials.

6.25 COST OF TRANSPORTING:

The Contractor shall allow in his cost for all transporting, unloading, stacking and storing of supplies of goods and materials for this work on the site and in the places approved from time to time by the Engineer. The Contractor shall allow in his price for transport of all materials controlled or otherwise to the site.

6.26 W.C. AND SANITARY ACCOMMODATION AND OFFICE ACCESSORIES AND ACCOMMODATION:

The contractor shall provide at his own cost and expense adequate closet and sanitary accommodation complying in every respect to the rules and regulations in force of the local authorities and other public bodies, for his workmen, for the workmen of nominated sub-contractors and other contractors / specified agencies working in the building, the Project Engineer of works and other Institute agents connected with this building project and maintain the same in good working order.

The Contractor shall also provide at his own expense adequate office accommodation for the Project Engineer of works preferably contiguous to his office and shall maintain the same in a satisfactory condition and shall provide light, fan and attendant etc., for the same and shall remove them after completion of the works. He shall arrange to provide latest survey Instruments and at all times maintain the same in good working order at site, to enable the Project Engineer of works or other representative of Institute to check the lines and levels of the work.

6.27 MATERIALS:

Materials shall be of approved quality and the best of their kind available and shall conform to I.S. specifications. The Contractor shall order all the materials required for the execution of work as early as necessary and ensure that such materials are on site well ahead of requirement for use in the work. The work-involved calls for high standard of workmanship combined with speed and to the entire satisfaction of the Project Engineer.

6.28 TO ASCERTAIN FROM CONTRACTORS FOR THE OTHER TRADES.

The Contractor shall ascertain from all agencies / Sub-contractors all particulars relating to their

work with regard to the order of its execution and the position in which chases, holes and similar items will be required; before the work is taken in hand as no patch works shall be allowed for cutting away work already executed in consequence of any neglect to ascertain these particulars before hand.

6.29 SAMPLE APPROVAL:

Before ordering materials, the Contractor shall get the samples approved from the Project Engineer cum estate officer well in time.

6.30 TESTING OF WORK AND MATERIAL:

The Contractor shall, if required by the Engineer arrange to test materials and/or portions of the works at his own cost in order to prove their soundness and efficiency. If after any such test the work or portion of works is found in the opinion of the Engineer to be defective or unsound, the Contractor shall pull down and redo the same at his own cost. Defective materials shall immediately be removed from the site at his own cost.

6.31 FOREMAN AND TRADESMEN:

All Tradesmen shall be experienced men properly equipped with suitable tools for carrying out the work of carpentry and joinery and other specialist trades in a first class manner and where the Engineer deem necessary, the Contractor shall provide such tools which are considered necessary for carrying out of the work in a proper manner.

All such tradesmen shall work under an experienced and properly trained Foreman, who shall be capable of reading and understanding all drawings, pertaining to this work and the contractor shall also comply with other conditions set out in different clauses of the conditions of the contract.

6.32 PROJECT PROGRAMME OF WORKS AND WEEKLY PROGRESS REPORT:

a) Organization chart:

The contractor should submit the proposed organization chart for the project including the details of staff to be deployed full time on site to the approval of Project Engineer , where the PROJECT ENGINEER raises any objection to either the qualification or experience or required professionalism of any of the staff deployed by the contractor, the same shall be replaced by suitably competent person to the approval of PROJECT ENGINEER within 7 days.

b) Program chart:

The Contractor shall furnish the detailed programme of execution for timely completion of the project within 24 months (inclusive of rainy season). Such a detailed program of works prepared using Industry Standard Scheduling Software like **MS Project 2000 or Primavera** shall be submitted by the Contractor within ten days after receiving communication of tender acceptance. As per the detailed drawings and schedule of quantities; the contractor shall work out concurrent activities with start and finish times, integrating of all tasks with interface and mile stone event drawn and to evaluate for reduction in total project duration through improved over lapping of tasks and activities where feasible. The Contractor shall plan for improved planning and scheduling of activities and forecasting of resource requirements, ability to use the Computer effectively to produce timely valid information for Project Management purpose. Accordingly, PERT; CPM Networking shall be drawn. GANNT charts shall also be furnished. The Contractor shall also furnish necessary particulars to the Project Engineer of works for compiling weekly progress reports in the form furnished by the Institute. A monthly financial programme shall also be submitted.

6.33 CLEARING OF SITE:

The contractor shall after completion of the work clear the site of all debris and left over materials at his own expense to the entire satisfaction of the Institute. The same should be carted out of the Institute at his own cost.

The contractor shall also clear the labour camp/RMC plant of all types of permanent/temporary structures, soak pits, sump, septic tanks or any other such installations as identified by the PROJECT ENGINEER to the entire satisfaction of the Institute. The debris/excess stuff shall be carted out of the Institute at his own risk and cost.

6.34 PHOTOGRAPHS:

The Contractor shall at his own expense supply to the Institute photographs in duplicate copies not less than 25 cm x 20 cm. (10" x 8") along with soft copy, of the works taken from all the portions of the building at intervals of not more than one week during the progress of the work, or at every important stage of construction, as directed by the Project Engineer of work.

6.35 PROVISION OF NOTICE BOARD:

The Contractor shall provide a notice board on proper supports 3m x 2m (10' x 6') in a position approved by the Engineer. He shall allow for painting and lettering stating name of work; name of Architects; Structural Consultants; General Contractor and Sub-Contractors. All letters except that of the name of the work shall be in letters not exceeding 5 cm. in height and all to the approval of the Engineer. Proper barricading shall be erected all-round the site before commencement of the work.

6.36 PROTECTION:

The contractor shall properly cover up and protect all work throughout the duration of work until completion, particularly masonry, moldings, steps, terrazzo or floor finishes, staircases and balustrades, doors and window frames, plaster angles corners lighting and sanitary fittings, glass, paint work and all finishing.

6.37 PREPARATION OF BUILDING FOR OCCUPATION AND USE ON COMPLETION:

The whole of the work shall be thoroughly inspected by the Contractors and all deficiencies and defects set right. On completion of such inspection, the Contractor shall inform the Engineer in writing that he has finished the work and it is ready for the Engineer's inspection.

On completion, the Contractor shall clean all windows and doors and all glass panes, including cleaning of all floors, staircases and every part of the building including oiling of all hardware. He will leave the entire building neat and clean and ready for immediate occupation and to the satisfaction of the Engineer.

6.38 The tenderer must understand clearly that the rates quoted are for complete items of works including charges due to materials, labour, all lead and lift, HOM of plant and machineries, scaffolding, supervision, service works, power, all types of royalties, sales tax, labor cess, all types of taxes payable to the Govt and local bodies, over head charges, etc., and includes all extra to cover the cost of night work if and when required and no claim for additional payment beyond the prices or rates quoted will be entertained for payment subsequently towards any claims on the grounds of misrepresentation or on point that he was supplied with information given by promise or guarantee by the Institute, or by any person whether member of or employee in Institute will not be entertained. Failure on the contractor's part to obtain all necessary information for the purpose of submitting his tender and quoting rates therein shall not absolve him of any risk or liability consequent upon the submission for tender.

- 6.39 All the works shall be carried out as per specifications prescribed by BIS, National Building code, CPWD / KPWD specifications, relevant IS codes or as directed by the Project Engineer in the absence thereof.
- 6.40 In case there is any conflict in the specifications and drawings the decision of the Project Engineer cum Estate officer shall be final and binding on the contractor.
- 6.41 All the materials shall be got approved by the Project Engineer cum Estate officer before use.
- 6.42 The rates quoted for in individual items shall include labour, cost of materials conveyance and lift charges for all materials required for successful completion of work and all taxes payable to any authority as per rules in vogue from time to time.
- 6.43 Necessary pillars shall be constructed by the Contractor for benchmark at no extra cost as directed by the Project Engineer.
- 6.44 Site order book shall be maintained in the work spot and the contractor shall sign in the order book in token of having gone through the instructions issued by the inspecting officers and carryout the instructions promptly.
- 6.45 In the work spot the contractor shall provide suitable temporary office with a covered area of 1000 sqft matching that of the Contractor's office with necessary furniture for use of Institute as directed by the Project Engineer for which no extra payment or compensation shall be claimed. The furniture however will after completion of the work, be the property of the contractor and shall remove them at the close of the contract.
- 6.46 The contractor shall take all precautions against damage from accident. No compensation will be allowed to the contractors for their tools and plant materials lost or damaged from any cause. The contractor is liable to make good the structure or plants damaged by any other cause at his own cost. The Institute will not pay the contractor for corrections or repairing any damaged portion of work done during construction.
- 6.47 The contractor shall employ adequate no. of skilled & unskilled labours required for successful timely execution of work. He shall submit daily reports to the Engineer in charge regarding the strength of labour employed both skilled and unskilled.
- 6.48 The contractor shall furnish weekly medical report showing number of persons ill or incapacitated and nature of their illness, to the Project Engineer.
- 6.49 The contractor shall furnish a report of any accident which may occur, within 24 hours of its occurrence to the Project Engineer.
- 6.50 The contractor shall keep on site of work a qualified Engineer as required as per rules of registration as their authorized representative who will receive all instructions given from the Institute officers. The representative shall have permanent office at site of work where communications can be sent and notices can be served by the Project Engineer throughout the duration of work.
- 6.51 Prior approval should be obtained from the Project Engineer for the construction and location of the temporary site office, store sheds and labour quarters, within the premises of the site, similarly the contractor shall get approval of the Project Engineer regarding the areas to be utilized for

stacking the materials etc., for the work.

- 6.52 Reference to detailed specifications are indicated against the items contained in the Schedule 'B', in case there is any item for which no detailed specifications is indicated, it shall be carried out as per specifications intimated by the Project Engineer. The contractor shall not be entitled for any extra claims or compensation on this account. In case of additional or extra items not covered by the Schedule 'B', the contractor shall carry out the work as per specifications intimated by the Project Engineer.
- 6.53 The Engineer shall have the right to direct the contractor to progress the various items of works in the manner prescribed by him.
- 6.54 Failure to adhere to any of the above will be sufficient cause for taking action under clause (2) or clause (3) or both along with their sub clauses of conditions of contract.
- 6.55 Contractor shall make arrangements at his own cost to construct approach road for conveyance of materials etc., preferably on the alignment accepted by the Institute to procure land etc. for housing, staff and workmen near the site of the work.
- 6.56 It is not possible for the Institute to release any quarry (metal and sand etc.,) for this work. The contractor has to make his own arrangements. No claim regarding leads and lift will be accepted.
- 6.57 The contractor has to make his own arrangements in regard to power supply and water required for construction and drinking water facilities.
- 6.58 Tool, Tax, Octroi, Royalty for collecting earth, gravel, sand, stone, excise duty, sales tax, labour cess or any other tax payable on account of this contract shall be met by Contractor.
- 6.59 The contractor shall be entirely responsible for sufficiency of the scaffolding, timbering, machinery, tools, implement and generally of all means used for fulfillment of the work. Whether such means may not be approved or recommended by the Project Engineer, the contractor must accept at his own cost all risks of accidents or damages.
- 6.60 After completion of the work, service drawings as per actual execution in Auto CAD should be submitted by the agency for services such as Electrical, Water supply and Sanitary before submission of final bill.
- 6.61 Extra care shall be taken regarding the laborers by providing waist belt, Helmets scaffolding etc. at your own cost and supervision and shall be carried out as per the directions of the Project Engineer.

6.62 WORKMANSHIP AND LABOUR:

The quality of all materials, tools, operators and labour used on the work shall be subject to the approval of the Project Engineer cum Estate officer or his authorized agent who shall have power to order immediate removal by the contractor any of the above that may not meet with his approval.

In case of failure to carry out orders of removal within the time specified, the Project Engineer or his authorized agents shall get the same removed at the contractor's expense.

6.63 KEEPING DRY AND PUMPING:

Unless otherwise provided for in the contract, the contractor will at his own expense keep all portions of the work free from undue water, whether due to springs, soakage or inclement weather and will use his own implements and machinery for this purpose.

6.64 BAILING OUT OR DEWATERING:

Adequate arrangements shall be made by the contractor for dewatering the foundation trenches and excavation and keeping the same dry while the masonry or concrete work is in progress and till the Project Engineer considers that the mortar is sufficiently set.

The rates for the various items include the cost of shoring, strutting, coffer dam, channels or other incidental devices necessary for diverting the water met within foundation. The cofferdam and the diversion channel shall, however, be maintained in good and working condition till the completion of the structure or until such time, as in the opinion of the Project Engineer till the coffer dam or/and diversion channel is no longer necessary. Bailing out water necessitated by the failure to maintain the cofferdam and diversion channel will not be paid for separately under any conditions.

No extra rate shall be paid for removing any stuff outside, which might find excess due to rains or for reasons whatsoever from the sides or bottom of the foundation trenches and excavation or from also where when the dewatering operations are in progress.

The contractor must assure himself by making the necessary investigation regarding the depths to which foundations are likely to go. If any work is ordered to be done beyond dimensions or deviations marked in the drawings, no extra rate other than the rate for the Undertaking of work quoted by the contractor be paid.

The contractor will make himself arrangements for necessary plant such as Pump, engines, and other materials required in this connection.

6.65 FACILITIES FOR INSPECTION:

The work at all times be open for inspection by the Project Engineer or his duly authorized Assistant and the contractor shall arrange easy access to every part of the work and shall provide such ladders, scaffolding and lifts for this purpose as necessary at his own cost.

6.66 DELIVERY OF WORKS:

The final bill will be prepared after the work is handed over to the Project Engineer or his duly authorized representative in a thoroughly complete, clean, sound and workman like state.

6.67 EXTRA ITEM:

Whenever the contractor is ordered by the Project Engineer or the person duly authorized by him to execute any item of work, which is not in his tender, it shall be the contractors duty to see that the order is duly entered in the order book on the work, unless a separate communication to this

effect is received by him, it shall be his duty to get the rates sanctioned for the item by the appropriate authority. For any extra item of work not thus ordered either by any entry in the order book or separate communication, the contractor shall have no claim to payment.

6.68 COMPLIANCE WITH BYELAWS AND PROTECTIONS AGAINST ACCIDENTS, ETC:

Contractor is responsible for complying with all acts, bye-laws, Municipal and other regulations for the provision and maintenance of lights during nights, barricading, providing any other protection that may be necessary and will be liable for all claims that may arise from accidents of nuisance caused by works.

6.69 DISPUTES:

Disputes on the points between the Project Engineer and the contractors shall be referred to the Center for campus management and Development, whose decision shall be given in writing and shall be final and binding on the contractor.

6.70 TOOLS ETC.,

The contractor shall unless otherwise specially stated in the contract, be responsible for the payment of all import duties, octroi duties, sales tax, quarry fees etc., on all materials and articles brought to site.

6.71 CLEARANCE OF SITE:

The site described and shown on the plan is to be cleared of all obstruction, loose stones and materials, rubbish of all kinds of shrubs and brushwood, the roots being entirely removed.

The products of the cleaning to be stacked in such a place and manner as ordered by the Project Engineer.

In jungle clearing all trees not marked for preservation, jungle wood and brushwood shall be cut down and their roots entirely removed up. All wood and materials from the clearings will be property of the Institute and should be stacked as the Engineer in charge directs. Trees shall not be cut without prior permission of the Institute.

All holes or hollow, whether originally existing or produced by digging up roots, shall be carefully filled up with earth well rammed to the required density and leveled off, as may be directed.

6.72 LINE OUT:

The contractor shall use necessary measuring instruments, theodolite, workstation and other materials like flags, strings, pegs, nails, pillars, paints, etc., and also Labour required for ascertaining of the initial ground levels at the different stages of excavation and construction of masonry or other structures at his own cost. Any dispute in regard to the accuracy of the measuring instruments and the device shall be subjected to the final decision of the Engineer-in charge of the work.

6.73 MACHINERY: All the machinery that will be employed on the work shall be approved, efficient and thoroughly, complying with the specifications of each machine or parts and shall have been manufactured by reputed and qualified firms. All the machinery employed on the work shall be open to inspection at all working hours, by the Project Engineer and any defect shall be rectified, repaired, replaced, renewed or remodeled so that its performance in the opinion of the Project Engineer is satisfactory. Any defective part of the machine, which requires replacement, shall be promptly replaced, failing which the Engineer-in-charge, shall be at liberty to cause the

defective fittings removed from site of work at the cost of the contractor.

6.74 OPERATORS: The machines shall be in charge of efficient and trained operators, which terms shall include drivers, mechanics or other personnel who are actually operating the machines. The Engineer in-charge has the right to test operators, etc., as deemed necessary by him for the class of machinery, which he is to operate and shall drive out such of the operators who fail in the tests.

6.75 SAFETY PRECAUTION : All reasonable safety precautions for the safety of workers shall be taken. The contractors shall be responsible for the maintenance of all regulations under the Factory Act, workmen's compensation. Minimum wages act and other act for the safety and welfare of the workers employed by him. In addition, the contractors shall provide adequate protection to all workers employed by him against natural elements such as rain, sun, wind etc., during working hours and provide free, pure protected drinking water during working hours.

6.76 NON-STOP OPERATION:

In the continuous or non-stop operations suitable shifts or working hours for each shift shall be maintained. The contractor is liable for all reasonable extra payment for all extra hours of work done by the workers employed by him.

6.77 TESTS:

The Project Engineer cum Estate officer or his authorized representatives shall have full scope and right of entry at all times to examine and test, measure, count, weigh, take bores, or in any manner satisfy himself that the work executed is according to the specifications and required strength. Any portion of work got disturbed, during such tests, shall be made good by the contractors, without extra cost. The Engineer in charge has the right to change the design proportions, mixes within reasonable limits to ensure requisite strength of the structure. Laboratory for requisite tests shall be established by the Contractor at site only, at his own cost.

6.78 ADEQUATE ARRANGEMENTS TO ACHIEVE PROGRESS:

The Project Engineer shall have the right to advise the contractor on the strength, quality and nature of labour to be employed on work to maintain progress on the work, commensurate with the strength of structure. Similarly, he shall advise the contractor on the nature and adequacy of the machinery that are required on the work.

6.79 DETAILS TO BE FURNISHED FOR ENGAGING SUB-CONTRACTOR FOR SPECIALISED WORKS:

The tenderer shall be required to engage agencies of standing and repute who have experience in executing works of similar nature and magnitude. Such specialized trades cover electrical installation (HT/LT), Lifts, A.C. sanitary and water supply works, firefighting installation and any such other trades as may be directed by the Institute. The successful tenderer shall be required to engage Sub-agencies for such specialized trades only with the prior written approval of the Project Engineer cum Estate officer after giving an opportunity to the Project Engineer cum Estate officer to evaluate the experience and competence of the sub-agency for each trade. In order to ensure implementation of this requirement, it is required that each tenderer shall submit along with his tender, names of three sub-agencies for each trade amongst whom tenderer proposes to engage if successful in the tender. Along with names of sub-agencies for each trade, the tenderer shall furnish in detail the following particulars in respect of each sub-agency in the format furnished in Technical Bid.

All such information concerning sub-agencies shall be furnished along with the tender. Any tender containing insufficient information in this regard is liable for rejection. In the event of non-compliance of this requirement, the Institute shall have the right to nominate any sub-

agency who in their opinion meets the selection criteria. In such event it would be incumbent on the successful tenderer, to accept and appoint then nominated sub-agency without demur and on this account, if there is any additional cost, such cost shall be borne by the successful tenderer. The Institute shall have no liability on this account. The Institute has the right to evaluate the experience, reputation etc., of such sub-agencies and on their approval in writing to the successful tenderer, successful tenderer shall be required to engage only such approved agencies for execution.

If the Institute is not satisfied with the performance or capability of the names in the panel furnished by the tenderer, the successful tenderer shall be required to engage an agency nominated by Institute. In all these matters, there shall be no additional financial implication to the Institute. The successful tenderer shall be required to execute works within the accepted rates only and no claim will be accepted due to the Institute, insistence on engaging any sub-agency. The Institute further reserves the right to instruct the successful tenderer to terminate the work of sub-agency at any time during the contract, if the performance is found unsatisfactory. In such case, the successful tenderer shall be required to furnish a further panel of names from whom a similar selection can be made by the Institute. In this instance also, the Institute is not liable for any additional cost. Responsibility for the delay occurred in this process, if any shall rest with the successful tenderer.

It is the responsibility of the successful tenderer to ensure that the sub-agencies engaged in the work comply with all the clauses in the agreement between the Institute and the successful tenderer. It shall be responsibility of the successful tenderer to exercise first line supervision on the works executed by his subagencies including supervision on the quality of materials and workmanship and to ensure that the sub agencies comply with the technical specifications, drawings and bill of quantities. The successful tenderer shall also establish competent site organization technically and administratively to ensure that the works of various sub-agencies are supervised and well co-ordinate to ensure proper sequencing of construction, and finishing works and to ensure that the overall time schedule is fully complied with.

The detailed construction programme schedule to be furnished by successful tenderer shall include action plan for procurement of materials and execution of works at site for each of the sub-agency and the detailed construction programme schedule shall reflect proper integration of each component of the building to ensure well-coordinated execution so as to complete the project including services within the stipulated time schedule.

6.80 Existing service lines such as electrical, water supply, sewer lines, telephone lines etc., shall be carefully protected and preserved before commencement and during excavation, dismantling /demolition operations. Details of UG facilities shall be provided to the successful tenderer. Any damage caused to the aforesaid service lines, etc., during excavation, demolition/dismantling shall be made good at Contractor's own expense/cost. Restoration of any service lines, which needs to be shifted and found in the proposed site, is the responsibility of the contractor and the agency shall carry out the work as per the direction of Project Engineer the cost of such work will be borne by the Institute.

6.81 Dust nuisance to neighbor shall be minimized by providing and erecting screens to the required height as per direction of Project Engineer cum Estate officer with Aluminum sheets or canvas or other suitable material before commencement of the work. The site shall be cleared off such protection arrangement after virtual completion of work. All the operations shall be carried out strictly in accordance to regulations of municipal and other local authorities and shall be restricted to normal working hours.

6.82 No debris or materials got from dismantlement/demolition the building(s) shall be thrown in the public road causing inconvenience to the traffic and any fine or penalty imposed by local authority for non-compliance of this provision shall be borne by the contractor.

6.83 The Contractor shall be responsible for any injury to persons, animals, or things and for all structural damage to property which may arise from the operation or neglect of himself and or any nominated sub-contractors, contractor's Employees and or third party whether such injury or damage arising from carelessness, accident or any other cause whatsoever, in any way connected with the carrying out the construction/dismantling/demolition.

The contractor shall take required insurance cover with an approved insurance company as provided in the contract and deposit with the Institute well before commencement of construction/ demolition / dismantling.

6.84 **Preservation of trees:** The contractor shall preserve all existing trees in and adjacent to the site which does not interfere with the construction as determined by the Engineer-in charge.

6.85 **Drawings and working Details:** The work shall be carried out strictly in accordance with the approved plans and estimates and specifications and as per the instructions of the Engineer-in-charge, and no deviations or changes are permitted without the written order of the Engineer. The designs and drawings enclosed with the tender documents are only typical and tentative. The working drawings and the working details of the several components of works will be prepared and made available at the time of execution and the contractor shall carryout the work in accordance with such working drawings and working details.

6.86 Omissions and discrepancies in drawings and instructions:

In all cases of omissions, doubts or discrepancies in the dimensions or discrepancies in the drawings and item of work, a reference shall be made to the Project Engineer cum Estate officer, whose elucidation and elaboration shall be considered as authorized. The Contractor shall be held responsible for any error that may occur in the work through lack of such reference and precautions.

6.87 The contractor shall be responsible for accuracy for all shapes, dimensions and Alignments both vertical and horizontal etc., of all the components of the work.

6.88 Lands for the use of the Contractors Camp:

The contractor shall have to make his own arrangements at his own cost for construction of living accommodation outside the IISc premises. The Employee shall not provide any space / building for labour camp.

6.89 Undesirable Person to be removed from site:

The contractor shall not employ on site any person who is undesirable, if in the opinion of the Project Engineer the person or persons at site of work employed on behalf of the contractor is/are considered undesirable. The Project Engineer shall notify the contractor to this effect and the contractor will be bound by the decision of the Project Engineer to remove such person or persons from the site of work and from the labour camp. The contractor shall not be entitled to any damage or loss on this account. On the contrary, the contractor shall be liable to compensate the Institute for any loss or damage to the Institute property caused by the employment of such person.

6.90 Labour Statistics:

The contractor shall submit daily reports on the following:

(a) Total No. of labour employed in the working area.

6.91 Execution of work during night time:

The work shall normally be carried out between 08.00 hours and 17.00 hours with a break of one hour and when permitted during night period, the second shift shall be between 17.00 hours and 00 hours with a break of half an hour during night. When ordered to work at night, adequate provision for lighting the working area should be made by the contractor at his cost and got approved by Engineer. The agency shall not be paid extra for the works executed during night.

6.92 Safety code:

- a) The Contractor at a prominent place at work spot should bring these safety provisions to the notice of all concerned by display on notice board. The persons responsible for compliance of the safety code shall be named therein by the contractor.
- b) To ensure effective enforcement of the rules relating to safety precautions, the arrangement made by the contractor shall be open to inspection by the Labour Officer, Engineer or his representatives.
- c) All necessary personal safety equipment's as considered adequate by the Engineer should be kept available for immediate use of persons employed at the site and maintained in the good condition and the contractor should take adequate steps to ensure proper use of equipment by those concerned.
- d) Workers employed on mixing concrete, cement grout, cement mortar shall be provided with protective footwear protective goggles and protective gloves. Those engaged in mixing or stacking cement or any materials injurious to the eye, nose and mouth shall be provided with a face mask and protective cover free of cost by the contractor.

- e) Those engaged in welding work shall be provided with welder's protective eye Shield and gloves. Stonebreakers shall be provided with protective goggle and protective clothing and seated at sufficiently safe intervals.
- f) Those engaged in binding and fabricating steel shall be provided with protective gloves.
- g) Those engaged in deep cuts, large rock excavation shall be provided with helmets.
- h) All labour / persons at work shall wear helmet compulsorily.
- i) When the work is near any place where there is risk of drowning all necessary equipment's shall be kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions should be made for prompt first aid treatment of all injuries likely to be sustained during the course of work.
- j) Adequate and suitable caution and danger signal boards shall be prominently exhibited at road/high tension overhead line/where heavy electrical machines are working where overhead cranes or hoist; derricks, winches are working where blasting zone is demarcated. The content of the board shall be in English and the local language for easy identification.
- k) All scaffolding, ladder, stairways, gangways, staging, centering, form work and temporary support and safety devices etc., shall be sound in strength and constructed and maintained as such throughout its use. The agency shall obtain approval from Project Engineer cum Estate officer for scaffolding, formwork etc., before commencement of work.
- l) No materials on any site of work shall be so stacked as to cause danger or inconvenience to any persons or public.
- m) The Contractor shall provide all necessary fencing and lighting to protect the public/working men from accident and shall be bound to bear the expense of defense of every suit action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost, which may be awarded in any such suit action or proceedings to any such persons or which may with consent of the contractor be paid to compensate any claims by any such person.
- n) No electric cables or apparatus, which is liable to be a source of danger to persons, employed shall remain electrically charged unless a caution Board is put into that effect and close approach to the same is prohibited.
- o) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosives. No floor, roof or other portion of any building used for residence shall be so over-loaded with debris or materials so as to render it unsafe.
- p) The final disposal of water used for work or removed from work spot as well as the supply used for domestic consumption shall be as directed by the Engineer. The contractor shall make his own arrangement for purification of domestic water supply used by his staff and labour colony and used on the site of work to the satisfaction of the Engineer.
- q) The source of drinking water supply/distribution system in workers colony shall be protected from chances of contamination by poisonous materials epidemic causing infections bacteria etc., by maintaining the source and system under adequate hygienic conditions.
- r) Notwithstanding the above clauses, there is nothing in this to exempt the contractor to exclude the operations of any other Act or Rules in force of the Central Govt., State Govt.

6.93 AWARENESS OF SITE CONDITIONS AND CARRYING OUT OF SITE INSPECTION PRIOR TO TENDER SUBMISSION:

Prior to the preparation and submission of his Tender, the Contractor shall make visits to the site and carry out all the necessary inspections and investigations in order to obtain all information and to make his own assessment of the conditions and constraints at site, including the means of access to it. The Contractor shall make himself aware of all the features of the site and the working conditions and space and shall, in general, be responsible for obtaining all the necessary and requisite information needed for him to prepare and submit his Tender.

Should the Contractor require any clarifications he shall seek these in writing from the Project Engineer before submitting his Tender. At no stage will any extra claims be entertained or allowed on any matter or for any reason arising from or as a consequence of the Contractor's failure to comply with all the requirements stipulated in this Clause.

6.94 WORK AND WORKMANSHIP

To determine the acceptable standard of workmanship, the Project Engineer may order the Contractor to execute certain portions of works and services under the close supervision of the Project Engineer. On approval, they shall label these items as guiding samples so that further works are executed to conform to these samples.

6.95 8.6 TEST CERTIFICATES

The contractor shall submit copy of test certificates for all the major electrical equipment such as circuit breakers, CTs, PTs, instruments, relays, busducts, rising mains, busbars, cables etc., and panel as a whole, confirming to relevant IS/BIS standards issued by manufacturers.

6.96 SAMPLES AND CATALOGUES

Before ordering the material necessary for these installations, the contractor shall submit to the Engineer-in-Charge/Consultants for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc., along with the catalogues with their dimensional details.

For major items such as sub lighting panels distribution boards, the submission of drawings/catalogues along with technical details shall be enough. Prior to ordering any electrical equipment/material/system, the contractor shall submit to the Engineer-in-Charge/Consultants the catalogues, along with the samples, where applicable, from the approved manufacturer. The contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the Engineer-in- Charge/Consultant.

Also the contractor shall ensure that the dimensional details of the equipment fit into the allotted space provided in the building.

6.97 COMPLETION CERTIFICATE

On completion of the electrical installation a certificate shall be furnished by the contractor countersigned by the licensed supervisor, under whose direct supervision the installation was carried out.

6.98 PERFORMANCE GUARANTEE

The contractor shall indemnify the Institute against defective materials and workmanship for a period of one year after completion of the work. The contractor shall also hold himself fully responsible during that period for reinstallation or replacement at free of cost to institute, the following :

Any defective work or material supplied by the Contractor.

Any material or equipment damaged or destroyed as a result of defective workmanship by the

Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore
contractor.

6.99 RATE ANALYSIS

At any time and at the request of the Project Engineer the contractor shall provide details or breakdown of costs and prices of any part or parts of the works.

6.100 The Project Engineer reserves the rights to delete any item from the contractor's scope of works.

7. CONTRACTOR'S LABOUR REGULATIONS

ANNEXURE - I

7.1 DEFINITION:

In these regulations unless otherwise, expressed or indicated the following words and expressions shall have the meaning hereby assigned respectively that is to say:

Labour means workers employed by the contractor or the Institute directly or indirectly through sub-contractor or any other person, or any agent on his behalf on a payment as per prevailing Karnataka State labour regulations and will not include supervisory staff like overseers etc.

Fair wages means whether for item or place of work notified at the time of inviting tenders for the work and where such wages have not been so notified, the wages prescribed by the Karnataka Public Works Department for the district in which the work is done.

Contractors shall include every person whether a sub-contractor head or agent employing labour on the work taken contract.

The relevant orders of Government of Karnataka in regard to payment of wages as amended from time to time shall be followed by the contractor.

7.2 WORKING HOURS:

Normally working hours of a labour employed should not exceed 8 hours a day. The working day shall be so arranged that inclusive of interval for rest if any, it shall not spread over more than 12 hours on any day.

When a worker is made to work for more than 8 hours on a day or for more than 48 hours in any week, he is entitled to double the ordinary rate of wages. Children shall not be made to work.

Every worker shall be given a paid weekly holiday normally on Sunday.

7.3 DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall (a) before he commences his work on contract, display and correctly maintain in a clean legible condition in conspicuous places on the work, notices in English and in the local language spoken by the majority of the workers, giving the rate of wages which have been certified by the Regional Labour Commissioner, as fair wages and the hours of work which such wages are earned, and a copy of such notices shall be sent to the certifying officers.

7.4 PAYMENT OF WAGES:

Wages due to every worker shall be paid to him direct.

7.5 FIXATION OF WAGES PERIODS:

The contractor shall fix the wages period of which the wages shall be payable.

Wages of every worker employed on the contract shall be paid.

In case of establishments in which the wage period is one week, within three days from the end of the wage period wages shall be paid.

In the case of other establishment before the expiry of the 7th day or 10th day from the end of the wage period according to the numbers of the workers employed in such establishment does not exceed 100 or exceeds 1000.

When the employment of any workers is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the days succeeding the one which his employment is terminated.

All payment of wages shall be made on a working day except when the work is completed before the expiry of the wages period in which case final payment shall be made within 48 hours of the last working day at work site and during the time.

NOTE: The term working day means a day on which the labour is employed and the work is in progress.

7.6 FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES:

The Wages of workers shall be paid to him without any deductions of any kind except the following deductions:

Deductions for absence for duty i.e., from the place or the places whereby the terms of his employment he is required to work. The amount of deductions shall be in proportion to the period for which he was absent.

Deductions for damage or loss of goods expressly entrusted to the employed person for custody or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to neglect or default.

Deduction for recovery of advance or for adjustment of over payment of wages, advance granted shall be entered in a register.

And other deductions which the Institute may from time to time allow.

7.7 Fines:

No fine shall be imposed on any worker save in respect of such acts and the Commissioner of Labour has approved omissions on his part as.

No fine shall be imposed on a worker and no deduction for damage or loss be made from his wages until the worker has been given an opportunity. Undertaking of showing cause against such fines or deductions.

The total amount of fines which may be imposed in any one wage period on a worker shall not exceed an amount equal to the wages payable to him in respect of that wage period.

No fine imposed on any worker shall be recovered from him by instalments or after the expiry of sixty days from the date which it was imposed.

Every fine shall be deemed to have imposed on a day of the act or omission in respect of which it was imposed.

The contractor shall issue an employment card in Form III to each worker on the day of the worker's entry into the employment. If the worker has already any such card with him for the previous employment of contractor, he shall merely endorse that employment card with relevant entries. On termination of employment, the employment card shall again be endorsed by the contractor and returned to the worker.

7.8 REGISTER OF UNPAID WAGES:

The contractor should maintain a register of unpaid wages in such a form as may be convenient at the place of work but same shall include the following particulars:

Full particulars of the laborer's whose wages have not been paid.
Reference number of the muster roll and wage register
Rate of wages
The period
Total amount not paid
Reasons for not making payment
How the amount of unpaid wages was utilized
Acquaintance with dates.

7.9 REGISTER OF ACCIDENTS:

The contractor shall maintain a register of accidents in such form as may be convenient at the work place but the same shall include the following particulars.

Full particulars of the laborers who met with accidents.
Rate of wages
Sex
Age
Nature of accidents and cause of accident
Time and date of accidents
Date and time when admitted in Hospital
Date of discharge from the Hospital.

7.10 REGISTER OF FINES ETC.

The contractor shall maintain a register of fines and a register of deductions for damages or loss in form Nos. I and II respectively which shall be kept at the place of work.

The contractor shall maintain both in English and local language a list approved by Commissioner for labour clearly stating the acts and commissions for which penalty or fine may be imposed on a workmen and display it in a good condition in conspicuous place on the work.

7.11 SUBMISSION OF RETURNS:

The contractor shall submit periodical returns as may be specified from time to time.

7.12 AMENDMENTS:

The Government of Karnataka may from time to time add to or amend the regulations and on may question as to the application interpretation on effect if these regulations the decision of the Commissioner of Labour or Deputy Commissioner for Labour to Govt. in that behalf shall be final.

ANNEXURE -II

7.13 Labour Clause

No labourers below the age of 15 years shall be employed on the work.

Payments of wages of labourers. The contractor shall pay not less than fair wage of labourers engaged by him on the work.

EXPLANATION:

(a) The contractor shall notwithstanding the provision of any contract to the contrary cause to be paid wages to labourers indirectly engaged for the work including any labour engaged by his sub-contractors in connection with the same works if the labourers have been immediately employed by him.

(b) In respect of all labours directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with

Karnataka Public Works Department Contractors Labour Regulations from time to time, in regard to payment of wages. Wage period, deductions from wages recovery of wages not paid and deductions unauthorized made, maintenance of wage book, wage slips, publication of scale of wage and other terms of employment, inspection and submission of periodical returns and all other matter of a like nature.

The Project Engineer cum Estate officer or In-charge Engineer concerned shall have the right to deduct from the money due to the contractors any sum required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or her wages which are not justified by their terms of the contractor non-observance of the regulations.

(c) For payment of minimum wages, the Contractor is bound to follow the relevant orders of Govt. of Karnataka from time to time.

(d) Vis-à-vis the Institute the contractor shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors. The regulations aforesaid shall be deemed to be part of this contract, and any breach thereof shall be deemed to be a breach of this.

7.14 In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this agreements the contractor shall at his own expense arrange for the safety provisions as per Karnataka P.W.D. safety code framed from time to time and shall at his own expense provide for all facilities in arrangements and provide necessary facilities as aforesaid he shall be liable to pay penalty of Rs.50/- for each default and in addition the Project Engineer cum Estate officer in charge shall be at liberty to make arrangements and provide facilities as aforesaid, and recover the cost incurred in that behalf from the contractor.

7.15 The contractor shall submit by the 4th and 19th of every month to the Project Engineer of true statement showing in respect of the second half of the preceding month and the first half of the current month respectively (1) the name of labourers employed by him on the work (2) their working hours, (3) the wages paid to them, (4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused to them and (5) the number of female workers who have been allowed, maternity benefit according to clause 19F and the amount paid to them, failing which the contractor shall be liable to pay the Institute a sum of not exceeding Rs. 50/- for each default or materially incorrect statement by deduction from any bill due to the contractor and amount levied as fine.

7.16 In respect of all labour directly or indirectly employed in the works for the performance of the contractor's part of this agreement, the contractor shall comply with or cause to be complied with all the rules framed by Institute from time to time for the protection of health and sanitary arrangements for workers employed by the Indian Institute of Science and its contractors.

7.17 Maternity benefit rules for female workers employed by contractor, leave and pay during leave shall be regulated as follows:

(i) in case of delivery: Leave during maternity leave not exceeding 8 weeks up to and including the day of delivery and 4 weeks following that day.

(ii) In case of miscarriage, up to 3 weeks from the date of miscarriage.

7.18 Pay:

i) In case of delivery: Leave pay during maternity leave will be at the rate of women's average daily earning calculated on the total wages earned on the days when full time work was done during the period of three months immediately preceding the date on which she gives notice that she expects to be confined.

ii) In case of miscarriages: Leave pay at the rate of average daily earnings calculated on the total wages earned on the day's full time works was due during a period of 3 months immediately preceding the date of miscarriage.

iii) Conditions for the grant of maternity leave: No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than 6 months immediately preceding the date of delivery /miscarriage.

8. CONDITIONS OF CONTRACT

Clause 1. Security Deposit

Estimated cost of the work put to Tender	E.M.D. Percentage	F.S.D. Percentage
(i)	(ii)	(iii)
Rs.114,20,000	1.5%	6%
Note : EMD + FSD to be limited to 7.5% of the contract value		

- (a) **Clause -1(a)** The person/persons whose tender may be accepted (hereinafter called the contractor which expression shall unless the context otherwise requires, include his heirs, executors, administrators and assigns) shall pay Earnest Money Deposit indicated in Column (ii) of the table given below and shall permit Institute (a) to deduct FSD at the percentage mentioned in Column (iii) of the table given below of all moneys payable of work done under the Contract, at the time of making such payments to him/ them and (b) to hold such deductions as further Security Deposit. The EMD + FSD will be limited to % of the contract value.

E.M.D. - Earnest Money Deposit

F.S.D. - Further Security Deposit

No Interest will be paid on EMD / Further / Additional Security deposit.

(b) Additional or Reduction in Security Deposit.

The EMD for the tendered work and additional amount of Security Deposit at the rates mentioned in **Sub-clause 1(a)** above should be, paid by the contractor. The Project Engineer cum Estate officer may allow if a portion of the work is withdrawn from the Contractor under the provisions of Clause 12(a) a proportionate reduction in the amount of security Deposit.

- a) *EMD paid along with the tender shall be refunded only after the completion of the defect liability period without any interest.*
- b) *1% labour cess towards workers Welfare Fund on the works expenditure will be recovered from RA bills for depositing the same to the welfare board as per Karnataka Govt. Order. Rates quoted should be inclusive of cess.*
- (c) However if the Contractor desires, agency may furnish a BG issued by the Public Sector Undertaking Bank / Scheduled commercial Bank / Nationalized Bank in favour of the Registrar, Indian Institute of Science, payable at Bangalore amounting to 7.50% of the total contract value valid up to completion of defect liability period in which case EMD deposited by them will be refunded and no recoveries towards security deposit will be effected in the running account bills.
- (d) **Dues to Institute, to be set off against Security Deposit.**
All compensation or other sums of money payable by the Contractor to Institute under the terms of this contract may be realized or deducted from any Security Deposit payable to him or from any sums which may be due or may become due by Institute to the Contractor on any account whatsoever and in the event of his security deposit being reduced by reason of any such realization or deduction as aforesaid, the Contractor shall, within ten days thereafter, make good in cash any sum or sums which have been deducted from his security deposit or any part thereof. Otherwise the amount will be treated as outstanding due from the agency.
- (e) **Refund of Security Deposit (EMD & FSD):**
i) EMD paid by the contractor at the time of tendering and FSD deducted from the R.A.bills at the prescribed rates shall be refunded to the contractor immediately after the virtual completion of the work against production of bank guarantee for an equal amount from any of the Public Sector Undertaking Bank/Scheduled commercial Bank/Nationalized Bank valid for a period as mentioned in clause (ii) below.

ii) The bank guarantee received as stipulated in (i) above, will be treated as performance guarantee and shall be returned to the contractor after the final bill is paid or after **eighteen months including monsoon period** from the date of virtual completion of the work during which period the work should be maintained by the contractor in good order, whichever is later. The validity of the bank guarantee shall be maintained for the above period.

iii) In case of BG's furnished towards security deposit same shall be returned after completion of the defect liability period.

Clause 2. PENALTY FOR DELAY

(f) Written Order to Commence Work

After acceptance of the tender, the Project Engineer cum Estate officer shall issue a written order to the successful tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of the Project Engineer cum Estate officer. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

(g) Programme of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed by the contractor during execution of agreement.

(h) Review of progress and responsibility for delay etc.,

The Project Engineer cum Estate officer shall review the progress of all works with the contractor at least once every month. Such a review shall take into account the programme fixed for the previous week, obligations on the part of the Institute for issue of drawings etc, and also the obligations on the part of the Contractor. The review shall also examine the accumulated delays by the contractor if any and mitigation measures proposed by the contractor to overcome the delay.

Apportioning of responsibility for delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by the Project Engineer cum Estate officer and the Contractor. If the contractor refuses to sign the said record, approval of the reasons for delay may be submitted to CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD) for approval and such approval is binding on the contractor.

Shortfall in progress made up subsequently.

To the extent the shortfall is assessed, as due to the delay on the part of the contractor, a notice shall be issued to him by the Project Engineer cum Estate officer to make up the shortfall. If the shortfall is not made up before the progress of the work is reviewed during the second month succeeding the month in which the shortfall was observed, the Contractor shall be liable to pay penalty as indicated in **Clause 2(d)** below.

Grant of extension of time.

If the delay is attributable to reasons beyond the control of the Contractor, requisite extension of time shall be granted by the Project Engineer cum Estate officer in accordance with **Clause 5** after obtaining the approval of his higher authorities, wherever necessary.

Review of progress by Centre for campus management and Development.

The Centre for campus management and Development shall review the progress periodically, preferably more number of times as required. These reviews are in addition to the monthly reviews required to be done by the

Project Engineer cum Estate officer. The results of such review by the CENTER FOR CAMPUS MANAGEMENT AND DEVELOPMENT (CCMD) shall, wherever necessary, be incorporated in the next review of the Project Engineer cum Estate officer.

If the Contractor stops the work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer then The Employer may terminate the Contract at the risk and cost of the contractor.

Settlement of dispute regarding shortfall in progress.

In case of dispute between the Project Engineer cum Estate officer and Contractor regarding the responsibility for the shortfall in progress, the matter shall be referred to the Centre for campus management and Development who shall thereupon give a decision within fifteen days from the date of receipt of reference. The decision of the Centre for campus management and Development shall be final and binding on the contractor and the Project Engineer cum Estate officer.

(d) Penalty for delay

In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per **Clause 2(b)** and **2 (c)**, the contractor shall be liable to pay as penalty an amount equal to half percent of the contract value of the balance work assessed according to the programme, for every week that the due quantity of work remains incomplete; provided always that the total amount of penalty to be paid under the provisions of this clause subjected to a maximum of 10 percent of the contract value of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.

Note: *If the Project Engineer cum Estate officer considers it necessary he shall be entitled to take action as indicated in **Clause 3 (d)** also.*

d.1 Liquidated damages

The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

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

(e) Adjustment of excess/over payments.

Excess/over payments as soon as they are discovered should be adjusted in the next running account bill of the contractor and in case the final bill has already been paid, the excess/over payment made shall be recovered from the Security Deposit of the contractor together with interest at such percentages as Institute may decide from time to time, from the date of such excess or over payment to the date of recovery.

ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

Clause 3. In any case in which under any clause or clauses of this contract the contractor shall have rendered himself liable to pay compensation and/or penalty amounting to the whole of his security deposit including the amount deducted in instalment from his bills as Further Security Deposit, the Project Engineer cum Estate officer on behalf of the Director, IISc shall have power to adopt any of the following courses as he may deem best suited in the interest of Institute.

(a) Forfeiture of Security Deposit

Without prejudice to Institute's right to recover any loss from the Contractor under sub-clauses (b) and (c) of Clause 3 of the Contract, to rescind the contract (of which rescission notice in writing to the contractor under the hand of the Project Engineer cum Estate officer shall be conclusive evidence). And in that case, the security deposit of the contractor including whole or part of the lump sum deposited by him and also the amount deducted from his bills as Further Security Deposit, shall stand forfeited and be absolutely at the disposal of the Institute.

a) Debiting cost of labour and materials supplied.

To employ labour paid by the Institute and to supply materials to carry out the work or any part of the work, debiting the contractor with the cost of the labour and the price of the materials (as to the correctness of which cost and price the certificate of the Project Engineer cum Estate officer shall be final and conclusive against the contractor) and crediting him with the value of the work done; in all respects in the same manner and at the same rates as if it had been carried out by the contractor under terms of this contract, and in that case the certificate of the Project Engineer cum Estate officer as to the value of the work done shall be final and conclusive against the contractor.

b) Recovery of extra cost on unexecuted work

To measure up the work of the contractor and to take such part thereof as is remaining unexecuted out of his hands and to give it to another contractor to complete it in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (as to the amount of which excess expenses the certificate in writing of the Project Engineer cum Estate officer shall be final and conclusive) shall be borne and paid by the original contractor and shall be deducted from any money due to him by Institute Otherwise the amount will be treated as outstanding due from the agency.

c) Action against unsatisfactory progress

If the contractor does not maintain the rate of progress as required under **Clause 2** and if the progress of any particular portion of work is unsatisfactory even after taking action under **Clause 2(c)** and **2(d)**, the Project Engineer cum Estate officer shall be entitled to take action under **Clause 3(b)** or **3(c)** at his discretion in order to maintain the rate of progress after giving the contractor 10 days notice in writing whereupon the contractor will have no claim for any loss sustained by him owing to such actions.

d) No compensation for loss sustained on advance action

In the event of any of the above courses being adopted by the Project Engineer cum Estate officer, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased, or procured any materials, entered into any agreements or made any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid the contractor shall not be entitled to recover or be paid any sum for any work thereof actually performed by him under his contract, unless and until the Project Engineer cum Estate officer shall have certified in writing the performance of such work and the amount payable in respect thereof, and he shall only be entitled to be paid the amount so certified.

e) Recovery of 1% of the contract value towards the laborers welfare fund created by the Government of Karnataka will be effected in the running account bills of the contractor.

Clause 4. CONTRACTOR TO REMAIN LIABLE TO PAY COMPENSATION IF ACTION IS NOT TAKEN UNDER CLAUSE-3.

In any case in which any of the powers conferred upon the Project Engineer cum Estate officer by **Clause 3** thereof shall have become exercisable and the same shall not have been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor for which under any clause hereof he is declared liable to pay compensation or penalty amounting to the whole of his security deposit and the liability of the contractor for past and future compensation or penalty shall remain unaffected.

Power to take possession of or require removal of or sell contractor's properties.

In the event of the Project Engineer cum Estate officer taking action under **sub-clause (a) or (c) of Clause 3**, he may, if he so desires, take possession of all or any tools, plant, materials and stores, in or upon works or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contract rates; or in the case of contract

rates not being applicable, at current market rates, to be certified by the Project Engineer cum Estate officer whose certificate thereof shall be final. In the alternative, the Project Engineer cum Estate officer may after giving notice in writing to the contractor or his clerk of the works, foreman or other authorised agent, require him to remove such tools, plant, materials or stores from the premises within a time to be specified in such notice; and in the event of the contractor, failing to comply with any such requisition, the Project Engineer cum Estate officer may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respect, and the certificate of the Project Engineer cum Estate officer as to the expense of any such removal; and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

Clause 5. GRANT OF EXTENSION OF TIME

- (a) If the contractor shall desire an extension of the time for completion of the work, he shall apply in writing to the Project Engineer cum Estate officer before the expiry of the period stipulated in the tender or before the expiry of 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred, whichever is earlier and the Project Engineer cum Estate officer or other competent authority may if in his opinion, there are reasonable grounds for granting an extension, grant such extension as he thinks necessary or proper. The decision of such competent authority in this matter shall be final.
- (b) The time limit for completion of the work shall be extended commensurate with its increase in cost occasioned by alterations or additions and the certificate of the Project Engineer cum Estate officer or other competent authority as to such proportion shall be conclusive.

Clause 6. ISSUE OF FINAL CERTIFICATE – CONDITIONS REGARDING

On completion of the work the contractor shall report in writing to the Project Engineer cum Estate officer the completion of the work. Then he shall be furnished with a certificate by the Project Engineer cum Estate officer of such completion, but no such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed, all scaffolding, surplus materials and rubbish, and shall have cleaned thoroughly all wood work, doors, windows, wall, floor or other parts of any building, in or upon which the work has been executed, or of which he may have had possession for the purpose of executing the work, nor until the works shall have been measured by the Project Engineer cum Estate officer or other competent authority, or where the measurements have been taken by his Project Engineer until they have received the approval of the Project Engineer cum Estate officer or other competent authority, the said measurements being binding and conclusive against the contractor. If the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish, and cleaning on or before the date fixed for the completion of the work the Project Engineer cum Estate officer or other competent authority may, at the expense of the contractor, remove such scaffolding, surplus materials and rubbish, and dispose of the same as he think fit and clean off such dirt etc., as aforesaid and contractor shall be liable to pay the amount of all expenses incurred but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

Note: CLOSURE OF CONTRACT PENDING COMPLETION OF MINOR ITEMS.

In cases where it is not desirable to keep the building contract open for minor items, such as flooring in the bath rooms, etc., which can be carried out only after installation of sanitary work the main contract may be finalized after getting a supplementary agreement executed in the prescribed form by the same contractor for doing the residual work.

Clause 7. Contractor to submit bills monthly in printed form

- (a) A bill shall be submitted by the contractor on or before 15th of each month for all items of work executed in the previous month as required by IISc. The Running account bills will be paid within three weeks from the date of submission of the bill in complete acceptable form after duly checked and certified by concerned Engineer, under normal circumstances.

All bills shall be prepared in the prescribed printed and electronic form in PDF format in quadruplicate and handed over to the Project Engineer in charge of the work/ Project Engineer cum Estate officer's Office and acknowledgment obtained.

The charges to be made in the bills shall always be entered at the rates specified in the tender in full or in part as the case may be, in the case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender, the charges in the bills shall be entered at the rates hereinafter provided for such work.

(b) Scrutiny of Bills and measurement of work

The details furnished by the Contractor in the bill will be completely scrutinized and the said work will be measured by the Project Engineer in the presence of the Contractor or his duly authorized agent. The countersignature of the contractor or the said agent in the measurement book shall be sufficient proof to the correctness of the measurements, along with the Test certificates to be produced with the bill, which shall be binding on the contractor in all respects.

(c) One copy of the passed bill shall be given to the Contractor without any charge.

Clause 8. PAYMENT PROPORTIONATE TO WORK APPROVED AND PASSED.

No payment shall be made for any work estimated to cost rupees five thousand or less until after the whole of the work shall have been completed and certificates of completion given. But in the case of works estimated to cost more than Rs. 5,000 the contractor shall on submitting the bill and after due verification by the Project Engineer as per Clause 7(b) entitled to necessary Payment proportionate to the part of the work then approved and passed by the Project Engineer cum Estate officer or other competent authority whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor i.e. part payment of submitted RA bills is admissible to contractor. Any such reduced payment amount is admissible for adjustment in the successive RA Bills or Final Bill.

Payment at reduced rates

The rates for several items of works agreed to within shall be valid only when the items concerned are accepted as having been completed fully in accordance with the stipulated specifications. In cases where the items of work are not accepted as so completed, The Project Engineer cum Estate officer or other competent authority may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

Payment or intermediate certificates be regarded as advances:

All such intermediate payments shall be regarded as payments by way of advance against the final payments only and not as payments for work actually done and completed, and shall not preclude the Project Engineer cum Estate officer or other competent authority from requiring any bad, unsound imperfect or unskilful work to be removed or taken away and reconstructed or re-erected nor shall any such payment be considered as an admission for the due performance of the Contract or any part thereof in any respect or the accruing of any claim, nor shall it conclude determine or affect in any other way the powers of the Project Engineer cum Estate officer or other competent authority as to the final settlement and adjustment of the accounts, or otherwise or in any other way vary or affect the contract.

Submission of Final bill and its settlement

The contractor shall submit the final bill within one month from the date of actual completion of the work in all respects. His claims shall be settled within five months from the date of submission of the bill in complete acceptable form after duly checked and certified by concerned Engineer, under normal circumstances.

Disputed items

Note: The contractor shall submit a list of the disputed items within 30 days from the disallowance thereof and if he fails to do this, his claim shall be deemed to have been fully waived and absolutely extinguished.

Clause 9. Definition of Work :

- (i) The expression 'Work' or 'Works' where used in these conditions, shall unless there be something in the subject or context repugnant to such construction, be construed to mean the work or works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.
- (j) **Work to be executed in accordance with specifications, drawings, orders etc.**

The contractor shall execute the whole and every part of the work in the most sound and substantial and workmanlike manner, and in strict accordance with the specifications both as regards materials and workmanship. The contractor shall also conform exactly, fully and faithfully to the designs, drawings and

instructions in writing relating to the work signed by the Project Engineer cum Estate officer or other competent authority and lodged in his office and to which the contractor shall be entitled to have access at such office, or on the site of the work for the purpose of inspection during office hours. The contractor shall also be responsible for the delivery of structure in sound conditions and the execution of the work strictly in accordance with the specifications of the work.

(k) Action where there is no specification

In the case of any class of work for which there is no such specification, then in such a case of the work shall be carried out in all respects in accordance with the instructions and requirements of the Project Engineer cum Estate officer or other competent authority.

(l) Work as per Specifications and IS Codes.

The detailed specification, which forms a part of contract, accompanies the tender document. In carrying out the various items of work as described in Schedule B of the tender documents and the additional, substituted, altered items of work these detailed specification shall be strictly adhered to, supplemented by relevant provisions of Indian standard specifications, the code of practice; etc., The Indian standard specification, National Building Code and the code of practice to be followed shall be the latest versions of those listed in the detailed technical specifications. Any class of work, not covered by the detailed technical specifications, shall be executed in accordance with the instructions and requirements of the Project Engineer cum Estate officer and the relevant provisions of the Indian standard specifications.

Clause 10. Alteration in quantity of work, specifications and designs, Additional work, deletion of work

- (i) The Project Engineer cum Estate officer shall have power to make any alternations in, omissions from additions to or substitutions for the original specification, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work. For that purpose or if for any other reason it shall in his opinion be desirable, he shall have power to order the Contractor to do and the contractor shall do any or all the following: -
- iii) Increase or decrease the quantity of any work included in the contract.
 - iv) Omit any such work.
 - v) Change the character or quality or kind of any such work,
 - vi) Change the levels, lines, positions and dimensions of any part of the work,
 - vii) Execute additional work of any kind necessary for the completion of the works and
 - viii) change in any specified sequence, methods or timing of construction of any part of the work.

Contractor bound by Project Engineer cum Estate officer's instructions

The Contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Project Engineer cum Estate officer or other competent authority and such alteration shall not in any way vitiate or invalidate the contract.

Standard Quantity Take-off (SQT)

Contractor within **14 days** of Issue of LOI to submit the Project Manager & seek approval for the Standard quantity Take-off sheets for all the items mentioned in the Tender BOQ, after due referencing the Tender/ GFC drawings and the Technical Specification. Upon approval, the SQT shall remain the base document for initiating any change orders/ variation in accordance to Clause 31, tracking the daily project progress, and for the measurement sheets.

Orders for variations to be in writing

- (ii) No such variations shall be made by the Contractor without an order in writing of the Project Engineer cum Estate officer; provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is the result of the quantities exceeding or being less than those stated in the 'Schedule B' provided also that if for any reason the Project Engineer cum Estate officer shall consider it desirable to give any such order verbally, the Contractor shall comply with such order without any confirmation in writing of

such verbal order given by the Project Engineer cum Estate officer, whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of the clause; provided further that if the Contractor shall within seven days confirm in writing to the Project Engineer cum Estate officer and if such confirmation is not contradicted in writing within fourteen days by the Project Engineer cum Estate officer, it shall be deemed to be an order in writing by the Project Engineer cum Estate officer.

- (iii) a) Any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on same conditions in all respects on which he agreed to do the main work and same rates as are specified in the tender for the main work. However, change in the Undertaking rates tendered and accepted shall be considered in respect of items under which the quantity of work performed exceeds tendered quantity by more than 25 percent and this actual change in rate will be restricted only to such excess quantity (i.e. beyond 125 percent of the tendered quantity).

(b) Rate for excess quantity beyond 125 percent of tendered quantity

The Additional quantity which exceeds 125 percent of the tendered quantity shall be paid at the rates entered in or derived from Schedule of Rates prevalent at the time of executing additions and alterations plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates (KPWD) of the year in which the tender is accepted (as per the comparative Statement prepared at the time of acceptance of the tender).

(c) Rates for additional, substituted, altered items of work

If the additional, substituted or altered work includes any class of work for which no rate is specified in the contract, then such work shall be carried out at the rates specified for or derived from similar item of work in the agreement. In the absence of similar items in agreement, rate shall be as specified for or derived from similar items in the schedule of rates of KPWD prevalent at the time of execution of such additional substituted or altered items of works, plus or minus the overall percentage of original tendered rates over the current schedule of rates of (KPWD) the year in which tender is accepted as mentioned in sub clause (b) above. With regard to the question whether the additional, substituted or altered item/items of work/works is / are similar or not, to that/those in the agreement / in the Schedule of Rates of KPWD and the decision of the Center for campus management and Development shall be final and binding on the contractor.

(D) Determination of rates for items not found in Estimate or Schedule of Rates

If the rates for additional, substituted or altered work cannot be determined in the manner specified in sub clauses (b) and (c) above, then the contractor shall within 7 days of the date of receipt by him of the order to carry out the work, inform the Project Engineer cum Estate officer of the rates which it is his intention to charge for such class or work, supported by analysis of the rate or rates claimed. Thereupon the Project Engineer cum Estate officer shall determine the rate or rates on the basis of observed data and failing this, on the basis of prevailing market rates. Under no circumstances the contractor shall suspend the work on the plea of non-settlement of rates for items falling under this clause. In the event of any dispute regarding the rates for such items the decision of Project Engineer cum Estate Officer, Center for campus management and Development shall be final.

Working out the data rates for non SR/ non tendered items shall be based on the procedures laid down in the standard rate analysis format of KPWD Bangalore circle Bangalore. The data rates shall be approved by the Project Engineer cum Estate Officer, Center for campus management and Development and shall be binding on the contractor.

Clause 11. TIME LIMITS UNFORSEEN CLAIMS

Under no circumstances whatever shall the contractor be entitled to any compensation from Institute on any account unless the contractor shall have submitted claim in writing to the Project Engineer cum Estate officer or other competent authority within 30 days of the cause of such claim occurring.

Clause 12. NO CLAIM TO ANY PAYMENT OR COMPENSATION FOR DELETION OF WHOLE OR PART OF WORK

- (a) If at any time after the execution of the contract documents, the Project Engineer cum Estate officer or other competent authority shall, for any reason whatsoever, require the whole or any part of the work as specified in the tender, to be stopped for any period or require the whole or part of the work (i) not to be carried out at all or (ii) not to be carried out by the tendered contractor, he shall give notice in writing of the fact to the contractor who will thereupon suspend or stop the work totally or partially as the case may be. In any such case, except as provided hereunder, the contractor shall have no claim to any payment of compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not so derive in consequence of the full amount of the work not having been carried out, or on account of any loss that he may be put on account of materials purchased or agreed to be purchased, or for unemployment of labour recruited by him. He shall not also have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions, which may involve any curtailment of the work, as originally contemplated.

- (b) **Payment for materials already purchased or ordered by contractor.**

Where, however, materials have already been purchased or agreed to be purchased by the contractor before receipt by him the said notice the contractor shall be paid for such materials, at the rates determined by the Project Engineer cum Estate officer or other competent authority provided they are not in excess of requirements and are of approved quality, and/or shall be compensated for the loss, if any, that he may be put to, in respect of materials agreed to be purchased by him, the amount of such compensation to be determined by the Project Engineer cum Estate officer or other competent authority whose decision shall be final.

- (c) **Labour charges during stoppage of work**

If the contractor suffers any loss on account of his having to pay labour charges during the period during which the stoppage of work has been ordered under this clause, the contractor shall on application, be entitled to such compensation on account of labour charges as the Project Engineer cum Estate officer or other competent authority, whose decision shall be final, may consider reasonable. Provided that the contractor shall not be entitled to any compensation on account of labour charges if in the opinion of the Project Engineer cum Estate officer or other competent authority, the labour could have been employed in the same locality by the contractor for the whole or part of the period during which the stoppage of the work has been ordered as aforesaid.

- (d) **Time limit for stoppage of work**

The period of stoppage ordered by the Project Engineer cum Estate officer or other competent authority should not ordinarily exceed six months. Thereafter the portion of works stopped may be treated as deleted from this agreement if a notice in writing to that effect is given to the Project Engineer cum Estate officer or other competent authority by the contractor within seven days after the expiry of the above period.

Execution of work deleted

The portion of work thus deleted may be got executed from the same contractor on supplemental agreement on mutually agreed rates, which shall not exceed current Schedule of Rates plus or minus tender percentage,

Clause 13. ACTION AND PENALTY IN CASE OF BAD WORK

If at any time before the security deposit is refunded to the contractor, it shall appear to the Project Engineer cum Estate officer or other competent authority that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Project Engineer cum Estate officer or other competent authority to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or articles complained of may have been paid for, the contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified on whole or in part as the case may require, or if, so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Project Engineer cum Estate officer or the competent authority in the written intimation aforesaid, the contractor shall be liable to pay a penalty not exceeding one percent on the amount of the estimate for every day not exceeding ten days during which the failure, so continues and in the case of any

such failure the Project Engineer cum Estate officer or other competent authority may rectify or remove, and re-execute the work or remove and replace the materials or articles complained of, as the case may be at the risk and expense in all respects of the contractor should the Project Engineer cum Estate officer or other competent authority for any valid reasons consider that any such inferior work or materials as described above is to be accepted or made use of, it shall be within his discretion to accept the same at such reduced rates he may fix thereof.

Clause 14. WORK TO BE OPEN TO INSPECTION - CONTRACTOR OR RESPONSIBLE AGENT TO BE PRESENT

- (a) All works under or in course of execution or executed in pursuance of the contract shall at all time be open to the inspection and supervision of the Project Engineer cum Estate officer or other competent authority and his Engineer-in-charge, and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Project Engineer cum Estate officer or other competent authority Project Engineer to visit the work shall have been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for the purpose. Orders given to the contractor duly authorized agent shall be considered to have the same force and effect as if they had been given to the contractor himself.

(b) Employment of Minimum technical staff

The Contractor shall employ the following technical staff during execution of this work:

- (i) One qualified Graduate Engineer & One qualified Diploma Engineer, when the cost of the work to be executed up to 1 Crore,
- (ii) Two qualified Graduate Engineer & Three qualified Diploma Engineer, when the cost of the work to be executed from 1 Crore to 10 crores;
- (iii) Three qualified Graduate Engineer & Six qualified Diploma Engineer, when the cost of the work to be executed above 10 crores;
- (iv) In addition to (i) and (ii) above, the contractor shall employ different types of such technical personnel as may be required and sufficient for execution of work and directed by the Project Engineer cum Estate officer to ensure efficient execution of work.

The technical staff so employed, should be available at site whenever required by Engineer in-charge to take instructions.

- (c) If the contractor fails to employ the technical staff as aforesaid, he shall be liable to pay a sum of Rs. 25000 (Rupees Twenty thousand only) for each month of default in the case of Graduate Engineers and Rs. 15000 (Rupees Ten thousand only) for each month of default in case of Diploma Holders.
- (d) If the Contractor himself possesses the required qualification and is available at the site for receiving instructions from the Project Engineer cum Estate officer and other competent authority vide **sub-clause (a)** above it will not be necessary for the technical staff to be available at site for receiving instructions.

Clause 15. NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than five days' notice in writing to the Project Engineer cum Estate officer or his Project Engineer in charge of the work before covering up or otherwise placing beyond the reach of the measurement any work in order that the same may be measured; and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement, and shall not cover up or place beyond the reach of measurement, and work without the consent in writing of the Project Engineer cum Estate officer or other competent authority or his Project Engineer in charge of work; and if any work shall be covered up or placed beyond the reach of measurement, without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Clause 16. CONTRACTOR LIABLE FOR DAMAGE DONE, AND FOR IMPERFECTIONS FOR TWELVE MONTHS AFTER CERTIFICATE OF COMPLETION

If the Contractor or his workmen or servants shall break, deface, injure or destroy any part of a building in which they may be working, or any building, road fence, enclosure or grassland or cultivated ground contiguous to the premises on which the work or any part thereof is being executed, or if any damage shall be done to the work, while it is in progress from any cause whatever or if any imperfections become apparent in it within Twelve months of the grant of a certificate of completion, final or otherwise, by the Project Engineer cum Estate officer or other competent authority the contractor shall make good the same at his own expenses, or in default the Project Engineer cum Estate officer or other competent authority may cause the same to be made good by other workmen, and deduct the expenses (of which the certificate of the Project Engineer cum Estate officer or other competent authority shall be final) from any sums that may be due or may thereafter become due to the contractor, or from his Security Deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

The Defects liability period shall be extended for as long as defects remain to be corrected. Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Institute.

Clause 17. CONTRACTOR TO SUPPLY PLANT, LADDERS, SCAFFOLDINGS, ETC., AND IS LIABLE FOR DAMAGES ARISING FROM NON-PROVISION OF LIGHT, FENCING ETC

The contractor shall supply at his own cost all materials, plant, tools, appliance, implements, ladders, scaffolding, and temporary works required for the proper execution of the work whether in the original, altered or substituted form and whether included in the specification, or other documents forming part of the contract or referred to in these conditions or not, and which may be necessary for the purpose of satisfying or complying with the requirements of the Project Engineer cum Estate officer or other competent authority as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore, to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or the materials. Failing this, the same may be provided by the Project Engineer cum Estate officer or other competent authority at the expense of the contractor and expense may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. The contractor shall provide necessary fencing and lights required to protect the public from accident, and shall also be bound to bear the expense of defense of every suit, action or other legal proceedings, that maybe brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any suit, action or proceedings to any person, or which may with the consent of the contractor be paid for compromising any claim by any such person.

Clause 18. Measures for prevention of fire

The contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permit from the Project Engineer cum Estate officer. When such permission is given, and also in all cases when destroying cut or dug up trees, brushwood grass, etc., by fire the contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property.

Clause 19. Liability of contractor for any damages done in or outside work Area.

Compensation for all damages done by contractor or his men whether in or beyond the limits of Institute property including any damage caused by spreading of fire mentioned in Clause 18 shall be estimated by the Project Engineer cum Estate officer and the estimate of the Project Engineer cum Estate officer, subject to the decision of the Center for campus mangement and Development on appeal shall be final and the contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the contractor as the damages in the manner prescribed in clause 1(c) or deducted by the Project Engineer cum Estate officer or other competent authority from any sums that may be due or become due from Institute to the contractor under this contract or otherwise.

The contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and shall pay any damages and cost that may be awarded by the court in consequence.

Clause 20. Work on Notified Holiday

No work shall be done on any notified holiday without the sanction in writing of the Project Engineer cum Estate officer or other competent authority

Clause 21. WORK NOT TO BE SUBLET

- (a) The contract shall not be assigned or sublet by the contractor. However, any specific portion of the work which is of a specialized nature and normally not executable by a general contractor could be got done by the specialized agencies which are executing such works, after obtaining the specific approval of the Project Engineer cum Estate officer in writing in each case. Such consent to sublet the work, if given, shall not relieve the contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor or his agents, servants or workmate as fully as if they were the acts, defaults or neglects of the contractor, his agents, servants or workmen.

Consequences of subletting work without approval, becoming insolvent, bribing etc., by contractor and action against the contractor.

If the contractor shall assign or sublet his contract or any portion thereof without the specific approval of the Project Engineer cum Estate officer or attempts to do so or become insolvent or commence any proceedings to get himself adjudicated as insolvent or make any composition with his creditors or attempts so to do or if any bribe, gratuity, or indirectly be given, promised or offered by the contractor or any of his servants or agents to any officer or person in the employ of Institute in any way relating to his office or employment or if any such officer or person in the employment or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Project Engineer cum Estate officer or other competent authority may thereupon by notice in writing rescind the contract and the security deposit of the contractor shall thereupon stand forfeited and be absolutely at the disposal of Institute and the same consequences shall ensure as if the contract had been rescinded under Clause 3 here of and in addition, the contractor shall not be entitled to recover or be paid for any work actually performed under contract.

- (b) **Recovery of excess payments based on excess measurements and action against contractor.**

Whenever it is noticed that excess payments have been made to the contractor based on excess measurements recorded by the Project Engineer in the measurement book and countersigned by the contractor or his duly authorized agent, action shall be taken to recover the excess payments together with interest immediately. Action may also be taken to remove the name of the contractor from the approved list of contractors and also to black-list him.

Change in classification of excavations accepted not permitted.

Once the measurements mentioning the classification of the excavations are recorded in the measurement book and the same is signed by the contractor or his authorized agent in token of acceptance, no request for reclassification by the contractors shall be entrained.

- (c) **Criminal proceedings against IISc Officer and Contractor for the lapses.**

Institute also reserve the right to initiate criminal proceedings against the concerned Institute Officers who are directly responsible for the lapse and the contractors who have colluded with the officers of the Institute in the lapse and fraudulently received amounts not due to them legitimately.

Clause 22. SUM PAYABLE BY WAY OF COMPENSATION TO BE CONSIDERED AS REASONABLE COMPENSATION WITHOUT REFERENCE TO ACTUAL LOSS.

All sums payable by a contractor by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied for the use of Institute without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.

Clause 23. SETTLEMENT OF DISPUTES -TIME LIMIT FOR DECISION

- (a) If any dispute or difference of any kind whatsoever were to arise between the Project Engineer cum Estate officer and the contractor regarding the following matters namely,
- (i) The meaning of the specification's designs, drawing and instructions herein before mentioned,
 - (ii) The quality of workmanship or materials used on the work and
 - (iii) Any other question, claim right, matter, thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specification, estimates, instructions, or orders, or those conditions, failure to execute the same whether arising during the progress of the work, or after the completion, termination or abandonment thereof, the dispute shall, in the first place, be referred to the Centre for campus management and Development who have jurisdiction over the work specified in the contract. The Centre for campus management and Development shall within a period of fifteen days from the date of being requested by the Contractor to do so give written notice of its decision to the Contractor.

If the decision of the Centre for campus management and Development is not acceptable to the contractor, he may approach the **Director, IISc** within a period of 15 days for settlement.

(b) Director's decision final.

Subject to other form of settlement hereafter provided, the Director's decision in respect of every dispute or difference so referred shall be final binding upon the contractor. The said decision shall forthwith be given effect to and contractor shall proceed with the execution of the work with all due diligence.

(c) Remedy when Director's decision is not acceptable to contractor

In case the decision of the Director is not acceptable to the contractor, he may approach the Law Court at Bangalore for settlement of dispute after giving due written notice in this regard to the Director within a period of ninety days from the date of receipt of the written notice of the decision of the Director. Further, the Bangalore courts alone shall have the exclusive jurisdiction.

(d) Time limit for notice to approach Court of law by contractor

If the Director has given written notice of his decision to the contractor and no written notice to approach the law court has been communicated to him by the contractor within a period of ninety days from receipt of such notice, the said decision of Director shall be final and binding upon the contractor.

(e) Time limit for notice to approach law court by contractor when decision is not given by Director, IISc as at (b).

If the Director fails to give notice of his decision within a period of ninety days from the receipt of the contractor's request in writing for settlement of any dispute or difference as aforesaid, the Contractor may within ninety days after the expiry of the first named period of ninety days approach the Law Courts at Bangalore giving due notice to the Director.

(f) Contractor to execute and complete work pending settlement of dispute.

Whether the claim is referred to the Director or to the Law Courts, as the case may be, the contractor shall proceed to execute and complete the works with all due diligence pending settlement of the said dispute or differences.

(g) Obligations of the Project Engineer cum Estate officer and contractor shall remain unsettled during considerations of dispute.

The reference of any dispute or difference to the Director or the Law Court may proceed notwithstanding that the works shall then be or be alleged to be complete, provided always that the obligations of the Project

Engineer cum Estate officer and the contractor shall not be altered by reason of the said dispute or difference being referred to the Director or the Law Court during the progress of the works.

Clause 24. CONTRACTOR TO PAY COMPENSATION UNDER WORKMEN'S COMPENSATION ACT.

- (a) The contractor shall be responsible for and shall pay any compensation to his own workmen payable under the relevant Workmen's Compensation Act for injuries caused to the workmen. If Institute pays such compensation on behalf of the contractor it shall be recoverable by Institute from the contractor under as per relevant clauses.

(b) Contractor to pay expenses of providing medical aid to workmen.

The contractor shall be responsible for and shall pay the expenses of providing medical aid to any workman who may suffer a bodily injury as a result of an accident. If Institute incurs such expenses, the same shall be recoverable from the contractor forthwith and be deducted without prejudice to any other remedy of Institute, from any amount due or that may become due to the contractor.

Clause 25. CONTRACTOR TO PROVIDE PERSONAL SAFETY EQUIPMENT FIRST AID APPARATUS, TREATMENT etc.

The contractor shall provide all necessary personal safety equipment and first aid apparatus for the use of the persons employed on the site and shall maintain the same in good condition suitable for immediate use, at any time and shall comply with the following regulations in connection therewith: -

- (i) The worker will be required to use the equipment so provided by the contractor and the contractor shall take adequate steps to ensure proper use of the equipment by those concerned.
- (ii) When work is carried on in proximity to any place where there is a risk of drowning; all necessary steps shall be taken for the prompt rescue of any person in danger.
- (iii) Adequate provision shall be made for prompt first - aid treatment of all injuries likely to be sustained during he course of the work.

Clause 26. Minimum age of persons employed by contractor (a):

No contractor shall employ

- (i) Any person who is under age of 15 years.
- (ii) Who does not produce a valid certificate of vaccination against epidemic deceases in respect of himself/ herself as well as all the members of his/her family.
- (b) The contractor shall provide potable water facilities to the workers. Similar amenities shall be provided to the workers engaged on large works in urban area.
- (c) Removal of persons not satisfying conditions (a) (i) & (ii)

The Project Engineer cum Estate officer or other authority is authorized to direct the removal or to remove through - his own agency, from the work any person referred to in sub-clauses (a) above not satisfying these conditions and no responsibility shall be accepted by the Institute for any delay caused in the completion of the work by such directions for removal.

- (d) Payment of fair and reasonable wages by contractor.

The contractor shall pay fair and reasonable wages, which shall not be less than the minimum wages fixed by Govt. of Karnataka from time to time to the workmen employed by him in the contract undertaken by him. In the event of any dispute arising between the contractor, and his workmen on the ground that the wages paid are not fair and reasonable the dispute shall be referred without delay to the Project Engineer cum Estate officer or other competent authority, who shall decide the same. The decision shall not in any way affect the conditions in the contract regarding the payment to be made by Institute at the agreed tender rates.

Clause 27. CONTRACTOR NOT ENTITLED TO ANY CLAIM OR COMPENSATION FOR DELAY IN EXECUTION OF WORK IN BORROW PITS.

The contractor shall not be entitled to claim compensation if there is any delay in the execution of the work on account of water standing in borrow pits and Compartments. The rates are inclusive for hard or cracked soil,

Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore

excavation in mud, sub-soil water or water standing in borrow pits and no claim for extra rate shall be entertained, unless otherwise specified.

Clause 28. METHOD OF PAYMENT OF BILLS

Payment to contractors shall be made by cheques drawn by the Institute

Clause 29. SET OFF AGAINST ANY CLAIM OF INSTITUTE

Any sum of money due and payable to the contractor (including the security deposit refundable to him) under this contract may be appropriated by the Institute and set off against any claim of Institute in respect of a payment of a sum of money arising out of or under any other contract made by the contract with the Institute.

Clause 30. RATES INCLUSIVE OF SALES TAX AND LABOUR CESS AND ROYALTY

- (a) The rates to be quoted by the contractor shall be inclusive of all taxes like GST , Labour cess, Royalty etc., No extra payment on this account will be made to the contractor. Any statutory levies imposed by the central Government/ state Government/ local body from time to time are to the contractors account only.
- (b) When there is a change in existing taxes from time to time i.e. upward or downward is admissible accordingly
- (c) All quarry fees, octroi dues levied by the state or any local body or authority and ground rent, if any, charged by the Project Engineer cum Estate officer for stacking materials should be paid by the contractor.

Clause 31. IMPORTANCE OF SAFETY

In addition to Contractor's Contractual Obligations on Safety as per the relevant clauses stated, The Contractor shall comply with all safety standards to the satisfaction of the Employer's Representative.

In respect of all labour, directly or indirectly employed on the project for the performance and execution of the Contractor's Work under the Contract, the Contractor shall at its own expense arrange for all the safety provisions as listed in (i) Safety codes of C.P.W.D. and Bureau of Indian Standards, (ii) The Electricity Act, (iii) The Mines Act, and Regulations, Rules and Orders made there under and such other acts as applicable. Precautions as stated in the safety clause are the minimum necessary and shall not preclude the Contractor taking additional safety precautions as may be warranted for the particular type of work or situations. Also mere observance of these precautions shall not absolve the Contractor of his liability in case of loss or damage to property or injury to any person including but not limited to the Contractor's labour, the Employer's, Architect's, Employer's Representative's and Project Manager's representatives or any member of the public or resulting in the death of any of these.

The Contractor shall institute and implement to the satisfaction of the Project Manager a construction safety programme, including:

- Preparing a Site-specific written safety programme consistent with the EHS Plan, Indian law and best practices. As a minimum, the programme shall require applicable safety equipment for all workers, use of barriers and barricades around potentially dangerous areas, protection of workers working under elevated conditions, accident reporting, first aid provisions etc.
- Weekly safety reviews and 'risk assessments' shall be carried out in conjunction with the Project Manager and the Employer in order to identify potential safety hazards and to mitigate against them.
- Attending weekly or as scheduled safety meetings at site conducted by the site safety representative of project manager
- The Contractor will be required to provide all personnel entering the Site an Identity and safety rules card and verbal explanation of the safety programme.
- Requiring all Sub-Contractors and other workers under the responsibility of the Contractor (including the Vendors or later phases of the construction of the Project) to adhere to the written safety programme as per approved format.

Experienced safety officers with adequate number of supporting personnel shall be appointed by the Contractor for full time on the site during the Contract period.

NON-COMPLIANCE OF REGULATIONS

If the Project Manager or the Employer's Representative notifies the Contractor of non-compliance with the foregoing regulations, the Contractor shall immediately, if so directed, or in any event not more than eighteen (18) hours after receipt of such notice, make all reasonable efforts to correct such non-compliance. If the Contractor fails to do so, the Employer may suspend all or any part of the Work. When the Contractor has undertaken satisfactory corrective action, Employer shall lift the suspension of the Work. The Contractor shall not claim any extension of time to complete the Work or additional fees due to any such work suspension.

The Client reserves the right to levy penalty if the safety norms such as not wearing helmets, safety gloves/belts/shoes/jackets. etc., even after a written notice by the enforcing authority, a penalty of Rs. 10,000/- per day per event or till the safety norms are adhered to in addition to stopping of work till the safety norms are adhered

Clause 32 Refund of Security Deposit (EMD & FSD):

The Security Deposit lodged/paid by a Contractor shall be refunded to him after the final bill is paid or after the successful completion of defect liability period, during which period the work should be maintained by the Contractor in good order, whichever is later.

Clause 33. PENALTY FOR DELAY

(a) Written Order to Commence Work

After acceptance of the tender, The Project Engineer cum Estate Officer, CCMD shall issue a written order to the successful tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of The Project Engineer cum Estate Officer, CCMD. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

(b) Programme of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed to the agreement.

(c) Review of progress and responsibility for delay etc.,

The Project Engineer cum Estate Officer, CCMD shall review the progress of all works with the contractor during the first fortnight of every month. Such a review shall take into account the programme fixed for the previous month, obligations on the part of the Contractor.

(d) Apportioning of responsibility for delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by The Project Engineer cum Estate Officer, CCMD and the Contractor.

Clause 34 BAR CHART / CPM CHART:

BAR chart /CPM chart shall be produced during agreement by the contractor. According to the bar chart work is to be executed otherwise penalty will be levied for the delay of work

9. THE ARTICLES OF AGREEMENT

This Agreement is made at Bangalore, on this _____ day of _____ (month) in the year _____

BY AND BETWEEN

INDIAN INSTITUTE OF SCIENCE, a Trust registered under the Charitable Endowments Act, 1890, a deemed University and an autonomous Institution funded by the Ministry of Human Resource Development, Government of India having its office at **Sir C.V Raman Road, Malleswaram, BANGALORE 560 012**, (hereinafter referred to as the EMPLOYER which expression shall unless repugnant to the context or meaning thereof, mean and include its successors in interest, trustees and permitted assigns) of the ONE PART

AND

_____, hereinafter referred to as the "CONTRACTOR", (which expression shall unless repugnant to the context or meaning thereof, mean and include their partners, their respective heirs, executors, administrators and assigns) on the OTHER PART.

WHEREAS the Employer is desirous of getting the work of "**Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore**" (hereinafter called the work) executed by the Contractor at the rates quoted by him amounting to **Rs. 1,14,20,000/- (Rupees one hundred fourteen lakh and twenty thousand Only)** which is the estimated amount put to tender.

AND WHEREAS the Contractor has agreed to execute the aforesaid work on terms and conditions mentioned herein and subject to Tender Conditions of Contract and in accordance with the particular specifications, general notes and the schedule of quantities, schedule of rates, payment and penalty condition.

AND WHEREAS the contractor has deposited a sum of Rs 1,71,300/- (Rupees One Lakh seventy one thousand and three hundred Only) with Employer as security for the due performance of this Contract.

NOW it is hereby agreed and declared by and between the parties hereto as follows;

1. In consideration of the payment to be made to them as hereinafter provided, the contractor shall, subject to the terms, conditions, specifications, schedule of quantities, drawings, etc., more particularly stated in the Schedules aforesaid, execute and complete the work within 4 **(Four) Months** starting after 10 days of issuance of work order or from the date of handing over of site, whichever is later.
2. The Employer shall pay to the contractor such sums as shall become payable hereunder at the time and in the manner specified in the conditions contained in the schedule aforesaid.
3. The time allowed for carrying out the work as entered in the tender Agreement shall be strictly observed by the contractor and shall be deemed to be the essence of the contract on the part of the contractor and shall be reckoned from 10 days after the date on which the order to commence the work is issued to the Contractor or the date of handing over of site, whichever is later. The work shall throughout the stipulated period of the contract be proceeded with all due diligence and the Contractor shall pay as compensation an amount equal to one percent, or such smaller amount, as the Director, Indian Institute of Science (whose decision in writing shall be final) may decide on the amount of estimated cost of the whole work as shown in the tender for every day that the work remains un commenced or unfinished, after proper dates.

Contractor

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Registrar

4. The contractor shall to ensure good progress during the execution of the work the contractor shall be bound in all cases in which the time allowed for any work exceeds one month (save for special jobs) to complete one-eighth of the whole work before, one-fourth of the whole time allowed under the contract has elapsed, three-eighths, of the work before one-half of such time has elapsed, and three-fourths of the work before three-fourths of such time has elapsed.

However, for special jobs if a time schedule has been submitted by the contractor and the same has been accepted by the Architects/ Project Engineer-cum-Estate Officer, CCMD the contractor shall comply with the said schedule. In the event of the Contractor failing to comply with the conditions he shall be liable to pay as compensation an amount equal to one percent or such smallest amount, as the Director, Indian Institute of Science (Whose decision in writing shall be final), may decide on the said estimated cost of the whole work for every day that the due quantity of work remains incomplete; provided always that the entire amount of compensation to be paid under the provisions of this clause shall not exceed seven and a half (7 ½) percent of the estimated cost of the work as shown in the tender.

5 The Director of the Indian Institute of Science, without prejudice to his rights under the contract in any respect of any delay or inferior workmanship or otherwise, or to any claim for damages in respect of any breaches of the Contract and without prejudice to any rights of remedies under any of the provisions of this contract or otherwise and whether the date of completion has or has not elapsed, by notice in writing absolutely determine the contract in any of the following cases:-

- (i) If the contractor having been given by the Architects/Project Engineer-cum-Estate Officer, CCMD a notice in writing to rectify reconstruct or replace any defective work or that the work is being performed in any inefficient or otherwise improper or un workmanlike manner, shall omit to comply with the requirements of such notice for a period of seven days of such notice thereafter or if the contractor shall delay or suspend the execution of the work so that in the judgment of the Project Engineer-cum-Estate Officer, CCMD (which shall be final and binding) either he will be unable to secure completion of the work by the date for completion of the work or he has already failed to complete the work by that date.
- (ii) If the Contractor being a company passes a resolution or if the Court passes an order to wind up the company or if a receiver or a manager is appointed on behalf of the creditors of the company or under circumstances which entitles the Court or the creditors to appoint a receiver or manager which would entitle the Court to make a winding up order.
- (iii) If the Contractor commits breach of any of the terms or conditions of this contract;
- (iv) If the contractor assigns or sublets without written approval of the Project Engineer-cum-Estate Officer, CCMD or becomes insolvent.

When the Contractor has made himself liable for action under any of the cases aforesaid, the Project Engineer-cum-Estate Officer, CCMD on behalf of the Director of the Institute shall have powers:

- (a) To determine or rescind the Contract as aforesaid (in which termination or recession notice in writing to the Contractor under hand of the Project Engineer-cum-Estate Officer, CCMD shall be conclusive evidence) Upon such determination or recession the security deposit of the Contractor shall be liable to be forfeited and shall absolutely be at the disposal of Institute.
- (b) To employ labor paid by the Institute and supply materials to carry out the work or any part of the debiting the Contractor with the cost of the labor and the price of the materials (of the amount of which cost and price certified by the Project Engineer-cum-Estate Officer, CCMD shall be final and conclusive against the Contractor) and crediting him with the value of the work done in all respect on the same manner and at the same rates as if it has been carried out by the contractor under the

term of his contract. The certificate of the Project Engineer-cum-Estate Officer, CCMD as to the value of the work done shall be final and conclusive against the contractor, provided always that action under the sub-section shall only be taken after giving notice in writing to the contractor. Provided also that if the expenses incurred by the Institute are less than the amount payable to the contractor at his agreement rates, the difference shall not be paid to the Contractor.

- (c) After giving notice to the contractor to measure up the work of the contractor and to take such part thereof as shall be un-executed out of his hands and to give it to another contractor to complete in which case any expenses which may be incurred in excess a sum of which would have been paid to the original contractor if the whole work had been executed by him (of the amount of which excess the certificate in writing of the Project Engineer-cum-Estate Officer, CCMD shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any monies due to him from the Institute under this contract or any other account whatsoever, of from his security deposit or the proceeds of sales thereof, or a sufficient part thereof as the case may be.

In the event of any one or more of the above courses being adopted by the Project Engineer-cum-Estate Officer, CCMD, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advances on account or with a view to the execution of the work or the performance of the contract. And in case action is taken under any of the provisions, aforesaid, this contractor shall not be entitled for recover or be paid any sum for work thereto/for actually performed under this contract unless the Architect/ Project Engineer-cum-Estate Officer, CCMD has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

6. The schedules above mentioned including the General Rules and Directions to Contractors and the following documents, viz.,

- i) Letter of Intent
- ii) Conditions of Contract – Volume I
- iii) Contractor's Bid – Bill of Quantities – Volume II
- iv) Technical Specifications – Volume III
- v) Drawings
- vi) The pre-Bid meeting proceedings and corrigendum
- vii) Any other document listed in the Contract Data as forming part of the contract

shall form an integral part of agreement and the decision of the Project Engineer-cum-Estate Officer, CCMD in reference to all matters of dispute as to material and workmanship shall be final and binding on both the parties.

7. The employer reserves to himself the right of altering the drawings of the works and of adding to or omitting any item of work from or of having portions of the same carried out departmentally or otherwise and such alterations or variations shall not vitiate this agreement.

8. This agreement comprises the work aforesaid and all subsidiary works connected therewith even though such works may not be shown on the schedule appended hereto.

9. Notwithstanding anything contained in the tender submitted by the contractor, all the clauses of this agreement shall be binding on both the parties.

10. Where counter terms and conditions, printed or copied, are offered by the contractor, the same shall not be deemed to have been accepted by the Employer, unless specific written acceptance thereof is furnished by the

Employer. Notwithstanding the foregoing, no verbal agreement or inference from conversation with any office members/representatives/employees of the Employer before, during or after the execution of the agreement, shall in any way affect or modify any of the terms/obligations contained herein.

11. In the event the contract is terminated by the Employer due to any aforementioned act/omission on the part of the contractor, or for any reason whatsoever, the Employer shall be entitled to engage the services of any other person, agency or Contractor to meet its requirement, without prejudice to its rights including claim for damages against the Contractor.

12. The Employer shall be indemnified for all losses due to commissions and omissions of persons deployed by the contractor. If any loss or damage is caused to the Employer on account of any negligence, carelessness, acts of omissions. commissions of contractors, his employees or staff, the same shall be made good by the contractor. The contractor shall defend, indemnify and hold the Institute harmless from any liability or damage, lawsuits, penalties imposed by any State of Central Government Department or statutory body or by a third party for reasons of violation of any of statutory provisions or requirements by the contractor. The Employer shall not be liable for any damage or compensation payable to any workmen or to any person as a consequence of this work and the Employer shall be completely indemnified accordingly.

13. In case of disputes s including all questions relating to the performance of the obligations under this agreement and all the dispute and differences which shall arise either during or after the agreement period or other matters arising out of or relating to this agreement or payments to be made in pursuance thereof shall be decided by the Director of IISc whose decision shall be binding on the contractor. The Contractor hereby agrees to be bound by the decision of the Director.

IN WITNESS WHEREOF the parties hereto have set their respective hands the day and the year here in above written.

In the presence of:

Signed by for and on behalf of the said Contractor.

In the presence of:

Signed by for and on behalf of the said Employer.

REGISTRAR
INDIAN INSTITUTE OF SCIENCE
BANGALORE-12

INDIAN INSTITUTE OF SCIENCE, BANGALORE-12
ITEM RATE TENDER FOR WORK

I/We, hereby tender for the execution for the Indian Institute of Science, Bangalore-12 of the works specified in the under mentioned memorandum within the time specified in such memorandum at the rates specified therein and in accordance, in all respects, with the specifications, designs, drawings and instructions in writing which have been read by me/read and explained to me and with such materials as provided for by and in all other respects in accordance with such conditions as for as possible.

MEMORANDUM OF WORK

1.	GENERAL DESCRIPTION	Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore
2.	ESTIMATED COST	Rs. 1,14,20,000/-
3.	EARNEST MONEY	Rs. 1,71,300/-
4.	FURTHER SECURITY DEPOSIT	6.0% on the running account bills and final bill in addition to Earnest Money Deposit. When the F.S.D. deducted from the RA bills of the Contractor @ 6.0% of the bill amount exceeds Rs.1.00 lakhs, the amount in excess of Rs.1.00 lakh may, at the request of the Contractor, be released to him against the production of a bank guarantee issued by a Nationalised /Scheduled Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.
5.	TIME ALLOWED FOR THE COMPLETION OF WORK IN ALL RESPECTS FROM THE DATE OF COMMENCEMENT OF WORK	4 (Four) Months
6.	BILLS OF QUANTITIES.	Enclosed
7.	SPECIFICATIONS.	The work shall be carried out strictly in accordance with the enclosed specifications and wherever items are not covered by those specifications in accordance with specifications/drawings/designs/requirements and directions of the Project Engineer-cum-Estate Officer, CCMD or his representatives.

I/We hereby agree to abide by and fulfil all the terms and provisions of the conditions contained in the articles of agreement, which have been read by me/us or in default thereof to forfeit and pay to the Registrar, Indian Institute of Science or his successors the sums of monies mentioned in the said conditions.

The sum of **Rs. 1,71,300/- (Rupees one lakh seventy one thousand three hundred Only)** has been deposited in cash/Bank draft as Earnest Money the full value which is to be absolutely forfeited to the Registrar or his successors in Office should I/We fail to commence the work specified in the above memorandum and complete the same.

Dated this

Contractor

Registrar

Signature of the Contractor/s

Witness to Contractor/s Signature:

NAME

ADDRESS

OCCUPATION

The above tender is hereby accepted by me on behalf of the Indian Institute of Science, Bangalore-12.

**REGISTRAR
INDIANINSTITUTE OF SICENCE
BANGALORE.**

Indian Institute of Science, Bangalore-12
A P P E N D I X

1.Name of the work	Supply, Installation, Testing and Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore IISc, Bangalore
2.Date of commencement of work	Within Ten days from the date of issue of work order or the date of handing over the site whichever is later
3.Time of Completion	4 (Four) Months
4.Frequency of interim Certificate and payment	Once every month.
5.Further Security deposit	6.0% on the running bills and final bill in addition to earnest money deposit. When the F.S.D. deducted from the R.A. Bills of the contractor @ 6.0% of the bill amount exceeds Rs.1.00 Lakhs, the amount in excess of Ra.1.00 Lakh may, at the request of the contractor, be released to him against the production of bank guarantee issued from a Nationalised /Scheduled Bank only for an equal amount in the prescribed form. The bank guarantee should be valid till the completion of the defect liability period.
6. Defects liability period / retention amount from the final bill/release of balance of deposit.	The security deposit lodged/paid by a contractor shall be refunded to him after the final bill is paid or after twelve months from the date of completion of the work, during which period the work so executed should be maintained by the contractor in good order, whichever is later.
7. Penalty for delay	In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per clause 2(b) and 2(c), the contractor shall be liable to pay as penalty an amount equal to one percent of the estimated cost of the balance work assessed according to the programme, for every day that the due quantity of work remains incomplete, provided always that the total amount of penalty to be paid under the provisions of this clause shall not exceed 7 ½ percent of the estimated cost of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.
8. Period for payment of Running Bill	Three weeks from the date of submission of each Running account bills by the Contractor.
9. Period for submitting the final Bill	One month from the date of virtual completion of the work by the Contractor.

10. REFERENCES

I.S. STANDARDS OF ELECTRICAL WORKS

Sl.No	STANDARDS	TITLE
	Code of Practice / Guide	
1	IS : 732 - 1989	Code of Practice for Electrical wiring installations.
2	IS : 4648 - 1968	Guide for Electrical layout in residential buildings
3	IS : 80614 - 1976	Code of Practice for Design, installation and maintenance of service lines up to and including 650V.
4	IS : 7752 (Part-1) - 1976	Code of Practice for interior illumination : General requirements and recommendations for welding interiors.
5	IS : 4347 - 1967	Code of Practice for hospital lighting
6	IS : 6665 - 1972	Code of Practice for industrial lighting
7	IS : 2672 - 1966	Code of Practice for Library lighting
8	IS : 10118 (Part-1) - 1982	Code of Practice for selection, installation and maintenance of switcher and Control gear : Installation.
9	IS : 4146 - 1983	Application guide for voltage transformers.
10	IS : 3043 - 1987	Code of practice for earthing.
11	IS : 5216 (Part-2) - 1982	Guide for safety procedures and practices in electrical work : General.
12	IS : 4237 - 1982	General requirements for switchgear and control gear for voltages not exceeding 1000 V AC or 1200 V DC.
13	IS : 6875 - (Part-1) - 1973	Control switches (Switching devices for control and auxiliary circuits including 1000 V AC and 1200 V DC : General requirements and tests.
14	IS : 10027 - 2000	Composite units of Air-Break switches and rewirable type fuses for voltages not exceeding 650 V AC.
15	IS : 4064 (Part-1) - 1978	Composite units of Air-Break disconnecter, Air-Break switch disconnecter and fuse- combination units for voltages not exceeding 1000 V AC or 120 V DC : General requirements.
16	IS : 8828 - 1996	Electrical accessories - circuit breakers for over current protection for household and similar installation.

17	IS : 2516 (Part-1/Sec01)-1985	Circuit-Breaks : Requirements and tests : Voltages not exceeding 100 V AC or 1200 V DC.
18	IS : 5039 - 1983	Distribution pillars for Voltages not exceeding 1000 V AC or 1200 V DC.
19	IS : 8544 (Part-4) - 1979	Motor starters for voltages not exceeding 1000 V : Reduced voltage AC starters, two- step auto transformer starters.
20	IS : 9537 (Part-1) - 1980	Conduits for electrical installations General requirements
21	IS : 9537 (Part-4) - 1983	Conduits for electrical installations : Pliable self recovering conduits of insulating materials.
22	IS : 3854 - 1997	Switches for domestic and similar purposes.
23	IS : 1293 - 1988	Plugs and sockets outlets of rated voltage upto and including 250 Volts and current upto and including 16 Amperes.
24	IS : 2418 (Part-1) - 1977	Tubular Fluorescent lamps for general lighting services : Requirements and tests.
25	IS : 9900 (Part-1) - 1981	High pressure mercury vapor lamps : Requirements and tests.
26	IS : 1913 (Part-1) - 1978	General and safety requirements for luminaries : Tubular fluorescent lamps.
27	IS : 10322 (Part-1) - 1982	Luminaries : General requirements
28	IS : 302 (Part-1) - 1979	General and safety requirements for household and similar electrical appliances.
29	IS : 6236 - 1971	Direct recording electrical measuring instruments.
30	IS : 2705 (Part-1) - 1992	Current transformers : General requirements.
31	IS : 2448 (Part-1) - 1963	Adhesive insulating tapes for electrical purposes : Tapes with cotton textile substrates.
32	IS: 8130-1984	Code for Conductor Construction
33	IS: 5831-1984	Code for Insulation & sheath material

34	IS:694-1990	PVC insulated Flexible Single Core Wire/ Unarmoured Multicore/ Flat Cables. For working voltage upto & including 1100V.
35	IS:1554(Part-1)-1988	Copper or Aluminium Conductor,PVC insulated,extruded inner sheathed PVC,galvanised steel wire/strip armoured,extruded PVC sheathed LT Control/Power Cable. For working voltage upto & including 1.1KV.
36	IS:3975-1990	Code for Number of Strips in armouring construction.
37	IS: 7098/II/85	XLPE insulated HT & AB Cables. For working voltage 6.35/11KV.
38	IS:14255-1995	Code for Aerial Bunched Cables.For working voltage upto 1.1KV.
39	IS:13573/VDE 0278/IEC 60502/HD 629.1.S2 CENELEC	Code of Type tests for HT termination jointing kit.
40	IS 7569:1987	Cast Acrylic Sheets for use in Luminaires
41	IS 8030:1976	Specifications for Luminaires for Hospitals
42	IS 10242: Part 3: Sec 6: 1986	Electrical installations in ships: Part 3 Equipment, Section 6 Luminaires & accessories
43	IS 10322: Part 2 1982	Specification for Luminaires - Part 2: Constructional Requirements
44	IS 10322: Part 3 1984	Specification for Luminaires - Part 3: Screw & Screw Less Terminals
45	IS 10322: Part 4 1984	Specification for Luminaires - Part 4: Method of Tests
46	IS 10322: Part 5: Sec 1: 2012	Luminaires: Part 5 Particulars requirements, Sec 1 General Purpose Luminaires
47	IS 10322: Part 5: Sec2: 2012	Specifications for Luminaires - Part 5 : Particular Requirements - Section 2: Recessed Luminaires
48	IS 10322: Part 5: Sec4: 1987	Luminaires: Part 5 Particulars requirements, Section 4 Portable general purpose luminaires
49	IS 13383: Part 1 : 1992	Photometry of Luminaires - Method of Measurement - Part 1: Luminaires for use in interior Lighting

50	IS 13383: Part 2 : 1992	Methods of Photometry of luminaires: Part 2 Luminaires for road & street lighting
51	IS 13383: Part 3 : 1992	Photometry of Luminaires - Method of Measurement - Part 3: Luminaires for Floodlighting
52	BSEN 10025 Grade 5, 355JO (or) ASTM A 572-50	Steel sheet thickness
53	IS 875 Part 3	Wind Velocity
54	IS 2062 (or) ASTM A 572-50	Base Plate
55	BSEN ISO 1461 (or) ASTM A123 (or) IS 2629	Galvanized in single hot dip / With Average 70 Microns
56	BS 5135	Welded Single L-Seam Joint
57	AISI 304 Grade	Stainless Steel Wire Rope (Factor of Safety : TR No. 7)
58	IS 1239	Maximum Load Carrying Capacity (Lantern)
59	IS 9595 (or) IS 10178 AWS	Single Section & Single Joint welded
60	ASTM - A 123 and 153	Hot dip Galvanized in Single dipping with not less than 65 Microns

11. TECHNICAL SPECIFICATION

1. 2500 KVA COMPACT SUB STATION

1.0 SCOPE

The specification covers design, manufacture, Testing, Inspection, Packing, Transportation and supply and on site sample commissioning of 11/0.433 kV Packaged Substation with all safety accessories, tools and tackles. The substation shall be designed, manufactured and tested as per IEC 60 1330. The substation shall be tested for internal arc test.

Test methods of Pre-fabricated sub-station which are cable connected to be operated from inside or outside for alternating current of primary rated voltage 10KV to 13KV and for a transformer of maximum power 2500 KVA for service frequencies. The Pre-fabricated sub-station can be situated at ground level or partially or completely below ground level.

2.0 SYSTEM DETAILS

Power is fed to Grid Substations at 66 / 11 KV from the 220 / 66 and where it is stepped down to the primary distribution voltage of 11kV.

3.0 BILL OF QUANTITY

Each offer of Packaged Substations shall consist of

- | | |
|--|---------|
| a) 11 KV RMU Unit (SF6/VCB type) | - 1 no. |
| b) 11 / 0.433 KV, Distribution transformer | - 1 no |
| a) Bus bar connection between LT terminal
of transformer to ACB | - 1 set |
| b) LT ACB, 4000A/2500 Amps & MCCB 630A | - 1 set |
| c) Enclosure for entire sub station | |
| d) Exhaust fan for Transformer Compartment | |
| e) Metering CT | |

4.0 SITE CONDITION

The equipment covered under this specification is for **outdoor installation** and should be suitable for use at the sites in IISc jurisdiction for the prevailing climatic conditions.

a) TEMPERATURE: The reference ambient temperature is to be taken as 43.3°C as per IS 9676.

- i) Maximum ambient air temp ----- 50°C
- ii) Maximum daily average ambient temp----- 40°C

b) RELATIVE HUMIDITY

- i) Maximum ----- 100%
- ii) Minimum ----- 10%
- c) Average Annual rainfall ----- 750mm
- d) Average no of rainy days/ annum----- 50
- e) Average no of thunderstorm days/ annum----- 40
- f) Altitude ----- Not exceeding 300 m
- g) Rainy months ----- June to Oct
- h) Wind pressure ----- 195kg/m² up to 30m
elevation as per IS 875/75.

The atmosphere is heavily polluted, laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during rainy months.

All equipments shall be designed to withstand seismic forces, corresponding to an acceleration of 0.1g.

5.0 DRAWINGS AND DOCUMENTS

Vendor shall furnish with the detail, as per "VENDOR DATA REQUIREMENT", attached with the specification.

6.0 Bidders should submit item wise price bids as per BOQ

7.0 INSTRUCTIONS TO BIDDERS

- 7.1 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals.
- 7.2 The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to date relevant IS code of practice and Indian electricity act. In addition, other rules of regulations applicable to the work shall be followed.
- 7.3 The high-tension Switchgear, distribution transformer, LT Switchgear & its accessories offered shall in general comply to the following specification attached.
 - A. Specification for 11kV Non extensible RMU
 - B. Specification for Distribution Transformer
 - C. Specification for LT system
 - D. Specification for enclosure for package substation.

A. SPECIFICATION FOR 11 kV Non-Extensible RMU

1.0 CODES AND STANDARDS

1.1 The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified.

IS 694:	PVC insulated cables for working voltages up to and including 1100V.
IS 722:	Integrating meters.
IS 1248:	Electrical indicating instruments.
IS 2071:	Methods of high voltage testing.
IS 2544:	Porcelain post insulators for systems with nominal voltage greater than 1000V.
IS 2705:	Current Transformer.
IS 3156:	Voltage Transformer.
IS 3231:	Electrical relays for power system protection.
IS 3427:	Metal enclosed Switchgear and Control gear for voltages above 1000V but not exceeding 11000V.
IS 3618:	Phosphate treatment of iron and steel for protection against corrosion.
IS 5082:	Material for data for aluminium bus bars.
IS 5578:	Guide for marking of insulated conductors.
IS 6005:	Code of practice of phosphating of iron and steel.
IS 9046:	AC conductors of voltage above 1000V up to and including 11000V.
IS 9920:	Switches and Switch isolators for voltages above 1000V.
IEC: 1330:	Specification for High Voltage Pre-
1995 IS: 14786/2000	Fabricated Sub-Station.
IEC:50 (441):1984	International Electro Technical
IS:1885 (Part 17)	Vocabulary (IEU) chapter 441 Switch gear, Control gear & fuses.
IEC: 298:1990:IS: 3427	AC metal enclosed Switch gear and Control gear for rated voltages above 1 KV and up to and including 52KV.
IEC: 364-4-441: 1992	Electrical installation of building.
Part 4	protection for safety, chapter 41 protection against electrical shock.
IEC:439-1:1992:IS:8623	Low voltage Switch gear and Control gear
(Part I)	assemblies Part-I, type tested and partially type tested assemblies.
IEC:466:1987:	AC Insulator-enclosed Switch gear and
IS:14659	Control gear for rated voltages above 1 KV and up to and including 38KV.
IEC:529:1989:	Degree of protection provided by
IS:12063	enclosures (IP code).
IEC:664-1,1992:	Insulators co-ordination for equipments with low voltage system Part-I, principles and tests.

IEC:694,1980:	Common clauses for high voltage Switch gear and Control gear standards.
IEC:947-1,1988	Low voltage Switch gear and Control gear
IS:13947 (Part I)	Part-I, general rules.
IEC:1180-1,1992	High voltage test Techniques for low voltage equipment Part - I, definition test and procedure requirement.
ISO:1052:1982	Steels for general engineering purposes.
ISO:1210:1992	Plastics determination of the burning behavior of horizontal and electrical Specimen in contact with small flame or ignition source.
IEC:694:IS:12729	Common clauses for high voltage Switch gear and Control gear standards.
IEC:298:IS:3427	AC metal enclosed Switch gear and Control gear for rated voltage above 1 KV and up to and including 52KV.
IEC:129	AC Switches and Earthing Switches.
IEC:265:IS:9920	Switches and dis-connectors (All parts)
IEC:801	Monitoring and Control.
IS:13118	High voltage AC circuit breakers.
IS/BS:5463	High voltage Switches.
IS/BS:5227	Metal enclosed AC Switch gear.
IEC:376	For SF6 Gas used for the filling of RMU.
IS 11353:	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS 12661:	HV motor starters.
IS 12729:	General requirements for Switchgear and Control gear for voltages exceeding 1000V.
IS 13118:	General requirements for circuit breakers for voltages above 1000V.
IS 13703:	Low voltage fuses.

- 1.2 In case of imported equipment standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.
- 1.3 The equipment shall also conform to the provisions of Indian electricity rules and other statutory regulations currently in force in the country.

2.0 DESIGN CRITERIA

- 2.1 The 11KV Non-Extensible, Non-metering Switchgear shall be installed at Outdoor substation location along the ring main 11KV feeder system in IISc supply area. 11KV wing isolator Controls incoming/Outgoing feeder cables of the 11KV distribution system. Tee-off Vacuum/ SF6 Circuit Breaker shall be used to Control and isolate the 11KV/433V

distribution transformer / HT Consumers connected through 11KV grade underground cable at distribution center.

- 2.2** The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.
- 2.3** For continuous operation at specified ratings temperature rise of the various Switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.
- 2.4** The equipment offered shall be suitable for continuous satisfactory operation as per site condition specified elsewhere.

2.5 Equipment Details

Technical Specifications for 2500KVA ,11KV/433V OUTDOOR COMPACT SUB-STATION WITH CAST RESIN TYPE TRANSFORMER		
Description of Equipment		Make
HT COMPARTMENT		
RMU	12Kv, 21kA, SF6 Insulated 3 Way Non extensible Compact ring main unit comprising, (a) 2Nos of manual/Motorized (24V DC) operated Vacuum circuit breaker of 630A as EB supply loop in/ loop out with integral earth switch, with live cable indicators, with self powered over current & earth fault relay With RS485 communication port, with shunt trip coil of 230v AC, with manual push buttons for closing/Tripping, with CTs for metering, with potential free contacts Breaker & Earth switch ON/OFF, With Local / remote switch, GE relay (IEC 61850 Protocol) (b) 1No of manual / motorized (24V DC) operated Vacuum circuit breaker of 630A as outgoing to Transformer with integral earth switch, with live cable indicators, with self powered over current & earth fault relay With RS485 communication port, with shunt trip coil of 230v AC, with manual push buttons for closing/Tripping, with CTs for metering, with potential free contacts Breaker & Earth switch ON/OFF, GE relay (IEC 61850 Protocol) (c) Metering module comprising Potential transformer of 11kV/v3/110V/v3,50VA, CL 0.5, With R-Y-B Lamps , with space heater & thermostat, With space for RTU Unit, with multifunction meter and Auxiliary transformer. (d) With mimic diagram, with padlocking facility & with IP67 degree of protection for SF6 Tank, with 2x12V DC,12AH Battery& Charger.	Schneider / Siemens /Eaton
Transformer Compartment		
Transformer	11kV/433V, 2500KVA, 3 Phase, 50Hz, Cast resin type, DYN11, Air natural cooled type, Copper wound, With Off circuit tap changer, Tap range +5 .0 to -5 .0%, With Digital Winding Temperature indicator with contacts for Trip/Alarm functions, With Losses and Impedance as per as per IS:1180 - Level 3)	IndoTech Transformers/ IMP Powers/ Toshiba T&D/ ABB/ Transformers &

		Rectifiers/ GE T&D/ Bharat Bijlee/Kirloskar
LT COMPARTMENT		
ACB Incomer	Air circuit breaker, 4P, 433V,4000A,65kA, Micro-processor based release , Electrical operated & Draw-out type, with O/L, S/C & E/F(LSIG) Protection, Qty: 1No	Schneider / Siemens / L&T / Eaton
ACB Feeder	Air circuit breaker, 4P, 433V,2500A,50kA, Micro-processor based release , Electrical operated & Draw-out type , with O/L, S/C & E/F(LSIG) Protection, Qty: 1No	Schneider / Siemens / L&T / Eaton
MCCB Feeder	Molded Case Circuit Breaker, 4P, 433V,630A,50kA,Thermal magnetic release, with O/L & S/C Protection, Qty: 2Nos	Schneider / Siemens / L&T / Eaton
Indicating lamps	Red/Yellow/Blue phase healthy/ON/OFF/TRIP indicating lamps, 230V AC,LED, 22 .5dia, Qty: 1set	Teknic / Vaishno
MFM	Multifunction meter, CT & PT ratio programmable, CL 0.5, Digital, 96 sq, Qty: 1No	Schneider / Elmeasure / Trinity
LT CTs	Current Transformer, 660V, 3200/5A, CL 1 .0, 5VA, IL .66/3KV,Resin cast, Qty: 3Nos	Kalpa / Equvt.
Enclosure - Sheet steel Thickness	1 .6/2 .0 mm for non-load / load bearing members, CRCA Sheet steel	
	Suitable cross section ISMC channel or Formed channel for Base.	
Degree of Protection	IP54 for HT / LT Compartment	
	IP23 for Transformer compartment	
Applicable standard	IEC: 62271-202	
Interconnection	1R x 3c X 185 Sq mm HT XLPE CABLE between HT unit and Transformer	
	Suitable cross section Aluminium bus bar between Transformer and LT unit	
Paint shade	Siemens grey to the shade RAL7032 for exterior, Koel blue for Canopy and Black for base frame, Polyester powder coated	
Cable entry	HT & LT Power cables bottom side	

3.0 SPECIFIC REQUIREMENT

3.1 The requirement of 11KV, 21 KA SF6/VCB insulated Non-Ext. Non-Metering SF6 insulated Ring Main Unit is as under.

a) Non-Extensible ring main unit suitable for Indoor/Outdoor installation shall consist of the following.

- i. Two numbers of 11kV, **630 Amps** Vacuum / SF6 Circuit Beaker (for Controlling transformer), load breaking and fault breaking type fitted with three 630 Amps continuously rated SF6 insulated busbar along with CT with combination for protection of transformer. It shall have arrangement for terminating up to 300 mm² 11KV, 3C PILC/XLPE cables.
- ii. One Tee-Off unit with 11kV, **630 Amps** Vacuum / SF6 Circuit Beaker (for Controlling transformer), load breaking and fault breaking type fitted with three 630 Amps continuously rated SF6 insulated busbar along with CT with combination for protection of transformer. It shall have arrangement for terminating up to 300 mm² 11KV, 3C PILC/XLPE cables.
- iii. Providing **Right angled reusable boot** for terminations (3X3 nos.)

3.2 SYSTEM :

3.2.1 The system network is 11000 Volts, 3 phase 3 wires 50 cycles with neutral solidly grounded. The voltage and frequency are subject to variation as per statutory limits governed by Indian Electricity Rules 1956 with latest amendments in force.

a. GENERAL FINISH :

The equipment should be totally enclosed, metal clad, vermin and dust proof suitable for tropical climate use as detailed above. The body of the RMU Unit should be of **metalized cast resin tank / stainless steel** and should be **rust free**.

b. PAINTING:

The surface of all metallic parts shall be thoroughly cleaned, scrapped and degreased preferably by shot blasting or any other treatment. The exterior surface shall be given two coats of rust resisting red oxide primer conforming to IS 2074:1992 and final two coats of weather resisting battleship grey enamel paint. The paint shall withstand the operating conditions described above and equipment shall not show any sign of the rust formation.

c. RATING:

The busbar shall have continuous rating of **630 Amps**. The isolator should have continuous rating of 630 Amps and Vacuum / SF6 circuit breaker shall have a continuous rating of 630 Amps.

All connection including band joints for busbars etc. shall be of ample cross section to cater the rated load current continuously and shall be suitable for short time rating of **21 KA for 3 seconds**.

4.0 BREAKING AND MAKING CAPACITY :

The Vacuum / SF6 circuit breaker shall be capable of having rupturing capacity of **350 MVA** symmetrical at 11000 Volts three phase. Symmetrical breaking capacity shall be **21 KA** and the making capacity of **52.5 KA** at 11000 Volts..

4.1 TYPE OF EQUIPMENT :

4.1.1 The equipment shall be compact, totally enclosed in as self contained, self supporting, gas tight compartment, mounted on base frame or channels. The assembly shall be equipped with common power busbars, load break Switches and SF6/vacuum circuit breaker as specified in specific requirement as above. All medium voltage parts should be totally enclosed in an SF6 environment.

4.1.2 **BUSBARS:** The busbar shall be SF6 insulated type. The cross sectional area of the copper busbar and jointing accessories shall be stated in the tender.

Vacuum / SF6 Circuit Breaker

4.2 All three verticals shall consist of 11KV, **630 Amps** VCB/ SF6 (for Controlling transformer), load breaking and fault breaking type fitted with three 630 Amps continuously rated SF6 gas insulated busbars and arrangement for cable to the primary side of the transformer.

4.3 The Tee-off circuit breaker shall be suitable for manual closing and opening and also for provision for remote tripping in future.

4.4 The operating mechanism shall be direct hand operated trip free with a mechanically operated indicator, positively coupled to the operating mechanism to indicate whether the breaker is in the closed or in the open position.

4.5 Off load isolator shall have three positions i.e. ON, OFF & EARTH.

4.6 Voltage Indication: There should be arrangement to check whether the cable connecting to the isolator is live or not.

4.7 There should be **fault passage indicator** for incoming and outgoing isolators. In case of fault current passing through that isolator, the flag must indicate that the fault current has passed through it. There shall be provision of resetting the indication by providing a timer having adjustable time setting 1 to 4 hrs.

- 4.8 The indications for ON/OFF/EARTH of the Isolator & Breaker Switches should be visible from outside even with the enclosure.
- 4.9 The tee-off unit shall be provided with accessories for tripping such as CT operated series trip coils for over current and earth fault protection.
- 4.10 Breaker shall be provided with a **shunt trip** coil suitable for **230VAC** supply.
- 4.11 Current Transformer: The Ratio of the CTs shall be suitable for Controlling transformer as specified in purchase enquiry. The VA burden of the CTs shall be sufficient to supply the energy required by the relay for normal operation and tripping of the circuit breaker.
- 4.12 Protection System: The protection system should be provided with the provision of suitable self-powered relays having scheme for both over current & earth fault. It must provide immediate protection and can detect faults instructing the circuit breaker to trip in less than 40 ms.

The protection system is a **self-powered relay which requires no external power source or batteries**.

It must have improved operation and Control with the Relay settings clearly displayed on the front of the panel.

It should have the provision for the trip test on circuit breaker. The 'trip inhibit' facility allows the Relay to be tested without tripping the circuit breaker. Secondary injection can also be carried out using conventional test equipments.

The free-standing metal housing shall be designed to withstand internal pressure and external mechanical loads without distortion. Where required the SF6 gas insulated Switchgear housing shall have an over pressure relief device vented to the rear side of the equipment. An operating mimic diagram shall be provided on the front side of RMU. Each unit shall be provided with lifting facility of proven design for easy handling.

Isolator / Breaker ON-OFF, Earth, (230VAC space heater, thermostat Controlled) with heater ON/OFF indication & 'SF6 gas pressure low' indication etc. shall be provided.

Handle operated 'spring charged' mechanical operation shall be provided.

Local Control of Switch / isolator shall be possible.

Local operation selector Switch shall be provided.

SF6 Insulation: Switchgear housing shall be completely gas tight. In the power compartment provision shall be made for filling up the gas at site.

A manometer should be provided to indicate the healthy state of SF6 gas pressure inside the tank. SF6 gas pressure inside the tank shall not be more than 1 bar at 20 Deg Centigrade.

The RMU Unit should be **SCADA compatible & with IEC 61850 compliant protection relay (MICOM P14N or equivalent 8I/O + Ethernet) in each VCB vertical.**

5.0 OPERATION AND INTERLOCKING :

- 5.1 All operations shall be from front of the equipment via spring assisted mechanism. The Ring Main Unit and SF6/VCB for Tee-off should be provided with a series trip coil for tripping. It shall be possible to operate the Switches and circuit breaker manually and spring assisted mechanism shall ensure speed of operation of Switches.
- 5.2 Operation handle shall be considered as part of the unit and should be provided with each RMU.
- 5.3 Load break Switches and earthing Switches shall be fully interlocked to ensure that operation is carried out in correct sequence. Movement of operating handle against interlock shall not by any means originate, store or activate the energy mechanisms. Padlocking facility shall be provided for operation of load Switch and earthing Switch. Safety of operation shall be ensured by interlocks.
- 5.4 Simultaneously closing of the main Switch and earth Switch. This interlock shall be integral part of the operating mechanism. Also separate operating shafts shall be provided for operation of earthing Switch and main Switch for the same purpose.
- 5.5 The fully interlocked integral test facilities are to be provided underneath the units, so that access to the test terminals is achieved only by removal of a cover.
- 5.6 The SF6 insulated isolators and SF6/VCB breaker operating mechanisms shall be totally enclosed and self-lubricating type. The manually operated handle shall be mounted in front of the isolators and so designed that the operation is complete by one movement without any undue strain on the operator.
- 5.7 All mechanical interlock shall be robust so as not to give any way during normal operation.
- 5.8 The tripping of breaker unit should be provided with push button.

6.0 SECONDARY WIRING:

- 6.1 The secondary wiring supplied for the equipment shall consist of non-deteriorating fireproof superior grade stranded copper PVC wires suitably colored and fitted with

numbered ferrules at both ends. The cross section of the wires shall be 4 mm² for CT and 2.5 mm² for others. Following color codes shall be used for wiring.

C.T.: Red, Yellow, Blue, Black,
D.C. Circuit: Grey, Earth: Green,
A.C. Circuit: Black.

- 6.2 Wiring shall be terminated with ring type ferrules with ferrule numbers marked at both ends of wiring. CT wiring shall be marked with additional distinct Red tags on both ends. All secondary wiring shall be terminated by using reputed make terminal blocks.

7.0 EARTHING ARRANGEMENT:

- a) It shall be easily possible to test the cables including the Tee-off (in case of RMU) by a simple earthing arrangement. In case of breaker, the earthing shall be preferably accomplished through the circuit breaker and the tripping arrangements made inoperative if required.
- b) Equipment earthing of copper strips of adequate size shall be provided.
- c) A set of earthing and a set of three phase test bushings shall form an integral part of RMU and shall be all enclosed within an interlocked cover to prevent incorrect operation. The access of the test bushing shall be fully interlocked.
- d) A mechanical 'ON/OFF' indicator shall be provided on SF6 insulated isolators and SF6/VCB breaker to indicate whether Switch is ON or OFF.
- e) SF6 insulated Switches shall be fitted with correct sequence device having "ON/OFF" and re-set and test position and shall have provision for padlocking operating handle.

7.0 CABLE BOXES

- 7.1 The isolators and SF6/VCB shall be provided with suitable and identical cable boxes for connection 3 core, 11KV PILC/XLPE cables of size up to 300 mm² approaching vertical from below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work.

- 7.2 The access for the isolator cable box shall be from side and the access for the Tee-Off SF6 / VCB cable box shall be from rear side and distanced of bottom level of wiping gland from ground shall be maintained at 310 mm (minimum).

- 7.3 The cable boxes shall be with detachable front cover for ease of termination & shall be interlocked with Switch position (i.e. when isolator is in Earth / OFF position).

- 7.4 The design of the cable box shall be such that any type of jointing methods such as heat shrinkable/push on type/cold shrinkable type terminations can be adopted.

- 8.0 Earthing: All ring main units shall have a special earth bar with a sectional area of not less than 100 mm² run along the whole of metal enclosed Switch structure, each end being connected to the main earthing system where metal cases are used on instruments these shall be connected to this bar by conductors of not less than 16 mm² section.
- 8.1 All foundation bolts, nuts and washers necessary for installation shall be supplied by the manufacturer.
- 8.2 Removable eye bolts shall be provided to facilitate the handling of the RMU/tee-off unit/SF6 isolators.
- 8.3 Labels: All RMUs shall be clearly labeled as required indicating where necessary their purpose and "ON" and "OFF" lettered on brass, ivory, enamel iron or other suitable materials.
- 8.4 Name plate:

1.0 CORONA DISCHARGE:

The equipment shall be so designed that corona discharge would occur under conditions mentioned earlier in this specification.

10. RATINGS AND REQUIREMENT

		Non-Metering SF6 Insulated Ring Main Unit with SF6/VCB Breaker
10.01	Switchgear Data	
a)	Service	Indoor
b)	Type	Metal clad
c)	Number of phases	3
d)	Voltage	11000V
e)	Rated Frequency	50 Hz
f)	Rated Current	630 Amps
g)	Short Circuit rating	
	Breaking Short time 3S	21 KA rms
h)	Insulation Level	75 KV peak
i)	System earthing	Solidly earthed at substation
10.02	Vacuum / SF6 Circuit Breaker	
a)	Type	SF6 / VCB encapsulated in SF6 Environment

b)	Rated Voltage	11 kV
c)	Breaking Current	21 KA
d)	Making Current	52.5 KA peak
e)	Rupturing Capacity	350 MVA
f)	Rated Current	630 Amps
g)	No. of Poles	3
h)	Operating mechanism	Trip free & free handle type with mechanically operated indicator
i)	SF6 tank	Tank with substantial stainless steel construction with SF6 pressure Gauge for indicator and filling arrangement.
j)	Interlocks	Suitable interlocks for: 1. Cable test terminals on the orifices will be accessible only in "Earth" position. 2. Test plugs can be inserted and withdrawn only in the "Earth" position. 3. To prevent operation from "ON" position to "Earth" position or vice versa in a Single operation. 4. To bring isolator to "OFF" position with test plugs inserted but to prevent operation to "ON" position with test plugs inserted or test terminals kept open.
k)	Operation safety	Safety against explosion and fire hazards etc.
10.04	Busbars:	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps
d)	Short time rating for 3 Sec.	21 kA
10.05	Cable Boxes	Vacuum / SF6 circuit breaker shall be provided with identical cable boxes for connecting 1 No. 11kV 3C, 70 to 300 mm ² XLPE/PILC cable
10.06	Current Transformer	
a)	C.T. Ratio	Shall be as furnished in Purchase order.
b)	Over current factor	To correspond to rupturing capacity of Switchgear.
c)	Class of Accuracy	5 P 20
d)	Rated Burden	15 VA

10.07	Configuration	3 function RMU loop in /loop out and tee off CB
10.08	Protection	SCADA compatible & with IEC 61850 compliant protection relay (MICOM P14N or equivalent 8I/O + Ethernet) in each VCB vertical.

11.0 TESTS

11.1 Each type of H.V. Switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards and during manufacture and on completion.

11.2 ROUTINE TEST

The tests shall be carried out in accordance with IEC 60298 include but not necessarily limited to the following:

- i. Withstand voltage at Power Frequency for all current carrying parts including wiring
- ii. Measurement of resistance of the main circuit
- iii. Gas Leakage test
- iv. Withstand voltage on auxiliary circuits
- v. Operation of functional locks, interlocks, signaling devices and auxiliary devices
- vi. Suitability and correct operation of protections, Control instruments and electrical connections of the circuit breaker operating mechanism (PRIMARY & SECONDARY INJECTION)
- vii. Verification of wiring
- viii. Visual Inspection

Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, meter etc. as per relevant standards.

11.3 TYPE TEST

The following tests shall be performed on a typical section of the bus assembly of each type of Switchgear. Units shall be type tested in accordance with IEC Standards 60056, 60129, 60265, 60298, 60529 and 60694.

- a) Impulse test with breaker inside the cubicle
- b) Temperature rise test with breaker inside the cubicle
- c) Short Circuit test with breaker inside the breaker
- d) Dielectric Tests
- e) Test of apparatus i.e. circuit breaker and earthing Switch
- f) Arc Fault test

The cost of such tests, if any, shall be quoted separately.

TEST WITNESS

All tests shall be performed in presence of owner's representatives, if so desired by the Owner. The Contractor shall give at least fifteen (10) days advance notice of the date when tests are to be carried out.

12.0 TEST CERTIFICATES

- 12.1 Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for approval of the Owner.
- 12.2 The equipment shall be dispatched from works only after receipt of Owner's written approval of the test reports.
- 12.3 Type test certificate on any equipment, if so desired by the Owner, shall be furnished; otherwise the equipment shall have to be type tested, free of charge, to prove the design.

13.0 DRAWAING APPROVAL

The bidder has to take the approval for the various drawings of the RMU unit including the protection scheme. The bidder has to provide us all relay characteristics.

13 MANUAL

The bidder has to provide the complete manual for the operation of the breaker.

B. SPECIFICATION FOR DISTRIBUTION TRANSFORMER

1.0 General Information

All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and ECBC manuals except where modified and / or supplemented this specification.

The electrical installation shall meet the requirement of Indian Electricity Rules as amended up to date, relevant IS code of practice and Indian electricity act. In addition other rules of regulations applicable to the work shall be followed.

The Transformer offered shall in general comply with the latest issues including amendments of the following Indian standards.

2.0 Code and Standards

The transformer shall comply with the latest edition of the following and other relevant Indian Standards / Manual:

S. No	Code No	Title
1	IS:5	Colours of ready mixed paints and enamels.
2	IS:694	PVC insulated cables for working voltages up to and including 1100 V.
3	IS:1271	Thermal evaluation and classification of electrical insulation.
4	IS:1893	Criteria for earthquake resistant design of structures.
5	IS:2026	Power transformers.
6	IS:2062	Steel for general structural purposes.
7	IS:2099	Bushings for alternating voltages above 1000V.
8	IS:2147	Degrees of protection provided by enclosures for low voltage switchgear and
9	IS:2705	Current transformers.
10	IS:2848	Industrial platinum resistance thermometer sensors.
11	IS:3043	Code of practice for earthing
12	IS:3144	Mineral wool thermal insulation materials -method of test.
13	IS:3639	Fittings and accessories for power transformers.
14	IS:3716	Application guide for insulation coordination.
15	IS:6005	Code of practice for phosphating of iron and steel.
16	IS:6160	Rectangular conductors for electrical machines.
17	IS:7421	Porcelain bushings for alternating voltage up to and including 1000V.
18	IS:8183	Bonded mineral wool
19	IS:10028	Code of practice for selection, installation and maintenance of
20	IS:11171	Dry type power transformers
21	IEC:60076	Power transformers
22	IEC:216	Guide for determination of thermal endurance properties of electrical insulating materials
23	IEC:270	Partial discharge measurements.
24	IEC:60551	Determination of transformer and reactor sound levels.
25	IEC:60606	Application guide for power transformers
26	IEC:60616	Terminal and tapping markings for power transformers.
27	IEC:60726	Dry-type power transformers
29	IEEE:344	IEEE recommended practice for seismic qualification of class-1E
30	ISO-9000	International standard for quality management
31		Indian Electricity Rules 1956

Indian Electricity Rules: 1956

Indian Electricity Act: 1910

The Electricity Act: 2003

Transformer shall also conform to the provisions of the latest revisions of the Indian Electricity rules and any other statutory regulations currently in force as per standards.

3.0 DESIGN CRITERIA

S. No.	Description	Technical Parameters
1	<u>GENERAL</u>	
	Application/designation	Distribution transformer
	Service	Step down transformer
	Type	Dry type cast resin / two winding
	Installation	Indoor
	Degree of protection for transformers	IP-33
	Applicable Standards and codes	As listed Clause No.2 in Specification
2	<u>RATINGS</u>	
	Rating	2500 KVA
	Rated primary voltage	11000 V
	Rated no load secondary voltage	433 V
	No. of phases	3-phase on HV 3-phase with neutral on LV
	Frequency	50 Hz
	Vector group	Dyn 11
	Percentage impedance	6.25%
	Permissible tolerance on	± 10%
	System fault current for 1 second duration	HV Wdg : 25 kA (rms) LV Wdg : 50 kA (rms)
	Type of cooling	Natural air cooling (AN)
3	<u>SYSTEM VOLTAGE</u>	
	Nominal system voltage	11000 V
	Highest system voltage	12 kV for 11 kV winding 1.1 kV for 433 V winding.
4	<u>NEUTRAL EARTHING</u>	
	Transformer neutral earthing	LV Winding: Effectively earthed Note:-1) Additional neutral bushing should be provided for neutral earthing. Note: - 2) Neutral CT Shall be provided for REF Protection .CT Details shall be finalized during drawing approval stage.
5	<u>INSULATION WITHSTAND VOLTAGE</u>	

	Impulse (1.2/50 μ -sec. wave)	HV Winding : 75 kV peak for 11 kV winding
	One minute power frequency	HV Winding : 28 kV for 11 kV winding LV Winding : 3.0 kV
	Class of Insulation	F
6	TEMPERATURE	
	Reference Ambient Temperature (Design)	45°C
	Temperature rise by winding resistance at lowest tap (Max)	90°C
	Temperature on enclosure by thermometer (Max)	50°C
7	Noise level	
	Permissible noise level (Max)	73 dB
8	TAP CHANGING LINKS	
	Taps required	Off-circuit full MVA rating at each tap
	Type	Bolted link (Tinned copper links)
	Tappings on windings	HV
	Total tapping range	+ 5% to -5%
	Steps	2.5%
	Parallel Operation	Momentary with similar transformer.
9	BUSHINGS/SUPPORT	
	Voltage class	a) HV line end - 11 kV
	Impulse (1.2/50 μ -sec. wave)	HV Winding : 75 kV peak
	One minute power frequency	HV Winding : 28 kV
	Minimum creepage distance	25 mm / kV
10	SURGE DIVERTER	3 nos. of Polymeric Zinc Oxide surge Arrestors, Make: TYCO / Oblum,
11	MINIMUM CLEARANCE IN AIR	
	HV phase to phase	230 mm
	HV phase to earth	180 mm
	LV phase to phase	25.4 mm
	LV phase to earth	25.4 mm
12	TERMINAL CONNECTIONS	
	HV line end terminal with HT cable box	Suitable for terminating 11 kV x 400sq.mm XLPE armoured earthed grade cables.
	LV line end terminal	Suitable for 4000A interleaved bus duct side entry.
	LV neutral bushing	LV neutral bushings as specified in clause 7.10
	PURCHASER's earthing	Two no's of 185 sq mm copper earth conductor

11KV/ 433 volt distribution transformer shall be a part of packaged substation which will be housed in the enclosure.

The transformers shall be installed in hot, humid tropical atmosphere. All equipment accessories and wiring shall be provided with tropical finish to prevent fungus growth.

The transformers shall be capable of continuous operation of rated output under the operating conditions of voltage and frequency variations as per statutory limits governed by relevant Indian Standard and Indian Electricity Rules, 1956 / IEC with latest amendments in force.

The transformer shall conform to best engineering practice.

The transformers shall be capable of withstanding the short circuit stresses due to terminal fault between phase to phase and phase to ground on one winding with full voltage maintained on the other windings for a minimum period of three seconds.

The transformers shall be free from annoying hum or vibration. The design shall be such as not to cause any undesirable interference with radio or communication circuits.

The equipment offered shall be suitable for continuous satisfactory operation in Delhi.

4.0 LIST OF ESSENTIAL SPARES TO BE SUPPLIED: -

S .No.	Item Description	Quantity
	HV Bushing with metal part	2 No.
	Support Insulators for Terminal	2 set
	Winding temperature Indicator	2 set

5. SPECIFICATION OF MAIN EQUIPMENT AND ACCESSORIES :-

5.1 This section covers the brief specifications and parameters of dry type transformers.

5.2 The transformers shall be dry type with cast resin two winding, three phase, 50 Hz, indoor type, having 6.25 % impedance connected in Dyn11 with off circuit tap ranging from + 5% to - 5% in steps of 2.5%.

5.3 HV side termination shall be designed for connecting PURCHASER's 11 kV XLPE insulated cables.

5.4 LT side terminations shall be suitably designed for connecting to switchgear by means of the direct connection (side connectivity) to the 4000A Interleaved aluminum bus duct. The neutral of the star connected winding shall be brought out in separate bushing terminal.

5.5 The HV and LV bus bars/terminals shall be sleeved with suitable system voltage levels and if necessary, where ever joints/tapoff/terminations shall be provided with button type flexible shrouds.

5.6 Technical parameters for the transformers and accessories are indicated in data sheets enclosed under this section.

6.0 EQUIPMENT CONSTRUCTION AND DESIGN DETAILS:-

This section covers the specification of Dry Type Transformers. The transformers shall be of dry type with cast resin encapsulated. The transformers will be located indoors and shall be suitable for site service conditions and the electrical system requirements as specified in this specification. Supplier can supply dry type cast resin transformers either with filled type technology (i.e. with mixing resin with quartz powder or unfilled technology (i.e. with chopstrand mat).

Features for filled type of technology and unfilled type technology are mentioned below. Supplier shall design, manufacture and supply transformers as per specifications mentioned below:

General Requirements of filled type of technology transformers:-

- 1) For better compatibility of thermal expansion of resin and conductor, supplier shall use aluminum/copper conductor for both LV and HV windings
- 2) LV winding shall be of foil winding type
- 3) Quartz powder can be used as filler material.
- 4) Quartz powder bags shall be stored in closed rooms. Bags shall be opened only in front of purchaser's inspector just before pouring into the resin chamber.
- 5) Quartz powder shall be heated before being mixed with resin.
- 6) Pre-heating shall be carried out for resin for 8 hours, the temperature between 80 - 100 deg. Celsius,
- 7) Casting shall be carried for 2 hours and curing shall be carried for 16 hours. 'DuPont make NOMEX tape insulation shall be used.

General Requirements of unfilled type of technology transformers:-

- (i) For better compatibility of thermal expansion of resin and conductor, supplier can use aluminum / copper conductor for both LV and HV windings.
- (ii) LV winding shall be of foil winding type
- (iii) Chopstrand mat shall be used for strength for resin.
- (v) Pre-heating shall be carried out for resin for 8 hours, the temperature between 80 - 100 deg. Celsius, Casting shall be carried for 2 hours and curing shall be carried for 16 hours.
- (vi) Fiber glass non treated tapes shall be used.

7.0 GENERAL CONSTRUCTIONAL FEATURES:-

7.1 All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over excitation, short circuits as per specified standards, without distortion or deterioration or the setting-up of undue stresses in any part and also without affecting the strength and suitability of the various parts of the work which they have to perform. Transformer shall be provided with suitable enclosure / cubicle. It shall be possible to withdraw the transformer from the enclosure after disconnecting the terminations without disturbing bus bars and cables.

7.2 All transformers supplied for system shall be identical. Further similar parts, particularly removable ones, shall be interchangeable.

7.3 Nuts, bolts and pins used inside the transformer shall be provided with lock washers or locknuts.

7.4 CORE :-

7.4.1 The magnetic circuit shall be constructed from high grade cold-rolled non-ageing grain oriented low loss silicon steel laminations and shall be of 'Core' type. The core shall be painted with suitable resin to protect it against corrosion and other parts shall be hot dip galvanised. The lamination shall be free of all burrs and sharp projections. The lamination Grade shall be laser etched type and shall be subject to the PURCHASER's approval.

7.4.2 The core shall be of Boltless type.

7.4.3 All steel sections used for supporting the core shall be non-magnetic. They shall be thoroughly shot or sand blasted, after cutting, drilling and welding.

7.4.4 The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and production of flux component at right angles to the plane of laminations which may cause local heating.

7.4.5 The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.

7.4.6 The core clamping structure shall be designed to minimize eddy current loss and bolts shall not pass through the lamination for any purpose whatsoever. Fibre glass or equivalent tapes of adequate strength shall be used for clamping the core through an approved procedure.

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

7.4.8 The transformer core should be equipped with minimum of 15mm thickness cooling duct.

7.5 WINDINGS :-

7.5.1 Windings shall be of high conductivity Aluminum/Copper conforming to IS: 2067. The conductors shall be transposed at intervals in order to minimize eddy currents and equalize the distribution of currents and temperatures along the windings. The insulation class for the windings shall be at least Class-F having high tensile and dielectric strength. Low voltage windings shall be of foil type. High voltage windings can be cross over coils or disc type coils separated from each other by keyed radial spacers.

7.5.2 Both HV and LV windings of one phase shall be separately cast on one rigid tubular coil co-axially arranged with no mechanical connection between their arrangements. The completed coil assembly shall be cast under vacuum into moulds, which forms the Insulation System. The coil shall be casted in epoxy resin with a fibre glass or super enamel

covering on the conductor to form a compact tubular spool for achieving high mechanical strength. Cooling ducts should be provide on LV and HV winding. HV winding cooling duct should be formed not more than 4 segments per layer to utilize more area for cooling.

7.5.3 The resin used for winding insulation shall be non- hygroscopic to prevent the penetration of moisture into windings. It should be possible to energize the transformer without pre-drying even after a long period of service interruption. The resin used shall be self-extinguishing and void free and shall be suitable for tropical climate and 100% air humidity.

7.5.4 The transformer shall be free of partial discharges at least up to 1.2 times of the rated voltage and shall be able to withstand short circuits as well as switching and atmospheric impulse voltages as specified.

7.5.5 The current density in case of Aluminium winding shall be 1.2 Amps or less & Copper winding 2.2Amps/sq.mm

7.6 Temperature sensors:-

Two nos. sensing elements (RTDs) shall be provided in each phase. The RTDs shall be embedded at the hottest spot. The type of RTD shall be simplex and the material shall be platinum.

7.7 Core and Coil Assembly:-

The cast coils are inserted on to the core limbs. The resin cast spacer blocks, end blocks and separators are used as required. The end frames are then assembled.

7.8 Earthing:-All internal metal parts of the transformers shall be earthed at one point only. The magnetic circuit shall be connected to the clamping structure at one point only. The frame work and clamping arrangements of core and coil shall be securely earthed by copper strip connection to the main frame and enclosure. Two earthing terminals shall be provided on the frame for external earthing. The terminals shall be suitable for the earthing conductor of size indicated in the Technical Specification.

Body earthing: Two Stainless steel earth pads of 20 mm thick and threads up to 15 mm shall be provided for terminating earth conductor.

7.9 Terminations:-

7.9.1 The HV side termination facility to be provided on transformers shall be suitable for terminating 11kV x 400sq.mm XLPE cables (as per the transformer rating), size of which will be intimated during the drawing approval stage. The cable entry shall be bottom. Formation of delta on the HV side is in the scope of manufacturer. Suitable undrilled gland plate shall be provided in bottom entry.

7.9.2 Phase to phase and phase to ground clearances within the enclosure shall be such as to enable either the transformer or cable to be subjected separately to HV tests. Minimum clearances shall be as specified in data sheets.

7.9.3 The Bus-bars shall be sleeved with respective voltage insulation levels.

7.9.4 The bottom of HT cable box shall be 1 meter from the enclosure bottom plate. The height of HT connectors shall be 750 mm from gland plate.

7.9.5 Cable supports shall be provided from enclosure bottom to cable box. Support arrangement will be approved during drawings approval stage.

7.9.6 Tinned Copper flat of size 50 x 6 mm shall be provided at bottom of cable box for terminating cable armour earthing.

7.9.7 One neutral bushing shall be provided to facilitate leading the earth conductor down to the ground level. The terminal shall be suitable for connecting to two separate earthing pads. Suitable lugs shall be supplied by the SUPPLIER for connecting the earthing conductors.

7.10 Bushings / Support Insulators:-

7.10.1 Bushings/Support Insulators shall be designed and tested to comply with the applicable standards.

7.10.2 Bushings shall have non-ferrous and non-magnetic flanges and hardware.

7.10.3 Fittings made of steel or malleable iron shall be galvanised.

7.10.4 All bushings/support insulators shall be supplied with terminal connector clamp suitable for supporting the bushing terminal & the PURCHASER'S conductor as specified in data sheet.

7.10.5 Minimum air clearance and minimum creepage distances shall be as per data sheet.

7.10.6 Bushing/support insulators material shall be porcelain.

7.11 Winding Temperature Indicators/Transformer Protection Relay With Healthiness:-

7.11.1 A device for measuring the hot spot temperature of the winding shall be provided. Winding temperature indicators consisting of temperature sensing elements. The no. of sensing elements shall be provided as indicated in Section D1.

7.11.2 Local indicating instrument with four adjustable electrically independent ungrounded contacts brought out to separate terminals for winding temperature high alarm and trip. One indicating instrument shall be provided for each phase. Contacts shall be suitable for 110V DC rated minimum 0.5A. Instrument shall be suitable for 110V D.C auxiliary power supply if required.

7.11.3 A temperature scanner shall be provided for taking inputs from RTDs in all the phases. This scanner shall have an accuracy of $\pm 1\%$. RTD / Scanner output shall be suitable for connection to SCADA inputs.

7.12 Marshalling Box:-

7.12.1 The SUPPLIER shall provide a 1 no marshalling box and shall mount the 2 no winding temperature indicators in the marshalling box and shall marshal to it all the

contacts/and winding temperature indicators required for the transformer. i.e. 3nos of sensor probes of each phase should connect to first temperature indicators and remaining three will be connected to send other temperature indicators.

7.12.2 The SUPPLIER shall provide the interconnection cabling between the above equipment and the marshalling box. The winding temperature indicator shall be mounted in the marshalling box. The marshalling box shall have viewing window for temperature indicator. This interconnection shall be through wires in GI conduits or through armoured cables. The insulation for the wires/cables shall be consistent with the ambient temperature in the housing. Compression type brass cable glands required for these interconnections shall be supplied by the SUPPLIER and external connections at the marshalling box will be supplied by the PURCHASER.

7.12.3 The marshalling box shall be mounted on the transformer housing. All doors, covers and plates shall be provided with neoprene gaskets. Bottom of the marshalling box shall be at least 600 mm above floor level and provided with removable bolted, undrilled gland plate.

7.12.4 All contacts for alarm. Trip and indication circuits shall be electrically free, wired for auxiliary D.C. supply as specified and brought out to separate terminals at the terminal blocks in the marshalling box. Terminal blocks shall be preferably of GE Power Controls/Elmex. Terminals shall be rated for 10A. Wiring shall be with PVC insulated, stranded, copper conductors of sizes not smaller than 2.5 sq.mm for control with ring type lugs. Engraved identification ferrules marked to correspond with the approved wiring diagrams shall be fitted to each wire. Ferrules shall be of yellow colour with black lettering. Local and Cross ferruling shall be provided.

C. SPECIFICATION FOR LT SYSTEM

LT compartment shall be suitable to house following equipment,

- Bus bar connection from transformer to LT ACB
- Air circuit breaker 1600A -1 No.
- Multi function meter
- Cable glands for outgoing feeders
- CT for metering
- CT and voltage connection wiring for multifunction meter

The design should comply for the following standards.

1. IEC-439-1, 1992 Low voltage Switch gear and Control gear assemblies Part-I, type tested and partially type tested assemblies.
2. IEC-947-1, 1998 Low voltage Switch gear and Control gear Part-I general rules.
3. IEC-1180-1, 1992 High voltage test techniques for low voltage equipment Part - I definition test and Procedure requirement
4. IEC-529, 1989 Degree of protection provided by enclosures (IP code)

EQUIPMENT SPECIFICATION

1. Air circuit breaker (ACB)

These shall be fixed type with manually operated mechanism. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / any Govt. approved recognized test house / laboratory.

The circuit breaker shall be fitted with CT operated thermal overload and short circuit releases devices for current rating 4000/2500/630Amps.

- a) Overload releases should be settable from 50% to 100% of the rated current In.
- b) Ambient temperature compensated type and there should not be de-rating of ACB current carrying capacity at 40 degree C. The testing of ACB for the temperature rise shall be carried out by the manufacturer as per the prevailing, IS / IEC or any other international standards.
- c) ACBs shall be provided with overload and short circuit release. Short circuit release should have settable value of 15kA to 25kA with a adjustable times having setting range of 40 – 460 m seconds, to have a proper co-ordination with short circuit release of outgoing MCCBs.

- 1) 3 phase, 4 wire, neutral earthed having link arrangement.
- 2) Rated current thermal current - 4000 Amps
- 3) Service voltage - 415 volts
- 4) No. of break / pole - 4
- 5) Frequency - 50 c / s
- 6) Rated insulation voltage - 1100 volts
- 7) Rated short circuit breaking capacity
Rated services S/C breaking capacity I_{cs} (rms) – 50kA
Rated ultimate S/C breaking capacity I_{cu} (rms) – 50kA
- 8) Break Time - less than 40ms
- 9) S/C making capacity 1cm (peak) - 143kA
- 10) Rated short time withstand current : I_{cw} 50kA for 1 sec.
- 11) Suitable for outdoor installation.
- 12) It shall conform to IS 13947 / pt.2 / 1993 with latest amendment, if any.
- 13) Performance category: Utilization category – B with operation cycle O – t – Co – t – Co.
- 14) The status of open and close shall be clearly visible.
- 15) The trip indication separated for overload and individual phase wise trip indication for short circuit to be provided.
- 16) The ACB shall have the provision to lock the operating mechanism in off position.
- 17) The operating mechanism should be on front and the compartment should have the degree of protection IP – 54.

- 18) Separator shall be provided between all phases inside. ACB enclosed to prevent travel of arc during short circuit.
- 19) The CTs mounted for thermal overload release shall have secondary winding inaccessible including tripping mechanism of O/L and magnetic releases to avoid tampering CTs should also have provision of separators.
- 20) Two nos. earthing bolts for propose of earthing of ACB may also be provided & suitable for G.I stay wire of size 7 / 10 SWG.
- 21) The bus bar size shall be confirming to relevant IS and the neutral bus bar shall be of same wire of size as phase bus bar and should be suitable for connecting neutral.
- 22) The ACB shall be tested in accordance with the provision of IS 13947 - Part I or relevant IEC

2. Interconnecting bus bar

Bus bar shall be of high conductivity aluminum (E91E) supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in BIS. The main bus bars shall have uniform current ratings throughout their length as specified in data sheet / job specification. The current rating of the neutral shall be half that of the phase busbars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of the specified short circuit currents for 1 second. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar, joints and supports. The short circuit capacity of the neutral bus bars shall be in line with IS: 13947.

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95 degree C for normal operating conditions.

The current rating of the bus bars shall be 4000A for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

All bus bars shall be insulated with heat shrink PVC sleeves of 1100V grade, red yellow and blue color shall be used for phase bus bars and black color shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.

Minimum clearance between live parts, between live parts / neutral to earth shall be 19mm. How ever clearances between terminals at components shall be as per applicable individual standard for components.

Interconnections between the main bus bars and individual units shall be made using vertical / horizontal Aluminium bus bars of adequate rating. All joints surfaces at

Aluminium to copper joints shall be silver / tin plated, alternatively cup - al- washers (bimetallic washers) may be used.

3. Multi Function meter and CTs

Suitable cut out shall be provided on LT compartment for installing Multi function meter. CT's & potential connection for metering shall be provided in the LT compartment. The details are as under.

CT's with accessories: CT's of rating as specified below are to be provided, mounted on the Transformer L.T busbar.

S. No	Particulars	Requirement
1	Current Ratio	4000 2500 630 A / 5A
2	Class of Accuracy	0.5
3	Burden	15 VA
4	Type	Resin Cast, Suitable for Outdoor use

The Secondary Terminals of the CT's shall be individually wired, using 2.5 sq mm flexible copper wires (with color coding, and ferrules at both ends) up to a Terminal block. Terminal Block shall be located, at a suitable height. The three phase voltages also are to be tapped from the L.T busbar and wired up to the terminal block. The C.T secondary shall be covered with sealable covers.

4. Auxiliary supply

3 phase with neutral, 440V AC supply shall be tapped from main bus bar after the ACB for supply to exhaust fan, lighting of the substation and Control supply for RMU etc. Necessary protection in incomer and outgoing shall be provided.

D. SPECIFICATION FOR ENCLOSURE FOR PACKAGE SUBSTATION

The package substation shall have the following features.

- i. Enclosure for the package substation shall be made of electronically galvanized sheets and MS sheets are not accepted.
- ii. Separate compartment for 11 kV RMU, Distribution Transformer & LT Switchgear
 - i. Door of the HT and LT compartment shall be designed such as complete door is divided into minimum two fold / parts vertically for minimum space requirement while opening.
 - ii. Double roof for each compartment
- iii. painting shall be tested for radiation test.
- iv. The painting specification and color shade of the enclosure shall be approved by the IISc.
- v. There should be proper earthing arrangement for the entire substation i.e. 11 kV RMU, Distribution Transformer, LT Switchgears along with the enclosures.

- vi. Design of Transformer Compartment shall be such to accommodate resin cast dry type 2500 KVA transformers
- vii. Non-metallic barrier shall be provided between MCCB.
- viii. Non-metallic phase separator shall be provided between the three phases connected to MCCB.

CT's with accessories: CT's of rating as specified below are to be provided, mounted on the Transformer L.T busbar.

S. No	Particulars	Requirement
1	Current Ratio	4000 2500 630 A / 5A
2	Class of Accuracy	0.5
3	Burden	15 VA
4	Type	Resin Cast, Suitable for Outdoor use

The Secondary Terminals of the CT's shall be individually wired, using 2.5 sq mm flexible copper wires (with color coding, and ferrules at both ends) up to a Terminal block Terminal Block shall be located, fixed at a suitable height. The three phase voltages also are to be tapped from the L.T busbar and wired up to the terminal block. The C.T secondary shall be covered with sealable transport covers.

- viii. Connected between LT terminal of transformer to ACB shall be by Aluminium busbar.

Bus bar

Bus bar shall be of high conductivity aluminium (E91E) supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in BIS. The main bus bars shall have uniform current ratings throughout their length as specified in data sheet / job specification. The current rating of the neutral shall be half that of the phase busbars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of the specified short circuit currents for 1 second. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar, joints and supports. The short circuit capacity of the neutral bus bars shall be in line with IS: 13947. The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95 degree C for normal operating conditions.

The current rating as defined for Switchboard and components in data sheet / job specification are for design ambient temperature at site conditions and for being inside the

cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

All bus bars shall be insulated with heat shrink PVC sleeves of 1100V grade, red yellow and blue color shall be used for phase bus bars and black color shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.

Minimum clearance between live parts, between live parts / neutral to earth shall be 19mm. However clearances between terminals at components shall be as per applicable individual standard for components.

Interconnections between the main bus bars and individual units shall be made by using vertical aluminium bus bars of adequate rating. These interconnections of the vertical bus bars shall be in separate compartment and fully shrouded. Vertical bus bars for circuit breaker panels shall be sized depending upon the rating and number of breakers per vertical panel. Vertical bus bar for MCC panel shall be of uniform cross section. Size of vertical bus bars for MCC panels shall not be less than 50 X 10mm aluminium per phase. All joints surfaces at aluminium to copper joints shall be silver / tin plated, alternatively cup - al - washers (bimetallic washers) may be used. Minimum size of busbar for starter / feeder power connections above 100Amps rating shall be 20 X 6 mm aluminium

- ix. The Packaged Substation should have adequate arrangements of ventilation and should be inclusive of all safety accessories like voltage detection rod, fire extinguishers, gloves etc. Adequate illumination is to be provided for Packaged Substation. There should be provision for providing enclosure around the entire Packaged Substation. There should be barrier for RMU section, Transformer section and LT Switchgear section for safety purpose. There should be easy access to all these three compartments independently.
- x. The Packaged Substation should have ample arrangement to meet the requirements of protection of all electrical equipments. The clearances between live parts and minimum clearances to earth have to be maintained to the respective standards. The size of the substation should be compact to meet the traffic and road requirements.
- xi. The bidder has to specify the total weight of the Packaged Substation.
- xii. Doors of HT & LT compartment:

RELAY CO-ORDINATION

Bidder shall ensure proper relay co-ordination between 11 kV RMU & LT ACB and shall provide calculation in support of the same.

DIMENSION

The approximate base dimension for packaged substation shall be around 3 Mtr.X 4 Mtr. However depending upon the design of the bidder, the same may be reviewed.

2. 2500A Air Insulated Bus Duct

1. General

Busduct system shall be designed to operate on 690V at 50Hz and shall be manufactured in compliance and accordance to IEC 60439-1, IEC 60439-2, IEC 60529 and other international standards. All material, components and accessories (such as elbows, joints, flange end/flange end box, tap-off units, end cap, expansion units, etc) used for the complete busduct system shall be of the same origin of manufacture.

The product should have the proven record of at least 10 years of experience of manufacturing. Busduct system shall be verified and certified by KEMA, ASTA, INTERTEK, T+V S+D PSB, SIRIM or other reputable third party testing authorities.

1.1 Construction

The busduct system shall be of the low impedance type, totally enclosed and non-ventilated for protection against mechanical damage and dust accumulation. The busduct system shall be manufactured and type-tested to IEC60529 (Classification of Degree of Protection) to meet the requirement of indoor and outdoor installation.

IP54	Indoor installation in non-sprinklered areas
IP65	Indoor installation in sprinklered areas
IP66	Outdoor installation

The busduct enclosure shall be rigidly constructed from electro-galvanized sheet steel of not less than 1.5mm in thickness and coated with epoxy powder paint to a black colour or the nearest manufacturer's colour of standard production. The assembly of the busduct enclosure shall consist of not more than two seams to enhance the mechanical strength of the busduct enclosure. The use of busduct enclosure as the earth conductor shall not be accepted.

The busduct system shall be capable of withstanding the short circuit strength (as indicated in the table below) of the electrical installation without damaging by the electrical, mechanical and thermal stress under fault condition. The short circuit rating of 1 second and 3 seconds shall be verified according to IEC 60439-2.

Busduct Rating	Short Circuit (kA/3sec)
2500A	50

Busduct system operates at full rated current and the ambient temperature changes. In particular, expansion units shall be provided where both ends of the busduct are fixed and where the busduct is installed across a building expansion joint.

1.2 Conductor

The copper conductors shall be three phases with full size neutral and half size integral earth made of hard drawn high conductivity solid copper bars to JIS H3140, ASTM B187M, BS EN 13601 and other relevant quality standards. Each conductor shall be round edge rectangular design and shall be electrically tin plated throughout its entire length. Conductor shall be insulated over their entire length except at joints and plug-in contact positions. The insulation material shall be made of polyester film that meets the requirement of range -70°C to 150°C with the insulation voltage of 1000V. The integral earth bar (non-insulated) of half size of phase conductor shall be provided within the busduct enclosure. The cross-sectional area (CSA) of copper conductors shall be in accordance to the following table as a minimum.

2500 A Busduct Rating CSA (mm²) 1200

The maximum operating temperature of busduct system shall comply with IEC 60439-1 IEC 60439-2. The temperature rise at any points of the busduct housing shall not exceed 55°C above ambient temperature when operating at rated load current. Busduct system shall be able to operate at full rated current at a maximum ambient temperature of 40°C without derating.

Fire rated busduct (IP66) shall be provided for all circuits incoming and outgoing from the emergency main switchboard. The conductors of fire rated busduct shall be insulated with two layers of mica tape and three layers of polyester film. All joint sections shall be protected with fire protective materials. Fire rated busduct feeder and joint section of IP66 shall be type-tested for resistance to fire alone (Category C) to BS 6387 by independent testing authority to meet the performance requirements to maintain circuit integrity under fire conditions. Besides, the IP66 fire rated busduct system shall also be verified for temperature rise limits to IEC 60439-2. Type test certificates shall be submitted for approval/endorsement.

1.3 Flange End / Flange End Box

Flange end or flange end box shall be provided for each busduct system. The rated current and rated short-time withstand current of the flange end shall not be less than that of the busduct system to which it is connected. The removable bottom cover of flange end box shall be made of non-ferrous material for the ease of cable termination works. Where connections are to be made to a switchboard or transformer, flange end shall be coordinated, such that the phase sequences at connected switchboard and transformer are matched. Braided type of copper flexible link bar shall be connected between the transformer LV terminals and busduct flange end. Laminated type of flexible link bar shall not be acceptable.

1.4 Tap-off Units

Tap-off units shall be used for branch circuits taken off from the busduct system. Every tapoff unit shall be of manufacturer's proprietary product to match and to be an integral part of the busduct system Moulded case circuit breaker (MCCB) complying with

IEC60947-2 of appropriate c u r r e n t ratings and short circuit breaking capacities shall be provided as near as practically possible to the tapping position for protection of the branch circuits. Tap off units shall be equipped with internal barriers to prevent accidental contact with the live parts at the terminals of the protective device. Tap-off units shall make positive ground connection to the busduct housing before the plugin clips make contact to the phase conductors. Mechanical interlock of rotary handle type shall be incorporated to prevent installation or removal of tap-off unit while the MCCB is in the 'ON' position. Plug-in holes on the busduct system for tap-off units shall be equipped with **phase isolator** to segregate the tapping position of each phase of the busduct system. Tap-off units shall be complete with a removable bottom cover made of non-ferrous material for the ease of cable termination works.

"Danger" warning signs of an approved type shall be provided at the front panel of all tapoff units.

1.5 Mounting Method

The full weight of the vertical busduct system shall be supported adequately by vertical spring hanger and vertical hanger which shall be mounted on the floor or wall. Intermediate supports shall be provided if the floor height exceeds 5000mm. The horizontal busduct system shall be supported by horizontal hangers at every interval of 1500mm.

1.6 Busduct Joint Section

Busduct joints shall be of removable type with clamping bolts that can be checked for tightness without de-energizing the whole busduct length. It shall be possible to tighten a busduct joint from one side in the event of the busduct is installed against a wall or ceiling. The joint shall be designed as to allow removal of any length without disturbing adjacent lengths. All bolts shall be tightened up by means of a torque wrench to a strength figure as recommended by the manufacturer. The busduct joint shall be of the **double-bolt joint design** coupled with a pair of leaf springs to ensure constant pressure on the conductor contact areas. In addition, the high tensile clamping bolts shall not penetrate through the conductors to ensure sufficient electrical contact and mechanical strength.

Bolt-through joint design and joint stack design shall not be acceptable.

The joint shall be covered up by metal cover plates of same type of material and finishes as the busduct enclosure.

1.7 Acceptance Tests at Manufacturer's Works

Completed busduct system shall be visually inspected for technical execution and conformity with the latest approved drawings and with the order. Spot checks shall be carried out to verify:

- (1) Outline dimension of busduct enclosure
- (2) The degree of protection of the enclosure
- (3) Creepage distances and clearances
- (4) Proper mounting of components

- (5) Internal connections
- (6) The availability of the earth points for connection
- (7) Measurement of insulation resistance (Megger Test) on the conductors
- (8) Dielectric test shall be carried out with 3.5kV rms for 1 minute
- (9) Testing of the mechanical and electrical operation of a number of functional units on a

Type Testing and Certification

Type test certificates complying to IEC 60439-1 and IEC 60439-2 shall be submitted during the tender submission. The type test certificates shall include as follows:

- (1) Verification of temperature-rise limits
- (2) Verification of dielectric properties
- (3) Verification of Short circuit strength
- (4) Verification of clearance and creepage distance
- (6) Verification of degree of Ingress protection
- (7) EMC test

3.11kV - 1250A - 26.3kA Metal Clad HT Switchgear Panel,

Ratings	
Type	Metal Clad Vacuum Circuit Breaker
Rated Voltage	upto 12kV
Rated Continuous Current	upto 1250 A
Rated Frequency	50 Hz
Rated Interrupting Current	upto 26.3 kA
Rated Short Time Current	upto 26.3 kA for 1 sec.
Operating Duty	O-0.3 sec-CO-3min-CO
Applicable Standards	IEC 62271-100 / 200 & IEC 62271-1
Power Frequency Withstand Voltage	28 kV / 35 kV rms*
Impulse Withstand Voltage	75 kV _p / 95 kV _p *
Degree Of Protection	IP4X external, IP2X internal (between compartments)
Type Of Mechanism	Motor charged, Stored energy, Spring operated
Special Switching Duties	Capacitor Bank Switching, Double line to ground fault
Quality System Certification	ISO 9001, 14001, 18001 (IMS Certified)
Seismic Sustainability*	Zone - V
Rated Single Capacitor Bank	400A Class C2 category
Rated Cable Charging Current	25A Class C2 category
Rated Line Charging Current	10A Class C2 category

APPLIED STANDARDS

The HT switchgear units meet following standards and regulations :

• Switchgear	62271-200 & IEC 62271-1
• Internal arc classification (IAC), LSC 2B	62271-200
• Circuit-breaker	62271-100
• Earthing switch	62271-102
• Isolating truck	62271-102
• Current transformers	60441-1
• Voltage transformers	60442-2
• Voltage Detecting Systems	61243-5, IEC 61958
• Protection against accidental contact, foreign bodies and water	60529

Other Features

- 1 Low-voltage cabinet with control device
- 2 Safety shutter suitable for bus bar spouts
- 3 Front door

- 4 Safety shutter suitable for circuit spouts
- 5 Cable compartment cover
- 6 Cable & CT compartment
- 7 Cable terminations
- 8 Cast Resin Current Transformers
- 9 Rating plate
- 10 Busbars (Cu/ Al)
- 11 Racking arrangement
- 12 Circuit breaker truck
- 13 Rack-in/ out access
- 14 Feeder description
- 15 Pad locking facility
- 16 Viewing window
- 17 Pressure relief flaps
- 18 Gas duct chamber (IAC requirement-optional)
- 19 Earthing

SAFETY FEATURES :

- SCADA compatible & with IEC 61850 compliant protection relay (MICOM P14N or equivalent 8I/O + Ethernet) compatible with existing SCADA.
- HV compartments are tested for internal arcs and the pressure release flaps are located in such a way to guide the bi-products away from the operator.
- Single point padlocking interlock on VCB push button (ON/OFF) can ensure total operational interlock.
- If louvers are provided, as is the case with higher current ratings, a safety flap covers the louvers in case of internal arc and protects the operator from arc bi-products.
- The panel offers a dead front execution and a door is provided for further protection. The door is hinged and designed to withstand internal arcing at 40kA for one second.
- The panel is 100% insulated and there is no access to any live part. All joints are insulated.
- In addition to normal interlocks, safety is reinforced at the door which is interlocked so that it cannot be opened with the breaker in closed position. All operations are possible with the door closed, thus guaranteeing independent operator safety.
- A sliding earth connection arrangement for the auxiliary plug and socket ensures continuous earthing when the trolley is withdrawn.
- The Schneider Electric design assures totally safe and operator independent operation for

busbar and circuit earthing, one of the most critical areas in switchgear operation.

- The breaker cannot be pushed in the panel beyond the "test" position if the front door is open. The unique feature protects the operator even in the remote event of leakage from the vacuum interrupter.
- Provision of rear inspection window on cable chamber and optional "Infra-red Window" for thermal imaging.

4. 11kV – 3.5 Core 400 Sq mm Round Armored XLPE Aluminum Cable

1.00.00 SCOPE:

- 1.01.00 The scope of this package, covers the design, manufacture, stage inspection at works, inspection and testing of finished cables at manufacture's works, testing at independent test house, packing, transport and delivery to consignee's address of 6.35/11KV Three Core, aluminium conductor, XLPE insulated, screened, under ground Cables as per specified construction.
- 1.02.00 Technical Requirement: Three Core 6.35/11KV grade, 90°C rating heavy duty power cable with stranded compacted circular aluminium conductor shielded with extruded semi conducting compound, cross linked polyethylene insulated, shielded with extruded semi conducting compound and copper tape, shielded cores laid up with fillers, inner sheath of extruded PVC, Galvanized round steel wire Armour and PVC ST-2 overall sheath.
- 1.03.00 The cables should be suitable for use in solidly earthed system.
- 1.04.00 The Stranded Aluminium Conductor for different sizes of cable shall have the short circuit rating specified in this document, in schedule of requirement, schedule-I, Annexure TS-1.

2.00.00 STANDARDS:

- 2.01.00 The 11KV UG Cables shall, in general, meet the requirements of the latest edition of the Bureau of Indian Standards, (generally referred as IS) IS 7098 (Part-2) 1985. The cables manufactured to and meeting the testing requirements of international standards, like B.S.S. IEC or equivalent standards are also acceptable. The bidders shall enclose a copy of the equivalent international standard, in English Language, along with the Bid.

The extracts from IS 7098 (Part 2) are given in Annexure TS-3.

The cables and components in general shall meet the requirement Indian Standards with latest amendments or equivalent International Standards.

IS: 7098 (Part 2)	1985	:	Specification for cross linked polyethylene
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		insulated PVC sheathed cables
IS: 8130	1984 :	Specification for conductors for insulated Electric Cables
IS: 3975	1979 :	Specification for mild steel wires, strips and tapes for armouring of cables.
IS: 10810 (Part 1 to 55)	1984 :	Specification for test on cables
IS: 5831	1984 :	Specification for PVC insulation and sheath of electric cables
IS: 10418	1982 :	Specification for drums for electric cables
IS: 10462 (Part-I)	1983 :	Fictitious calculation method for determination of dimensions of protective covering of cables: Part-I Elastomeric and thermoplastic insulated cables.

2.02.00 11KV underground cables shall be manufactured to the highest quality, best workmanship with scientific material management and quality control. The Bidder shall furnish the quality plan, giving in details the quality control procedures/management system.

The successful bidder shall give sufficient advance notice to the purchaser of not less than fifteen days to arrange for stage inspection and inspection of quality assurance programme during manufacture, at the works.

3.00.00 **SYSTEMS DETAILS:**

General Technical Particulars:

- | | | |
|--|---|-----------------|
| 1) Nominal System Voltage (rms) (u) | - | 11 KV |
| 2) Highest System Voltage (rms) (um) | - | 12 KV |
| 3) Phase to Earth Voltage (uo) | - | 6.35 KV |
| 4) Number of Phases (for 3 core cables) | - | 3 |
| 5) Frequency | - | 50 Hz |
| 6) Variation in frequency | - | ±3% |
| 7) Type of Earthing | - | Solidly Earthed |
| 8) Basic impulse level (1.2/50 Micro Second Wave - | - | 75 KV |
| 9) Total relay & circuit break operating time | - | 15-20 Cycles |
| 10) One minute power frequency withstand voltage- | - | 28 KV |

4.00.00 **INSTALLATION CONDITIONS:**

- a) Mostly directly buried in ground, partly in RCC/Hume pipes or stoneware pipes at road crossing in case of 3 core cables.

- b) If more than one circuit is laid in the same trench, then laid in flat formation for 3 core cables.
- c) Metallic coverings are connected solidly to earth at both ends of the run for 3 core cables and.
- d) Normal depth of laying is 900 mm to 1000 mm (from top of round to centre of cable).
- e) Nature of soil – Heterogeneous, sandy.
- f) Soil resistivity: variable 18 to 100 Ohm – meter
- g) Soil Thermal resistivity (assumed) 120 to 150 dig. C. Cm/w.

5.00.00 **CLIMATIC CONDITIONS:**

The climatic conditions at Bangalore City where these 11KV Cables will be installed are as under:

1	Location	Karnataka (28.58 N, 77.38E)
2	Altitude	1000 M above MSL
3	Max. ambient air temperature	45 ⁰ C
4	Max. daily average air temp.	38 ⁰ C
5	Minimum ambient air temp.	10 ⁰ C
6	Ground temperature at depth of laying assumed	35 ⁰ C (Max.)
7	Isoceran level	5 ⁰ C (Min.)
8	Avg. annual rainfall	As per IS:45
9	Avg. number of rainy	1450 Sq.mm.
10	Climate	Tropical Moderately hot and humid
11	Soil	Normally dry. As per IS:1200 Part-I, 1974, likely hood of subsoil water at certain location at depth of burial of cables.

6.00.00 **DESIGN CRITERIA:**

- 6.01.00 The cables that are covered in these specifications are intended for use in the Karnataka Power distribution system, under the climatic conditions and installation conditions described in the technical specification.
- 6.02.00 Any technical feature, not specifically mentioned here, but is necessary, for the good performance of the product, shall be incorporated in the design. Such features shall be clearly brought out under Technical deviations schedule only in the offer made by the Bidder, giving technical reasons, and justifying the need to incorporate these features.
- 6.03.00 For continuous operation of the cables, at specified drawing, the maximum conductor temperature shall be limited to the permissible value as per the relevant standard,

generally not exceeding 90°C under normal operation and 250°C under short-circuit conditions.

- 6.04.00 The cables in service will be subject to daily load cycles, of two peaks during day, morning peak and evening peak with reduced loading during the nights.
- 6.05.00 The materials used for sheaths shall be resistant to oils, acids and alkalies.
- 6.06.00 The cables shall be designed to withstand the thermo mechanical forces and electrical stresses during normal operation and transient conditions.

The Cables shall be designed to have a minimum useful life span of forty years.

Core identification: The core identification for 3 core cables shall be provided, by suitable means, like, by application of coloured stripes, or by numerals or by printing on the cores as per clause 13 of IS:7093.

7.00.00 **MANUFACTURE PROCESS, CROSS LINKING OF INSULATION:**

- 7.01.00 Cross linking of the insulation materials (pre compounded polyethylene) shall be conforming to IS:7098 (Part-II).
- 7.02.00 The conductor screen shall be of extruded semi conducting compound. The insulation screen shall consist of the nonmetallic part extruded semi conducting compound with non magnetic metallic port. The XLPE insulation and the shields for conductor and insulation shall be extended in one operation.

8.00.00 **MATERIALS:**

- 8.01.00 **CONDUCTOR:** The conductor shall be of stranded construction. The material for conductor shall consist of plain aluminium of H2 or H4 grade as per clause-3 of IS:8130/1984.

The number of wires in the conductor shall be not less than the appropriate minimum number given in Table-2 of IS:8130/1984.

- 8.02.00 **INSULATION:** The insulation shall be cross linked polyethylene conforming to the requirements given in Table-1 of IS:7098 Part-II.
- 8.03.00 **SCREENING:** The screening shall consist of semi conducting compound. The metallic screen for core shall consist of copper tape. The metallic screen with Armour shall be designed to carry the minimum short circuit rating for 1 second. (The design calculations shall be furnished by the tenderer).

8.03.01 The semi-conducting compound shall withstand the operating temperature of the cable and shall be compatible with the insulting materials.

8.04.00 **Filler and inner sheath for Multi Core Cables:**

For Multi Core cables, the interstices at the centre shall be filled with a non-hygroscopic materials.

The interstices around the laid up cores shall be covered with PVC compound type S.T-2. This will form the inner sheath for Multi Cores Cables.

8.05.00 **ARMOURING FOR 3 CORE CABLES:**

The armour shall be galvanized round steel wire, complying with the requirements of IS:3975. The Single Core Cables shall be armoured with hard drawing Aluminium round wire. A binder tape may be applied on the armour.

8.06.00 **OUTER SHEATH:**

The outer sheath shall consist of Poly Vinyl Chloride (PVC) compound, confirming to the requirements of Type ST-2 of IS:5831 suitable additive shall be added to give anti termite protection.

9.00.00 **CONSTRUCTION:**

The general constructional features of the cables shall be as follows:

- a) **3 Core Cables:** Stranded, Compacted, Circular, Aluminium Conductor, Conductor Screen of extruded semi conducting compound, Cross linked polyethylene insulation, cross linked, shall be conforming to IS:7098 (Part-II).

Insulation screen consisting of non-metallic part of extruded semi conducting compound and the metallic part of copper tape(s).

Pressure Extruded PVC inner sheath

Armour (Galvanised Steel round wire)

Other PVC sheath with anti-termite treatment.

10.00.00 **CONDUCTOR:**

10.01.01 The conductor shall be stranded, compact, circular of aluminium wires of H2 or H4 grade plain aluminium wires.

10.01.02 The conductor shall be clean, uniform in size and shape smooth and free from harmful defects.

- 10.01.03 Not more than two joints shall be allowed in any one of the single wire forming every complete length of conductor and no joint shall be within 300 mm of any other joint in the same layer. The joint shall be made by brazing, silver soldering or electric or gas welding.
- 10.01.04 No joints shall be made in the conductor after it has been stranded.
- 10.02.00 **CONDUCTOR SCREEN:** The conductor screen shall be provided over the conductor consisting of extruded non metallic semi conducting compound.
- 10.03.00 **INSULATION:** The insulation shall be provided over the screened conductor with cross linked polyethylene, applied by extrusion and shall be of high quality, cross linked, shall be conforming to IS:7098 (part-2).
- 10.03.01 **THICKNESS OF INSULATION:** The average thickness of XLPE insulation shall not be less than the nominal value subject to the applicable tolerance as specified in table 2 of IS: 7098.
- 10.03.02 The insulation shall be applied to closely fit on the conductor screen, and it shall be possible to remove it without damaging the conductor.
- 10.03.03 The thickness of semi conducting screen over insulation should not be included in the thickness of Insulation.
- 10.04.00 **INSULATION SCREENING:** The Insulation screen shall be applied over the Insulations.
- 10.04.01 The Non-Metallic part of the Insulation screen shall consist of extruded Semi conducting compound.
- 10.04.02 The metallic part of the insulation screen shall consist of non-magnetic material, consisting of copper tape or tapes, and shall be applied over the non-metallic part. The metallic tape(s) shall be designed to carry the rated short circuit current.
- 10.05.00 **LAYING UP OF CORES:** For multi-core cables, the cores shall be laid together with a suitable right hand lay. The interstices at the centre shall be filled with a non-hygroscopic material.
- 10.06.00 **INNER-SHEATH FOR MULTI CORE CABLES:**
- 10.06.01 The cores shall be laid up with a suitable right hand lay and the interstices should be filled with PVC compound type ST2 conforming to IS:5831 or equivalent standard. The filling up of interstices shall be by pressure extrusion and this circular shape and shall bind the cores also.

- 10.06.02 The minimum thickness of the inner sheath shall conform to Table 3 of IS: 7098 (Part-2), 1985 or equivalent standard.
- 10.06.03 The inner-sheath shall be so applied that it fits closely on the laid up cores and it shall be possible to remove it without damage to the insulation cables.
- 10.07.00 **ARMOURING FOR 3 CORE CABLES:**
- 10.07.01 **Application:** The armour consisting of Galvanised steel wire shall be applied over the inner sheath for multi core cables.
- 10.07.02 The armour wires shall be applied as closely as possible.
- 10.07.03 The diameter of the galvanised round steel and hard drawn aluminium wires shall conform to IS: 7098 Part (2).
- 10.07.04 A binder tape may be applied on the armour.
- 10.07.05 The Joints in the armour wires shall be brazed/welded with joint surface and rendered smooth. The joints shall be staggered by at least 300 mm from the nearest joint in any other armour wire in the completed cable.
- 10.08.00 **OUTER SHEATH:**
- 10.08.01 The PVC outer sheath with anti termite treatment shall be extruded over the armouring for 3 core cables.
- 10.08.02 The colour of the outer sheath shall be black.
- 10.08.03 The thickness of outer sheath shall be not less than the minimum value specified in column 5 of Table 5 of IS: 7098 (Part-2) 1985.
- 10.09.00 **IDENTIFICATION:** The outer-sheath shall have the following information embossed or indented on it, the manufacturer's name or trade mark, the voltage grade, the year of manufacture and the letters "BESCOM". The identification shall repeat every 300/350 mm along with length of the cable.
- 11.00.00 **INSPECTION:**
- 11.01.00 **Quality Control:** The Bidder shall furnish a complete and detailed quality plan for the manufacturing process of the cable. All raw materials shall conform to relevant applicable standards and tested for compliance to quality and requirement.

During the manufacturing process, at all stages, inspections shall be made to check the physical and dimensional parameters, for verification to compliance to the standards.

11.02.00 The Bidder shall arrange, for inspection by the purchaser, during manufacture, if so desired by the purchaser, to verify the quality control process of the Bidder.

12.00.00 **TYPE TESTS:**

Notwithstanding, that type test have been conducted earlier, the successful bidder the each member of consortium shall conduct all type tests as per IS:7098 part (2), 1985 with upto date amendments or equivalent international standard at his cost at either CPRI or any other accredited national laboratory/testing house and materials offered for inspection. Only after approval of the test reports from the purchaser materials shall be offered for inspection.

12.01.00 All type tests, routine, acceptance test shall be conducted in the presence of the purchaser, representative.

12.02.00 The successful Bidder shall give 15 days advance notice for inspections, and witnessing of tests by the purchaser or his representative.

12.03.01 The following type tests will be conducted on the cable.

- a) Test on conductor
- b) Test on armour wires
- c) Test for thickness of XLPE insulation and inner and outer sheaths
- d) Physical test on XLPE insulation
- e) Physical test for outer sheath
- f) Partial discharge test
- g) Bending test
- h) Di-electric power factor test
 - (i) As a function of voltage
 - (ii) As a function of temperature
- i) Insulation resistance (Volume resistivity) test
- j) Heating cycle test
- k) Impulse withstand test
- l) High voltage test
- m) Flammability test

12.03.02 The following test shall be performed successively on the same test sample of completed cable, not less than 10 M in length between the test accessories.

- a) Partial discharge test
- b) Dending test followed by partial discharge test

- c) Dielectric power factor as a function of voltage
- d) Dielectric power factor as a function of temperature
- e) Heating Cycle test, followed by dielectric power factor and function of voltage and partial discharge test.
- f) Impulse withstand test
- g) High voltage test.

12.04.00 **ACCEPTANCE TEST:**

12.04.01 The sampling plan for acceptance test shall be as per IS:7098 Part (2) 1985, Appendix 'A'.

12.04.02 The following shall constitute the acceptance test.

- a) Tensile test for aluminium
- b) Wrapping test for aluminium
- c) Conductor resistance test
- d) Test for thickness of insulation
- e) Test for thickness of inner and outer sheath
- f) Hot-set test for insulation
- g) Tensile strength and elongation at break test for insulation and outer sheath
- h) Partial discharge test (on full drum length)
- i) High voltage test
- j) Insulation resistance (volume resistivity) test.

12.05.00 **ROUTINE TEST:**

The following shall constitute routine tests:

- a) Conductor resistance test
- b) Partial discharge test on full drum length
- c) High voltage test

13.00.00 **PACKING:**

13.01.01 The cables, as per specified delivery lengths, shall be securely wound/packed in non-returnable, well seasoned sturdy wooden drums, with strong reinforcements so as to withstand rough handling during transport by Rail, Road etc., The packing should withstand storage conditions in open yards. The cable drums shall conform to IS:10418-1982 or equivalent standard.

13.01.02 The drawing of cable drums with full detail shall be furnished, and got approved before dispatch.

13.02.00 **SEALING OF CABLE ENDS ON DRUMS:**

- 13.02.01 The Cable ends shall be sealed properly so that ingress of moisture is completely prevented.
- 13.02.02 The individual core endings shall be sealed effectively with water resistant compound applied over the core and provided with a heat shrinkable cap of sufficient length with adequate cushion space so that the conductor does not puncture the cap in case of movement of the core during unwinding or laying. Before sealing, the semi conducting layer on the cores may be removed for about 2 mm at each end, to facilitate checking the insulation resistance from one end, without removing the sealing cap at the other end.
- 13.02.03 The three cores should have a over all heat shrinkable cap with adequate end clearance, and sufficient cushioning to prevent puncturing of the overall sealing cap due to stretching of the cores. The sealing cap shall have sufficient mechanical strength and shall prevent ingress of moisture into the cable.
- 13.02.04 **CABLE LENGTHS:** The cables shall be supplied in continuous lengths of 250/500 m in case of 3 core cables with a tolerance of $\pm 5\%$ of drum length.
- 13.02.05 **QUANTITY TOLERANCE:** $\pm 5\%$ tolerance shall be allowed on the ordered quantity.
- 14.00.00 **MARKING:**

The packed a cable drum shall carry the following information, clearly painted or stenciled.

- a) The letters "BESCOM"
- b) Reference to Standard and ISI Mark
- c) Manufacture's Name or trade mark
- d) Type of Cable & Voltage grade
- e) Number of cores
- f) Nominal cores sectional area of conductor
- g) Cable code
- h) Length of cable on the drum
- i) Direction of rotation
- j) Gross weight
- k) Country of Manufacture
- l) Year of Manufacture
- m) Purchase Order No. and Date
- n) Address of consignee.

- 15.00.00 Cross sectional drawings of the cables giving dimensional details for each size of cable.

- a) An illustrated literature on the cable giving technical information, on current ratings, cable constants, short circuit ratings, derating factors for different types of installation packing date weights and other relevant information.

SCHEDULE-I

Schedule of requirement of 3 core armoured, 1 core armoured,
6.35/11KV (E) aluminium conductor, XLPE UG Cables

Sl. No.	Cross sectional area of conductor (Sq.mm.)	Minimum current rating (Amps) in ground	Minimum short circuit rating (KA/1 Sec)	Delivery length per drum ($\pm 5\%$)
1	3 x 95	190	8.9	500 M
2	3 x 240	315	22.5	250 M
3	3 x 400	395	37.6	250 M

The approximate current ratings in column 3 are for the following standard installation conditions.

i)	Maximum conductor temperature for continuous operation	90 Deg. C.
ii)	Ambient air temperature	40 Deg. C.
iii)	Ground temperature	30 Deg. C.
iv)	Thermal resistivity of soil	150 Deg. C.
v)	Depth of laying	90 cm
vi)	Maximum conductor temperature at the end of short circuit	250 Deg. C.
vii)	Method of installation	Installed single directly buried in ground

TABLE-1:- PROPERTIES OF XLPE INSULATION

Sl. No.	Property	Requirement
1	Tensile Strength	12.5 N/Sq.mm. Min.
2	Elongation at break	200 percent, Min.
3	<u>Ageing in air over:</u> a) <u>Treatment:</u> Temperature Duration b) Tensile Strength Variation c) Elongation Variation	135 ± 3 Deg. C 7 Days ± 25% Max. ± 25% Max.
4	<u>Hot Set:</u> a) <u>Treatment:</u> Temperature Time under load Mechanical stress b) Elongation under load c) Permanent Elongation (Set after cooling)	200 ± 3 Deg. C 15 minutes 20 N/Sq.mm. 175% Max. 15% Max.
5	<u>Shrinkage:</u> a) <u>Treatment:</u> Temperature Duration b) Shrinkage	130 ± 3 Deg. C 1 Hour 4% Max.
6	<u>Water absorption (gravimetric):</u> a) <u>Treatment:</u> Temperature Duration b) Water absorbed	85 ± 2 Deg. C 14 Days 1 Mg/Sq.mm. cm. Max.
7	<u>Volume resistivity:</u> a) At 27 Deg. C b) At 90 Deg. C	1 x 10 ¹⁴ ohm-cm. Min. 1 x 10 ¹² ohm-cm. Min.

TABLE-2:- NOMINAL THICKNESS OF INSULATION

Nominal Area of Conductor in Sq.mm.	Nominal thickness of insulation (ti) in mm. 6.35/11KV - 3 Core
95	3.6
240	3.6
400	3.6

- 1) Thickness of insulation: The average thickness of insulation shall not be less than the nominal value (ti) specified in Table-2.
- 2) Tolerance on thickness of insulation: The smallest of the measured values of thickness of insulation shall not fall below the nominal value (ti) specified in Table-2 by more than 0.1 mm + 0.1 ti.

TABLE-3:- THICKNESS OF INNER SHEATH (All dimensions in mm)

Calculated diameter over laid up cores (ref. IS 10462 Part 1, 1983) *		Thickness of inner sheath (Min.)
Over	Upto & including	
(1)	(2)	(3)
-	25	0.3
25	35	0.4
35	45	0.5
45	55	0.6
55	-	0.7

(*) Fictitious calculation method for determination, dimensions of protective coverings of cables: Part-I Electrometric and Thermoplastic Cables.

TABLE-4:- DIMENSIONS OF ARMOUR GALVANIZED STEEL ROUND WIRES AND STRIPS

NOTE: The dimensions of Galvanised steel wires or strips shall be as specified in Table-4.

Calculated diameter for Armour (ref. IS 10462 Part 1, 1983) *		Nominal thickness of steel strip	Nominal diameter of Round wire
Over	Upto & including		
1	2	3	4
a) For all diameter in excess of 13		0.8	Nil
-	13	-	1.40
13	25	0.8	1.60

25	40	0.8	2.00
40	55	1.4	2.50
55	70	1.4	3.15
70	-	1.4	4.00

Note: (a) and (b) indicate two methods of practice in the application of armouring.

* Fictitious calculation method for determination of dimensions of protective covering of cables: Part-I Electrometric & Thermoplastic Insulated Cables.

TABLE-5:- THICKNESS OF OUTER SHEATH (All dimensions in mm)

Calculated diameter under the outer sheath (ref. IS:10462 Part 1, 1983) *		Nominal thickness of steel strip		Minimum thickness of outer sheath for Armoured Cables
Over	Upto & including	Nominal (ts)	Minimum	
1	2	3	4	5
-	15	1.8	1.24	1.24
15	25	2.0	1.40	1.40
25	35	2.2	1.56	1.56
35	40	2.4	1.72	1.72
40	45	2.6	1.88	1.88
45	50	2.8	2.04	2.04
50	55	3.0	2.20	2.20
55	60	3.2	2.36	2.36
60	65	3.4	2.52	2.52
65	70	3.6	2.68	2.68
70	75	3.8	2.84	2.84
75	-	4.0	3.00	3.00

(*) Fictitious calculation method for determination of dimensions of protective covering of cables: Part-I Electrometric & Thermoplastic Insulated Cables.

Note:

Armoured Cables: The thickness of outer sheath shall be not less than the minimum value specified in column 5 of Table-5.

Extracts from IS:7098 (Part 2), 1985, on Tests on Cables:

- i) Partial Discharge Test: The Partial discharge magnitude at test voltage equal to 1.5 U₀ shall not exceed 20 PC.

- ii) Bending Test: The diameter of test cylinder shall be $(20D \pm 5)$ percent, where D is the overall diameter of the completed cable.
- iii) Dielectric Power Factor Test:
 - a) Tan 'delta' as a function of voltage:
The measured value of tan 'delta' at U_0 shall not exceed 0.004 and the increment of tan 'delta' between $0.5 U_0$ and $2 U_0$ shall not be more than 0.002.
 - b) Tan 'delta' as a function of temperature:

The measured value of tan 'delta' shall not exceed 0.004 at ambient temperature and 0.008 at 90 Deg. C.
- iv) Heating Cycle (As per IS: 10810 Part 49):

After their cycle, the sample shall be subjected to dielectric power factor as a function of voltage and partial discharge test.
- v) Impulse withstand test:

The impulse voltage level for cables of rated voltage 6.35/11KV is 75 KV. No breakdown of insulation shall occur during the test.
- vi) High voltage test (As a type test/ Acceptance test) for 6.35/11KV rated voltage cables:

The cable shall withstand without breakdown an A.C. Voltage equal to $3 U_0$ but not less than 17 KV (rms when applied to the sample between conductor and screen/metallic tape/armour, the voltage shall be gradually increased to the specified value and maintained for a period of 4 hours.

GUARANTEED TECHNICAL PARTICULARS FOR
11KV Non-Extensible RMU

The bidder should fill up Technical particulars of 11 kV panel in the following format)

Name of the Bidder: _____

Sr. No.	Description	RMU
1.0	SWITCHGEAR ASSEMBLY	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
1.4	Voltage (Normal/Max.) kV	
1.5	Phase (Nos.)	
1.6	Frequency (Hz)	
1.7	Short Circuit Rating	
	a) Breaking Symmetrical (kA)	
	b) Breaking Asymmetrical (kA)	
	c) Short time for 1 Sec.	
	d) Short time for 3 sec.	
1.8	Insulation Level	
	a) Impulse Withstand (kVpeak)	
	b) 1 minute 50 Hz. Voltage Withstand (kVrms)	
1.9	Metal Clad Construction	Yes/ No
1.10	Degree of protection :	
1.11	Switchgear completely wire and tested at factory :	Yes/ No
2.0	CONSTRUCTION	
2.1	Overall Dimensions	
a.	Breaker	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	
b.	Isolator	
	a)Length (mm)	
	2) breadth (mm)	
	3) Height (mm)	
c.	Total Non-Extensible 3 Panel RMU	
	1) Length (mm)	
	2) Breadth (mm)	
	3) Height (mm)	
2.2	Weight	
	a) Breaker (kg)	
	b) Isolator (kg)	
	c) Non-Extensible 3 panel RMU (kg)	
3.0	Bus Bar	
3.1	Make	
3.2	Material & Grade	
3.3	Reference Standard	

3.4	a) Cross Sectional area (m m ²)	
	b) Size (m m ²)	
3.5	Continuous Current	
	a) Standard	
	b) At site conditions and within cubicle	
3.6	Maximum temperature rise over ambient (c)	
3.7.	Short time current for 3 Sec. (KArms)	
3.8	Minimum clearance from bare bus bar connection	
	a) Phase to phase (mm)	
	b) Phase to earth (mm)	
3.9	Bus Bar provided with	
	a) Insulation Sleeve	
	b) Phase barriers	
	c) Cast Resin shrouds for joints	
3.10	Bus bar connection	
	a) Silver Plated	
	b) Made with anti oxide grease	
3.11	Bus bar support spacing (mm)	
3.12	Bus support insulators	
	a) Make	
	b) Type	
	c) Reference Standard	
	d) Voltage Class (kV)	
	e) Minimum creepage distance (mm)	
	f) Cantilever strength Kg/mm ²	
	g) Net Weight (kG)	
4.0	SF6/VCB CIRCUIT BREAKER	
4.1.	Make	
4.2.	Type	
4.3.	Reference Standard	
4.4.	Rated Voltage	
4.5	Rated Frequency	
4.6	No. of Poles	
4.7	Rated Current	
	a) Normal (Standard) Amps	
	b) Derated (Site) Amps	
4.8	Maximum temperature rise over ambient °C	
4.9	Rated operating Duty	
4.10	Rupturing capacity at rated voltage (MVA)	
4.11	Breaking capacity at rated voltage & operating duty	
	a) Symmetrical (kArms)	
	b) Asymmetrical (kArms)	
4.12	Rated making Current (kA _{peak})	
4.13	a) Short time current for 1 sec. (kArms)	
	b) Short time current for 3 Sec. (kArms)	
4.14	Transient Recovery Voltage	
	a) Rate of rise (kV/ms)	
	b) Peak Voltage (kV)	
4.15	Insulation Level	
	a) Impulse voltage withstand on 1/50 full wave	
	b) 1 minute 50 Hz. Voltage withstand	

4.16	Maximum over voltage factor when Switching off	
	a) Un loaded transformer	
	b) Loaded transformer	
	c) Un loaded cables	
	d) Capacitors	
4.17	Opening time maximum No load condition (ms)	
4.18	Opening and closing time under SF6 gas loss or vacuum loss condition (ms)	
4.19	At 100% Breaking capacity	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max (ms)	
	c) Total break time (ms)	
4.20	At 60% breaking capacity	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time (ms)	
4.21	At 30% breaking capacity (ms)	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time (ms)	
4.22	At 10% breaking capacity (ms)	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time	
4.23	a) Make time (Max) (ms)	
	b) Total closing time (ms)	
4.24	Number of breaks per pole	
4.25	Total length of breaks per pole (mm)	
4.26	Total length of contact travel (mm)	
4.27	Speed of break (100% short circuit current)	
	Rate of contact travel	
	a) At tripping M/sec.	
	b) At closing M/sec.	
	No. of breaker operations permissible without requiring inspection, replacement contacts and other main parts.	
	a) At 100% rated current	
	b) At 100% rated breaking current	
	Type of contacts	
	a) Main	
	b) Arcing	
	Material of contact	
	a) Main	
	b) Arcing	
	c) Whether contacts silver plated	
	d) Thickness of silver plating	
	Contact pressure at No load (Kg)	
	Type of arc Control device provided	
	Operating mechanism-closing	
	a) Type	
	b) No. of breaker operations stored	
	c) Trip free or fixed trip	
	d) Anti pumping features provided	

	e) Earthing for operating mechanism and metal parts furnished	
	f) Earth terminal size and material	
	Operating mechanism-tripping	
	a) Type	
	b) No. of breaker operations stored	
	c) Trip free or fixed trip (V)	
	d) Anti pumping features provided (%)	
	e) Earthing for operating mechanism and metal parts furnished	
	f) Earth terminal size and material	
	1. Spring Charging mechanism 2. Make 3. Type 4' Size 5. Rating	
	Breaker suitable for capacity Switching Operating duty Max. rating of capacity bank that can be safely Controlled	
	Tripping Coil	
	a) Voltage	
	b) Permissible voltage variation (%)	
	c) Tripping Current at rated Voltage (A)	
	d) Power at rated voltage (W)	
	e) 2-Over current trip with 1- earth fault furnished as specified.	
	Breaker/Accessories Accessories such as Control Switch indication lamps etc. to be furnished as specified: (Please attach separate sheet giving details of all accessories inter locks and safety shutters)	
	a) Mechanical Safety Interlock	
	b) Automatic Safety Interlock	
	c) Operational Interlock	
	d) Emergency manual trip	
	e) Operation counter	
	f) Charge/discharge indicator	
	g) Manual spring charging facility	
	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (Kg)	
6.0	CURRENT TRANSFORMER	
6.1	Make	
6.2	Type & voltage level	
6.3	Reference standard	
6.4	C.T. ratio as specified	
6.5	Rated frequency	
6.6	Short circuit withstand i) Short time current for 3 Sec. KA RMS ii) Short time current for 5 Sec. KA RMS iii. Dynamic current kA peak	
6.7	Class of insulation	

6.8	Temperature rise over ambient ° C	
6.9	Basic insulation level	
6.10	For tripping CT Ratio Class of accuracy Rated burden VA Knee point voltage V Excitation current at $V_k/2$ Amps Rated saturating current Amp Over current rating Continuous % over load (%)	
7.0	Secondary Wiring	
7.1	Type and insulation	
7.2	Voltage grade	
7.3	Conductor material	
7.4	Conductor size (minimum) and insulation wiring	
7.5	Wires identified at both ends with markers	
7.6	Wiring and other accessories provided as per specification.	
8.0	CABLE TERMINATIONS	
8.1	Circuit Breaker Type Material Dimensions Size Height of cable box from ground level Arrangement for supplying bus end cable box furnished for extensible ring main unit Arrangement for mounting an extra cable box on each equipment furnished	
8.2	Isolator Type Material Dimensions Size Height of cable box from ground level	
9.0	Name Plate	
9.1	Material	
9.2	Thickness	
9.3	Size for	

	a) Breaker cubicle	
	b) Instruments/devices	
10.0	Painting	
10.1	Finish of Breaker Inside Outside	
10.2	Finish of Isolator Inside Outside	
11.0	No. of Accessories Furnished	
	a) Earthing Equipment	
	b) Test Plug	
12.0	TESTS	
12.1	Reference Standard	
12.2	Routine tests to be performed on Switchgear	
12.3	Type Tests quoted	
13.0	Drawing/Data	
13.1	General arrangement for Panel Board	
13.2	Foundation plan	
13.3	SF6/VCB tripping & material schematic	
13.4	Bill of material	
13.5	SF6/VCB LT Panel Wiring Diagram	

GUARANTEED TECHNICAL PARTICULARS FOR DISTRIBUTION TRANSFORMERS

The bidder should fill up Technical particulars of Distribution Transformer in the following format)

Name of the Bidder: _____

		2500 kVA
1.0	<u>General</u>	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
2.0	<u>Rating</u>	
2.1	Rated output with AN cooling (MVA)	
2.2	Type of cooling	
2.3	Rated Voltage (kV)	
	2H.V. 3L.V.	
2.4	Rated Current (Amps) a)H.V. b)L.V.	
2.5	Guaranteed No Load current @ 100% rated voltage A H.V. B L.V.	
2.6	Guaranteed No Load current @ 110% rated voltage 8H.V. 9L.V.	
2.7	No. of phases	
2.8	No. of windings per phase	
2.9	Rated Frequency (Hz)	
2.10	Vector Group reference	
3.0	<u>Temperature</u>	
3.1	Reference ambient temperature (deg C)	
3.2	8.0Temperature rise over reference Ambient b) Winding by resistance (deg C)	
3.3	Maximum continuous overloading capacity of the transformer without exceeding the specified winding temperature	
4.0	<u>Tappings</u>	
4.1	Type	
4.2	Capacity	
4.3	Range-Steps x % variation	
4.4.	Taps provided on H.V. windings	
4.5	Details of Tappings	
	Tap Position	HV (V)/ LV (V)
	1	
	2	
	3	
	4	

	5	
4.6	Off load Tap Links	
	a) Operating Voltage (kV)	
	b) Rated Current (Amp)	
	c) Type	
	d) Reference Standard	
	e) Number of Poles	
	f) Defined features provided (Please attach technical catalog giving details and drawing)	Yes/No
5.0	<u>Impedance at principal tap rated current and frequency (%)</u>	
5.1	Impedance	
5.2	Reactance	
5.3	Resistance	
5.4.	Zero Sequence impedance	
	a) H.V.	
	b) L.V.	
5.5	Resistance of the winding @ 75 Deg C	
	a) H.V.	
	b) L.V.	
6.0	<u>Guaranteed Losses at principal tap full load and 75 Deg C without any positive tolerance as per IS 1180 (level 3)</u>	
6.1	No load losses (kW)	
6.2	Load Losses (kW)	
6.3	Total Losses (kW)	
6.4	No Load loss at maximum permissible voltage and frequency (approx.) kW.	
7.0	<u>Efficiency</u>	
7.1.	Efficiency at 75 Deg C and unity power factor (%)	
	a) at 110% load	
	b) at 100% load	
	c) at 80% load	
	d) at 60% load	
	e) at 40% load	
	f) at 20% load	
7.2	Efficiency @ 75deg C and 0.8 power factor lag (%)	
	a) at 110% load	
	b) at 100% load	
	c) at 80% load	
	d) at 60% load	
	e) at 40% load	
	f) at 20% load	
	Maximum efficiency (%)	
	Load and power factor at which it occurs	
8	<u>Regulation</u>	
	Regulation at full load @75 Deg C	
	a) at Unity power factor	
	b) at 0.8 Power factor lagging	
	Regulation at 110% load @ 75 Deg C	

	a) at Unity power factor	
	b) at 0.8 Power factor lagging	
9	<u>No. load current (Amps)</u>	
	At 100% voltage	
	a) H.V.	
	b) L.V	
	At 110 % voltage	
	a) H.V.	
	b) L.V	
10	<u>Maximum flux density (Lines/cm²)</u>	
	At 100% rated voltage	
	At 110% rated voltage	
11	<u>Maximum current density Amps/ cm².</u>	
	H.V. Winding	
	L.V. Winding	
	<u>Withstand time and current as multiple of full load current without injury for (Amps x Sec.)</u>	
	Three phase dead short circuit at terminal with rated voltage maintained on the other side.	
	Single phase short circuit at terminal with rated voltage maintained on other side	
12	<u>Cooling System (if applicable)</u>	
	Type of cooling	
	No. of cooling exhaust fans	
	Capacity of cooling exhaust fan	
13	<u>Core</u>	
	Type/Core/or shell	
	Core Material	
	Thickness of lamination (mm)	
	Insulation of lamination (mm)	
	Equivalent cross section area (mm ²)	
14	<u>Coils</u>	
14.1	Type of coils	
	a) H.V.	
	B) L.V	
14.2	Conductor material	
	Gauge/area of cross section of conductor	
	a) H.V.	
	b) L.V	
14.3	Insulating material (class H/180 Deg C or above)	
	a) H.V. Turn	
	b) L.V. Turn	
	c) L.V. Core	
	d) H.V – L.V.	
14.4	Insulating material thickness (mm)	

	a) H.V. Turn	
	b) L.V. Turn	
	c) L.V. Core	
	d) H.V - L.V.	
15	<u>Minimum design clearance (mm)</u>	
	H.V. to earth in air	
	L.V. to earth in air	
	Between H.V. & L.V. in air	
	Top Winding and Yoke	
	Bottom winding and yoke	
16	<u>Transformer impulse level (KV)</u>	
	H.V. Winding	
	L.V. Winding	
17	<u>Bushing</u>	
	Make	
	Type	
	Reference Standard	
	Voltage Class (kV)	
	Creepage distance factor (mm/kV)	
	Weight (Kg)	
	Free space required for bushing removal (mm)	
18	<u>Terminal connections</u>	
	H.V	
	L.V	
	L.V. Neutral	
19	<u>Accessories</u>	
	Each Transformer furnished with fittings and accessories as per Clause No.5.00.00 (Please attach separate sheet giving details)	
20	<u>Overall dimensions</u>	
	Length (mm)	
	Breadth (mm)	
	Height (mm)	
21	<u>Weight Data Kg)</u>	
	Core and frame (Kg)	
	Core windings etc. (Kg)	
	Total Weight (Kg)	
22	<u>Shipping Data</u>	
	Weight of heaviest package (Kg)	
	Dimensions of the largest package (L x B x H) (mm)	
23	<u>Tests</u>	
	Routine tests as per IS:11171/1985	
	Core bolt withstand voltage for 1 minute	
	Type Test quoted:	
	Temperature rise test at ANAN rating	

Impulse Test (kV peak) (Add Sheets if necessary)	
Partial Discharge Level:	

GUARANTEED TECHNICAL PARTICULARS FOR
11KV 1250A MCVCB FEEDER PANEL

The bidder should fill up Technical particulars of 11 kV panel in the following format)

Name of the Bidder: _____

	PARAMETER	MCVCB Panel
1	SWITCHGEAR ASSEMBLY	
1.1	REFERENCE STANDARD	IEC62271-200;2003,IEC-62271-1;2007
1.2	TYPE OF SWITCHGEAR	Indoor, Metal Clad, Horizontal Isolation Horizontal Draw out
1.3	VOLTAGE	
1.3.1	Nominal System Voltage	3.3kV, 6.6kV, 11kV
1.3.2	Rated Voltage	3.6kV, 7.2kV, 12kV
1.3.3	1 min. Power Frequency Withstand Voltage	10kV, 20kV, 28kV ,35kV
1.3.4	1.2/50 micro sec. Impulse Withstand Voltage	40kVp, 60kVp, 75kVp, 95kVp
1.4	NO OF PHASES	3
1.5	FREQUENCY	50 HZ +/- 3%
1.6	SHORT CIRCUIT RATING	
1.6.1	Peak Withstand Current	65.75kAp,78.75kAp,100kAp,110kAp,125kAp
1.6.2	Short Time Current for 3 sec..	26.3kArms,31.5kArms,40kArms,44kArms,50kArms
1.7	DEGREE OF PROTECTION	IP-4X standard
1.8	NO OF COMPARTMENTS	Four (4)
1.9	TYPE OF SHEET STEEL	CRCA/ALU-ZN
1.10.	SHEET STEEL THICKNESS	
1.10.1	Load Bearing Members	2.5 & 3 mm
1.10.2	Others	2 mm
1.11	SURFACE TREATMENT PROCESS	9 Tank Process
1.12	PAINTING	
1.12.1	Paint Thickness	60-80microns
1.12.2	Standard Paint Shade	RAL 7032, Powder coating with texture finish

Contractor

Registrar

1.13	SERVICE, TEST & DISCONNECTED POSITION INSIDE THE CUBICLE	Yes
1.14	MINIMUM CLEARANCE IN AIR	Not applicable as all live parts insulated/shrouded Clearance below for fully insulated/interposing barrier Between interrupters.
1.14.1	Between Phases	NA
1.14.2	Phase to Earth	NA
1.14.3	Minimum Height of live parts From bottom of the cubicle	700 mm
1.15	MINIMUM CLEAR SPACE REQUIRED	
1.15.1	Front for Breaker Withdrawal	1000 mm
1.15.2	Rear	1000mm
1.16	GROUNDING	
1.16.1	Material of Earth Bar	Half Hard, Hard drawn, High Conductivity Copper as per IS-613.
1.16.2	Size of Earth Bar	DDE
1.16.3	Bus Side Earthing	Through earthing truck
1.16.4	Line Side Earthing	Through earthing truck
1.17	OVERALL DIMENSIONS	
1.17.1	Minimum Panel Shipping Dimension (W X D X H)	660 mm X 1720mm X 2400mm up to 1600A panel
		860mm X 1720mm X 2120mm beyond 1600A panel
1.18	OVERALL WEIGHT WITH VCB (in kg.)	
1.18.2	b) upto 1600 Amps	550 approx.
1.18.3	b) for 2500 Amps	650 approx.
1.19	APPROXIMATE MAXIMUM DYNAMIC WEIGHT FOR FOUNDATION DESIGN	Negligible shock load as compared to dead weight of the cubicle
1.20.	DESIGN AMBIENT TEMPERATURE	40 deg C
1.21	MAXIMUM TEMPERATURE RISE IN ANY PORTION OVER 40 C AMBIENT	As per Table 3, IEC:60694,2003
1.22	BREAKER/ CUBICLE ACCESSORIES	
1.22.1	Mechanical Safety Interlocks	As per Clause 5.106, IEC 62271-200 / IS 3427
1.22.2	Automatic Safety Shutters	Gravity Operated Shutters
1.22.3	Emergency Manual Trip	Provided
1.22.4	Mechanical On-Off Indicator	Provided

1.22.5	Operation Counter	Provided
1.22.6	Spring Charge-Discharge Indication	Provided
1.22.7	Manual Spring Charging Facility	Provided
1.22.8	Individual Shutter Padlocking	Provided
1.22.9	Padlocking of Breaker in Test & Service position	Provided
1.23	INTERNAL ARC TESTED.	Yes.
2	BUSBAR COMPARTMENT	
2.1	BUS BAR	
2.1.1	Material	Half Hard, Hard drawn, High Conductivity Electrolytic Grade Copper as per IS-613 upto 3150A
		OR
		High Conductivity (60% IACS) Electrolytic Grade Aluminium, 19501 as per IS-5082 (upto 3150A)
2.1.2	Shape	Radiused edge Rectangular copper/aluminium
2.2	MINIMUM CLEARANCE OF BUSBAR (FULLY INSULATED)	Not applicable as all live parts insulated, shrouded Clearance given below for fully insulated Busbars
2.2.1	Phase to phase	NA
2.2.2	Phase to Earth	NA
2.3	BUSBAR CURRENT RATING & SIZE	
2.3.1	630/800A	YES
		YES
2.3.2	1250A	YES
		YES
2.3.3	1600A	YES
		YES
2.3.4	2000A	YES
2.3.5	2500 A	YES
2.3.6	3150 A	YES
2.4	CURRENT RATING	
2.4.1	Continuous at 40 C Ambient	Upto 2500A with natural cooling ; 3150A with forced cooling
2.4.2	Derating factor for 45 Ambient	0.96
2.4.3	Derating factor for 50C Ambient	0.92
2.4.4	Short time rating for 3 sec.	65.75kAp,78.75kAp,100kAp,110kAp,125kAp
2.4.5	Dynamic Rating	26.3kArms,31.5kArms,40kArms,44kArms,50kArms
2.5	BUSBAR INSULATION	PVC Sleeving (2mm), Heat shrinkable.

2.6	INTERPANEL BARRIER	
2.6.1	Type of insulation	Air.
2.6.2	Material of Insulation	Glass fibre
2.7	INTERPHASE BARRIER	Not Required
2.7.1	Type of barrier	NA
2.7.2	Material of barrier	NA
2.8	BUS BAR SUPPORT INSULATOR	Not applicable as supported by Spou Connection
2.8.1	Make	NA
2.8.2	Voltage Class	NA
2.8.3	Material	NA
2.8.4	Creepage Distance	NA
2.8.5	Failing Load	NA
2.8.6	Net Weight	NA
2.8.7	Reference Standard	NA
2.1	BUSBAR JOINTS	
2.10.1	Type of Joint	Bolted lap joint with spring washer
2.10.2	No. of Bolts	2 No M12 Bolt (upto 2000A), 4 No M12 Bo (above 2000A)
2.10.3	Type of Bolts	HT Bolts (upto 1250A) Non-Magnetic Stainles Steel Bolts (above 1250A)
2.10.4	Insulation of Joints	Self amalgamated, self vulcanisating HT tape
2.10.5	Shrouding Material	Not Standard (Available on Request)
2.10.6	Whether Shrouding Removable	Yes
2.10.	BUSBAR IDENTIFICATION MARK	Band of Colour PVC Tape for Identification
2.11.	JUMPERS	
2.11.1	Material of Jumpers	Half Hard, Hard drawn, High Conductivity Copper as per IS-613.
2.11.2	Type of Joints	Bolted lap joint with spring washer
2.11.3	Insulation of Joints	Self amalgamated, self vulcanisating HT tape
2.11.4	Shrouding Material	Not Standard (Available on Request)
2.11.5	Whether Shrouding Removable	Yes
3	CIRCUIT BREAKER	
3.1	REFERENCE STANDARD	IEC-62271-100; 2006 , IEC-62271-1;2007
3.2	NO. OF PHASES & POLES	3
3.3	INTERRUPTING MEDIUM	Vacuum
3.4	RATED FREQUENCY	50 HZ +/- 3%
3.5	VOLTAGE CLASS	

3.5.1	Nominal System Voltage	Upto 11kV
3.5.2	Rated Voltage	Upto 12kV
3.5.3	Rated 1 min Power Frequency Withstand Voltage	
3.5.3.1	Between Live Terminal to Earth	Upto 35kV
3.5.3.2	Between Open Breaker Contacts	Upto 35kV
3.5.4	Rated 1.2/50 micro-sec Impulse Withstand Voltage	Upto 95kVp
3.6	CURRENT	
3.6.1	Rated continuous Current at 40 deg C Ambient	upto 2500/3150Amps
3.6.4	Rated Short Time Current for 3 sec..	upto 50kA rms
3.6.5	Rated Peak Withstand Current	upto 125kAp
3.6.6	Rated Making Current	upto 125kAp
3.6.7	Rated Breaking Current	
3.6.7.1	Symmetrical at System Voltage	50kA
3.6.7.2	Symmetrical at Rated Voltage	50kA
3.6.7.3	% DC Component	less than 35%
3.6.7.4	Asymmetrical	As per IEC
3.7	DUTY CYCLE	
3.7.1	Autoreclosing	O-0.3sec -CO-3 min -CO
3.7.2	Minimum Dead Time	300 ms
3.7.3	Whether Dead Time Adjustable	No
3.8	MAXIMUM INTERRUPTION TIME UNDER ALL CONDITIONS	
3.8.1	Opening Time	45 ms +/- 5 ms
3.8.2	Arcing Time	08 ms
3.8.3	Break Time	53 ms +/- 5 ms
3.9	MAXIMUM MAKE TIME UNDER ALL CONDITIONS	
3.9.1	Motor Operated Mechanism	47 ms +/- 5 ms
3.9.2	Solenoid Operated Mechanism	NA
3.10.	MAXIMUM SWITCHING OVERVOLTAGE GENERATED	
3.10.1	Switching off motors at no load	Within 2.5 P.U.
3.10.2	Switching off motors under during starting	Within 2.5 P.U.
3.10.3	Switching off motors under locked rotor condition	Within 2.5 P.U.
3.10.4	Switching off unloaded transformer	Within 2.5 P.U.
3.10.5	Switching off capacitor Banks	Within 2.5 P.U.
3.11	EXTERNAL DEVICE FOR LIMITING SWITCHING OVERVOLTAGE	Available on Request
3.11.1	Manufacturers Name	DDE

3.11.2	Type of Device	Zinc Oxide Surge Suppressors
3.11.3	Applicable Standard	DDE
3.11.4	Rated Voltage	DDE
3.11.5	Frequency	DDE
3.11.6	Rated Discharge Current	DDE
3.11.7	Rated 1.2/50 micro-sec Impuls Withstand Voltage	DDE
3.11.8	Over Voltage Withstand Capacity	DDE
3.11.9	Residual Voltage at Rated Discharge Current	DDE
3.11.10	Maximum Switching overvoltage with Device	DDE
3.12	TRANSIENT RECOVERY VOLTAGE PARAMETERS FOR TERMINAL FAULTS	3.6kV, 7.2kV, 12kV (RATED VOLTAGE)
3.12.1	For 30% Breaking Capacity	
3.12.1.1	TRV Peak Value "Uc" (kV)	6.6, 13, 22
3.12.1.2	Time Coordinate "T3" (micro sec.)	9, 11, 13
3.12.1.3	Time Delay "Td" (micro sec.)	2, 2, 3
3.12.1.4	Rate of Rise of Recovery Voltage "Uc/T3" (kV/ micro sec.)	0.77, 1.2, 1.7
3.12.2	For 60% Breaking Capacity	
3.12.2.1	TRV Peak Value "Uc" (kV)	6.6, 13, 22
3.12.2.2	Time Coordinate "T3" (micro sec.)	17, 22, 26
3.12.2.3	Time Delay "Td" (micro sec.)	3, 4, 5
3.12.2.4	Rate of Rise of Recovery Voltage "Uc/T3" (kV/ micro sec.)	0.39, 0.6, 0.85
3.12.3	For 100% Breaking Capacity	
3.12.3.1	TRV Peak Value "Uc" (kV)	6.2, 12.3, 20.6
3.12.3.2	Time Coordinate "T3" (micro sec.)	40, 52, 60
3.12.3.3	Time Delay "Td" (micro sec.)	6, 8, 9
3.12.3.4	Rate of Rise of Recovery Voltage "Uc/T3" (kV/ micro sec.)	0.15, 0.24, 0.34
3.13	FIRST POLE TO CLEAR FACTOR	1.5 FOR NON EFFECTIVE EARTHED SYSTEM
3.14	SPECIFIC SWITCHING REQUIREMENT	
3.14.1	Rated Short Line/Kilometric breaking Current	Not applicable below 52kV as per IEC 56 (1987) CL. No. 4.105
3.14.2	Rated Line Charging Breaking Current	Not applicable below 72.5kV as per IEC 56 (1987) CL. No. 4.107
3.14.3	Rated out of Phase Breaking Current	
3.14.3.1	For Earthed Neutral System	Not applicable below 100 kV. As per IEC 56 (1987) CL. No. 4.106
3.14.3.2	For Other than Earthed Neutral System	Refer table no VIA, CL.NO. 4.106 IEC 56
3.14.4	Rated Cable Charging Breaking Current	10A/ 10A/ 25A for 3.6 kV /7.2V/ 12kV
3.14.5	Rated Small Inductive Breaking Current	Test parameters under consideration of IEC as per Cl. No. 4.112

3.14.6	Rated Capacitor Bank Switch Current	
3.14.6.1	Three Phase	400 A
3.14.6.2	Whether Breaker Restrike Free	Yes
3.15	INTERRUPTER	
3.15.1	No. of interrupter per Phase	One
3.15.2	Pressure Inside Interrupter	10-7Torr
3.15.3	Method for in Service Vacuum Monitoring	Not required as sealed for life
3.15.4	Method to Check Contact Wear	Contact Wear Gauge
3.15.5	Method to Provide X-ray Shielding	Not required as not applicable under service conditions
3.15.6	Main Contact	
3.15.6.1	Type of Contact	Butt
3.15.6.2	Material of Contact	Copper Chromium Alloy for Contact Tip & OFHC Copper for Contact arm
3.15.6.3	Thickness of Silver Plating	Not applicable as not required
3.15.6.4	Contact Area	Not applicable as contact surface with projected configuration
3.15.6.5	Contact Pressure	Not applicable as contact surface with projected configuration
3.15.6.6	Short Circuit Rating	26.3kArms,31.5kArms,40kArms,44kArms,50kArms
3.15.6.7	Contact Force (kGf)	As per IEC
3.15.7	Arcing Contacts	Not applicable as not required
3.15.8	No. of Breaks per Phase	One
3.15.9	Material of Envelope	Alumina Ceramic
3.15.10	Endurance (No of Operations without Maintenance)	
3.15.10.1	At No Load (Mechanical Life)	30,000
3.15.10.2	At rated Current	10,000
3.15.10.3	At rated Short Circuit Current	100
3.16	OPERATING MECHANISM	
3.16.1	Fixed trip/ Trip Free	
	Motor Operated	Trip Free
	Solenoid Operated	NA
3.16.2	Type of Antidumping Device	Contact (Standard)
3.16.3	Type of Mechanism	Standard: Motor Operated, Spring Charge Stored Energy
3.16.4	Closing Coil	205W
3.16.4.1	Rated Voltage	Standard: 110 Dc. Other Voltage on request.
3.16.4.2	Voltage Operating Range	85% -110%
3.16.4.3	Power for Closing	
	At rated Voltage	Max under entire operating range Spring Charged Mechanisms : 205W
	At 80% rated Voltage	
	At 100% rated Voltage	
3.16.5	Trip Coil	115W
3.16.5.1	Rated Voltage	Standard: 110 Dc. Other Voltage on request.

3.16.5.2	Voltage operating range	70% -110%
3.16.5.3	Power for Tripping	
	At Rated Voltage	Max under entire operating range - 115 W
	At 70% Rated Voltage	
	At 110% Rated Voltage	
3.16.6	Spring Charging Motor	
3.16.6.1	Type of Motor	Universal
3.16.6.2	Rated Voltage	Standard 220V AC/ DC
3.16.6.3	Permissible Voltage Variation	+/- 10%
3.16.6.4	Power Rating	250W
3.16.6.5	RPM	130
3.16.6.6	Full Load Current	1.2A max at 230V AC
3.16.6.7	Starting Current	4.5A
3.16.6.8	Insulation Class	E
3.16.6.9	Time required to Charge spring	Less than 15 Second
3.16.6.10	Protection for Motor	HRC fuses
3.16.7	Operation sequence stored In spring	O -C - O
3.16.8	Is spring Immediately Charged After Closure	Yes
3.16.9	Slow Closing/ Opening for Maintenance	No
3.16.10	Provision for Manual Spring Charging	Provided
3.16.11	Type of Operation Counter	5 Digit, Stroke Counter/ not resettable
3.16.12	Mechanical Life	10000 Operations
3.17	LENGTH OF CONTACT TRAVEL	8 mm $\pm$ 1mm (In Vacuum Interrupter)
3.18	RATE OF CONTACT TRAVEL	
3.18.1	Closing	0, 7-1 m/ sec.
3.18.2	Opening	Approx. 1 m/ sec.
3.19	GAP BETWEEN OPEN CONTACTS	8 mm $\pm$ 1mm (In Vacuum Interrupter)
3.20.	TYPE OF ARC	ROTATORY
3.21	AUXILIARY CONTACTS	
3.21.1	No. of Auxiliary Contacts	6 NO + 6 NC
3.21.2	Whether Contacts Convertible	NO
3.21.3	Continuous Current rating	10A (Thermal)
3.21.4	Breaking Current	
	a) AC: Pf 0.3-0.4	5/3A for 110/240V AC
	b) DC: L/R 0.01 Sec	10/2/1A for 24/110/220V AC
3.21.5	Making Current	
	a) AC: Pf 0.7	5/3A for 110/240V AC
	b) DC: L/R 0.01Sec	10/2/1A for 24/110/220V AC
3.21.6	Whether Contact Silver Faced	Yes
3.21.7	Thickness of Silver Plating	25 microns
3.22	NET WEIGHT OF BREAKER	1250 A : 128 kG approx.
		2500 A : 170 kG approx.

3.23	MINIMUM CLEARANCE IN AIR	Not applicable as all live part insulated/shrouded Clearance below for fully insulated/interposing barrier Between interrupters.
3.23.1	Between Phases	NA
3.23.2	Phase to Earth	NA
3.24	MATERIAL OF INTERPHASE BARRIER	EPOXY
3.25	CRITICAL CURRENT (CURRENT GIVING MAX ARC DURING BREAKING)	Not Applicable
3.26	Primary Disconnects	
3.26.1	Type	Jaw Type Contact
3.26.2	Contact Material	Hard Drawn High Conductivity Copper to IEC 613
3.26.3	Self-Aligning	Yes
3.27	Secondary Disconnects	
3.27.1	Type	Plug & Socket with Umbilical cord
3.27.2	Contact Material	Copper
3.27.3	Self-Aligning	Yes
4	CABLE BOX	
4.1	POWER CABLE ENTRY FROM	Bottom/Side/Top
4.3	POWER CABLE ACCOMMODATION	
4.3.1	No. of Cables in Standard Panel	2 Nos./ ph, 1000mm ² Single core OR 2 Nos./ ph, 630mm ² Three core
4.3.2	Additional No. of Cables in Standard Extension	2 Nos./ ph, 1000mm ² Single core OR 2 Nos./ ph, 630mm ² Three core
4.4	POWER CABLE GLAND	Not Required
4.4.1	a) Material	N. A.
4.4.2	b) Thickness	N. A.
5	CONTROL WIRING	
5.1	CONTROL CABLE ENTRY FROM	Front Top/ Front Bottom
5.2	CONTROL CABLES	
5.2.1	Size For Control Circuit	1.5 Sq.mm (Std) 2.5 Sq.mm.(optional)
5.2.2	No. of Strands	48x0.2mm ² (1.5); 80x0.2mm ² (2.5)
5.2.3	Size For Current Circuit	2.5 Sq.mm.
5.2.4	No. of strands	80x0.2mm ² OR 50x0.25mm ²

5.2.5	Voltage Class	
5.2.5.1	Rated Voltage	1100V
5.2.5.2	1 minute Power Frequency Voltage	2 kV
5.2.6	Control Wiring Tined/ Untinned	Untinned (tinned Available on request)
5.2.7	Material of Insulation and Sheath	PVC
5.2.8	Is Control Cable FRLS Type	Not Standard. (Available on Request)
5.2.9	Color Coding	Not Standard. (Available on Request)
5.2.9.1	DC Control Circuit	Grey with Blue Band Eyelet
5.2.9.2	AC Auxiliary Power Circuit	Black with Blue Band Eyelet
5.2.9.3	AC Metering Circuit	Red, Yellow, and Blue for Respective Phases
5.2.9.4	Earthing	Green
5.2.12	Ferrules Provided at Both ends	Yes
5.2.13	Insulation Sleeves at Wire Termination	PVC
5.3	CONTROL CABLE GLAND	Not Required
5.3.1	a) Material	N. A.
5.3.2	b) Thickness	N. A.
6	SUPPORT INSULATOR	
6.1	Material	Epoxy Cast
6.2	Rated Voltage	upto 12kV
6.3	1 min. Power Frequency Withstan Voltage	upto 35kV
6.4	1.2/50 micro sec. Impulse Withstan Voltage	upto 95kVp
6.5	Minimum Creepage Distance	325mm
6.6	Cantilever Strength	1250 kG
6.7	Net Weight	1.32 kG

GUARANTEED TECHNICAL PARTICULARS FOR
11KV 3.5Core X 400Sq mm, Aluminum Round Armored XLPE Cable

The bidder should fill up Technical particulars of 11 kV panel in the following format)

Name of the Bidder: _____

Sl. No.	Particulars	unit	HT UG Cable
1	Cables		
	a) Name of manufacturer		
	b) Place of manufacture		
2	Cable Type		A2XWY
3	Applicable specification & standards voltage Grade		IS: 7098 (Part-2) /11kV
4	Suitable for effective Earth/Unearth system		
6	Permissible voltage & frequency variation for satisfactory operation		
7	Continuous current for standard condition as per IS:		
	a) In air (45° C)	Amps	
	b) In Ground (30° C)	Amps	
	c) In Duct	Amps	
8	Conductor		
	a) Material		Aluminium (H2/H4 Grade)
	b) Shape of conductor		Standard compacted circular
	c) Geometrical cross sectional area	mm ²	
	d) Number of wire: (min)	No	
	e) Diameter of Wire : mm before compacting & strand Diameter	mm	
	f) Maximum DC resistance of the conductor at 20° C	Ω/KM	(CR value only for reference) Resistance test conductor to 5mtrs sample (Not in full drum length)
	g) Sampling batch for test		10% of ordered quantity
9	Conductor Screening		
	a) Material		Pressure Extruded Semiconducting compound
	b) Process		Triple Extrusion
	c) Thickness (Min)	mm	

	d) Continuous working temp	deg.C	90
	e) Max allowable temp at termination of short circuit	deg.C	250
10	Insulation:		
	a) Material		XLPE
	b) Thickness of Insulation (Nom)	mm	
	i) Between Cores	mm	
	ii) Between Cores & Inner Sheath		
	c) Minimum thickness of insulation at any one point	(mm)	
	d) Extrusion Type		Pressure Extruded
	e) Specific insulation resistance at 90° C	Ohm-cm	
	f) Process of Curing		
	g) Hot Set test:		
	a) Elongation under load	%	 Max
	b) Maximum Permanent elongation after cooling	%	Max
	c) Tensile Strength at break	N/mm ²	 Minimum
	d) Elongation at break	%	 Min
11	Insulation Screening:		
	a) Material		Extruded Cross linked semi conducting compound
	b) Min. Thickness of extruded semi conducting layer	mm	
	c) Metallic Part: (Material)		Plain copper tape
	d) Size of copper Tape	mm	0.045
	e) Whether over lapping provided		Min 5% of Overlapping
	f) Short Circuit rating in 1 sec.	KA	
12	Inner Sheath		
	a) Material		PVC -ST2
	b) Extrusion Type		Pressure Extruded
	c) Thickness (Min)	mm	
	d) Nominal Dia over Inner Sheath	mm	
13	Armouring		
	a) Material		Galvanised Steel
	b) Type of armouring		Round wire
	c) Nominal Dimension of Armour wire	mm	 Dimension and % of Tolerance
	d) Number of wires(not less than as per CSR 18-19)		 Numbers
	e) Whether Galvanised		
	f) Mass of Zinc coating	gm/mm ²	
	g) Nominal Dia over Armouring	mm	

	h) Short Circuit rating in 1 sec	KA	
14	Outer Sheath		
	a) Material		Extruded PVC Compound Type ST-2
	b) Extrusion type		Extruded
	c) Min. thickness of sheath	mm	
	d) Nominal Overall diameter of cable	mm	
	e) Thermal stability test for sheath	Minutes	100 minutes(Min) Number of test specimen:6 Test results shall be within the range of $\pm 5\%$ variation.
15	Short circuit withstand capacity		
	a) Short Circuit withstand capacity	KA	
	b) Duration of short circuit	sec	one
16	AC resistance per core at operating temperature	ohm/km	
17	Reactance Ohm/Km	ohm/km	
18	Capitance per core	$\mu\text{F/Km}$	
19	Allowable maximum conductor temperature when carrying current		
20	Insulation resistance at 27° C	ohm-cm	
21	Loss tangent		
22	Maximum cable charging current at normal operating volt	A/km	
	Additional data		
23	Core identification		Application of coloured stripes Red, Yellow & Blue
24	Standard Packing Length and Tolerance	Mtrs	

Validate

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Help

Item Rate BoQ

Tender Inviting Authority: The Registrar, IISc, Bangalore

Name of Work: Supply,Installation,Testing & Commissioning of 2500kVA CSS at CAF building in IISc, Bangalore

Tender No: IISc/Tender-1/2020-21

Name of the Bidder/
Bidding Firm
/ Company :

PRICE SCHEDULE for Indigenous Items: Notes for bidder
1. Bidder must mandatorily quote basic rate and GST percentage for each item.
2. For all general notes full description and other details Bidder must refer BOQ in tender document and quote accordingly.

Sl. No.	Item Description	Quantity	Unit	Basic Rate per Unit	GST in %	GST Rate per Unit	Amount Including GST	Total Rate in Words
1	2	4	5	13	16	17	54	55
1	Supply, Installation, Testing and commissioning of 11kV 1250A, 350/500MVA, 25kA for 3 Sec HT Indoor single panel VCB Board unit made out of M.S sheet steel clad dust and vermin proof with 1250A Aluminium Busbars, interconnections, necessary protections, measuring Instruments, Indicating Instruments, Protection Relays, CTs, PT with necessary control fuses/MCBs, Termination arrangements for Incoming and Outgoing Cable of 11 kV 3Core 400Sq.mm. XLPE Alu. Armoured earthed cable, Terminal Blocks, Earthing, Painting, etc., with complete all accessories as required for satisfactory operations and as per the detailed technical specifications attached. The VCB panel shall be aligned with the existing 11 KV HT panel & shall be compatible to connect with existing SCADA network with IEC 61850 compatability for remote operation. Make: Siemens / Schneider / Eaton	1	Job			0.00	0.00	INR Zero Only
2	Supply, store, Excavation, laying, Refilling, testing, commissioning and handover of 11 KV grade, 3 Core 400 sq.mm (Earthed), compact, circular and stranded Aluminium conductor, covered by XLPE insulation, shielded with black extruded semi-conducting compound, round wire armoured cable as per latest BESCOM specification from 66KV MRSS -to- CAF New CSS. The Cable to be laid in 300mm dia hume pipe including earth digging & refilling etc as required.	500	Mtrs			0.00	0.00	INR Zero Only
3	Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, 400 Sq.mm XLPE aluminium conductor cable of 11 KV grade as required	2	Nos			0.00	0.00	INR Zero Only
4	Supplying and fixing cable route marker with 10 cm X 10 cm X 5 mm thick G.I. plate with inscription there on, bolted /welded to 35 mm X 35 mm X 6 mm angle iron, 60 cm long and fixing the same in ground as required.	50	Nos			0.00	0.00	INR Zero Only
5	BUS DUCT: 1.1 kV Grade 2500 Amps, 3ph, 4 wire, 415V, 50KA Aluminium Air Insulated type Busduct (Outdoor), with neutral of 100% of phase conductor rating, IP-54, with suitable size of earth bus on both sides of busduct, for connectivity as per the following. The accessories indicated below are tentative. However, Contractor to assess actual as per the drawing shared. - CSS to HVAC Panel - a) Straight Run	10	Mtr			0.00	0.00	INR Zero Only
6	b) Terminal Flange	2	Nos			0.00	0.00	INR Zero Only
7	c) Elbows	4	Nos			0.00	0.00	INR Zero Only
8	d) Black painted MS Supporting Brackets	10	Nos			0.00	0.00	INR Zero Only
9	e) Flexible	2	Sets			0.00	0.00	INR Zero Only
10	f) Installation, Testing and Commissioning of LT Busduct	1	Job			0.00	0.00	INR Zero Only
11	Supply and Installation of 3 Mtrs 40mm Dia Class "B" GI Pipe Earth station, with including construction of brick pedestal, providing meshed funnel, 450 X 450 CI heavy duty cover, brick work of 1.5 cubic mtr and other civil engineering works, spreading a homogenous mixture of salt and charcoal around the pipe, copper bolt nut etc, completely as per IS 3043, 1987 or latest revision. The Rate is also include Brick masonry chamber with Precast frame, Chamber, Plastering CI Frame and CI Cover, Watering, funnel, GI fasteners and heavy duty precast cover complete with Laying & Connecting of 50X6 / 25X6 GI Strip & 25X6 Copper Strip to the Transformer Earth Terminal Earthing etc as required.	7	No			0.00	0.00	INR Zero Only
12	Supply & Laying of 30x6mm Cu. Strip	50	Mtr			0.00	0.00	INR Zero Only
13	Supply & Laying of 50x10mm GI Flat	150	Mtr			0.00	0.00	INR Zero Only
14	Supply, Installation, Testing & Commissioning of 11kV/433V, 2500kVA, Outdoor Compact Substation with the following items as per technical specifications attached. 1) SF6 Insulated 3 Way DAS RMU with IEC 61850 Relay 2) Resin Cast Dry Type 2500kVA Transformer with OCTC, 3) ACB & MCCBs	1	Job			0.00	0.00	INR Zero Only
15	Civil Foundation for CSS with necessary concrete, size stones, angles / Channels and plastering works complete in all respects as per OEM Foundation Specification & Drawings	1	Job			0.00	0.00	INR Zero Only
Total in Figures							0.00	
Quoted Rate in Words				INR Zero Only				