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PUNJAB TECHNICAL UNIVERSITY

NOTICE

Sub : **Supply, Installation, testing and commissioning of External Electrical works including civil works for Electric Sub-station at Punjab Institute of Technology, Rajpura (Punjab).**

Due to administrative reasons, the tenders invited for the subject work are hereby cancelled.

(H. P. Singh)
Executive Engineer

TENDER DOCUMENT

FOR

SUPPLY, INSTALLATION, TESTING

AND

COMMISSIONING OF

EXTERNAL ELECTRICAL WORKS

INCLUDING CIVIL WORKS

AT

PUNJAB INSTITUTE OF TECHNOLOGY RAJPURA (PUNJAB)

TECHNICAL BID

PART - I

JULY 2014

PUNJAB TECHNICAL UNIVERSITY
JALANDHAR-KAPURTHALA HIGHWAY
PUNJAB

CONTENTS

PUNJAB TECHNICAL UNIVERSITY
JALANDHAR-KAPURTHALA HIGHWAY
(PUNJAB)
(Established By Punjab Government)

NOTICE INVITING TENDER

1.0 Sealed tenders are invited from contractors/agencies having requisite experience and financial capability under 'Two Packet System' (Technical Bid – Unpriced & Financial Bid – Priced) on behalf of Punjab Technical University hereinafter referred as PTU for the following works:-

S. No.	Name of Work	Estimated cost (Rs)	Earnest Money (Rs)	Completion Period
1.	Supply, Installation, testing and commissioning of External Electrical works including civil works for Electric Sub-station at Punjab Institute of Technology, Rajpura (Punjab) – a constituent campus of Punjab Technical University.	58.53 lacs	1,17,000/-	4 months

2.0 The tender document can be obtained from 10.00 AM to 04.00 PM on all working days from 03.07.2014 to 23.07.2014 from the office of 'The Registrar, Punjab Technical University, Jalandhar-Kapurthala Highway, Punjab on payment of Rs. 1000/- (Rupees One Thousand only), non-refundable, in cash or demand draft/pay order drawn in favour of 'The Registrar, Punjab Technical University payable at Jalandhar towards the cost of one tender document. Tender document can also be downloaded from PTU's website www.ptu.ac.in and in such a case, the bidder shall deposit the cost of tender documents alongwith submission of the tender, failing which his tender shall not be opened. The cost of tender documents in this case shall be deposited in the form of demand draft/pay order and submitted in the envelope containing Earnest Money Deposit (EMD).

3.0 The Earnest Money for an amount as specified above shall be deposited in the form of demand draft/pay order drawn in favour of 'The Registrar, Punjab Technical University' payable at Jalandhar.

4.0 The bidders are advised not to make any corrections, additions, alterations in the downloaded tender documents. In case, any corrections, additions, alterations are made in the downloaded tender documents, such tender shall not be considered.

5.0 Eligibility Criteria:

Eligibility Criteria of the bidders shall be assessed based upon the "Qualifying Criteria" forming part of the tender documents.

6.0 PTU may issue addendum(s)/corrigendum(s) to the tender documents. In such case, the addendum(s)/corrigendum(s) shall be issued and placed on PTU's website atleast three days in advance of date fixed for opening of tender. The bidders who have downloaded the tender documents from website must visit the website and ensure that such addendum(s)/corrigendum(s) (if any) is also downloaded by them. Such addendum(s)/corrigendum(s) (if any) shall also be submitted, duly stamped and signed, alongwith the submission of the tenders. Any tender submitted without addendum(s)/corrigendum(s) (if any) is liable to be rejected.

7.0 The tender documents shall be submitted in two separate sealed packets viz. Packet-I containing Technical Bid and Packet-II containing Financial Bid.

Detailed credentials as per the requirement of eligibility criteria and all tender papers except Bill of Quantities are to be submitted in "Technical Bid".

Tender documents issued by PTU or downloaded, duly stamped and signed on all pages shall also be deposited in the envelope containing Technical Bid (Packet-I). In case, any tenderer will not submit these documents alongwith the tender, his bid will be out-rightly rejected.

All DDs/cash receipts for cost of documents and DD for EMD, must be enclosed in a separate envelop alongwith Technical Bid.

Bill of Quantities with rates duly filled in are to be submitted in "Financial Bid".

8.0 Completed tender documents in two packets viz. Packet-I and Packet-II shall be sealed separately in envelopes super-scribing as Packet-I (Technical Bid) and Packet-II (Financial Bid) along with the name of the work. These two sealed envelopes and the envelop (super-scribing "Earnest Money and cost of tender documents for the work" containing the Earnest Money and cost of tender documents) in the form as prescribed in the tender documents shall further be sealed in a larger envelope super-scribing the name of the work as stated above (alongwith date and time of opening of tenders) and should be deposited in the tender box at the following address:

THE REGISTRAR,
PUNJAB TECHNICAL UNIVERSITY
JALANDHAR-KAPURTHALA HIGHWAY
PUNJAB

before **12.00 hours of 24.07.2014**. Tenders (Technical Bids only) shall be opened at **12:30** hours on the same day in the presence of the tenderers or their authorised representatives intending to attend the opening. After evaluation of the technical bids, the financial bids of only those agencies who fulfill the eligibility criteria specified in the tender documents shall be opened. The date, time and location for opening of financial bids of these shortlisted agencies will be intimated separately to enable intending agencies to attend and opening of financial bids. The decision of PTU regarding evaluation/fulfillment of eligibility criteria shall be final and binding. Any bid received later than the time and date of opening of Technical bids shall be rejected and returned to the bidder unopened.

9.0 In case, the date of submission/opening of tenders happens to be holiday, the tenders shall be received/opened on the next working day.

10.0 Tender shall be submitted as per "Instructions To The Tenderers" forming a part of the tender document.

11.0 Any tender received without Earnest Money & the cost of tender document in the form as specified in tender documents shall not be considered and shall be summarily rejected.

12.0 PTU reserves the right to cancel the tenders or postpone the tender and to accept/reject any or all tenders without assigning any reasons thereof.

13.0 Tenderers may note that they are liable to be disqualified at any time during tendering process in case any of the information furnished by them is not found to be true. EMD of such tenderer shall be forfeited. The decision of PTU in this regard shall be final and binding.

14.0 The validity of the offer shall be 90 days after the date of opening of the tender. If any bidder withdraws his tender within the validity period or makes any modifications in terms and conditions of the tender and/or rates after submission of tender which are not acceptable to PTU or does not start the work within stipulated period from the date of issue of letter of acceptance, then PTU shall without prejudice to any other right or remedy, be at liberty to forfeit the earnest money deposited by the bidder. In case of forfeiture of EMD, the tenderer shall be debarred from bidding in case of re-invitation of the tenders.

15.0 The transfer of tender documents purchased by one intending tenderer to another tenderer is not admissible. Tenderer can submit tenders only on the documents purchased/downloaded from PTU's website.

Registrar
Punjab Technical University

ELIGIBILITY CRITERIA:

The tenderers **fulfilling all the following** shall be considered as qualified for opening of financial bids:

1. Similar Works:

The tenderer should possess the experience of having successfully completed similar works during the last five years (ending last day of the previous month to the one in which tenders are invited) as under:

1.1 Any of the following:-

i. Three External Electrical works each costing not less than Rs. 15.0 lacs.

ii. Two External Electrical works each costing not less than Rs. 19.0 lacs.

iii. One External Electrical work costing not less than Rs. 30.0 lacs.

AND

1.2 Any of the following:-

i. Three building works each costing not less than 8.0 lacs.

ii. Two building works each costing not less than 11.0 lacs.

iii. One building work costing not less than 17.0 lacs.

The bidders should submit performance certificates issued by the Clients for having successfully completed the works.

2 The agency should have minimum average annual turnover of Rs. 50.0 lacs in the last 3 financial years from construction works.

The financial turnover shall be judged from annual reports and/or profit and loss account statement duly signed by the Chartered Accountant. The bidders should submit these reports for the financial years 2013-14, 2012-13 and 2011-12 alongwith the bids. Alternatively, Chartered Accountant's certificate indicating the turnovers may also be submitted.

3 The bidder should not have been blacklisted or debarred from bidding or declared as a non-performer by any Govt./Semi Govt./Autonomous body. The bidders shall submit an affidavit duly attested by Notary that they have not been blacklisted or debarred from bidding or declared as a non-performer by any Govt./Semi Govt./Autonomous body.

4 The bidders should have the following registrations/documents:

i. Provident Fund Registration.
ii. VAT Registration
iii. Valid PAN in the name of the bidder.

In case, any agency is not having the above registrations i.e. S. No. i and ii, the agency shall submit an undertaking that he will get the same in case the work is awarded to him.

Enclose self attested copies of the above registration certificates.

SPECIAL CONDITIONS OF CONTRACT

1.0 **Date of commencement:** On 7th day after issue of "Letter of Acceptance".

2.0 **Date of completion:** All the works shall be completed in a phased manner within four months from the date of commencement of works.

3.0 **Tender bond (earnest money):** Rs. 1,17,000/- (Rupees One Lac Seventeen Thousand only) by way of Demand Draft shall be adjusted against Security deduction from on account bills.

4.0 **Deleted**

5.0 **Security deposit:** An amount @ 10.0% of the running on-account bills/final bill will be deducted towards security deposit after adjusting earnest money deposit, which may be released against submission of Bank Guarantee on satisfactory completion of works. This Bank Guarantee shall remain valid till Defect Liability Period plus two months. No interest can be claimed for the deposit of earnest money or security money which will be lying with the Punjab Technical University.

The certificate for satisfactory completion of Defect Liability Certificate shall be issued by the Engineer-in-charge.

6.0 **Deleted**

7.0 **Deleted**

8.0 Deleted.

9.0 **Running Bill Value:** Only one bill shall be submitted/paid in a month.

10.0 **Defects Liability Period:** The defect liability period will be 12 months from the date of completion of works in all respects.

11.0 **Insurance and Registration:** The tenderer shall allow in their Tender for arranging the following insurances policies such as Workmen Compensation Policy and Contractors All Risk Policy in joint names of The Punjab Technical University and the Contractor with The Punjab Technical University name appearing first in the policy.

i. Comprehensive project insurance: The project shall be insured for 120% of its full Contract value till handing over;

ii. Third party insurance in respect to injury of persons and damage to property shall be as follows.

a) Public Liability: Limit for bodily injury or death not more than Rs 1.0 lacs for one person and Rs 2.0 lacs for any one accident with no limit on the number of accidents.

b) Property Damages: Limit for each accident not more than Rs 5 lacs.

The above insurance coverage shall be taken out before physical start of work and maintained by the Contractor for the duration of Contract including the extended periods, if any.

No certificate of payment shall be issued by the Engineer, if the contractor fails to arrange for total insurance cover.

Indemnity Bond: The Employer / Engineer shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or his sub-contractor or petty contractor. The contractor shall indemnify and keep indemnified the Employer / Engineer against all such damages and compensation for which the Contractor is liable. An Indemnity bond shall be furnished by the Contractor in this regard. Performa for furnishing the Indemnity Bond is forming part of the tender documents.

12.0 Submission of Policies and other documents: The original policies, receipts for premium, guarantees and certificates shall be deposited with the Engineer, and the Engineer, reserves the right to withhold any payment until all the provisions of this clause have been complied with.

13.0 Contractor will comply with payment of Wages Act, Minimum Wages Act, Employer's Liability Act and Contract labour Rules etc. and any other Statutory Act as applicable from time to time.

14.0 **Liquidated Damages**: Liquidated damages will be charged @ 0.25% of original Contract value per day subject to a maximum of 5% of the original Contract value. The Contractor may make a representation to the BOG committee to reduce the amount and BOG committee's decision in this regard shall be final.

15.0 **Facilities**: The Employer shall not provide any facilities like water; electricity etc. at site and the contractor shall have to make his own arrangements for the same.

16.0 **Material Issue**: All materials are to be purchased by the Contractor. The same will be brought to the Site with challans in quadruplicate, to be entered at the security gate (1 copy to be given to security), stamped and submitted to the Engineer of the Site for quality control. (1 copy for Contractor record, 1 copy for Engineer).

17.0 **Tax Deductions**: All taxes like Income Tax, Sales Tax, Turnover Tax, Octroi, VAT, Labour Cess etc as applicable will be deducted and deposited with the concerned Govt. Department by the Employer and the Employer will give certificate/proof to the Contractor as per Income Tax, Sales Tax and W.C. Tax Rules. Service tax as applicable will be payable by the Contractor directly.

18.0 **E.S.I/E.P.F.**: Clearance from appropriate authority to be obtained and submitted by the Contractor otherwise suitable amount payable to E.S.I/E.P.F. will be withheld.

19.0 **Quantities in Bill of Quantities**: Quantities shown against each item are provisional and likely to increase or decrease. Some of the items may be omitted altogether. No claim whatsoever shall be entertained on this account. All other terms and conditions of the contract shall remain unaffected by such alteration.

20.0 **Temporary Work:** The areas under constructions are to be cordoned off such that no visitors are put to inconvenience. Appropriate signage of "Work under progress" is to be displayed. In addition, the Contractor shall abide by the Safety code provision as per Indian Standard Safety Code framed from time to time for all the temporary works including shuttering and scaffolding.

21.0 Deleted.

22.0 **For New Items (Non-Scheduled Items):** For items not included in the tender, the rates for these items will be derived from CSR of Punjab PWD after applying quoted percentage. If the similar item is not available in the CSR also, then the market rate analysis will be carried out in which the contractor profit, supervision and overhead is fixed at 15%. Work contract tax and VAT as applicable will be paid extra**.** Analysis of rates for the new items will be submitted by the Contractor and got approved from the Engineer, before execution.

23.0 **Time Schedule:** Immediately on award of contract the contractor shall furnish to the Engineer a time bound schedule of completion schedule and all related schedule resources.

24.0 **Deleted.**

25.0 **Canvassing** in connection with the tenders is strictly prohibited and the tenders submitted by the Contractors who resort to canvassing will be liable to rejection.

26.0 Deleted.

27.0 Scope of Work:

The scope of work is supply, installation, testing and commissioning of electrical sub-station i.e. external electrical works including transformer, panels, cables, DG set and related works plus civil works of sub-station building at PTU's constituent campus Punjab Institute of Technology at Works Centre, Rajpura (Punjab).

28.0 Approval of Source for procurement of various materials:

Before start of the work, the Contractor shall get approval of source/factory for procurement of various materials required for the works from PTU and its Architect. In the interest of timely completion of works, PTU may consider approval of more than one source. However, it will be ensured by the contractor that the materials procured from different sources will not be mixed while fixing. All materials shall be procured by the Contractor from approved source(s) only for which documentary evidences shall be submitted by the Contractor.

INSTRUCTIONS TO TENDERERS

1. Definitions

1.1 The tender documents consist of **Part I – Technical Bid :** Notice Inviting Tender, Special Conditions of Contract, Instruction to Tenderers, General Conditions of Contract, Technical Specifications, Tender forms, Tender Drawings and DDs/Cash Receipt for cost of tender documents and EMD; **Part-II – Financial Bid –** Bill of Quantities.

1.2 Definitions set forth in the general conditions of the contract for construction, or in other contract documents are applicable to the tender documents.

1.3 Addenda / Corrigenda: Graphic instruments or revised agreement or conditions issued by the Employer prior to submission of tender, which modify or interpret the tender documents by additions, deletions, clarifications or corrections.

1.4 A tender is a complete and properly signed proposal to do the work for the sums stipulated therein, submitted in accordance with the tender documents.

1.5 The base is the percentage (higher or lower) stated in the tender for which the tenderer offers to perform the work described in the tender documents, above or below the estimated cost, to which work may be added or from which work may be deleted for items stated in the tender.

1.6 A unit price is an amount stated in the tender as a price per unit of measurement for materials, equipment or services or a portion of the work as described in the tender documents.

1.7 A tenderer is a person or entity that submits a tender.

1.8 A sub-tenderer is a person or entity that submits a tender to the tenderer for materials, equipment, labour or for a portion of the work.

2. Tenderer's representations

2.1 The tenderer by making a tender shall mean that:

2.1.1 The tenderer has read and understood the tender documents and the offer is made in accordance therewith.

2.1.2 The tenderer has read and understands the tender documents or contract documents to the extent that such documentation relates to the work for which the tender is submitted, for other portions of the project, if any, being tendered concurrently or presently under construction.

2.1.3 The tenderer has visited the site, become familiar with local conditions under which the work is to be performed, has correlated the tender's personal observations with the requirements of the proposed contract documents and has made allowances in his quote for any difficulties, site conditions etc. in carrying out the work in accordance with the specifications, conditions of contract etc. even though these may not be specifically mentioned.

2.1.4 The tender is based upon the materials, equipments, labor and the systems required by the tender documents without exception.

3. Tender documents

3.1 **Copies**:

3.1.1 Tenderers may obtain complete sets of the tendering documents from the issuing office designated in the advertisement or invitation to tender or the same can be downloaded from PTU's website.

3.1.2 Tenderer's documents will not be issued directly to sub-tenderer's or others. Tenderer assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of tender documents.

3.1.3 In making copies of the tender documents available on the above terms, the Employer and Architect do so only for the purpose of obtaining tenders on the work and do not confer a license or grant permission for any other use of the Tender Documents.

3.2 Interpretation or correction of Tender documents.

3.2.1 The Tenderer shall carefully study and compare the tender documents with each other, and with other work being tendered concurrently or presently under construction to the extent that it relates to the work for which the tender is submitted, shall examine the site and local conditions, and shall report in writing to the Engineer for errors, inconsistencies or ambiguities discovered at least three days before the last date of submission of tenders.

3.2.2 Tenderers and sub-tenderer's requiring clarifications or interpretation of the tender documents shall make a written request at least seven days before the last date of submission of tenders.

3.2.3 Interpretations, corrections and changes of the tender documents will be made by the Employer by addendum / corrigendum. Interpretations, corrections and changes of the tender documents made in any other manner will not be binding, and tenders shall not rely upon them.

4 Addenda and corrigenda

4.1 Addenda and corrigenda, if any, will be mailed / faxed to all who are known by issuing office to have purchased a complete set of tender documents. The same will also be uploaded on PTU's website.

4.2 Copies of addenda and corrigenda, if any will be made available for inspection at the office of the Executive Engineer, PTU, Jalandhar.

4.3 No addenda and corrigenda will be issued later than three days prior to the date for receipt of tenders except an addendum and corrigendum withdrawing the request for tenders or one which includes postponement of the date for receipt of tenders.

4.4 Each tenderer shall ascertain prior to submitting a tender that the tenderer has received all addenda and corrigenda issued, and the tenderer shall acknowledge their receipt in the tender.

5 Tendering procedures

5.1 Form and style of tenders:

5.1.1 Tenders shall be submitted on the original forms included in the tender documents and this written data will form part of the agreement between the employer and the contractor.

5.1.2 All blanks on the tender form shall be filled in by typewriter / electronically printed or manually in ink.

5.1.3 The rates for items shall be written both in figures and words and in case of discrepancy between the amount in figure and in words, the amount written in words shall govern.

5.1.4 Interlineations, alterations and causers must be initialed by the signer of the tender.

5.1.5 Deleted

5.1.6 Submission of tenders by a Joint Venture firm or Consortium is not permitted.

5.2 Tender security/Earnest Money:

5.2.1 Each tender shall be accompanied by the tender security/Earnest Money in the form and amount required pledging that the tenderer will enter into an agreement with the Employer on the terms stated in the tender and will furnish bonds covering the faithful performance of the contract and payment of all obligations arising there under. Should the tenderer refuse to enter into such contract or fail to furnish such bonds if required, the amount of the tender security shall be forfeited to the Employer as penalty.

5.2.2 Earnest money/Tender security for an amount, as specified in Notice Inviting Tender will be submitted in the form of demand draft/Pay order only. If the tender is not awarded with in the validity period / extended validity period, the earnest money will be refunded.

5.3 Submission of tenders

5.3.1 The tender documents shall be submitted in two separate sealed packets viz. Packet-I containing Technical Bid and Packet-II containing Financial Bid. Detailed credentials as per the requirement of eligibility criteria and all tender papers except Bill of Quantities are to be submitted in "Technical Bid". Bill of Quantities with rates duly filled in are to be submitted in "Financial Bid".

5.3.2 Completed tender documents in two packets viz. Packet-I and Packet-II shall be sealed separately in envelopes super-scribing as Packet-I (Technical Bid) and Packet-II (Financial Bid) along with the name of the work. These two sealed envelopes and the envelop (super-scribing "Earnest Money and cost of tender documents for the work" containing the Earnest Money and cost of tender documents) in the form as prescribed in the tender documents shall further be sealed in a larger envelope super-scribing the name of the work as stated above (alongwith date and time of opening of tenders) and should be deposited in the tender box at the following address:

THE REGISTRAR,
PUNJAB TECHNICAL UNIVERSITY
JALANDHAR-KAPURTHALA HIGHWAY
PUNJAB

5.3.3 The tenderer shall assume full responsibility for timely delivery at the location designated for receipt of tenders. Oral, telephonic or telegraphic tenders are invalid and will not receive consideration.

5.4 Modification or withdrawal of tender

5.4.1 A tender shall not be modified, withdrawn or cancelled by the tenderer during the stipulated time period following the time and date designated for the receipt of tenders, and each tenderer so agrees in submitting a tender. If tender is withdrawn within validity period, the tender bond (earnest money deposit) will be forfeited.

5.4.2 Tender once submitted can not be withdrawn / amended and if any contractor does so, his earnest money will be forfeited.

6 Consideration of tenders

6.1 Opening of tenders: The Employer will open all the Tenders (Technical Bids only) received (except those received late), in the presence of the Tenderers or their representatives who choose to attend the opening. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

6.2 "Part I; Technical Bid", shall be opened first and if the same is found to be incomplete in any respect, or if the Cost of tender documents and/or Earnest Money is not found in the envelope – then the Tender shall be rejected and "Part II; Financial Bid" of the concerned Tenderer shall not be opened.

6.3 Rejection of tenders : The Employer shall have the right to reject any or all tenders for any reason whatsoever without disclosing the same including but not limited to rejecting a tender not accompanied by required tender security or by other data required by the tender documents, or reject tender which is in any way incomplete or irregular.

6.4 Acceptance of tender (award): Acceptance of Lowest tender is not obligatory and the employer reserves the right to reject any or all the tenders received without assigning any reason.

7 Post-Tender information

7.1 Submittals

7.1.1 The tenderer shall, within 3 days after notification of selection for the award of a contract, furnish the following to the employer's projects team in writing**:**

a. A designation of the work to be performed with the tenderer's own forces.

b. Name of the manufacturers, products and the suppliers of principal items or systems of materials and equipment proposed for the work.

c. Name of person or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the work.

7.2 The tenderer will be required to establish to the satisfaction of the Employer the reliability and responsibility of the persons or entities proposed to furnish and perform the work described in the tender documents.

7.3 Prior to the award of the contract, the Engineer will notify the tenderer in writing if The Employer after due investigation, has reasonable objection to a person or entity proposed by the tenderer. If The Employer has reasonable objection to proposed person or entity, the tenderer may, withdraw the Tender, or submit an acceptable substitute person or the entity with an adjustment in the base tender or alternate tender to cover the difference in cost occasioned by such substitution. The Employer's projects team may accept the adjusted tender price or disqualify the tenderer. In the event of either withdrawal or disqualification, the Tender bond will be forfeited.

7.4 Person and entities proposed by the tenderer and to whom The Employer has made no reasonable objection must be used on the work for which they were proposed and shall not be changed except with the written consent of the Employer's projects team.

8 Deleted

9 Agreement between Employer and Contractor

9.1 Once the contract has been awarded, the party shall enter into a formal agreement on the broad terms of this tender. Unless otherwise required in the tender documents, the agreement for the work will be written on "Construction Contract Agreement" between The Punjab Technical University and contractor where basis of payment is a quoted percentage of the estimated cost above or below which the contractor agrees to works . The following shall be deemed to form and be read and construed as part of the contract:

A. Part I containing:
   1. Notice Inviting Tender
   2. Special Conditions of Contract;
   3. Instruction to tenderers;
   4. General Conditions of Contract;
   5. Technical specifications,
   6. Tender Forms;
   7. Tender Drawings

B. Part II containing Priced schedule of quantities with accepted rates; and

C. All addenda and corrigenda, if any.

9.2 The Agreement shall be drawn up in quadruplicate, the original and a copy of which shall remain in the custody of the Employer and shall be produced by him as and when required either by the Engineer or by the contractor or by both. The other two copies of the Agreement may, however, be retained by the Engineer and the contractor. The contractor on signing here shall be furnished by the Employer free of cost with two sets each of blank tender copies and drawings. The contractor shall keep one copy of all drawings on the works and the Engineer or their representatives / Employer /Engineer in-charge shall at all reasonable, times have access to the same. Before the issue of the final certificate to the contractor, he shall forthwith return to the Engineer all drawings and specification.

9.3 All the costs, charges and expenses incurred in connection with the preparation and completion of this Agreement including Stamp Duty shall be paid by the contractor.

GENERAL CONDITIONS OF CONTRACT

1 Definitions

1.1 In construing the Conditions of Contract, the specifications, the tender form (Bill of Quantities) and other documents forming part of this Contract, the following words shall have the meaning herein assigned to them except where the subject or context otherwise requires unless the contrary intention appears.

1.1.1 Employer shall mean The Punjab Technical University (PTU)**.**

1.1.2 BOG : shall mean Board of Governors of PTU.

1.1.3 BOG Committee: shall mean Committee nominated by Board of Governors of PTU.

1.1.4 Building Construction Committee : shall mean a committee constituted by the Board of Governors of PTU for construction of PTU campus.

1.1.5 The VC: shall mean the Vice Chancellor of the PTU.

1.1.6 The Registrar: shall mean the Registrar of the PTU.

1.1.7 Executive Engineer: shall mean the Executive Engineer (Construction), PTU.

1.1.8 Engineer: shall mean Asstt. Executive Engineer or Asstt. Engineer , PTU, or an Agency / Person appointed by the PTU, to perform the duties of the Engineer.

1.1.9 Engineer's Representative: shall mean a person designated by the Engineer.

1.1.10 Architect shall mean Archigroup Architects (Regd.), A-14, Sector 15, Noida-201301, U.P. and their service consultants.

1.1.11 Architect's Representative shall mean a person designated by the Architect.

1.1.12 Consultants / Advisors shall mean Engineers / Experts appointed by the Employer to design and supervise architectural, structural, electrical, plumbing, and all engineering works and also to supervise installation of systems and equipment in the works.

1.1.13 Contractor shall mean the individual, firm, company, corporation, who enters into a contract with Employer/Engineer and shall include its heirs assigns, successors, legal representatives.

1.1.14 Contractor's Representative: shall mean a person designated in writing by the authorized signatory of the Contractor.

1.1.15 Contract shall mean the formal agreement signed by the Employer and contractor.

1.1.16 Defects liability period–shall mean twelve (12) months from the date of testing, commissioning certified by the employer project team.

1.1.17 Nominated sub–contractor shall mean any person or agency appointed by the Employer for the execution of any particular work or providing any services under the contract.

1.1.18 Nominated supplier shall mean any person or agency appointed by the Engineer to supply specified material equipment.

1.1.19 Sub–contractor shall mean a person or agency selected by the contractor with the written consent of the Engineer for carrying out specified part of the works under a direct agreement with the contractor.

1.1.20 Site shall mean location of the proposed works, as more particularly described in the plan annexed herewith.

1.1.21 Work or works shall mean the item of Work and activities to be carried out under the contract whether of permanent or temporary nature, and including all additional, altered substituted items for the employer.

1.1.22 Substantial Completion shall mean completion of the Works as per drawings and specifications to the entire satisfaction of the employer's projects team and particularly the securing of the virtual completion certificate from the employer.

1.1.23 Final completion shall mean the completion of the works and any necessary rectification directed to be carried out during the defects liability period, and any extension thereof granted by the Employer and the securing of such final completion certificate from the Employer's projects team, signaling the final handing over of the works to the Employer's projects team, and the acceptance of the same.

2 Documents

2.1 The intent of the contract document is that the contractor shall carry out and complete the works in accordance with the drawings, specifications, bills of quantities and other related documents and further the contractor shall provide all labour, material and management services necessary for the proper and timely executions of the works.

2.2 The contract and all documents, correspondence, inspection site records, etc shall be in English only and in accordance with Indian law, local customs and practices notwithstanding.

2.3 The contract documents, especially the drawings and specifications shall be studied by the contractor and any discrepancy there in, whether with in document or between documents shall be reported in good time to the Engineer whose decision in consultation with the consultant shall be final and binding.

2.4 Reference standards:

2.4.1 Incorporation by reference portion in all documents and publications (such as manuals, handbooks, codes, standards, Specification) issued by any technical society, trade or professional organization or association, or regulatory or governmental authority which are cited in the contract document for the purpose of establishing requirements applicable to equipment, material or workmanship under this contract, shall be deemed to be incorporated where in as fully as if printed and bound with the specifications of this contract, in accordance with the following:

a. Wherever reference is made to any such document the contractor shall comply with requirement set out in addition to specified in this contract, or if specified, the latest edition or revision there of, as well as the latest amendments or supplements there to, in effect on the date of solicitation of this project, accept as modified by, or as otherwise provided in, or as limited to type, class or grade, by the specifications of this contract.

b. No provision for any such reference document or standard shall have the effect to change the responsibilities of the Employer, the Engineer or their consultants, agents and employees from those set forth in the contract documents, nor to assign to any of them any responsibility, duty or authority for safety precautions or procedures or to supervise or direct the performance of the Work.

2.4.2 Copies to be provided by contractor: The contractor shall make available at the project site for inspection and reference by the Engineer, a copy of each manual, handbook, code, standard or specification which is incorporated by reference in the contract and which governs quality and workmanship.

2.4.3 The work shall be got executed as per latest CPWD specifications, with up-to-date correction slips for all works. The specifications mentioned in bill of quantities will prevail over these in case of any ambiguity. I.S. 1200 with up to date correction steps will be followed where the CPWD specification is silent.

2.5 Order of precedence:

2.5.1 Any inconsistence among the contract documents shall be resolved by giving precedence in the following order.

i. The executed construction contract form. (signed agreement between Employer and contractor)
ii. Solicitation instruction
iii. Construction addenda, if any

iv. Special Conditions of Contract.
v. General conditions of Contract
vii. Specifications- (i.e. technical Specification of Bill of Quantities)
viii. Drawings
ix. Bill of quantities.

2.5.2 Anything in the specifications but not in the schedule of items or the drawings, or in the drawings but not in the specification or schedule of items or in the bill of quantities and not in the specifications, drawings shall have like effect as if in all three. In case of differences between small and large-scale drawings, the latter will govern. Where the portion of the work is drawn in details and the remainder of the work is indicated in the outline the parts drawn in detail shall apply also total other like portions of the Work. Contract document in the English language shall govern in the event of conflict in other language version. In case apparent error, discrepancy or omission either in the drawings or specifications, the more stringent of the requirements, as determine by the Engineer, shall apply. Any question shall be submitted by the Contractor promptly to the Engineer for clarification. The Engineer shall review the question and submit his response in writing. If it is determined by the Engineer that there is an error, discrepancy or omission and changing it would modify the contract, a written decision from the Engineer must be obtained by the contractor. Any contract changes made by the contractor before he receives approval from the Engineer shall be at his own risk and expense.

2.6 Specifications and drawings for construction:

2.6.1 Drawings and specifications at site: The contractor shall keep on the work site a copy of the contract drawings and specifications and at all times shall give the Engineer access thereto.

2.6.2 Use of words unless otherwise expressly stated:

a. Wherever on the contract documents the words “directed” “required” “ordered” “designation” “prescribed” or words of like import are used it shall be understood that the “directions” “requirements” “order” “designation” or “prescription” of the Engineer is intended and similarly the words “approved” “acceptable” “satisfactory” or words of like more import shall mean “approved by” or “acceptable to” or “satisfactory to” the Engineer.

b. Where the words “as shown” “as indicated” “as detailed” or words of similar import are used, it shall be understood that the reference is made to the contract drawings and specifications.

c. The word “provided” used in the contract documents shall be understood to mean “provided complete in place” or “furnished and installed”.

d. Where the word "similar" or "typical" occurs on the drawings, it shall have a general meaning and not be interpreted as being identical, and all details shall be worked out in relation to their location and their connection with other parts of the work.

2.7 The Tender Drawings are for guidance only for the bidder quoting for the tender. It should be clearly understood that the final drawing can vary to accommodate employer's / vendors requirement and necessary modification or adjustment can be made by the Architect from time to time. No additional payment for such cause will be entertained by employer on this account from the contractor.

2.8 Drawings, specifications, models, if any, and all documents furnished to the contractors, except the signed contract agreement shall remains the property of the Architect and shall neither be copied, revised nor used on any other work.

2.9 The contractor shall supply to each sub-contractor copies of such drawings that pertain to specific works to be executed by them respectively.

2.10 The contractor shall accurately mark up and update progress of work on one set of drawings and specifications regularly and as the work progresses. Any and all modifications and corrections shall be reflected in these drawings and specifications from which the contractor shall prepare the final as – built drawings required to be submitted with the penultimate bill. The Engineer shall from time to time initial the marked-up drawings, the accuracy of which will be the responsibility of the contractor.

2.11 "As built" documents: After final completion of the work, but before final acceptance thereof, the contractor shall provide the complete sets of "as-built" drawings based upon the recorded set of the drawings, marks to show the details of construction, as actually accomplished and recorded shop drawings and other submittals, in the number and from as required by the contract documents.

3 **Scope of Work:**

3.1 The scope also includes, providing necessary power, fuel, supplies, labour, labour camps, materials, scaffoldings, construction equipment, tools and plants, appliances, as well as preparing detailed shop drawings including, detailed fabrication drawings, detail drawings for steel work and getting them approved by the Engineer, necessary supervision by competent supervisors and execution of all incidental items not specified or indicated but implied or required to complete the work under this scope in all respects and in strict accordance with the specifications and drawings including their revisions and amendments made from time to time.

3.2 The scope of work includes, providing drawings/catalogues, sample, etc. of all bought out items to the employer's supervisors at site or the Engineer in design office as per instruction of the Architect at no extra cost to the Employer.

3.3 The contractor shall carry out and complete the work in every respect in accordance with the contract and with the direction of and to the satisfaction of the Engineer and the Employer. The Engineer may from time to time issue further written instructions, details, directions and instructions to the contractor for construction of the said work.

4 Additional instructions

4.1 The contractor shall be responsible for seeking any clarification or additional instruction, which he may need for executing the works well in advance to avoid any delay.

4.2 Gratuities

4.2.1 Termination: The right of the contractor to proceed may be terminated by written notice if, after notice and hearing, the agent head or a designee determines that the contractor, its agent, or another representatives offered or gave a gratuity (e.g. an entertainment or gift) to an officer, official, or employee of the Employer and intended, by the gratuity, to obtain a contract or a favorable treatment under a contract.

4.2.2 Review ability: The legal jurisdiction to review the facts supporting this determination shall be of Jalandhar.

4.2.3 Damages: If this contract is terminated under paragraph 4.2.1 above, the Employer is entitled to pursue the same remedies as in a breach of a contract.

4.2.4 Rights and remedies: The rights and the remedies of the Employer provided in this clause shall not be exclusive and are in addition to other rights and remedies provided by law or under this contract.

4.3 Covenant against contingent fees / Warranty: The contractor warrants that no person or agency has been employed or retained to solicit or obtain this contract upon an agreement or understand for contingent fee, except a bonafide employee or agency. For breach or violation of this warranty, the Employer shall have the right to annul this contract without liability or, in its discretion, to deduct from the contract price or consideration, or otherwise recover, the full amount of the contingent Fee.

4.4 No claim for interest will be entertained by the employer with respect to any moneys or balances which may be in their hands owing to any dispute between themselves or the Engineer and the contractor or with respect to any delay on the part of the employer in making monthly or final payments or otherwise.

5 The Engineer

5.1 The Engineer shall be the Employer's representative during construction and until expiry of the defects liability period or any extension thereof, and shall be authorized to issue instructions on behalf of the Employer to the contractor.

5.2 All instructions in connection with the executions of the works shall be communicated to the contractor through the Engineer. All correspondence between the consultants and contractor shall be routed through the Engineer.

5.3 Interim and final bills will be checked by the Engineer after which the payments shall be made by the Employer.

5.4 Claims, disputes and other matters in question relating to the performance of the Work or the Interpretation of the Contract Documents shall be referred in writing to the Engineer, who will review the referred matter, and convey his decision to the contractor.

5.5 The Engineer shall invite the consultants and contractor as necessary for the co-ordination meetings at which the contractor shall present progress reports, plans and everything that may be required to assess the work status and related matters.

6 Time schedule and delays

6.1 Time is the essence of the contract and contractor shall undertake to complete the work within stipulated time. In the event the contractor does not complete the work the Employer shall suffer irreparable financial losses and damage which the contractor shall have to make good subject to the terms and conditions of the formal agreement.

6.4 The contractor shall have complete control of the works and shall effectively direct and supervise the work so as to ensure conformity with the contract documents and completion of the works within the time stipulated. He shall be solely responsible for construction means, and methods, techniques sequences and procedures and for coordinating various parts of the works, whether
performed by him or by any sub- contractors.

6.5 The totality of this project covered by this contract shall be completed in all respects within the stipulated time. The contractor shall guarantee completion of the works within the stipulated time, or any extension thereof pursuant to general conditions of contract.

6.6 Within 3 days of the award of the contract, the contractor shall furnish the Engineer a detailed program chart for the works. The schedule shall be reviewed by the Engineer, amended if necessary and approved for the implementation by the contactor.

6.7 The contractor shall adhere closely to the approved schedule, closely monitor progress of work, promptly report and delays and submit catch up action plans to make good such delays to the Engineer.

6.8 Any delays due to any reason whatsoever shall be the responsibility of the contractor and shall attract penalties.

6.9 Within one week of the occurrence of any of the following, which the contractor might regard as impediments in the progress of work, the contractor shall apply in writing to the Engineer for extension of time, setting out the reasons for delays sought to be condoned. The contractor shall not be entitled to extension of time if he fails to apply as above.

a. Addition, alteration or substitution ordered in the work, which could have a significant time impact and issued to the contractor an official change order only.

b. Act of god or force majure, i.e. a situation arising out of any occurrence totally beyond the control of the contractor, and explicitly excluding consequences of actions of the contractor or his staff or agents.

c. Forced closure of the works by a general political strike and unrest not related to contractor's labour or personnel.

6.10 The contractor's application for extension of time in any of the above circumstances shall be considered by the competent authority of PTU and its decision shall be final and binding. The University may consider further extension of time after granting extension of time on the basis of reasons of delays in completion of works.

6.11 The granting of any extension of time shall not entitle the contractor to claim any additional remuneration or consideration whatever for costs incurred as a result of such delays or due to cost escalation.

6.12 The contractor shall also be liable for all incidental costs and expenses incurred by the Employer on account of the delays including fees payable to the consultants for the entire overrun period until final completion.

6.13 Compensation For Delay: The time allowed for carrying out the work as entered in the Tender shall be strictly observed by the Contractor and shall be reckoned from the date on which the order to commence work is given to the Contractor. 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) and the Contractor shall pay as Liquidated Damages). Liquidated damages will be charged @ 0.25% of original Contract value per day subject to a maximum of 5% of the original Contract value. The Contractor may make a representation to the BOG committee to reduce the amount and BOG committee's decision in this regard shall be final.

6.14 The Contractor may make a representation to the BOG Committee to reduce the amount of penalty and its decision in this regard shall be final. Any money due to the Contractor or lying to his credit with the Employer will be adjusted from the amount of extra expenses incurred.

7 Employers right to take over work or terminate contract

7.1 The Employer shall be entitled to take possession of the site and works and to remove the contractor giving the contractor seven days notice under any of the following circumstances.

7.1.1 If in the opinion of the Engineer, the contractor has failed to proceed with the work with due diligence and failed to make such progress as would enable the works to be completed within the stipulated time.

7.1.2 The contractor has suspended the work in contravention of the conditions of the contract and failed to resume the work within seven days of receipt of such notice from the Engineer.

7.1.3 The contractor has abandoned the work.

7.1.4 The contractor has neglected or failed persistently to implement instructions of the Engineer after due written warnings.

7.1.5 The contractor has sub- let or assigned the work or any part thereof without the written consent of the Engineer.

7.1.6 The contractor has become or is adjudged to be insolvent.

7.2 The Employer shall have the right to take possession of and use any completed or partially completed portion of the work not withstanding that the time for completing the entire work may not have expired. Taking such possession and use shall not be deemed acceptance of any work completed in accordance with the terms of this contract.

7.3 Upon receipt of the take-over notice the contractor shall not remove from site any equipment, plant tools, scaffolding, materials of installations of any kind, and the same shall be used by the Employers as own property in completing the work directly or through any other agency or contractors. The contractor shall not in any manner prevent such takeover of the site and thereon by the Employers nor shall he hinder or interrupt the work taken over in any manner.

7.4 After take-over of the site and works, the Employer shall be entitled to withhold further payments to the contractor until accounts are settled as provided herein after completion of the works expiry of the defects liability period. The contractor shall not exercise his builder lien in the event the Employer has taken over the site and work.

7.5 Upon completion of his work through an agency other than the contractor, the Engineer shall by written notice inform the Contractor that it requires the contractor to remove from site any remaining material as also plant, equipment etc. belonging to the contractor. Should the contractor fail to remove his materials and equipment within fourteen days, the Employer shall be at liberty to auction or sell such materials and equipment and credit the proceeds of such sale to the account or to the contractor.

7.6 In the above circumstances the contractor shall neither claim compensation of the use of his property by the Employer or other agency completing the work, nor shall he claim any losses on account of damage to or wear and tear to his property.

7.7 Taking possession of the site and removal of contractor shall not be construed as cancellation of the contract by the Employer and this event shall in no way absolve the contractor of his remaining contractual obligations and responsibilities.

7.8 Should it become necessary for the Employer to take over the works under the above circumstances the contractor shall be liable to make good all constructions costs exceeding the agreed rates in the contract and also incidental expenditure of every nature incurred in completing the Work and duty certified by the Engineer.

7.9 The total sum payable by the contractor to the Employer by way of costs incurred in completing the works, damages, and compensation shall be deducted from amounts payable to the contractor. If the amount payable to the contractor is not sufficient to cover the sum due to the Employer, the contractor is bound to pay the difference to the Employer.

8 Foreclosure of contract in full or in part

8.1 If at any time after the award of work to the Contractor, the employer decides to abandon the work completely or reduce the scope of the work for any reason whatsoever and hence not require the whole or part of the work to be carried out, the Engineer shall give notice in writing to that effect to the Contractor.
The Contractor shall have no claim to any payment of compensation or otherwise whatsoever on account or any profit or advantage which he might have derived from the execution in full but which he did not derive in consequence of the foreclosure of the whole or part of the work.

8.2 The Contractor shall be paid at quoted percentage rates full amount for works actually executed at site or as per quantities shown in Estimates whichever is low, and, in addition, a reasonable amount as certified by the employer in consultation with the Engineer for the items hereunder mentioned which could not be utilized on the work to the full extent because of the foreclosure:

a. For any expenditure incurred on preliminary site work such as temporary access roads, temporary labour huts, staff quarters, site office, stores, workshops casting yards, fabrication platforms and water storage tanks;

b. For materials taken over or to be taken over by the employer, the employer shall pay to the Contractor cost of such materials. The cost shall however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to material white in the custody of the contractor.

c. For Contractor's material not retained by the employer, reasonable cost of transporting such materials from the site to his other works/stores or such materials may be disposed off with the approval of the University. Any loss incurred by the Contractor on this account will be reimbursed. The decision of the University regarding disposal of such materials will be final and binding. If materials are not transported or disposed off, no cost shall be payable.

8.3 If any material supplied by the employer remains surplus, the same except for normal wastage shall be returned by the contractor to the employer. Any deterioration or damage which may have been caused while the materials were in the custody of the Contractor shall have to be borne by the contractor. In addition, cost of transporting such materials from the site to the employer's store, if so required by the employer will be borne by the Contractor. However, the employer's decision as to what materials can be accepted back shall be final & binding.

8.4 The employer shall have the option to take over the contractor's materials or any part thereof either brought the site or which the Contractor is legally bound to take delivery from suppliers for incorporation on or incidental to the work, which the Contractor does not desire to retain.

8.5 If required by the Engineer, the contractor shall furnish to him books of account, wage books, time sheets and other relevant documents as may be necessary to enable him to certify the reasonable amount payable to the Contractor under these circumstances.

9 Assignment of contract

9.1 Type of contract: The contract is based on quantities & quoted percentage of the estimated cost above or below which the contractor agrees to works. The contract is payable in Indian Rupees. No additional sum would be payable on account of escalation in the cost of material, equipment or labour, or because of tenderer's failure to properly estimate or accurately predict the cost or difficulty of achieving the results required by the contract documents.

9.2 Scope of Contract:

9.2.1 The contractor shall furnish all labour materials equipments and services, supervision and management for the project described about, in strict accordance with and as described in the contract documents (including amendments and accepted alternatives, if any) and by any authorized modifications to the contract.

9.2.2 The contractor shall be responsible for doing this work in collaboration with other contractors and works of any other trades subsequently employed so as to expedite the execution of his and other contracts which are to run simultaneously. This will require the progress of site work to be synchronised and harmonised with the work of other contractors giving proper facility and security to them and to their workers. The main building contractor is also to include in his tender, charges for final surfacing to all repairs done by other trades for their fixtures, installation etc. and removal of soil arising out of these contractors. The contractor will provide adequate watching and protection of material against theft or damage with night lighting and watching. He will cover up and protect all work throughout the duration and until completion of the work.

9.3 The contractor shall not transfer, assign or sub let the contract or any part thereof except where determined otherwise by the contract and approved in writing by the Engineer.

10 Sub contractors

10.1 Where and when the appointment of specialist sub-contractors is indicated, such sub-contractors shall be appointed only with the written approval of the Engineer and on the following conditions:

10.1.1 The contractor shall enter into written agreements with sub-contractors and ensure that they perform their work in accordance with and subject to the terms and conditions of these contract documents. A copy of each such agreement shall be furnished to the Engineer.

10.1.2 The contractor shall remain fully responsible to the Employer for the performance and workmanship and all actions of all sub-contractors and persons directly or indirectly employed by them.

10.1.3 The contractor shall supply and permit all sub-contractors to avail the site facilities and services to enable them to complete their work safely, without hindrance or delay and conducive to produce the highest quality of work required.

10.1.4 The contractor shall upon receipt of instructions from the Engineer terminate and remove from site forthwith such sub-contractor whose work may be considered unsatisfactory.

10.1.5 The contractor shall make regular and prompt payment to each sub-contractor not later than one week of receipt of payment from Employer for their measured works certified by the Engineer. If the contractor fails to make payments to sub-contractors, the Employer may, with prior intimation to the contractor, make direct payments to sub-contractors, and recover such sums from the contractor. Such direct payments to sub-contractors shall be on behalf of the contractor and shall in no way relieve the contractor of his responsibilities or create a contractual relationship between the Employer and sub-contractor.

11 Nominated sub-contractor

11.1 The Employer shall be entitled to nominate to the contractor, selected sub-contractors for carrying out certain sections of the work or to replace terminated sub-contractors. Such nominated sub-contractors shall receive the same assistance and co-operation from the contractor as other sub-contractors and the contractor shall be equally responsible for their work. Nominated sub-contractors shall have direct agreements with the Employer and shall receive direct payment also. Payment for the site facilities and the services made available by the contractor at his cost to the nominated sub-contractors, including water, electricity, insurance, staging, scaffolding etc. is to be made by the nominated sub-contractor.

11.2 Nothing shall absolve the contractor, including the approval, termination or nomination of sub-contractors by the Employer of his overall responsibility under the contract to closely supervise the work, on or off the site, and to ensure adherence to the specification and schedule.

12 Separate contracts

12.1 The Employer is entitled to enter into separate contracts for items of work not included in this contract, such as the supply and installation of special material, equipment, systems, fixtures, interior decoration, furniture, fit-out, etc. for whose work the Employer shall be responsible.

12.2 The contractor shall render all assistance to separate contractors in the execution of their work.

12.3 The contractor shall in writing report to the Engineer any apparent deficiencies in the work of separate contractors, which would affect the work of this contract. Failure of the contractor to report any deficiencies shall debar him from making any claims against the Employer in respect thereof.

13 Changes in the work

13.1 In case the Engineer thinks proper at any time during the progress of the works, any alterations in or omission from the works or any alteration in the kind or quality of the materials to be used therein and shall give notice thereof in writing to the contractor shall after add to or omit from as the case may require in accordance with such notice but the contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the contract, stipulation, specification or contract drawing without the previous consent in writing from Engineer. A verbal authority or direction by the Engineer, if confirmed by the contractor in writing within seven days, be deemed to have been given in writing.

13.2 Each tender item is an item in itself and the percentage to be quoted shall take into account all aspects of the workability of that particular item including all material, labour, supervision, management costs including taxes and profit etc. Any addition or deletion in quantity of the quoted item shall not impact the percentage quoted for that particular item.

13.3 The contractor shall agree to the rate for any additional, altered or substituted work, if not already specified in the contract, with the Engineer, before proceeding with such work. For procedure to be adopted for calculation of rates of Extra / substituted items see clause 18 below and the same shall be added to or deducted from the Contract amount accordingly.

13.4 The contractor shall not claim for any delays on account of altered, substituted or additional work, nor shall he claim for loss of anticipated profits on account of variations in the nature and scope of the works, unless extension of time has been agreed to in advance and in writing at the timing of issuance of a contract modification order.

13.5 The quantities indicated in the Bill of Quantities are tentative and may vary to any extent while actual execution of works. The Contractor shall execute the works as per actual requirements of the works at the accepted rates. No compensation on account of variations in quantities shall be payable.

14 Extra work

14.1 The Engineer shall have power and authority from time to time and all times to make and issue further drawings and instructions and may make any additions alterations and omissions in the work. No allowances shall be made to the contractor for an increase in measurements or any extra work wherever except upon the written order of the Engineer.

14.2 No deviations from the contract will on any account be allowed unless an order in writing is obtained from the Engineer on alteration, omission or variation shall vitiate this contract.

14.3 The contractor shall give to the Engineer, before the 10th of every month, a statement in writing of extra work which may have been performed during the preceding month.

15 Deleted

16 Billing and payments, records and measurement

16.1 The contractor shall submit to the Engineer monthly progress bill in approved format showing detailed agreed measurements for the various items of work executed, and all support documents, calculations etc. The measurements will be jointly recorded by the representatives of the Contractor and the Engineer in the Measurement Books supplied by the contractor, in the approved format and attested by the Engineer and the abstract of the Bills shall be entered in separate Measurement Books.

16.2 Each bill shall separately show amounts of altered, additional or substituted work. Otherwise bills for executed works shall be at tendered percentage only. No extra items/subtitled work bills will be approved after the payment of final bill.

16.3 Each bill shall be checked and confirmed or corrected by the Engineer.

16.4 The contractor shall submit the final bill as above. On submission of the final bill the contractor will ensure that no extra items/new item/substituted items have been left unsettled. The final bill shall be accompanied by:

16.4.1 All technical documents on the basis of which the work was carried out including all measurement books.

16.4.2 Three sets of construction and installation drawings showing therein modifications corrections and additions signed and confirmed by the Engineer to be "as built" drawings.

16.4.3 Completion certificates for embedded and covered –up works issued by the Engineer.

16.4.4 Certificates for tests carried out for various items of work

16.4.5 Manufacturer's operating and maintenance manuals as well as guarantee papers for all equipment installed.

16.5 Payment against interim bills shall be deemed as payments by way of advances only against the final amount payable under the contract and shall not be construed to be either approval of or payment for work done. Interim payments shall in no way prejudice the rights of the Employer under the contract as to the adjustments and final settlement of accounts.

16.6 The Employer shall have a lien on and over or any money that may become due and payable to the contractor under these presents, and /or also on and over the deposit of security amount or amounts made under this contract and which may become repayable to the contractor under the conditions in that behalf herein contained, for or in respect of any debt or sum that may become due and payable to the employer by the contractor either or jointly with another, and either under this or under any other contracts or transactions of any nature whatsoever between the employer and the contractor.

16.7 Records and measurements: All works shall be measured and duly recorded in the measurement book by the Engineer and the contractor. Works are to be measured in detail in accordance with Bureau of Indian Standard Method of Measurements IS: 1200:1957 /as per latest C.P.W.D. specifications with up-to date correction slips, except, where otherwise indicated with specifications or schedule of items. In the event of any discrepancy between the Indian Standard Method of Measurement and the method indicated in the specifications of bill of quantities forming the part of the contract, the method adopted with CPWD Specification and schedule of rates shall prevail. The measurement shall be taken jointly both by the Engineer and the contractor.

16.8 If the contractor's representative fails to attend the measurements on the date notified by the Engineer, the Employer shall have power to proceed by themselves to take the measurements and in that case, these measurements shall be accepted by the contractor as final. The measurement book will be kept with the Engineer at site.

17. Certificate of completion

17.1 Within ten (10) days of the completion of the work, the contractor shall give notice of such completion to the Engineer, and within thirty (30) days of the receipt of such notice Engineer shall inspect the work and if there is no defect in the work shall furnish the contractor with a certificate of completion, after obtaining approval from the employer otherwise a provisional certificate of completion indicating defect(s) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued but no certificate of completion provisional or otherwise, shall be issued nor shall the work be considered to be completed until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all the huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor and cleaned off the dirt from all wood work, doors, windows, walls, floors or other parts of any building in upon or about with the work is to be executed, or of which he may have had possession for the purpose of the execution thereof, and not until the work shall have been measured by the Engineer. If the contractor shall fail to comply with the requirements of this clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary

arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of the work the Engineer may at the expense of the contractor remove such scaffolding, surplus materials and rubbish, etc. and dispose of same as he thinks fit and clean off such dirt as aforesaid and the contractor 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. The work should be completed in accordance with the provisions of this contract with any authorized alterations, amendments, additions or omissions within the period stated in the tender or such extended period as may be allowed by the Employer under clause "Extension of Time" hereunder and shall not be considered as completed until the Engineer have certified in writing that it has been completed to their satisfaction.

18 Rates for extra / substituted items

18.1 The contractor shall execute the extra/substituted items as ordered by the Engineer in writing which may be required for proper completion of work. The rates of such items shall be derived/ paid in the following manner; but the payment shall be made by considering the lowest rate only as decided by the Engineer.

18.1.1 If the percentage rates of the additional, altered or substituted work are specified in the contract for the work, the contractor is bound to carry out the additional altered or substituted work at the same rates as are specified in the contract for the work.

18.1.2 If the percentage rates for additional, altered or substituted work are not specifically provided in the contract for the work, then such rates will be derived from the rates for a similar class of work as specified in the contract for the work.

18.1.3 If the altered, additional or substituted work includes any work for which no rate is specified in the contract for the work and cannot be derived from the similar class of work then such work's rates shall be derived from D.S.R. 2007 with up to date correction factor duly applied after applying appropriate index and quoted percentage.

18.1.4 If the rates for altered, additional or substituted work cannot be determined in the manner specified above in clause 18.1.1 – 18.1.3, then the rates will be settled on the basis of actual vouchers of prevailing market cost plus labour, and 15% contractor's profit, supervision and overhead charges.

18.2 Analysis of rates, for extra items are to be submitted by the contractor within 2 weeks from the date of commencement or in anticipation.

19 Taxes

19.1 The rates quoted by the contractor shall be inclusive of all the taxes and duties such as work contract tax, sales tax, excise duty, octroi, VAT, Service Tax, Labour Cess etc. The Employer shall not be responsible for any of the aforesaid taxes.

20 Laws

20.1 The contractor shall faithfully observe and implement all laws and rules applicable to the execution of the work and contract, whether prevailing or which may come into force during the operation of the contract.

20.2 The contractor shall observe and pay special attention to laws and rules pertaining to employment and labour. He shall provide, as prescribed by law, for the welfare of his staff and labour, and it shall be his sole responsibility and maintain good rapport with all personnel and labour to ensure uninterrupted progress of work.

20.3 The contractor shall maintain and keep updated all records and registers required under various laws and make such records available for inspection to concerned authorities as well as to the Engineer whenever required, including co-ordination with the concerned authorities during inspections.

20.4 In the event of the Employer having to take any action due to the failure of the contractor in the observance or implementation of any requisitions of any authorities, then such action shall be deemed to be for and on behalf of the contractor and shall be entirely at the contractor's risk as to costs and consequences.

20.5 Contactor shall abide by applicable Environmental & pollution norms

21 Indemnity

21.1 The contractor shall indemnify and hold completely harmless the Employer, Engineer, consultants their agents and employees against all claims, demands, fines, penalties, losses, costs, damages, action, suits and proceedings by any third parties, that arise out of act of commission or omission of the contractor or attributable to the actions of the contractor or any sub-contractors in the performance of the contract.

21.2 The Contractor shall fully indemnify the employer against any action claims or proceeding relating the infringement or use of any patent of design or any alleged patent or design, rights and shall pay any royalty which may be payable in respect of any article or part there of included in the contract.

21.3 Wherever any claim against the contractor for the payment of a sum of money arises out of or under the contract, the employer shall be entitled to recover such sum by appropriating in part or in whole, the security deposit of the contractor. In the event of security being in sufficient then the balance or the total sum recoverable as the case may be, shall be deducted from any sum then due or which at any time thereafter may become due to the contractor under this or any other contract with the employer. Should this sum be not sufficient to cover the full amount recoverable, the contractor shall pay to the employer on demand the balance remaining due within 10 days.

22 Insurance

22.1 The Contractor shall at his own expense, arrange for insurance policies, such as workmen compensation policy and contractor's all risk policy in the amount of the contract effective from the date of commencement of work until final completion, against all of the following risk:

22.1.1 Injuries and damage of persons, property, animals or things, within or outside the site, arising out of his operations or of any sub-contractors, nominated or otherwise, or out of any actions of his employees, agents or representatives.

22.1.2 Damage to or loss of the property, equipment and materials at site, of the Employer, contractor and all sub-contractors, as a result of natural causes such as lightning, storm, flood, rain, fire, earthquake, explosion, landslide etc.

22.1.3 Damage and injuries to persons, property and materials arising out of riot and civil commotion, theft, sabotage malicious acts, terrorist activities, etc.

22.2 The insurance policy or policies to cover risks of every nature shall be in the joint names of the Employer and contractor, and the original of such policy or policies shall be kept with the Engineer.

22.3 If the contractor fails to arrange the requisite insurance or fails to renew the policies, the Employer shall arrange for the policies and / or renew them and recover the cost of all premiums from the contractor.

22.4 No certificate of payment shall be issued by the Engineer, if the contractor fails to arrange for total insurance cover.

22.5 The contractor shall reinstate, in a manner approved by the Engineer, all damage of every sort entirely at his cost, so as to deliver up to the Employer the whole of the works complete and perfect in all respects, and so certified by the Engineer and also be make good or otherwise satisfy all claims for damage to property of third parties.

22.6 The contractor shall be responsible for anything within his control and for all risk and consequence, which are not included in the preview of the insurance policies.

22.7 The insurance shall be extended until final completion.

22.8 The contractor undertakes not to cancel any insurance policy or its scope without the written consent of the Engineer.

22.9 The contractor undertakes to file necessary insurance claims jointly with the Employer, and also to join the Employer in filing any claim the Employer chooses to.

22.10 Payment against all insurance claims shall be received in the name of the Employer and commensurate adjustments made in accounts of the Contractor.

23 Protection of persons, works and property

23.1 Accident prevention

23.1.1 General: In performing this contract, the contractor shall provide for protecting the lives and health of employees and other persons, preventing damage to or theft or loss of property, materials, supplies, and equipment, and avoiding work interruptions. For this purpose, the contractor shall provide appropriate safety barricades, signs and signal lights. Comply with the standards issued by any local governmental authority having jurisdiction over occupational health and safety. Ensure that any additional measures as required by the Engineer for this purpose are taken.

23.1.2 Records: The contractor shall maintain an accurate record of exposure data on all accident to work performed under this contract resulting in death, traumatic injury, occupational disease, or damage to or theft or loss of property, materials, supplies, or equipment. The contractor shall report this data in the manner prescribed by the Engineer.

23.1.3 Sub-contractors: The contractor shall be responsible for its sub contractor's compliance with this clause.

23.1.4 Written program: Before commencing the work, the contractor shall submit a written proposal for implementing this clause: and meet the Engineer to discuss and develop a mutual understanding relative to administration of the overall safety program.

23.2 Barricades: Contractor shall erect and maintain barricades required in connection with his operation to guard or protect.

a) Excavation of blasting work (if permitted by the concerned authority).
b) Area adjudged hazardous by Contractor or the Engineer.
c) Employer's existing property subject to damage by Contractor's operations.
d) Contractor's employees and those of its sub-contractors shall become acquainted with CPWD barricading practice and shall respect the provisions thereof,
e) Barricade and hazardous areas adjacent to but not located, in normal routes of travel shall be marked by red flashed lanterns at nights.

23.3 Scaffolding:

23.3.1 Suitable double stage steel scaffolding should be provided for workmen for all work that cannot safely be done from the ground or from solid construction except short period work as can be done safely from ladders. When a ladder is used an extra Mazdoor shall be engaged for holding the ladder and if ladder is used for carrying materials as well, suitable footholds and handholds shall be provided on the ladder and the ladder shall be given an inclination not steeper that I in 4 (I horizontal and 4 vertical). Lights to protect the workers and staff from accidents and Contractor shall be bound to bear the expenses of defense of every suit, action or other proceeding's at law that may be brought by any person for injury sustained owing to neglect of laid down precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.

23.3.2 Scaffolding or staging more than 4 metres above the ground or floor swing suspended from an over-head support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise secured at least 3 high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as maybe necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

23.3.3 Working platform gang ways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform, of the gangway or the stairway is more than 4 metres above ground level or floor level they should be closely boarded, should have adequate width and should be suitably fastened as described above.

23.3.4 Every opening in the floor of the building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing' or railing whose minimum height shall be I meter.

23.3.5 Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 metres in length while the width between the said rails in rung ladder shall in no case be less than 30 cms for ladder upto and including 3 metres in length. For longer ladder this width should be increased at-least. 5 cms for each additional foot of length. Uniform steps spacing shall not exceed 30 cms. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any sites of work shall be so stacked or placed to cause danger or inconvenience to any person or public. The contractor shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings at law that may be bought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.

23.4 Excavation and trenching:

23.4.1 All trenches 1.2 metres or more in depth shall at all times be supplied with at least one ladder for each 50-metre length or fraction thereof.

23.4.2 Ladder shall be extended from bottom of the trench to at least I metre above other surface of the ground. The sides of the trenches which are 1.5 metres in depth shall be stepped back to give suitable slope or securely held by timber bracing. so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 metres of the edge of the trench or half of the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.

23.4.3 All necessary personal safety equipments considered adequate by the Engineer should be kept available for the use of persons employed on the site and maintained in condition suitable for immediate use, and the Contractor shall take adequate steps to ensure proper use of equipment by those concerned.

a) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective gloves.

b) Those engaged in mixing or stacking of cement bags or any materials which are injurious to the eyes shall be provided with protective goggles.

c) Those engaged in welding and cutting lead joints shall be provided with protective face and eye shields, hand gloves etc.

d) Stonebreakers shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

e) When workers are employed in sewers and manholes, which are in use, the contractor shall ensure that the manhole covers are opened and are ventilated at least for an hour before the workers are allowed to get into the manholes and the manholes so opened shall be cordoned off with suitable tailing and provided with warning signals or board to prevent accident to the public. Proper Safety Belts shall be used by the workers going in the sewers & manholes. Further before entry presence of TOXIC gages shall be tested and presence of oxygen shall be verified.

23.4.4 The Contractor shall not employ men & women below the age of 18 years and women of any age on the work of painting with products containing lead in any form. Wherever men above the age of 18 years are employed on the work of lead painting, the following precautions should be taken:

a) No paint containing lead or lead product shall be used except in the form of paste or ready-made paint.

b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or surface having lead paint dry rubbed and scrapped.

c) Overalls shall be supplied by the Contractor to the workmen and adequate facilities shall be provided' to enable the working painters to wash them during and on cessation of work.

23.4.5 Use of hoisting machines and tackles including their attachments anchorage and supports shall conform to laid down standard precautions:

a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defect and shall be kept in good working order.

b) Every rope used in hoisting or lowering materials or as means of suspension shall be of durable quality and adequate strength and free from patent defects.

c) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to the operator.

d) In case hoisting machine and of every chain ring hook shackle swivel and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gears referred to above shall be plainly marked with the safe working load of the conditions under which it is applicable which shall be clearly indicated. No part of machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

e) Incase of departmental machine, the safe working load shall be notified by the Engineer. As regards contractor's machines, the Contractor shall notify the safe working load of the machine to the Engineer whenever he brings any machine to site of work and get it verified by the Engineer concerned.

f) Motors gearing transmission electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Housing appliances should be provided with such means as to reduce to the minimum the accidental descent of the load, adequate pre-cautions should be taken to reduce to the minimum the risk of any part or any part of a suspended load becoming accidentally displaced, When workers are employed on electrical installations, which are already energised, insulation mats, wearing apparel, such as gloves, sleeves, and boots, as may be necessary should be provided, The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

g) All scaffolds, ladders and other safety devices mentioned or described herein shall he maintained in safe conditions and no scaffold, ladder or equipment shall be altered or removed while it is in use, Adequate washing facilities should be provided at or near places of work.

h) These safety provisions should be brought to the notice of all concerned by displaying on a notice hoard at a prominent place at the work- spot. The person responsible for compliance of the safety code shall be named therein by the Contractor.

i) To ensure effective enforcement of the rules and regulations relating to the safety precautions, the arrangements made by the Contractor shall be open to inspection by the Engineer.

j) Notwithstanding the above clauses there is nothing in these, to exempt the Contractor from the operations of any other Act or rules in force in the Republic of India, the works throughout including any temporary work shall be carried out in such a manner so as not to interfere in any way whatsoever with the traffic on any roads or footpaths at the site or in the vicinity thereto or any existing works whether the property of the Administration or of a third party.

23.4.6 In addition to the above, the Contractor shall abide by the Safety code provision as per Indian Standard Safety Code framed from time to time.

23.5 Protection of property

23.5.1 Vegetation, structures and equipment: The contractor shall preserve and protect all structures, equipment, and vegetation on or adjacent to the work site, which are not to be removed and which do not interfere with the work required under this contract. The contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place.

23.5.2 Utilities and improvements: The contractor shall protect from damage all existing improvements and utilities at or near the Work Site; and on adjacent property of a third party the locations of which are made known to or should be known by the contractor - The contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the contractor fails or refuses to repair the damage promptly, the Engineer may have the necessary work performed and charge the cost to the contractor.

23.6 Watchmen : The contractor shall provide sufficient personnel and materials to provide adequate protection of property at the site, in transit and storage including but not limited to measures specifically required by the contract documents and any security requirements under this contract.

23.7 Corrective Action:

23.7.1 Authority to stop Work: The Engineer shall notify the contractor of any non-compliance with the safety and property protection requirements of this contract of which the Engineer becomes aware, and of the corrective action required. This notice, when delivered to the contractor or the contractor's representative at the site of the work, shall be deemed sufficient notice of non-compliance and corrective action required. After receiving the notice, the contractor shall immediately take corrective action. If the contractor fails or refuses to take corrective action promptly, the Engineer may issue an order stopping all or part of the work satisfactory corrective action has been taken. The contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop work order issued under these circumstances.

23.7.2 Rectification: The contractor shall be solely responsible to make good at his cost any damage to the works, property of the Employer and adjacent property, to the satisfaction of the Engineer.

24 Site securities

24.1 The contractor shall be deemed to be in possession of the works site and shall be responsible for its total security, and shall ensure that all materials, sheds, equipment, plant tools, etc, whether his own or belonging to any sub-contractor, are well protected.

24.2 The contractor shall at his own install and maintain sufficient security fences and gates and employ full time round-the-clock, security personnel to prevent the intrusion of the public or other unauthorized persons or vehicles into the works site.

24.3 The presence of the consultants or their representatives, or the Employer's security personnel, shall in no way relieve or absolve the contractor of his responsibilities in ensuring the security and protection of the Site and everything stored or lying thereon.

25 Deleted

26 Warranty

26.1 The contractor shall be responsible for the proper performance of the works, including installations and systems.

26.2 Subject to 26.1 above, the contractor shall, at his own cost and in the shortest possible time, repair and remove any defect or deficiency in the works, which may appear prior to or during the defect liability period/warranty period, to the satisfaction of the Engineer.

26.3 Water proofing works:

26.3.1 The Contractor shall guarantee through a guarantee bond (a guarantee bond is to be executed on non judicial stamp paper of Rs. 10/- duly attested by notary public) in prescribed Performa and deposited with the Punjab Technical University (PTU) all water proofing work done by him or his subcontractors for 05 years from the date of virtual completion of the project and shall indemnify the PTU in a format approved by PTU against any defects that arise therein during the guarantee period as aforesaid. He shall immediately rectify, replace and repair any defects, leakage, seepage etc. that may occur therein, and repair all other damage occurring to any part of the structure on account of defect in water proofing treatment during the guarantee period as aforesaid, in accordance with the conditions of the said guarantee to the satisfaction of the PTU at the time of damage. In case of failure of the Contractor to rectify the defects, the same shall be got done at his risk and cost. No request to releasing cash retention against bills shall be accepted at any stages.

26.4 Deleted

27 Defects liability period

27.1 Any defects, cracks, settlement, disfiguration or other faults which may appear within the "one year from date of completion", arising in the opinion of the Engineer from materials and/or workmanship not in accordance with the contract, shall upon the directions in writing of the Engineer and within such reasonable time as shall be specified therein, be amended and made good by the contractor at his own cost, and in case of default the Employer may employ and pay other persons to amend and make good such defects, shrinkage, settlements or other faults, and all damages, loss and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damage, loss and expenses shall be recoverable from him by the Employer or may be deducted by the Employer upon the Engineer's certificate in writing, from any money due or that may become due to the contractor or the Employer may in lieu of such amending and making good by the contractor, recover from the contractor any expenses the Employer may have incurred in connection therewith. Should any defective work be done or materials supplied by any sub-contractor employed on the works who' has been nominated or approved by the Engineer or the Employer as provided in clause for the Engineer and "Nominated sub-contractors, the contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the contractor and been subject to the provisions of this clause and clause for "Scope of Contract" hereof. The contractor shall remain liable under the provisions of this clause notwithstanding the signing by the Engineer of any Certificate or the passing of any accounts.

28 Contractor's responsibilities and Work control

28.1 The contractor shall have complete control of the works and shall effectively direct and supervise the work so as to ensure conformity with the contract documents. He shall be solely responsible for construction means, methods, techniques, sequences and procedures, and for co-coordinating the carious parts of the work, whether carried out by him or any sub-contractor.

28.1.1 Personnel at site : The Contractor will furnish a list of qualified technical staff indicating their names, qualifications and experience, that will be employed at the site along with copies of certificates and experience. All personnel employed by the contractor at site shall have to be acceptable to, and qualified as required by, the Engineer from time to time.

28.1.2 The technical staff should be available at site constantly at all times throughout the Contract / extended duration of Contract and three months beyond the date of virtual completions to supervise the work and take instructions from the employer and or the Engineer, when the respective work is in progress. Electrical Engineer will be available at site, when electrical work starts.

28.2 Tools and Plants: The Contractor shall arrange, at his own expense, all tools plant and equipments required for the satisfactory execution of the work and in such, number or quantity as to meet the time of completion specified in the Contract and to meet the approval of the employer.

28.3 Labor camps and other temporary structures: The Contractor shall examine the site and satisfy himself regarding the space available for labour camps, workshops, cement storage, site office and storage of steel and other building materials. Any additional space required by the Contractor shall be arranged by him at his own cost. The contractor shall take all approvals if required. It will be responsibility of the contractor to follow all safety and environmental norms while making labour camps.

28.3.1 The Contractor shall prepare a plan showing location of temporary offices, stores, godowns, labour camps, material storage bins and yards, fabrication platforms in consultation with and approval of the employer, before erecting these facilities. Nothing extra shall be payable on account of preparation of plans and construction / maintenance and removal of above on completion of the work.

28.3.2 The contractor shall ensure that the labour camps are vacated on completion / termination of the contract. In case of his failure to vacate the men, the employer will be at liberty to withhold his payment and initiate legal action for eviction. The legal action will be initiated against the contractor and not against the individual labourers.

28.3.3 The contractor shall be responsible for the design, erection, operation, maintenance and removal of temporary structures and other facilities at his own cost. No approval sought, given or implied, regarding sufficiency, stability and safety of temporary staging and facilities shall in any way relieve the contractor of his responsibility.

28.4 The contractor shall study all contract documents and promptly report to the Engineer any non-conformity, discrepancy, inconsistency or omission he may discover. In the event of such discovery the contractor shall not proceed with the effected work until he has received due corrections and clearance from the Engineer.

28.5 The contractor shall be deemed to have thoroughly studied and satisfied himself regarding, contract documents and particularly all drawings before proceeding with the work should any discrepancy or error be discovered during execution of parts of the work, necessitating, demolition, repairs or reconstruction, all such remedial measures shall be carried out only with the approval of the Engineer and entirely at the contractor's cost. In such an event the contractor shall neither claim any extra payment nor extension of time for any delays.

28.6 Any instructions given to the contractor's supervisory staff by the Engineer shall be deemed to have been given to the contractor. Instructions that involve any variations in design or specifications, and which may have a time and cost impact shall be through a written change order of the Engineer and at rates and percentage agreed in writing prior to implementation.

28.7 The contractor shall, at his own cost, obtain any permits or authorization necessary for the execution of the work and obtaining any permits or approvals for the works executed by him, from all concerned authorities, government departments and statutory bodies.

28.8 The contractor shall not be entitled to claim additional sums on account of having to work overtime in order to complete an operation that cannot be interrupted, for working in extended shifts, for working in night shifts or for working on holidays.

28.9 In the event the contractor chooses to work overtime, in extended shifts, at nights or on holidays, he shall do so by obtaining prior written approval from the Engineer at least twenty-four hours in advance. The contractor, moreover, shall ensure in any of the above circumstances he maintains the full agreed strength of his supervisory staff.

28.10 The contractor shall take all necessary precautions to protect the site and works, materials, plant and equipment, whether his own or belonging to the Employer or any sub-contractors, against hazards of fire, rains, floods, landslides, underground water, accidents, etc.

28.10.1Submittals

28.10.2"Shop Drawings" means those drawings or other documents, which are specifically prepared by or on behalf of the contractor to illustrate details of construction for the purpose of fabrications or installation and are submitted to the Employer to indicate the contractor's intended method of achieving the end result required by the contract drawings and specifications.

28.10.3"Project data: Include standard drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data and similar materials furnished by the contractor to explain in details specific of the work required by the contract.

28.10.4"Samples" are physical examples, which illustrate materials, equipment or workmanship and establish standards by which the work will be judged."

28.10.5Other submittals" includes progress schedules, setting drawings, and inspection reports, and other information required by the contract documents to be submitted by the contractor for information or approval by the Employer.

28.10.6Schedules of submittal: Within two weeks after contract award the contractor shall submit to the Engineer submittal schedule showing when shop drawings, project data, samples and other submittals required by the contract documents would be submitted for approval.

28.10.7Review and approval of submittals by contractor: The contractor shall coordinate all submittals required by the contract documents, and thoroughly check them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon in the form required by the contract documents evidence of such co-ordination and checking. Submittals submitted to the Engineer without satisfactory evidence of the contractor's approval may be returned for resubmission. Submission of shop drawings, project data or samples shall constitute a representation that the contractor has ascertained that the assemblies, products or materials indicated therein will be available in a timely manner and in the quantities required for the project.

28.11 Submission: All submittals shall be in the English language, and any system of dimensions (i.e. English and metric) shown shall be consistent with that used in the contract documents. The contractor shall submit all submittals in the form and number required by the contract documents, within required time limits and sufficiently in advance of construction requirements to permit adequate review by the Employer for correction and resubmission if required, and approval. No extension of time shall be allowed on account of a delay by the Employer in approving such submittals if the contractor has failed to act promptly and responsively in making his submission shall be identified as required by the contract documents.

28.12 Action on submittals: The Engineer will indicate an approval or disapproval of the submittals requiring approval by the Employer and if not approval as submitted shall indicate the Employer's reasons thereof. Approval by the Engineer shall not relieve the contractor from responsibility for any errors to omissions in its submittals, nor from responsibility for complying with the requirements of this contract, except with respect to variations described by the contractor and approved in accordance with the "Variations in submittals" clause. The Employer's approval of submittals will be for general compliance with the intent of the contract document and with the information therein, and shall not be construed:

a) As permitting any departure from the /Contract requirements.

b) As believing the Contractor of responsibilities for any error, including details, dimensions, materials etc.

c) As approving departures from details appearing on Contract Drawings and specifications. Where approval of submittals is required, the Contractor shall perform the Work in accordance with such approved submittals. Any Work performed by the contractor prior to such approval shall be at the contractor's risk.

d) Variation in submittals : If submittals contain any variations from the contract requirements other than these requested on previous submittals, the contractor shall specifically describe such variations in writing and the reasons therefore, in his transmittals letter. If the approval of any such variations affects the contract price or the contract time, the Engineer shall issue an appropriate contract modification: otherwise, the variation may be approved by the Engineer, but only by specific reference thereto in writing. The contractor shall not be entitled to rely on general approval of a submittal as an approval of variations from the requirements of the contract. If the contractor fails to describe such variations he shall not be relieved from the responsibilities for executing the work in accordance with the contract, notwithstanding a general approval of such submittals, nothing herein shall relieve the contractor of the responsibility of notifying the Engineer of any part of the contract drawings or specifications which the contractor knows or reasonable should have known could result defects in construction.

e) Use of submittals: The Employer may duplicate use and disclose in any manner and for any purpose shop drawings, product data and other submittals delivered under this contract.

28.13 Placement of order: The contractor shall place orders for items requiring a sample or product data submittal promptly after receiving the written approval of the submittal by the Engineer. No such materials or products shall be ordered or used in the work until such written approval by the Engineer has been given, except at the contractor 'risk.

28.14 Use and testing of samples

28.14.1 Use: Approved samples not destroyed in testing will be sent to Engineer. Those, which are in good condition, will be marked for identification and may be used in the work. Materials and equipment incorporated in the work shall match the approved samples within any specified tolerances. Other samples not destroyed in testing or not approved will be returned of the contractor at his expenses if so requested at the time of submission.

28.14.2 Failure of samples: Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material of equipment which previously has proved unsatisfactory in service.

28.14.3 Taking and testing of samples: Samples of various materials or equipment delivered on the site may be taken by the Engineer for additional testing by the Employer outside of those found not to have meet contract requirement unless the Engineer determines it to be in the Employer's interest to accept the non-confirming materials or equipment.

28.14.4 Cost of additional testing – Unless otherwise specified, when additional tests are made, the cost of which shall be borne by the contractor. Samples, which do not meet contract requirements, will be rejected.

28.14.5 A schedule of tests, which will be conducted on the material, is to be forwarded by the contractor to the Engineer, within 5 days of the letter of intent, for approval by the Engineer.

29 Workers

29.1 The contractor shall, at his own expense, arrange for the requisite workers, foremen, technical and general support staff for the timely and satisfactory execution of the works.

29.2 The contractor shall promptly pay his staff and workers their due wages, salaries and other allowances as per prevailing laws. Should the contractor fail to do so, and if the situation warrants it, the Employer may, at his unquestioned discretion, pay wages due to the workers on behalf of the contractors after prior intimation to him. Any sums so paid to employees of the contractor shall be to the account of the contractor and shall be recovered from him.

29.3 The Engineer shall have the right without assigning any reason, to the contractor to dismiss and remove from the site any worker or anybody employed by the contractor, directly or indirectly, and the contractor shall, without demur remove such person's immediately. Such dismissal shall attract no liability of any nature whatsoever to the Employer. Arrangements for replacement of such person/s removed from the site shall also be the responsibility of the contractor.

29.4 The contractor shall maintain such registers, musters, forms and employment records at site as required by law and shall make these available to concerned authorities and the Engineer whenever required. the register to be maintained are (inspection register, site order register, hindrance register, material at site register, cement register, steel register, paint and chemical register, measurement register, register of cube and master test register.

29.5 The contractor shall not remove from site any materials, equipment, temporary structures, etc. without prior written permission of the Engineer and through a gate pass.

29.6 Labour compliance:

a) The contractor shall comply with the requirements of various statutory provisions such as minimum wages act, contract labour [regulation and abolition] act, employees state insurance act, 1948, and other applicable laws in respect of its employees, and staff disputes at the site and the employer shall be, in no way, be responsible for the same. Therefore, contractor shall maintain the statutory records in these regards and shall make available to the employer, copies thereof upon request. It shall

indemnify and keep indemnified the employer, its directors, employees, agents or representative against all charges, fees, penalties, damages, costs including reasonable attorney fee arising due to any non-compliance therewith or losses, damages and other consequences arising from such non compliance, including any claims by third parties.

b) Without prejudice to the other provisions of the contract, the contractor will take out insurance policies for sufficient amounts to cover him against workman's compensation etc. and will keep the employer, its directors and employees indemnified against all such risks.

c) The contractor hereby undertakes to indemnify and keep the Punjab Technical University its directors, agents, employees indemnified against all claims, demands, costs, expenses, charges, penalties fees etc. of any kind whatsoever in including third party claim due to personnel injury or death (including reasonable attorney fee) which may arise against or incurred by the Punjab Technical University, in connection with the services rendered by /contractor and due to any act, default or negligence of contractor or otherwise arising out of any breach of any of the provisions, undertakings and covenants of contractor contained herein.

d) No employee-Employer relationship shall be deemed to be created or construed between the personnel deputed by contractor and the Punjab Technical University. Contractor shall be solely responsible for all salaries, wages, bonuses, gratuity etc. and all other fringe benefits and the Punjab Technical University shall not be liable for any such matter whatsoever.

e) The Contractor shall be bound to follow Government Rules relating to layout, water supply and sanitation, Indian Electricity Act and Fire Control Rules and Regulations in labour camps and the provision of the Materials Building Code of India 1970 in regard to constructional practices and safety.

30 Deleted

31 Site and its use

31.1 The site will be made available to the contractor in its present conditions, site organization within the site boundaries shall be his responsibility. No space other than the above site can be made available to the contractor for site office, labour camps, storage etc.

31.2 The contractor shall confine his equipment, storage of materials, and all operations at site to limits determined by the Engineer within the area defined in the contract.

31.3 The contractor shall ensure that the transportation of materials to and from the site, movement of personnel or equivalent, operations of any sub-contractor or any other activity at site does not in any way interfere with or disturb with or disturb the management and normal activities.

32 Clean up of Site

32.1 The contractor shall maintain the works and site in tidy condition and free from accumulation of waste materials and debris.

32.2 Upon substantial completion of works, the contractor shall retain at site only such materials, equipment and tools as may be required for the performance of any remaining work. The contractor shall, at his cost, remove all scrap, debris, waste materials, and temporary structures so as to leave the work and site clean and suitable for occupation by the Employer.

32.3 if the contractor fails to clean up the site and to remove his materials and equipment, as above, the Employer shall be entitled to withhold payments due to the contractor, and also to arrange for the clean-up of the site and removal of the contractor's materials and equipment, entirely at the risk and cost of the contractor, and without incurring any liability of any nature whatever.

33 Inspection and correction of Work

33.1 Access: the Employer and their authorized agents and representatives shall at all times have access to the site and at other locations, where parts of the work are under preparation.

33.2 Deleted

33.3 The contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work called for by this contract confirm to contract requirements. The contractor shall maintain complete inspection records and make them available to the Employer. All work shall be conducted under the general direction of the contractor and is subject to the Employer inspection and test at all places and at all reasonable times before final completion and acceptance to ensure strict compliance with the terms of the contract.

33.4 The Employer's inspection and tests: inspections and test conducted by or on behalf of the Employer are for the sole benefits of the Employer and do not:

a) relieve the contractor of responsibility for providing adequate quality control measures;

b) relieve the contractor of responsibility for damage to or loss of the materials before final completion and acceptance of the work;

c) constitute or imply acceptance; or

d) Affect the continuing rights of the Employer after acceptance of completed work.

33.5 Performance of inspections and tests; the contractor shall promptly furnish, without additional charge, all facilities, labour and materials reasonably needed for performing such safe and convenient inspections and test as may charge to the contractor any additional cost of inspection or testing when work is not ready at the time specified by the contactor for inspection or test, when prior rejection makes reinsertions or retesting necessary. The Employer shall perform all its inspection and test in a manner that will not unnecessarily delay the work. Special, full size and performance test shall be performed as described in the contract documents or as instructed by the Engineer from time to time.

33.6 Rejected work: the contractor shall, at no additional cost or time, promptly replace or correct work found by the Employer not to confirm to contract requirements, unless the Employer consents to accept the work with an appropriate adjustment in the contract price. The contractor shall promptly segregate and remove rejected material from the premises.

33.7 Failure to correct: If the contractor does not promptly replace or correct rejected work, the Employer may:

a) by contract or otherwise, replace and correct the work and charge the cost to the contractor.

b) Terminate for default the contractor's right to precede.

34 Materials and workmanship

34.1 The contractor shall ensure that all materials and workmanship is of the kind and quality described in the contract documents. All materials shall be new and of the best quality, and the contractor shall, at his own cost, carry out prescribed tests to ensure reliability and conformity with relevant standards.

34.2 The contractor shall, at his own cost, supply or produce samples of materials and workmanship whenever required by the Engineer and specifications well ahead of time to allow for alternative experiments.

34.3 The Employer reserves the right to instruct the contractor to purchase materials from suppliers nominated and at such rates and prices as many be agreed with such suppliers. The Employer further reserves the right to supply selected materials free of cost to the contractor. In either of the above cases payments to the contractor shall be subject to commensurate adjustments, in all events, however, the contractor shall be responsible to check and test all the materials, received from any source, to ensure satisfactory quality.

34.4 All materials shall be purchased by the contractor at his cost, save in the instances when the Employer exercises his right to supply some materials free of costs. However, if the contractor is required by the Engineer to procure materials well in advance of the approved procurement schedule, then the cost of materials so ordered shall be borne by the Employer and such costs shall be paid to the contractor as advance payments to the contractor, to be adjusted against his bills.

34.5 No materials shall be used in the works beyond its expiry date or prescribed shelf life. Any materials found to have deteriorated in quality and considered unfit by the Engineer for use in the works shall be replaced by the contractor at his own cost.

34.6 The contractor shall maintain accurate records of the receipt, usage and dispatch of materials from site, so as to present an update register of stocks of all materials whenever required by the Engineer.

34.7 The contractor shall prepare checklist of work to be carried out and approved by the Engineer for every stage or element of the work, and a review of such lists by the Engineer shall be mandatory before completion of each phase of the work.

34.8 The signing of any checklist or approval of any form of work by the Engineer shall not in any way relieve the contractor of his responsibility to ensure completion of each phase of the work of the quality and specifications required and within approved time schedule, as per contract documents.

34.9 The contractor shall be solely responsible for the protection of all finished surfaces and works so as to avoid any repairs, and shall deliver to the Employer upon final completion the works free of any blemish, defect or damage.

35 Rejected Work

35.1 The Engineer shall be authorized to reject any work, which in his opinion, does not conform to the requirements of the contractor document.

35.2 Defective work, whether due to poor workmanship, use of sub-standard materials, or damage, whether by the contractor or any sub-contractor, which may be rejected by the Engineer shall be demolished by the contractor and removed promptly from the site and replaced or re-executed expeditiously by the contractor at his own cost.

35.3 If in the opinion of the Engineer, it is not expedient to correct defective work, the Employer shall be entitled to deduct from moneys due to the contractor, the difference in value between the executed work and that required under the contract, the amount of which shall be determined by the Engineer.

36 Water

36.1 The contractor shall, at his own cost make necessary arrangements for water, its storage and distribution for construction and emergencies.

36.2 The contractor shall satisfy himself regarding the quality and suitability of the water, and if required to have the tested at his own cost.

36.3 In the event of unacceptable quality for construction, insufficiency or non-availability of water at site, the contractor shall arrange, at his cost, for delivery of water from outside. He shall provide test reports of water used by him to the Engineer for his satisfaction and acceptance.

36.4 The contractor shall permit all the sub-contractors to use his water storage and distribution facilities for their respective work. Any additional or special arrangements needed by sub-contractors shall be made by them at their own cost.

36.5 Upon completion of the work, temporary storage tanks, built or installed, shall be removed by the contractor and the site restored to its original condition.

36.6 Insufficiency or non-availability of water shall not be cited by the contractor as an excuse for delays, or deficiencies in the work or a reason for claiming extra payments.

37 Electricity

37.1 The Contractor shall make his own arrangements for electrical power for the constructions well as for general lightning and other usages.

37.2 The contractor shall at his own cost, provide approved, temporary connections, cables distribution boards and related equipment, as required by the Engineer.

37.3 The contractor shall permit and enable all sub-contractors to use his power distribution facilities to which the contractor shall recover at cost from sub-contractor.

37.4 The contractor shall, at his own cost and in order to prevent interruption of his work in the event of power failures, provide for a stand-by diesel generator of sufficient capacity to supply adequate electricity for the works and other uses.

37.5 Disruptions in power supply, whether due to power failures, load shedding, generator breakdown, or any other reason, shall not be accepted as a valid reason for delays and deficiencies in the work or for claims for additional payments.

38 Telephone

38.1 The contractor shall at his own expense, arrange and provide for separate and independent telephone and fax connection at his site office.

38.2 The Employer shall not permit the use of his telephone or fax facilities by the contractor for any purpose whatsoever.

39 Approvals and permits

39.1 The contractor shall be completely responsible, at his own cost, for obtaining any and all approvals, permits, no objection certificates or any other required clearance from any statutory body for any part of the work under this contract whether initially, during the progress of work or finally.

40 Registers to be maintained by the Contractor at site

40.1 The contractor shall maintain at site a site order register in which he shall daily register detailed particulars of activities at site and progress of work. The format of such work diary shall be approved by the Engineer.

40.2 In addition, the contractor shall maintain daily works register, stage passing order, sample approval register, material test-result register, material at site register etc. at site and make relevant entries in these registers in the format approved by the Engineer.

40.3 The contractor shall submit to the Engineer copies of the duly filled and update site order register every day for their study and comments.

40.4 Any observations or objections made by the Engineers shall be clarified or explained within 48 hours by the contractor, otherwise such observations shall be deemed to be confirmed by the contractor.

40.5 Neither the submission of the registers to the Engineer nor their perusal nor endorsements shall prejudice the rights of the Employer or in any manner relieve the contractor of his responsibilities under the contract.

41 Deleted

42 Appointment of Apprentices as per Apprentice Act

42.1 The contractor shall during the currency of the contract when called upon by the Punjab Technical University engage and also ensure engagement by sub-contractor and other employed by the contractor in connection with the works such number of apprentices in the categories as directed, and for such periods as may be required under the Institute of Architects. The contractor shall train them as required under the apprentices Act, 1961 and' the rules made there-under from time to time and shall be responsible for all obligations of the Employer under the said act including the liability to make payments to apprentices as required under the said Act.

43 Technical Audit

43.1 The Employer reserves the right to carry out post payment audit and technical examination of the works and final bill, including all supporting vouchers, abstracts etc., the employer further reserves the right to carry out the aforesaid examination and enforce recovery detected, not withstanding the fact that the amount of final bill may have been included by one of the parties as an item of dispute before an arbitrator appointed under the arbitration clause of the contract and notwithstanding the fact that the amount of the final bill figures in the Arbitrator's Award.

43.2 If as a result of such audit and technical examination, over payment is discovered in respect of the work done under the contract, the contractor shall on demand make a payment of a sum equal to the amount of overpayment or agree for effecting necessary adjustments from any amounts due to him by the employer. If however, he refuses or neglects to make the payment on demand or does not agree to effecting adjustment from any amount due to him, the employer shall be entitled to take actions in sub-para above. If as a result of such audit & technical examination an under payment is discovered, the amount of underpayment shall be duly paid to the contractor by the employer.

44 Resolution of Disputes/Arbitration

44.1 The Employer and the Contractor shall make every effort to resolve amicably by direct informal negotiations any disagreement or dispute arising between them under or in connection with the contract.

44.2 All disputes and differences arising out of or in connection with, touching or concerning this work shall be referred to the sole Arbitrator appointed for the purpose by Vice Chancellor of Punjab Technical University (Employer). The decision of the Arbitrator shall be final and binding on both the parties subject to the provisions of the Indian Reconciliation and Arbitration Act of 1996 or any statutory modifications or reenactment thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause.

44.3 Venue of the arbitration proceedings shall be Kapurthala.

45 Miscellaneous

45.1 This contract has been made on an arms length basis. There is no relationship existing between the contractor and Employer prior to the execution of the contractor.

FORM OF TENDER

To

The Executive Engineer,
Punjab Technical University
Jalandhar-Kapurthala Road,
Kapurthala.

Sir,

I/We do hereby offer to execute the works comprised in the tender documents for the completion of _____ (Name of the work) in strict accordance with the drawings, specifications, schedules of quantities and upon the terms set out there-in.

I/We undertake to complete the whole work as scheduled in the Special Conditions of Contract from the date on which the order to commence the work is given to us by the Punjab Technical University.

I/We send herewith the sum of Rs……(Rupees..... only) as a deposit of Earnest Money, in bank draft or pay order drawn on …… (name of Bank) as proof of my/our willingness to enter into the contract if my/our tender is accepted in full or in part.

In the event of my/our tender being accepted, we also agree to enter into a contract in the form annexed hereto with such alterations or additions thereto which may be necessary to give effect to the acceptance of this tender and such contract shall contain and give full effect to Instructions to Tenderers, the Specification, Schedule of Quantities and rates schedule of materials and Estimates to be supplied by the Punjab Technical University and the drawings attached to the tender/supplied by PTU.

Witness:
Address:
Date:

Tenderer's Signature
Address:
Date:

STAMP RS.I00/

AGREEMENT

This Contract / Agreement is made on the …….day of ……200
BETWEEN
Punjab Technical University-Jalandhar, hereinafter called the "the PTU (which expression shall, wherever the context so demands or requires, includes their successors and assignee) of the one part
AND
M/s…… "
hereinafter called "the Contractor" (which expression shall, wherever the context so demands or requires, include his/ their legal successor and assignee) of the other part.

WHEREAS

A) The PTU is desirous that _____ (Name of the work) be executed as mentioned, enumerated or referred to in the Tender Documents including Quantities, Estimates, Agreed Variations and other document as called for in the Tender.

B) The Contractor has inspected the site and surroundings of work specified in the Tender Documents and has satisfied himself by careful examination before submitting his tender as to the nature of surface, strata, and ground, the form and nature of Site and local conditions, the quantities, nature, and magnitude of the work, availability of labour and materials necessary for the execution of work, the means of access to site, the supply of power and water thereto and the accommodation he may require and has made local and independent enquiries and obtained complete information as to the matters and things referred to or and obtained complete information as to the matters and things referred to, or implied in the Tender Document or having any connection therewith, and has considered the nature and extent of all probable and possible situations, delays, hindrances, (except any Archeological Monuments/ Structures or unforeseen underground Service) or interference to or with the execution and completion of work to be carried out under the contract and has examined and considered all other matters, conditions and things and probable and possible contingencies, and generally all matters incidental thereto and auxiliary thereof affecting the execution and completion of work as per the terms and conditions of the contract and which might have influenced him in making his bid. However the contractor shall be entitled to extra payment for any extra work not incorporated in the bill of quantities as per mutually agreed terms/ rates if the said work is allotted to the contractor.

AND WHEREAS

The PTU has accepted the tender for _____ (Name of the work) and conveyed vide letter No. …….. dated at the percentage as quoted in the schedule of Quantities for the work and accepted by the PTU upon the terms and subject to the conditions of the contract.

NOW THIS AGREEMENT WITNESSETH AND IT IS HEREBY AGREED AND DECLARED AS FOLLOWS

1. The following documents in conjunction with addendum/corrigendum to Tender Documents shall be deemed to *form* and be read and construed as part of this Agreement, viz

   (a) This Contract Agreement
   (b) All documents forming part of the tender document.
   (c) Any other document, as felt necessary

2. In this Agreement words and expressions shall have the same meaning as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

3. The work shall be strictly executed in accordance with the conditions of the Contract set forth in the documents mentioned in para 1.

4. In consideration of the payment to be made to the contractor for the work to be executed by him, the Contractor hereby covenants with PTU that the Contractor shall and will duly provide, execute and complete the said work and shall do and perform all other acts and things in the Contract, mentioned or described or which are to be implied there from or may be reasonably necessary for the completion of the said work and at the times and in the manner and subject to the terms and conditions or stipulations mentioned in The Contract.

5. In consideration of the due provision, execution and completion of the said work, the PTU does hereby agree with the contractor that the PTU will pay to the contractor in respect of the amounts for the work actually done by him and approved by the Architect/Executive Engineer PTU at the quoted percentage of the estimates and other sums payable to the Contractor under provisions of the Contract, such payment to be made at such time and in such manner as provided for in The Contract.

AND

In consideration of the due provision, execution and completion of the said work, the Contractor does hereby agree to pay such sums as may be due to the PTU as per the terms and conditions set forth in the said contract, and such other sums as may become

payable to the PTU towards loss, damage to the PTU's equipment, materials, construction plant and machinery, such payments to be made at such time and in such manner as is provided in the contract.

It shall be specified and distinctly understood and agreed between the PTU and contractor that the contractor shall have no right, title or interest in the site made available by the PTU for the execution of the work or in the building, structure or the work executed in the said site or in the goods, articles or materials etc. brought to the said site (unless the same specifically belong to the contractor) and the contractor shall not have or deem to have any lien or whatsoever charge for unpaid bill and on this account will not be entitled to assume or retain possession or control of site or structures or materials or equipment and the PTU shall have an absolute right to take full possession of the site and to remove the Contractor, their servants, agents, representatives, materials etc. belonging to the Contractor and lying on the site. The agreement is being executed in quadruplicate for facility of reference.

IN WITNESS WHEREOF the parties have executed these presents in the day and the year first above written.

Signed and delivered for and on behalf of the PTU	Signed and delivered for and on behalf the Contractor.
Dated	Date
Place	Place

IN PRESENCE OF TWO WITNESS

1.	1.
2.	2.

INDEMNITY BOND

(To be executed on Stamp Paper of Rs. 100 duly notarised)

KNOW all men by these presents that l/We…….do hereby execute Indemnity Bond in favour of the Punjab Technical University, Jallandhar, on this …… day of …….

WHEREAS the Punjab Technical University, Jallandhar have appointed M/s ……. as the Contractors for their _____ (Name of the work).

THIS DEED WITNESS AS FOLLOWS:

I/We……. hereby do Indemnify and save harmless the Punjab Technical University, Jallandhar against and from:.

1. Any third party claims, civil or criminal complaints / liabilities, site mishaps and other accidents or
disputes and/or damages occurring or arising out of any mishaps at the site due to faulty work negligence, faulty construction and/or for violating any law, rules and regulations in force, for the time being while executing/executed works by me/us.

2. Any damages, loss or expenses due to or resulting from any negligence or breach of duty on the part of me /us or my sub contactor's if any, servants or agents.

3. Any claim by an employee of mine/ours or of sub contractors if any, under the Workmen's Compensation Act, 1939 or any other law, rules and regulations in force for the time being and any Acts rcplacl11g and/or amending the same or any of the same as may be in force at the time and under all any law in respect of injuries to persons or property arising out of and in the course of the execution of the contract work and/or arising out of and in the course of employment of any workman/employee.

4. Any act or omission of mine/ours of sub-contractor/s if any, our/their servants or agents which may involve any loss, damage, liability civil or criminal action.

WITNESS WHEREOF THE …….. has set his/their hand on this day of ……
2005.

SIGNED AND DELIVERED BY THE AFORESAID

(name and address of the contractor)

IN THE PRESENCE OF WITNESSES:

1. 2. .

TECHNICAL SPECIFICATIONS

A. Civil Works:

All the civil works shall be executed, measured and paid as per latest Punjab PWD specifications. In case, any item(s) is/are not covered under Punjab PWD specifications, latest CPWD specifications shall be followed. In case, any item (s) is not covered under Punjab PWD and CPWD specifications, latest IS codes shall be followed.

A. Electrical Works:

All the electrical works shall be executed, measured and paid as per the following special technical specifications. In case, any item(s) is not covered in these special technical specifications, latest Punjab PWD specifications shall be followed. In case, any item(s) is/are not covered under special technical specifications and Punjab PWD specifications, latest CPWD specifications shall be followed. In case, any item (s) is not covered under any of the above, latest IS codes shall be followed.

SPECIAL TECHNICAL SPECIFICATIONS

FOR SUPPLYING, INSTALLATION, TESTING & COMMISSIONING OF EXTERNAL ELECRICAL WORK FOR RAJPURA, PUNJAB TECHNICAL UNIVERSITY

CHAPTER – 1

11 KV VACCUM CIRCUIT BREAKERS:-

1. SCOPE:

This specification covers three-pole, 50Hz, 11KV vacuum circuit breakers for indoor installations in electrification system.

2. APPLICABLE STANDARDS:

Unless otherwise modified in this specification, the vacuum circuit breakers shall comply with the following Indian Standards as amended from time to time:

IS-2516: Circuit Breakers

IS-3156: Voltage Transformers

IS-2705: Current Transformers

3. RATED VOLTAGE:

The rated voltage for the circuit breaker shall be 12KV. This represents the highest system voltage corresponding to the nominal system voltage of 11KV.

4. RATED CURRENT:

4.1 The standard rated normal current shall be 630A.

4.2 The bus-bar rating of the indoor type vacuum circuit breaker shall be 1000A.

5. RATED SHORT-CURCUIT BREAKING CAPACITY:

5.1 The rated short-circuit breaking capacity shall be minimum 350MVA.

5.2 The value of d.c. component shall be calculated in accordance with the recommendations contained in IS: 2516.

6. RATED SHORT-CIRCUIT MAKING CURRENT:

The rated short-circuit making current of the circuit breakers shall be taken as 2.5 times the rms value of the a.c. component of the rated short-circuit breaking current.

7. RATED VOLTAGE OF OPERATING DEVICES:

The standard DC voltage for the operating devices shall be 110V/ as indicated in BOQ.

8. VOLTAGE TRANSFORMER FOR METERING:

8.1 Voltage Ratio: The rated voltage ratio shall be 11 KV/ 110V or as indicated in B.O.Q./Drawings. The transformer shall be star connected.

8.2 Rated Output: The standard rated output (burden) of the voltage transformer shall be 150VA per phase.

8.3 Accuracy Class: The standard accuracy class shall be 1.0.

9. CURRENT TRANSFORMER FOR METERING & PROTECTION:

9.1 Transformer Ratio: The standard transformation ratios shall be either of the following/ as indicated on the drawings/ as indicated in the Schedule of Quantities:

(i) 30/5A

(ii) 100/5A

(iii) 200/5A

(iv) 300/5A

NOTE: The double ratio current transformers may be used to cover the load demands of the outgoing feeders as well as the requirements of incoming panels for sub-station and nothing extra shall be paid to the contractor on this account.

9.2 Accuracy Class: The standard accuracy class shall be 1.0.

9.3 Rated Output: The rated output (burden) of the current transformers which depends upon the type and make of relays and meters used will have to be decided in each case.

10 METERING AND PROTECTION:

10.1 Meters/instruments on the incoming and outgoing circuit breaker panels shall be provided in accordance with the B.O.Q./these specifications.

10.2 A triple-pole IDMTL type protection relay having high set elements for over current protection shall be provided on the incoming breakers and a similar relay with two elements for over-current protection and one element for earth fault protection shall be provided on outgoing circuit breakers. The current setting range of the over-current elements shall be from 50% to 200% in steps of 25% and that of the earth fault element from 20% to 80% in steps of 10%.

11 CLOSING/ TRIPPING MECHANISM:

11.1 The circuit breakers shall be provided with motor operated closing mechanism suitable for 110V DC supply with provision for manual closing.

11.2 The trip mechanism shall be suitable for direct operation from the Current Transformers in conjunction with the `Series trip" relays of the type indicated in clause 10.2/B.O.Q.

12 TESTS:

The circuit breakers, voltage transformers and current transformers shall be subjected to the following routine and type tests in accordance with the details specified in the relevant Indian Standards, as amended from time to time. Only non-destructive type of tests shall be conducted on various components/equipments and for all other tests, 'the test certificates' of tests carried out on similar products shall be submitted by the contractor.

12.1 Circuit Breakers-IS: 2516 (Part IV/Section 2) - 1980 amended upto date.

12.1.1 Routine Tests:

a) Power frequency voltage dry test on the main circuit.

b) Voltage test on control and auxiliary circuits.

c) Measurement of resistance of the main circuit.

d) Mechanical Operating test.

12.1.2 Type Tests:

a) Tests to prove mechanical performance.

b) Tests to prove mechanical operation.

c) Tests to prove that temperature rise of any part does not exceed specified limits.

d) Tests to prove that insulation complies with specified limits.

e) Tests to prove short-circuit making and breaking performance.

f) Tests to prove short-time current performance.

g) Tests to prove performance when breaking line charging current.

h) Tests to prove performance when breaking cable-charging current.

j) Tests to prove the performance when breaking single capacitor bank currents.

k) Tests to prove the performance when breaking small inductive currents.

12.2 Voltage Transformer- IS: 3156 (Part I)-1978.

12.2.1 Routine Tests:

a) Verification of terminal markings and polarity.

b) Power-frequency dry withstand tests on primary windings.

c) Power frequency dry withstand tests on secondary windings.

d) Determination of errors according to the requirements of the appropriate accuracy class.

12.2.2. Type Tests:

a) Verification of terminal markings and polarity.

b) Power frequency dry withstand tests on primary windings.

c) Power frequency dry withstand tests on secondary windings.

d) Determination of errors according to the requirements of the appropriate accuracy class.

e) Temperature-rise test

f) Impulse voltage tests on voltage transformers for service in electrically exposed installations.

12.3 Current Transformers-IS: 2705 (Part I)-1964.

12.3.1 Routine Tests:

a) Verification of terminal markings and polarity

b) High voltage power-frequency test on primary windings.

c) High voltage power frequency test on secondary windings.

d) Over-voltage inter-turn test.

e) Determination of error according to the requirements of appropriate accuracy class.

12.3.2 Type Tests:

a) Verification of terminal markings and polarity.

b) High voltage power frequency test on primary windings.

c) High voltage power frequency test on secondary windings.

d) Over-voltage inter-turn test.

e) Determination of error according to the requirements of appropriate accuracy class.

f) Short-time current test.

g) Temperature-rise test.

h) Impulse voltage test for current transformers for service in electrically exposed installations.

13 INSPECTION:

13.1 All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacturers and Architect/Consultant at the time of purchase.

The manufacturer shall provide the inspector representing the Architect/Consultant all facilities, without charge, to satisfy him that the material is being furnished in accordance with the specifications.

13.2 The Architect/Consultant has the right to have the tests carried out at the contractor's cost by an independent agency whenever there is dispute regarding the quality of supply.

CHAPTER – 2

H.T. DISTRIBUTION BOARD:-

1. CONSTRUCTION

1.1 The metal enclosed panel will be fully extensible and compartmentalized with internal partitioning by insulated material (epoxy reinforced fiber glass or equivalent) to give.

i) Circuit breaker compartment.

ii) Bus Bar Compartment.

iii) C.T. & Cable Compartment.

1.2 The standard H.T. Panel shall contain a basic frame assembly reinforced with formed sheet steel profiles and cross members. Sheet steel partitions shall be bolted to this frame to form the full structure. Basic structure is made out of minimum 14 S.W.G (2 mm. thick) sheet steel. All sheet steel shall be cold rolled.

1.3 The pre-treatment process shall involve de-greasing, rinsing, de-scaling, rinsing, de-rusting, rinsing, phosphating, rinsing & passivation. After this, it shall be spray finished with a primer, oven dried and spray painted with finish paint, 2 coats wet on wet. Then it shall be baked in oven to achieve a uniform, smooth and tough film. The standard shade offered shall be light grey shade 631 semigloss as per IS: 5. the painting shall be with synthetic enamel stoving grade to a final overall dry film thickness of 30/40 microns. Stoving grade to a final overall dry film

2. BREAKER COMPARTMENT:

V.C.B. shall be mounted in Drawout truck with front plate which should cover the cubicle when the breaker is in service position. The front plate should be provided with a view glass to facilitate observation of Mechanical ON/OFF indication, circuit breaker, and spring charged/discharged indication and operation counter. Necessary orifice shall be provided for manual charging of the spring and also mechanical ON/OFF push buttons for opening & closing the circuit breaker. The drawout truck will have two positions for the circuit breaker viz. Isolated/Test and service position.

3. BUS BAR COMPARTMENT:

Bus bar of rectangular cross section of insulated copper, supported by epoxy insulators designed to withstand full short circuit currents upto 44KA for 3 seconds shall be provided at the rear of the panel.

4. LOW VOLTAGE PLUG & SOCKET CONNECTOR:

The control instrumentation & interlock circuits on breaker truck and in the panel shall be connected by means of flexible leads and a 24 pin plug and socket connection. The plug and socket assembly shall be suitably interlocked with truck position like service and test/isolated position.

5. POTENTIAL TRANSFORMER:

Epoxy cast potential transformer shall be fitted in the panel wherever specified. Feeder connected P.Ts shall be mounted on the breaker trunk itself. Bus bar connected P.T. shall be supplied in P.T. Panels.

6. SAFETY DEVICES:

To ensure safety of operating personnel adequate safety devices not limited to followings shall be provided.

a) Circuit breaker & sheet metal enclosure shall be fully earthed.

b) Self locking shutters shall be provided which would close automatically when the breaker is withdrawn to test position.

8. INTERLOCKS & SAFETY DEVICES:

Minimum following interlocks shall be provided in the panel board:

a) The truck can not be moved from either test to service position or vice versa, when the circuit breaker is ON.

b) The circuit breaker cannot be switched ON when the truck is in any position between test and service position.

c) Front part of the truck cannot be removed when the breaker is in ON position.

d) The low voltage plug & socket cannot be disconnected in any position except test/Isolation position.

e) The truck cannot be moved inside the panel when LT plug & socket is disconnected.

f) Earthing switch cannot be switched ON when the truck is inside the panel.

g) The truck cannot be inserted when the earthing switch is ON.

9. PROTECTIVE EARTHING:

The earthing connection between the truck and cubicle shall be with the help of sliding contacts. This should be arranged in such a way so that the truck is already earthed in the isolated position when inserted. The earthing contact is maintained when the truck is pushed further into the connected position. When the track is being withdrawn, the earthing connection is not interrupted until the truck is moved past the isolated position.

CHAPTER – 3

RELAY & CONTROL PANEL:-

1. SCOPE

This specification covers the requirements of indoor relay and control panel.

2. CODES AND STANDARDS

The design, manufacture and performance of equipment shall comply with all currently applicable i.e. rules and statutory regulations and safety codes in the locality where the equipment will be installed.

Unless otherwise specified, equipment shall conform to the latest applicable Indian Standards and in particular to the following:-

1.	IS: 2147 -	Degree of protection provided by Enclosures for low voltage switchgear and controlgear.
2.	IS: 4237 -	General requirement for switch-gear and control for voltage not exceeding 1000V.
3.	IS: 375 -	Arrangement for switchgear, Bus-Bars main connections, auxiliary wiring, marking.
4.	IS: 1248 -	Direct acting electrical indicating instruments.
5.	IS-2208 -	HRC cartridge fuse links upto 650V.
6.	IS-4064 -	Specification for air brake Switches disconnector and fuse combination units.

3. GENERAL REQUIREMENT

Relay and control panel shall be 14 gauge CRCA sheet steel enclosed and shall be dust and vermin proof. Enclosure shall provide degree of protection not less than IP 20 in accordance with IS: 2147. All doors and removable covers shall be casketed all around preferably with neoprane gasket.

Relay and control panel shall be free standing, floor mounting type and shall be provided with hinged door at back side with padlocking arrangement.

Design, material selection and workmanship shall be much as to result in neat appearance inside and outside with no welds, revets or bolt heads apparant from outside, with all exterior smooth surfaces.

Cable entries to the panel shall be from the bottom. The bottom plates of the panel shall be fitted with removable gland plates of adequate size for fixing the cable glands.

All equipment on front of panel shall be mounted flush or semi-flush. Cut-outs, if any, provided for mounting future equipment, the same shall be properly blanked-off.

Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent equipment. Equipment mounted inside the panel shall be located as such so that terminals and adjacent devices are readily accessible without the use of special tools. Terminal marking shall be clearly visible.

The centre lines of switches, pushbuttons and indicating lamps shall be not less than 75 mm from the bottom of the panel. The centre lines of relays meters and recorders shall be not less than 45 mm from the bottom of the panel.

No equipment shall be mounted on the doors without prior approval of Architect/PM.

Wherever required, panel shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment on the front.

All sheet steel work shall be degreased, pickled, pheshphated and then applied with two coats of zinc primer, two coats of finishing synthetic enamel paint, both inside and outside. The colour of the finishing paint shall be as specified in data sheet.

4. COMPONENTS

For the V.C.B. being used as incomer, the following meters, indicators, relays, push buttons shall be provided etc.;

i) 1 No. frequency meter.

ii) 1 No. power factor meter 0.5-1-0.5 range.

iii) 1 No. 0-50 KV range voltmeter with selector switch.

iv) 1 No. ammeter 0-300A range with selector switch.

v) 1 No. IDMT relay with 2No.s high set elements for over current and one element for earth faults.

vi) 1 No. Trip Neutral close switch.

vii) 6 No.s Indicating Lamps for the following;

a) Red for VCB ON.

b) Green for VCB OFF.

c) Orange for Auto Trip.

d) White for Trip ckt. Healthy.

e) Blue for Spring Charged.

f) Amber for Non Trip Alarm.

viii) Push buttons for the followings,

a) Green for VCB ON

b) Red for VCB OFF.

c) Yellow for trip alarm cancellation.

d) Black for D.C. Trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

ix) 1 No. KWH meter

x) 1 No. MDI.

xi) Restricted Earth Fault Relay.

It shall also have the provisions, in the form of wired connections upto the terminal block on the panel itself, of connecting the similar indicators, push buttons etc on the Remote Control Console Board through potential free contacts.

Each of the V.C.B. being used to control the out going feeders shall be provided with the following meters, indicators, relays, push buttons etc.;

i) 1 No. ammeter 0-100 A range with selector switch.

ii) 1 No. IDMT relay with 2No.s high set elements for over current and one element for earth faults.

iii) 1 No. Trip Neutral close switch.

iv) 6 No.s Indicating Lamps for the following;

a) Red for VCB ON.

b) Green for VCB OFF.

c) Orange for Auto Trip.

d) White for Trip ckt. Healthy.

e) Blue for Spring Charged.

f) Amber for Non Trip Alarm.

v) Push buttons for the followings,

a) Green for VCB ON

b) Red for VCB OFF.

c) Yellow for trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

vi) Solid state annunciater with Test, Accept, Reset and Trip ckt. healthy Push Buttons and auxiliary Relays as reqd. for;

a) 1 No. for D.C. failure.

b) 1 No. for Transformer tripped due to over temp.

c) 1 No. for High winding temp.

d) 1 No. for Transformer tripped due to Buchholz Relay signal.

It shall also have the provisions, in the form of wired connections upto the terminal block on the panel itself, of connecting the similar indicators, push buttons etc on the Remote Control Console Board through potential free contacts.

5. PANEL WIRING

Panel shall be supplied completely wired internally to equipment and terminal blocks and ready for purchaser's external cable connections at the terminal blocks. When panels areto be mounted adjacent to each other, all inter-panel wiring and connections between panels shall be furnished by Contractor.

All wiring shall be carried out with 1100V. grade, single core, standard copper conductor wires FRLSH PVC insulated. The minimum size of the stranded copper conductor used for panel wiring shall be as follows:

a) All circuits except CT circuits: 1.5 sq.mm

b) CT circuit 2.5 sq.mm

Panel wiring shall be securely supported, neatly arranged, readily accessible and connected to equipment terminals blocks. Wiring troughs shall be used for this purpose.

Wire terminations shall be made with solder less crimping type of tinned copper lugs which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules, marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected from terminal blocks. The wire numbers shown on the wiring diagram shall be in accordance with IS-375. All wires directly connected to trip circuit of breaker or device shall be distinguished by the addition of a red coloured unlettered ferrule.

Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

Terminal blocks shall be 650V.grade, 15 amps rated, one piece moulded, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts and identification strips. Marking on the terminal strips shall correspond to wire numbers on the wiring diagrams. Terminal blocks shall be suitable for connecting the following conductors:

a) All circuits except CT circuits: Min of two 2.5 mm copper.

b) CT circuits : Min of four 2.5mm copper.

Terminal blocks for CT and VT secondary leads shall be provided with test links and isolating facilities. Also CT secondary leads shall be provided with short circuiting and earthing facilities.

At least 20 spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

All spare contracts and terminals of the panel mounted equipment and devices shall be wired to terminal blocks.

6. FUSES

All fuses shall be of the HRC cartridge type, conforming to IS: 2208 mounted on plug-in type of fuse bases having a prospective current rating of not less than 46 KA. Fuses shall be provided with visible operation indicators to show that they have operated. Insulated fuse pulling handle shall be supplied with each control panel.

7. INDICATING INSTRUMENTS & METERS

Electrical indicating instruments shall be flush mounted moving iron type having a minimum of 144 mm, square size.

8. RELAYS

All protective relays shall be of draw out type, suitable for flush mounting. Relays shall be equipped with externally reset, positive action operation indicator visible from the front. Voltage relays shall have sufficient thermal capacity for continuous energization, using external resistors, if necessary.

9. CONTROL AND SELECTOR SWITCHES

Control and instrument switches shall be of the rotary type and shall be provided with properly designated plate. Control switches shall have momentary contacts spring return to centre with pistol grip handle. Instrument and selector switches shall have stay put contacts. The number of contacts and operation of each switch shall be as per the requirements of the connected circuit enclosed data sheet/enclosed drawing.

10. PUSH BUTTONS

All push buttons shall be of push to actuate type have 2 `NO' and 2 `NC' self reset contacts. They shall be provided with designation plates, engraved with their functions. push button contacts shall be rated for 10 amps at 415V A.C. and 0.6 Amp. inductive breaking at 220V D.C.

11. INDICATING LAMPS

Indicating lamps shall be of the LED type having low watt consumption. Colour of lens shall be as per enclosed drawing/ data sheet.

12. **SPACE HEATER**

Strip type space heaters of adequate capacity shall be provided inside each cabinet to prevent moisture condensation. Space heaters shall be rated for 110V DC supply. Heaters shall be complete with rotary type `ON-OFF' switch, HRC fuse and thermostat to control switching of the heater.

13. **INTERIOR LIGHTING AND RECEPTACLE**

Control cabinet shall be provided with a 110V, DC, CFL lamp for interior illumination controlled by a `ON-OFF' switch and 110V. DC 10 amp. 3 pin metal clad plug receptacle with plug top.

14. **ANNUNCIATORS**

Annunciators of facia type having translucent plastic window of 35mm x 50mm (minimum) size engraved with appropriate function in block letters for each alarm point shall be provided on the control cabinet when specified on enclosed Schedule of Quantities. Annunciators shall be suitable for operation on the voltage specified and shall have a single alarm buzzer common to all points. Three push buttons for audible alarm reset, trouble lamp reset and lamp test with appropriate designation plates shall be provided common to all alarm points. Annunciators shall be suitable for operation with both normally open and normally closed alarm contacts. All necessary relays shall be supplied and mounted within the cabinet by the contractor.

On receiving an alarm impulse, even if necessary, the appropriate alarm relay shall pick up the signal energizing the corresponding visible and audible alarm units. It shall be possible for the operator to reset the audible alarm even if the `alarm' (fault), condition persists. However, visible alarm shall not reset unless the alarm condition has disappeared and operator presses the lamp reset, push button. Annunciator shall provide sealed in lamp indication and audible alarm shall be ready to operate for any new alarm condition immediately after the alarm is reset for a previous alarm condition. Annunciators shall operate satisfactorily between 80% and 110% of rated supply voltage.

The panel shall be provided with the following hooters, buzzers etc as required:

i) 1 No. Hooter for trip alarm/alarm circuit

ii) 1 No. Bell for D.C. failure.

15. **LABELS**

All door mounted equipment as well as equipment mounted inside the control panel shall be provided with individual labels with equipment designation engraved or with plastic stickers. Also the control panel shall be provided on the front with a label engraved with designation of the control panel as furnished by Architect/Consultant.

Labels shall be made of non-rusting metal or engraved plastic. Labels shall have white letter on black or dark blue background or as agreed upon.

16. **EARTHING TERMINALS**

Controls cabinet shall be provided with two separate earthing terminals suitable to receive main earthing conductors of size 50mm x 6mm.

17. **TESTS**

Following routine tests shall be carried out on Relay and Control portion of the Panel:-

a) Mechanical Operation Test.

b) High voltage test (2000 volts for 1 minute).

c) Electrical control, Interlock and Sequential operation test.

d) Verification of wiring as per approved schematic.

e) Secondary injection test for Relays.

Five copies of type test and routine test certificates shall be submitted for Architect/Consultant's approval before dispatch.

18. **INSPECTION**

Inspection including witnessing tests will be carried out by Architect/Consultant or his authorised representatives.

Contractor shall notify Architect/Consultant or his authorised representative in writing at least fifteen (15) days prior to Firm's scheduled inspection tests. No material shall be dispatched without the written dispatch advise from the Architect/Consultant.

19. **GUARANTEE**

Contractor shall guarantee design, materials/workmanship and performance for a period of twelve (12) months from the date of commissioning of the Sub-Station.

20. **DRAWINGS**

Contractor shall submit four prints of the following drawings for approval after award of contract:

1) Outline dimensions and general arrangement including plan, all sides' elevations, and relevant cross sectional views.

2) Drawing showing floor opening for cabling.

3) Schematic control circuit Diagram.

4) Three sets of manufacturer's descriptive literature on various equipment mounted on the control panel.

5) Detailed wiring diagram including terminal block details numbers, ferrule numbers and cable connections.

One print of each drawing will be returned to the contractor after making all necessary corrections, changes and required clarifications. Contractor shall incorporate these and send within fifteen (15) days, five prints of each drawing marked "certified for record and use".

CHAPTER – 4

TRANSFORMER:-

1. This shall be Oil type as specified in the Schedule of Quantities of approved make and conforming to the following standards.

a) Transformer: IS: 2026-1977 & IS 11171 of 1985

b) Installation and Commissioning of Transformer:

i) Latest I.S.S. amended upto date.

ii) Regulations of local State Electricity Board.

The capacity and other particulars shall be as given below:

1) Output 250 KVA

2)	Voltage Ratio	11KV/0.433 KV
3)	Supply	11 KV
4)	Taps-(a) HV	-10% … +5% in suitable steps
	(b) Type	OFF LOAD
5)	Connection of winding	Delta/ Star
6)	Terminals - HV	Cable end box for (As /BOQ) for aluminum conductor XLPE cable.
	LV	Cable end box for (As /BOQ) for aluminum conductor XLPE cable.
7)	Limiting Size	To suit the area indicated in drawing
8)	Type of Cooling	ONAN

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2. **MISCELLANEOUS ACCESSOREIES:**

Oil conservator
Dehydrating breather
Rollers
Dial type thermometers
Oil level indicator; Oil level gauge
Explosion vent
Drain cocks
External hand operated off circuit tap charging switch with position indicator and locking arrangement.

Connection diagram and rating plate; earthing terminals first filling of oil.
Buchholz relay.

The Transformer shall be rated for a maximum temperature rise of 50^{o}C by thermometer in oil with a daily average ambient temperature of 45^{o}C.

3. **TRANSFORMER CORE:**

Transformer cores shall be built from high quality no ageing, low loss, silicon steel laminations conforming to IS: 648-1962 and insulated on both sides. Cores shall be pressed and rigidly clamped so that hum is minimized.

Cores shall be held in substantial frame structure securing the bottom and top yokes and shall have lifting lugs.

4. **WINDINGS:**

Coils shall be made of pure electrolytic copper with circular or rectangular cross section.

L V winding shall consist of spiral coils and H V windings shall be either cross-over type of disc type.

Cores shall be assembled with adequate ventilation ducts. Coils shall be braced to the frame structure, both in the radial and axial directions so that they withstand rated short-circuit stresses.

Winding shall fully dried, pre-shrunk and varnished or oil impregnated.

Insulation used in and between windings shall have a specific inductive capacity comparable with that of immersing oil and a slow rate of ageing. Insulation shall withstand impulse voltage laid down in the I S S.

5. **TAPPING:**

Tapping of – 15% amd +5% shall be provided on the H V side unless other wise stated.

Tapings shall be so arranged as to maintain the magnetic balance between the H V and L V windings.

6. **TRANSFORMER TANK:**

Transformer tank shall be fabricated from mild steel plates of adequate thickness. Lifting lugs shall be provided to lift the transformer complete with core windings and oil. Tank cooling surface shall be augmented, wherever necessary, with cooling tubes.

Bi-directional rollers shall be provided on the under-frame of the transformers.

7. **CONSERVATOR:**

Conservator of welded mild steel construction shall be provided. Conservator shall be removable.

Conservator shall be complete with fill connection with cap or valve, drain connection and oil level gauge.

8. **TERMINALS:**

Terminals shall be provided as shown in the Equipment Schedule. Cable terminations shall be through a disconnecting chamber and complete with cable boxes and glands as required.

9. **FITTINGS:**

Following additional fittings shall be provided:

1. Rating & diagram plate
2. Two ground terminals
3. Filter valve
4. Drain and filter connection with valve
5. Air vent plug
6. Dial thermometer with alarm contacts

10. **OIL:**

Transformers shall be supplied with first fill of oil conforming to IS: 335-1953.

11. **TESTING:**

Each transformer shall be subjected to the entire test as specified in I S S except for Heat Run and Impulse tests. Tests certificates shall be furnished for each unit.

Type tests on similar transformers for Heat Run and Impulse tests will be acceptable on submission of satisfactory test certificates.

The transformers shall be subjected to the following routine tests at the manufacturer's works before dispatch.

a) Measurement of winding resistance.

b) Voltage ratio, polarity and phase relationship.

c) Measurement of impedance voltage.

d) Load losses.

e) No load losses and no load current.

f) Induced over voltage withstand.

g) Separate source voltage withstands.

The power frequency test voltage for the secondary winding shall be 2.5 KV R.M.S. The transformer shall be charged only after the tests are conducted and approval of local authorities is obtained.

Consultants/Architect/PM shall have the right of inspection of all tests.

12. **INSTALLATION:**

Installation shall conform to Indian Standard Code of Practices IS: 1886-1967 and meet with the approval of the Electrical Inspectorate and other statutory bodies.

Transformers shall be positioned with acceptable clearance all round.

Visual inspection shall be conducted for mechanical damage to any part or parts, leaking tanks, tubes or bushings. Suitable steps shall be taken to rectify the defects immediately.

Before connecting the transformers to the supply, the tank must be earthed by two separate and distinct connections through two separate copper/ GI leads of not less than 50mm X 6mm cross section each. All connections to the earthing system should be visible for inspection. Gas or water pipes should not be used for such earth connections.

The star point of L V winding shall be earthed by means of two separate and distinct earth conductors of not less than 50mm x 6mm copper strip. Earth resistance shall not exceed 0.2Ohms. Contractor shall provide necessary earthing system to achieve the required earth resistance.

All earthing shall be by means of 6mm thick copper plate buried in ground and shall be in accordance with Indian Standard Code of Practice IS: 3043 amended upto date.

13. **COMMISSIONING:**

The following pre-commissioning tests shall be conducted and test results recorded.

a) Continuity of the windings.

b) Insulation resistance between windings and also between windings and earth.

c) Testing of oil in accordance with latest IS amended upto date.

d) Earth resistance test.

In case the I R value and the condition of the oil are not found satisfactory, the transformers shall be dried out in the manner described in IS: 1886-1967. Drying out shall be carried out by means of a streamline filter.

Insulation resistance and oil tests shall be conducted after the drying out and the transformer shall be energized if the tests are satisfactory.

After energising, transformer shall be kept on `No Load' for a period of 24 hours before load is switched. Thereafter Transformers shall be brought up to full load over a period of one hour.

The contractor shall provide the necessary data as per Annexure-`A' alongwith the Tender.

CHAPTER – 5

SANDWICH BUS BAR TRUNKING

1.0 SCOPE

This section covers the technical requirements of Design, manufacture, test at works, supply of 415V, LT Bus bar trunking.

2.0 STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, constructed and tested in accordance with the latest revisions of relevant International standards 439 – 2 (2000).

IEC 529	:	Degree of Protection provided by enclosures
IEC 439-2 (Part – II)	:	Particular requirements for Bus trunking systems.
IEC 947 (Part III)	:	Specification for Low voltage Switchgear and Control gear.

3.0 GENERAL

Bus bar trunking system shall have nominal current rating as specified in the BOQ. , and shall be used for the Sub Distribution of Electrical energy.

The supply of support materials like clamps, steel channel etc. shall also be included in the scope of the contractor and nothing extra shall be paid for the same.

Bus bar trunking enclosure shall be dust and vermin proof, rectangular in cross section and shall be fabricated out of 1.6 mm thick GI . It shall be rigid and robust in construction and shall be treated to prevent any possibility of corrosion. Joints in the enclosure shall be bolted and shall be provided with neoprene gaskets. All retaining catches, screws, bolts and nuts etc. . . .

Bus bar trunking shall be manufactured in standard lengths of 3.0 Mts. The Bus Ducts being used for indoor use for power distribution shall be with arrangements for 2 TO 3 tap off in 3 meter length. The out-door bus trunking shall not have any openings at all except for ventilation.

4.0 BUSBAR SYSTEM

The busbar systems shall be produced and tested as "type-tested Switchgear combinations" (TCS), and shall be equipped with fully covered connectors having at least four poles for plug-in tap off boxes.

The busbars shall be **Sandwich type** and made up of high conductivity Aluminum. The busbars shall have a continuous current rating as mentioned in Particular Specification and shall have fault withstand capacity of minimum 50KA for 1 Sec & depending on the current rating of bus bar...

The busbar surface shall be tinned, with the contact. The individual conductors shall have a high quality, heat-resistant insulation rated for conductor

In their functional position, they shall be horizontally pluggable, on edge or flat, and in each position they shall be operatable at continuous nominal current and at an ambient temperature of 40° C the type of protection shall be IP 42 which can be raised upto IP-55 with accessories.

The conductor should be in sequence of RY BN or NRYB. The cross section of neutral conductor should be same us phase conductor.

4.1 Feeding System

All busbar systems shall be equipped with a central, or end feeder cabinet with suitably rated MCCB.

Necessary extension chambers for easy terminations of incoming cable shall also be provided.

4.2 Expansion Joints

The bus bar systems shall be equipped with standard expansion joints or with expansion bolts in each unit length to compensate thermal elongation of the bus bars.

As far as local conditions permit, the longest bus bar unit lengths shall be used to minimize electrical losses at the butt or bolted connections of the bus bars.

The busbar junction points shall be marked with plastic phenolic or aluminum labels.

4.3 Tap-Off Points

Tap of points shall be provided in-door bus ducts at every 1000mm intervals, to make connections to the live bus bars safely. These points shall be provided with safety shutters to prevent inadvertent touching of bus bars when no tap off box is fitted and to ensure that no foreign matter enters bus bar chamber.

4.4 Accessories

All suspension fixings shall be fully tested and approved exclusively as suitable for the installation with particular regard to ambient temperature, environment and loading.

The bus system shall be assembled from standard approved components completed at the factory and suitable for the application. Fully certified fireproof bulkheads shall be incorporated within horizontal and vertical section direction changes and where the system penetrates fire rated sections of the building.

5.0 EARTHING

Bus bar trunking enclosure shall be earthed by a continuous GI earth bar of minimum 32 x 5 mm size, running on the both the sides of the enclosure throughout the entire length of the Bus bar trunking.

Earth connection shall be brought to the end feed box to from connection to the 5 core incoming cable.

6.0 TESTS

Bus bar trunking shall be completely assembled, adjusted and tested for operation under stimulated conditions to ensure proper functioning of all equipments.

7.1 TYPE TESTS

The Bidder shall furnish two (2) sets of type test certificates for all the tests conducted on similar equipment.
Short time current test.
2. Temperature Rise Test

7.2 Drawings and Documents

The following drawings and documents shall be furnished in six (6) copies within (1) one week of receipt of order.

a. General arrangement drawing of the bus bar trunking showing,
Overall Dimensions for Different rating.
Terminal locations.
Total weight / meter.
Sectional views.
Fixing details.
Sectional view of Tap Off Box.

b. Single Line Diagram.
c. Technical details for Fuse switches.
d. Manufacturing schedule and test schedule.
e. Calculation for busbar sizing.
f. O & M Manual.

8.0 TECHNICAL PARTICULARS

SL.N0.	Description	Details
1.	Service	Indoor / Outdoor As per BOQ
2.	Normal System Voltage	415V
3.	Rated Continuous Current	As per BOQ.
4.	Frequency	50 Hz

5.	System Earthing	Earthed
6.	No of Phases	3ϕ 4 Wire
7	Bus bar	
	a. Material	Copper/Aluminum As per BOQ
8.	Enclosure	
	a. Material	GI
	b. Thickness	1.6 (mm)
	c. Degree of Protection	IP 42 for indoor/ IP 55 for out door With canopy.
7.	BUS Insulator	
	a. Material	FRP/ PROPLENE SLEEVING ON CONDUCTORS 'B' CLASS INSULATION MYLER TAPE, GLASS RE-ENFORCED POLYESTER AT JOINTS
	Earth Bus (GI)	32x 5 mm minimum

CHAPTER – 6

CABLES:-

1. MEDIUM AND LOW PRESSURE:

Cables should be steel armoured XLPE type with fire retardent compound Aluminum/copper conductor conforming to the quality as specified in the schedule of work. All cables, accessories and other materials should conform to I S Specification. The jointing work should be carried out by a competent authorised cable jointer.

2. H.T.CABLES:

All cables used for 11KV system shall be XLPE cables. These cables shall have individually screened cores and be manufactured and tested according to IS: 7098 (Part II) - 1973 amended up to date. The conductor for these cables shall be from electrical purity Aluminum 3/4 H or H Temper. All conductors shall be compacted circular in shape. The insulation shall be high quality cross linked Polythene - obtained by chemical cross linking of polythene molecules. The armouring applied over the common covering shall be of flat steel wires.

Each and every delivery length of the cable shall be subjected to routine tests as per IS: 7098 (Part II) 1973 amended upto the date. The operating characteristics of these cables shall be as under.

i) Permissible maximum continuous operating temperature - 90o C

ii) Permissible short circuit temperature - 250^{o} C

iii) Di electric constant (Er) at 50^{o}Hz, 30^{o}C to 90^{o}C - 2.4

iv) Loss factor at 50Hz, 30o to 90^{o}C -0.5X100X-3

v) Sp.Vol. resistivity at 20^{o}C ->10^{14}Ohm cm.

3. LAYING OF CABLES:

All cables shall be laid as per C.P.W.D GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS (PART-II EXTERNAL) - 1974 with all upto date amendments.

4. TESTING THE CABLES:

All cables shall be tested as per C.P.W.D GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS (PART-II EXTERNAL) - 1974 with all upto date amendments.

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CHAPTER – 7

MAIN L.T. PANEL:-

1. The draw out type L.T. Panel shall be with copper bus bars, indoor type, free standing, floor mounting type, extensible on either side.

2. **SITE CONDITIONS:**

Max. Peak room temperature in shade: 45.C.

Altitude - 200 mtrs. Above mean sea level.

3. **STANDARDS:**

The design, manufacture & testing of the various items are covered by the following standards:

IS 8623 - 1977 : Factory built assemblies.

IS 4237 - 1967 : General requirement for Switchgear and Controlgear for voltages not exceeding 1000V.

IS 2147 - 1962 : Degree of protection provided by enclosure for low voltage switchgear and Controlgear.

IS 3619 - 1966) : Phosphate treatment.

IS 6005 - 1970)

IS 5 - 1978	:	Colors for ready mixed paints & enamals.
IS 5082 - 1969:		Wrought aluminum for electrical purpose.
BS - 162	:	Clearance & creepage for bus systems.
IS 375 - 1963:		Marking arrangement for busbar/cable.
IS 5578 - 1970		
IS 4237 - 1967:		Clearances & Creepages for Part I & II devices.
IS 6875	:	Push buttons & related control switches including control contactors.
IS 9224 Part I & Part II – 1973:		HRC Fuses
IS 2516 Part I & II - 1979?		Alternating current circuit breakers (ACB).
II Sec. I - 1977.		Voltage not exceeding 1000V AC or 1200V DC.
IS 3231 - 1965	:	Protective relays.
IS 3156 - 1965	:	Voltage transformers.
IS 2705 - 1981	:	Current transformers.
IS 1248 - 1968	:	Elect. indicating instruments.

4. **SPECIFICATIONS:**

Rated System	:	440V. 50Hz. TPN.
Rated insulation level:		660V rms.
HV withstand level	:	2.5 KV rms for power circuit.
(for 1 min).		: 1.5KV rms for control circuit

Horizontal busbar: rating. / Drawings.	As indicated in B.O.Q.
Rated short time : rating of H.Bus &peak (36MVA). V.Bus.	Upto 50kA rms for 1 sec. 110kA
Protection of : enclosure.	IP43.

5. CONSTRUCTION:

The standard L.T. Panel shall contain a basic frame assembly reinforced with formed sheet steel profiles and cross members. Sheet steel partitions shall be bolted to this frame to form the full structure. Basic structure is made out of minimum 14 S.W.G (2 mm. thick) sheet steel. The load bearing members are made out of 14 S.W.G. and non-load member items are out of 14 S.W.G. (2 mm.) sheet steel. All sheet steel shall be cold rolled.

The pretreatment process shall involve de-greasing, rinsing, de-scaling, rinsing, de-rusting, rinsing, phosphating, rinsing & passivation. After this, it shall be spray finished with a primer, oven dried and spray painted with a finish paint, 2 coats wet on wet. Then it shall be baked in oven to achieve an uniform, smooth and tough film. The standard shade offered shall be light grey shade 631 semigloss as per IS: 5. The painting shall be with synthetic enamel stoving grade to a final overall dry film thickness of 30/40 microns. Stoving grade to a final overall dry film

The Panel design shall be of single front cubicle with horizontal busbars mounted at top, extensible on either side. The breaker, instruments and aux. equipments shall be accessible from front. The cable terminations shall be accessible from the rear side.

Each section shall be divided into 3 compartments, enclosing either Air Circuit Breakers or On Load Change Over Switch fuse Units or Switch Fuse/Fuse Switch Units or Auxiliary equipments. Max. of 2 tier ACB compartments shall be provided in one section.

A standard transportable shipping section shall contain max. three sections with length not exceeding 3 m and weight not exceeding 2.5 tonnes.

The standard draw out ACB shall have two parts namely:

i) Draw out carriage with TP incoming & outgoing power terminals & Controls sliding contacts.

ii) Basic breaker with mechanism & releases mounted on sliding rails.

The sliding contacts shall be provided for control circuit.

When the ACB is in test position, the power circuit shall be disconnected and contol circuits shall be engaged through sliding contacts.

This test position shall permit a ready inspection of all the mechanism, interlocks, automatic devices and electrical indicators.

Automatic safety shutters shall be provided for personal safety against accidental live contact to terminal when the breaker is fully drawn out.

The incoming terminals of the breakers shall be connected to the busbar by suitable links. The outgoing terminals shall be extended in the cable chamber for direct Bus Truncking/ cable connections. These shall be identified by coloured PVC tape/paint, wherever required link extension to form busduct entry from top shall also be provided. Adequate shrouding and caution notice plate shall be provided to prevent the accidental contact to live terminals.

The ACBs shall be mounted on the channel frame and shall be partitioned at the top by insulated barrier on the either side by sheet metal barrier with necessary cutout for power linking for control wiring. The control equipment, fuses, timers, contactors, etc., shall be laid out in standard fashion on a painted base plate and fixed with screws to the frame at appropriate location.

Each ACB module compartment shall be provided with front access door made out of 14SWG (2 mm.) sheet steel. All closing and opening operation of ACB (mechanically or electrically) of draw out ACB up to test position shall be performed from the front without opening the door. The breaker can be left in TEST position with the door fully closed.

Basic instrument such as ammeter, voltmeter with selector switch and lamps shall be provided on the ACB module door itself. Meters such as KW, Hz, PF, if specified, may be provided in a separate moudle for a single tier ACB or on the vertical bus door for a 2 tier ACB panel. KWh meters or KVA meter with or without MDI and protective relays shall be located in the bottom most compartment or on the vertical bus chambers. Meters/relays shall be identified with feeder identification name plates when they are located away from feeder module.

Suitable inscription plates shall be provided to identify the feeders, function of the doors mounted devices and caution plate shall be provided at appropriate locations.

Cubicle illuminating lamp, 240V, 5A, 3 pin plug and socket shall be provided with MCB for protection in cable chamber a standard item in each compartment.

Suitable M.S. removable, undrilled gland plates shall be provided. For single core cables non magnetic gland plates shall be provided.

All ACB shall be computer compatible.

6. SAFETY INTERLOCKS

The following safety interlock shall be provided for each module:

i) When ACB is ON door cannot be opended - electrically or mechanically. (Defeat interlock to be provided.)

ii) Padlocking in OFF position (locks to be provided.)

iii) Castell interlocks for feeder co-ordination as per B.O.Q. / Drawings.

7. AIR CIRUIT BREAKERS:

The Air Circuit Breaker shall be draw out or non-draw out type as indicated in the Schedule of Quantities.

The air circuit breakers shall comply with IS - 2516 - 1977.

The air circuit breakers shall have 100% certified rating when mounted in the panel. (All de-rating factors shall be clearly indicated by the contractor in his offer).

The air circuit breakers shall be (as indicated in the schedule of quantities) either manually operated or with motor operated store charged, spring closing mechanism in which case the motor shall be suitable for 110V DC supply. The motorised mechanism shall charge a closing spring upon circuit connection. This charged spring may be electrically or manually released affecting the closer of the breaker. The closing spring shall automatically be recharged for the next closing command. An Operator shall also be in position to manually charge the closing spring. The spring condition `Charged' or `Free' shall be visible through the indicator.

The draw-out type ACBs shall have 3 distinct positions - Service/Test/Isolated.

Fault lock out/anti-pumping device shall be provided on each breaker so that it could not be re-closed after tripping on fault without manual resetting being done.

The incoming and the outgoing breakers shall be provided either with static trip release intrigrally mounted on the breakers/or other suitable relays. These release/relays should have the following adjustments:

a) Over current pick-up.

b) Inverse tripping time at 6 times the current setting.

c) Short time delay pick-up at various current settings.

d) Short time delay - instantaneous.

e) Earth fault pick-up at various current settings.

f) Earth fault delay - instantaneous.

The incoming breaker shall also have an under-voltage release, the voltage of which shall be calibrated for pick-up and drop off in accordance with IS 25/6 - 1977.

The breakers being used as bus couplers shall be without integral release.

The air circuit breaker being used as incomer shall have the following accessories, indications, meters, provided on its housing;

i) 3 No. Phase indicating Lamps.

ii) 1 No. power factor meter 0.5-1-0.5 range.

iii) 1 No. 0-500 V range voltmeter with selector switch.

iv) 1 No. ammeter of suitable range and C.T.s as indicated on the drawing/s with selector switch.

v) 4 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

c) Orange for Auto Trip.

d) Blue for Spring Charged.

vi) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

c) Yellow for trip alarm cancellation.

d) Black for D.C. Trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

The air circuit breaker being used as incomer shall also have the provision for providing the following indications, controles etc to be provided at a remote controle console through potential free contacts.

i) 4 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

c) Orange for Auto Trip.

d) Blue for Spring Charged.

ii) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

c) Yellow for trip alarm cancellation.

d) Black for D.C. Trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

The air circuit breaker being used on out going feeder shall have the following accessories, indications, meters, provided on its housing;

i) 1 No. ammeter of suitable range and C.T.s as indicated on the drawing/s with selector switch.

ii) 4 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

c) Orange for Auto Trip.

d) Blue for Spring Charged.

iii) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

c) Yellow for trip alarm cancellation.

d) Black for D.C. Trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

iv) 3 No. Phase indicating Lamps.

The air circuit breaker being used on out going feeders shall also have the provision for providing the following indications, controles etc to be provided at a remote controle console through potential free contacts.

i) 4 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

c) Orange for Auto Trip.

d) Blue for Spring Charged.

ii) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

c) Yellow for trip alarm cancellation.

d) Black for D.C. Trip alarm cancellation.

e) Blue for Non Trip alarm cancellation.

The air circuit breaker being used as Bus Coupler shall have the following accessories, indications, meters, provided on its housing;

i) 2 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

ii) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

The air circuit breaker being used as Bus Coupler shall also have the provision for providing the following indications, controles etc to be provided at a remote controle console through potential free contacts.

i) 3 No.s Indicating Lamps for the following;

a) Red for ACB ON.

b) Green for ACB OFF.

c) Orange for Auto Trip.

ii) Push buttons for the followings,

a) Green for ACB ON

b) Red for ACB OFF.

c) Yellow for trip alarm cancellation.

8. **MOULDED CIRCUIT BREAKERS:**

The normal Moulded case circuit breakers shall have all live parts totally enclosed in a moulded insulated housing. It shall have a quick make and quick break mechanism. The mechanism shall be trip free so that the contacts can not be held closed against a fault. The bi-metallic mechanism shall be provided for inverse time current trip characteristic, to prevent interruption on normal inrush currents or temporary overloads. The instantaneous release shall be provided to protect equipment against very high current or short circuits. There shall be a common trip bar so that in case of fault on any of the phases, all the three phases trip together.

The arcing shall be totally contained within the housing so that the possibility of any damage to any adjacent equipment or personnel due to accidental mishandling is avoided. Individual arc chutes shall be provided on each phase to draw the arc away from the contact tips, thus, quenching it rapidly.

The minimum breaking capacity of Moulded Case Circuit Breakers at 415 V AC and 0.3 PF shall be 30 KA. Each Moulded Case Circuit Breakers shall have the following accessories;

a) Auxiliary switch.

b) Remote trip facitiy.

It shall also have the following indications and metering;

a) CT operated ammeter of suitable rating as indicated on the drawing/s complete with CT and selector switch.

b) 3 Nos. indicating lamps for the followings

i) Red for MCCB ON

ii) Green for MCCB OFF

iii) Orange for auto trip

c) 3 Nos. phase indicating lamps

d) Provisions to have remote indications for MCCB ON; MCCB OFF; MCCB Auto trip and for switching OFF of the MCCB through potential free contacts.

9. COMBINATION FUSE SWITCH UNITS and ON LOAD CHANGE OVER SWITCH FUSE UNITS

These Units should comply with IS:4064 amended upto date. These should be suitable to accomodate high rupturing capacity cartridge fuse-links complying with IS:2208 amended upto dateand having a certified rupturing capacity of not less than 35KVA, at 440Volts.

9.1 CONSTRUCTION:

The unit housing shall be of robust construction designed to withstand the hardest conditions met in industry. It should have double breaks per phase to ensure complete isolation of the fuse links when the unit is in the `off' (isolation) position. The `on' and `off' positions of the handle shall be clearly indicated and the action of the switch should be positive. The contacts of all units should be silver-plated.

Interlocks must be provided to ensure that the enclosure cannot be opened until the switch is in the `off' position. It should, however, be possible for a competent examiner to operate the switch with the enclosure open by releasing a suitable interlock.

The switch should have an external earthing terminal to enable the enclosure to be earthed. The arrangement and disposition of the parts in the unit should provide for straight through connections thereby avoiding looping in of cables. The unit should be fitted with top and bottom detachable end cover and provision should be made for fixing cable boxes to the flanges of the unit in place of end covers.

The unit should be capable of breaking the stalled current of the largest induction motor with which it is likely to be associated. If necessary, the contractor should be prepared to produce type test certificates set out in the appropriate Indian standards with which the unit complies.

10. BUSBAR SYSTEM:

10.1 HORIZONTAL BUSBAR:

The horizontal busbars shall be located at the top/ bottom/ center busbar compartment. The busbars shall be of electrical grade, high conductivity, Aluminium sections of required ratings.

10.2 VERTICAL BUSBAR:

The vertical busbar shall also be made from high conductivity electrical grade aluminium sections, the rating and size shall depend upon the total rating of all feeders in the column considering the diversity factors O.9.

All the bus bars shall be provided with black heat shrinkable sleeving with R.Y.B phase identification at regular intervals.

10.3 NEUTRAL BUS:

It shall run parallel to horizontal and vertical busbars. Standard neutral busbar size is half the size of main busbar.

10.4 CONTROL BUSBAR:

Control bus of 60A and 415V, if required, shall be provided at top in the front portion. These shall be supported with insulator at required interval.

10.5 EARTH BUS:

50 x 6 mm. GI earth bus shall be provided in the bottom most compartment along the entire length of the board for connection to project earth at either end.

10.6 BUS JOINTS:

Joining between busbars shall be by using rigid or flexible buslinks.

10.7 BUS BAR SUPPORTS :

Both horizontal and vertical busbars shall be supported at uniform intervals on high impact, anti-tracking, non-hygroscopic, arc resistant, flame retardant, self extinguishing GRP (Glass reinforced plastics), insulators. These insulators shall be type tested for short circuit withstand capacity.

10.8 **MODULES:**

10.8.1 **INCOMER:**

ACB in single tier or in 2 tier shall be provided as incomer from transformer. Bus Bar entry from top shall be provided for each incomer breaker.

10.8.2 **OUTGOING FEEDERS:**

The outgoing feeders shall be as indicated in B.O.Q./ Drawing. Irrespective of the panel depths, the panels shall be coupled front flush. Each outgoing feeder shall have the provision for Cable/bus duct connection from the bottem/top.

11. **CONTROL WIRING:**

All control wiring shall be done as a standard, using 1.5 sq.mm. multistrand pvc insulated FRLSH copper wires. These shall be black in colour for AC and grey in colour for DC. The C.T. connections shall be done using 2.5 sq.mm. multistrand PVC insulated FRLSH copper wires of red colour.

The outgoing control wires shall be terminated from the equipment terminals to control terminal block in cable chamber. Whenever required PVC channels shall be used for wire routing. On either ends of these wires self locking yellow ferrules with black letters shall be provided. Multistrand wire termination shall be provided with crimping type lugs.

12 **INTER-MODULE WIRING:**

The control wiring between modules located in the same vertical section shall be connected at the respective terminal blocks/terminals. These shall be routed through the cable duct in PVC wire channels.

Inter connections between adjacent cubicle in the same shipping sections shall be done in a similar way.

13. **CURRENT TRANSORMERS:**

Current transformer meant for metering & protection shall be mounted on the bus links either on the incoming side or outgoing side as the case may be. They shall be wired and terminated suitably for external connection.

14. **FUSES**

All fuses shall be of the HRC cartridge type, conforming to IS:2208 mounted on plug-in type of fuse bases having a prospective current rating of not less than 50 KA. Fuses shall be provided with visible operation indicators to show that they have operated. Insulated fuse pulling handle shall be supplied with each control panel.

15. **INDICATING INSTRUMENTS & METERS**

Electrical indicating instruments shall be flush mounted digital type having min. 96 mm square dial.

16. **CONTROL AND SELECTOR SWITCHES**

Control and instrument switches shall be of the rotary type and shall be provided with properly designated plate. Control switches shall have momentary contacts spring return to centre with pistol grip handle. Instrument and selector switches shall have stay put contacts.

17 **PUSH BUTTONS**

All push buttons shall be of push to actuate type having 2 `NO' and 2 `NC' self reset contacts. They shall be provided with designation plates, engraved with their functions. push button contacts shall be rated for 10 amps at 415V A.C. and 0.6 Amp. inductive breaking at 220V D.C.

18. **INDICATING LAMPS**

Indicating lamps shall be of the LED type having low watt consumption. Colour of lens shall be as per enclosed drawing/ data sheet.

19. **DRAWINGS**

The contractor shall provide the following drawings for approval to Architect/Consultant before commencement of supply/ fabrication.

i) General layout-Plan, section, elevations

ii) Foundation

iii) Wiring-Power & Control

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CHAPTER – 8

CAPACITOR BANKS:-

1. LT Power factor improving capacitors shall be robust in construction and as per IS: 2834 of 1964 with latest amendments. Best quality capacitor tissue paper, polypropelene, conductors impregnant, etc. shall be used for manufacturing the capacitors. Non-PCB oil shall be used at every stage wherever and whenever required.

2. Elements shall be accurately and uniformly wound and shall be provided with its own built-in fuses. Each element should be tested before assembly, under fault conditions.

3. Insulators shall be of metallic, ceramic material.

4. The properly assembled elements shall be dried under high vacuum and non-inflammable impregnants should be used for impregnation. The assembly shall then be placed in MS container which will then be hermetically sealed.

5. Every capacitor shall be provided with low loss discharge resistance which shall be externally fitted.

6. Units/banks shall be provided with double earthing arrangements.

7. The container shall be painted only after proper cleaning. degreasing, phosphating and then coat of Zinc Chromate Primer before the final two coats of the final paint.

8. Each capacitor shall be tested for loss angle and watt losses. Loss angle should not exceed 0.0004.

9. Capacitor shall also be tested for all leakage test ensuring that no oil leaks in 12 hours at 100^{o}C. The capacitors shall be designed for 415 V, 50 Hz 45^{o}ambient temperature. This shall be designed to withstand a voltage upto 110% of rated RMS voltage.

10. The banking of the capacitor shall be done with the help of suitable size copper bus bars and the banks shall be mounted on angle iron frames (minimum size 50mmx50mmx6mm) duly painted with epoxy paints.

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CHAPTER – 9

EARTHING:-

1.0 SCOPE:

This chapter covers the essential requirements of earthing system components and their installation. For details not covered in these Specifications, IS Code of Practice on Earthing (IS: 3043-1987) shall be referred to.

2. APPLICATION

The electrical distribution system in the BDL campus is with earthed neutral (i.e., neutral earthed at the transformer/ generator end). In addition to the neutral earthing, provision is made for earthing the metallic body of equipments and non-current carrying metallic components in the sub-station, as well as in the internal electrical installations.

Earthing requirements are laid down in Indian Electricity Rules, 1956, as amended from time to time, and in the Regulations of the Electricity Supply Authority concerned.

3. MATERIALS

3.1 EARTH ELECTRODES

3.1.1 Types

The type of earth electrode shall be Plate earth electrode.

3.2.1 Electrode materials and dimensions

The materials and minimum sizes of earth electrodes shall be as per BOQ.

3.2.2 EARTHING CONDUCTOR:

The earthing conductor (protective conductor from earth electrode up to the main earthing terminal/earth bus, as the case may be) shall be of the same material as the electrode, viz. GI or copper, and in the form of wire or strip as specified in BOQ.

3.2.4 HARDWARE ITEMS

All hardware items used for connecting the earthing conductor with the electrode shall be of GI in the case of GI pipe and GI plate earth electrodes, and forged tinned brass in case of copper plate electrodes.

3.2.5 PROTECTIVE (Earth continuity / Loop earthing) CONDUCTOR:

The material and size of protective conductors shall be as specified in the BOQ.

4. LOCATION FOR EARTH ELECTRODES

Normally an earth electrode shall not be located closer than .5 m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the building; in such cases, electrodes may be located further away from the building, with the prior approval of the Architect/Consultant.

The location of the earth electrode will be such that the soil has a reasonable chance of remaining moist as far as possible. Entrances, pavements and road ways, should be avoided for locating earth electrodes.

5. INSTALLATION

5.1 ELECTRODES

5.1.1 Various types of electrodes

Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3 m below the ground level.

When more than one electrode (plate/pipe) is to be installed, a separation of not less than 2 m shall be maintained between two adjacent electrodes.

5.2 Artificial treatment of soil

The electrode shall be surrounded by charcoal/ coke and salt as indicated in tender drawings

5.3 Watering arrangement

In the case of plate earth electrodes, a watering pipe 20 mm dia. medium class pipe shall be provided and attached to the electrodes. A funnel with mesh shall be provided on the top of this pipe for watering the earth.

The watering funnel attachment shall be housed in a masonry enclosure of size not less than 30 cm x 30 cm x 30 cm.

A cast iron/MS frame with MS cover, 6 mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

6. EARTHING CONDUCTOR (Main earthing lead)

In the case of plate earth electrode, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, checknuts and washers.

The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class by 40 mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by bolt, nut and washer.

7. PROTECTIVE (Loop earthing/earth continuity) CONDUCTOR

Earth terminal of every switch board in the distribution system shall be bonded to the earth bar/terminal of the upstream switch board by protective conductor(s).

Two protective conductors shall be provided for a switch board carrying a 3 phase switchgear thereon.

The earth connector in every distribution board (DB) shall be securely connected to the earth stud/earth bar of the corresponding switch board by a protective conductor.

All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor (also called circuit protective or loop earthing conductor), looping from one box to another upto the DB.

The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protective conductor. Twisted earth connections shall not be accepted in any case.

8. EARTH RESISTANCE

The earth resistance at each electrode shall be measured. No earth electrode shall have a greater ohmic resistance than 5 ohms as measured by an approved earth testing apparatus.

Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, such as additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Architect/Consultant.

9. MARKING:

Earth bars/terminals at all switch boards shall be marked permanently, "E" or as;

Main earthing terminal shall be marked "SAFETY EARTH - DO NOT DISCONNECT".

TABLE VIII

MATERIALS AND SIZES OF EARTH ELECTRODES

Type of Electrode	Material	Size
Plate	Copper	60 cm x 60 cm x 3 mm thick.
Plate	GI	60 cm x 60 cm x 6 mm thick.

It shall be carried out as per C.P.W.D GENERAL SPECIFICATIONS FOR ELECTRICAL WORKS (PART-I INTERNAL) - 1995 with all upto date amendments.

CHAPTER - 10

TESTING OF INSTALLATION:-

SCOPE

This chapter describes the details of tests to be conducted in the completed internal electrical installations, before commissioning.

1. GENERAL

1.1 Tests

On completion of installation, the following tests shall be carried out:-

1. Insulation resistance test.

2. Polarity test of switch.

3. Earth continuity test.

4. Earth electrode resistance test.

2. Witnessing of tests

Testing shall be carried out for the completed installations, in the presence of and to the satisfaction of the Architect/Consultant by the contractor. All test results shall be recorded & submitted to the Architect/Consultant/SIEL.

3. Test instruments

All necessary test instruments for the tests shall be arranged by the contractor.

4. INSULATION RESISTANCE

4.1 The insulation resistance shall be measured by applying between earth and the whole system of conductors, or any section thereof with all MCB.s in place, and all switches closed, all lamps in position, or both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure, provided it need not exceed 500 volts. Where the supply is derived from a polyphase A.C. system, the neutral pole of which is connected to earth either directly or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

4.2 The insulation resistance shall also be measured between all the conductors connected to one pole, or phase conductor of the supply, and all the conductors connected to the neutral, or to the other pole, or phase conductors of the supply with all the lamps in position and switches in "off" position, and its value shall be not less than that specified in sub- clause 7.2.3.

4.3 The insulation resistance in megaohms measured as above shall not be less than 12.5 megaohms.

4.4 The term "outlet" includes every point along with every switch, except that a switch combined with a socket outlet, appliance or lighting fitting is regarded as one outlet.

5. POLARITY TEST OF SWITCH

5.1 In a two wire installation, a test shall be made to verify that all the switches in every circuit have been fitted in the same conductor throughout, and such conductor shall be labeled or marked for connection to the phase conductor of the supply.

5.2 In a four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted in a conductor which is labeled, or marked for connection to one of the phase conductors of the supply.

5.3 The installation shall be connected to the supply for testing. The terminals of all switches shall be tested by a test lamp, one lead of which is connected to the earth. Glowing of test lamp to its full brilliance, when the switch is in "on" position irrespective of appliance in position or not, shall indicate that the switch is connected to the right polarity.

6. TESTING OF EARTH CONTINUITY PATH

The earth continuity conductor, including metal conduits shall be tested for electric continuity. The electrical resistance of the same alongwith the earthing lead, but excluding any added resistance, or earth leakage circuit breaker, measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

7. MEASUREMENT OF EARTH ELECTRODE RESISTANCE

7.1 Two auxiliary earth electrode, besides the test electrode, shall be placed at suitable distance from the test electrode (see figure). A measured current is passed between the electrode 'A' to be tested and an auxiliary current electrode 'C', and the potential difference between the electrode 'A' and auxiliary potential 'B' is measured. The resistance of the test electrode 'A' is then given by

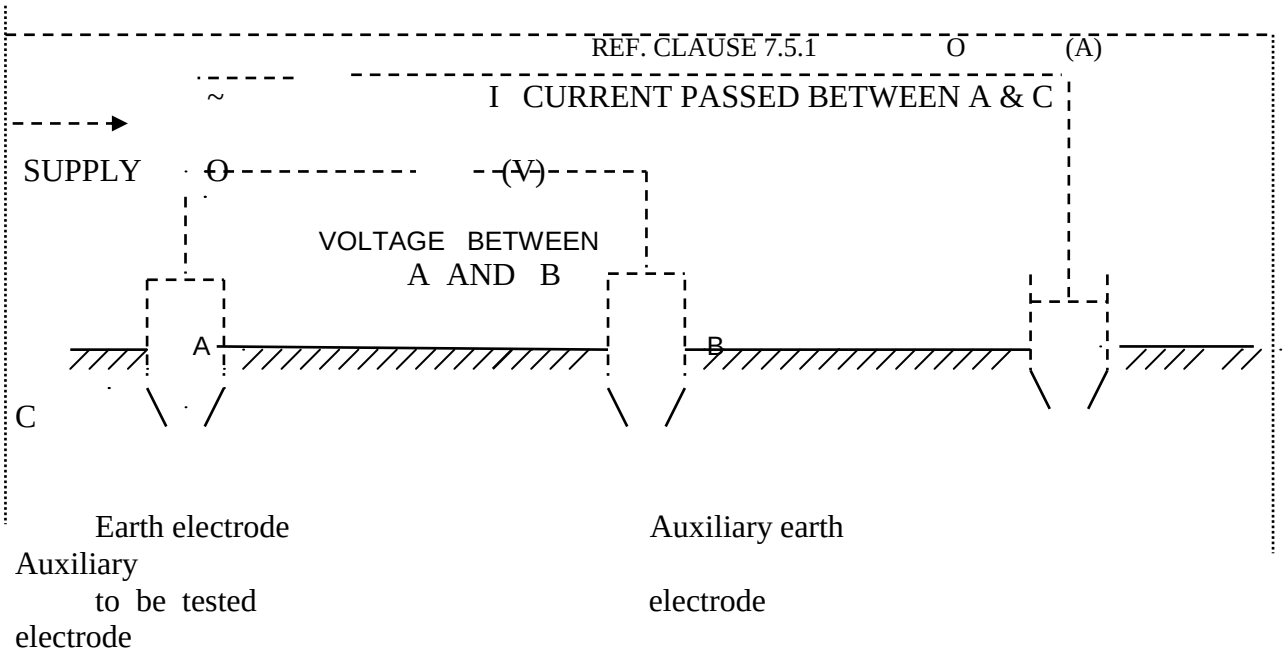
$$R = \frac{V}{I}$$

Where,

R - Resistance of the test electrode in ohms,

V - Reading of the voltmeter in volts.

I - Reading of the ammeter in amps.



7.2 Stray currents flowing in the soil may produce serious errors in the measurement of earth resistance. To eliminate this, hand driven generator shall be used.

If the frequency of the supply of hand driven generator coincides with the frequency of stray current, there will be wandering of instrument pointer. An increase or decrease of generator speed will cause this to disappear.

7.3 At the time of test, the test electrode shall be separated from the earthing system.

7.4 The auxiliary electrodes shall be of 13 mm dia meter mild steel rod driven upto 1 m into the ground.

7.5 All the three electrodes shall be so placed that they are independent of the resistance area of each other. If the test electrode is in the form of a rod, pipe or plate, the auxiliary current electrode 'C' shall be placed at least 30 m away from it, and the auxiliary potential electrode 'B' shall be placed mid-way between them.

7.6 Unless three consecutive readings of test electrode resistance agree, the test shall be repeated by increasing the distance between electrodes A and C upto 50 m, and each time placing the electrode B midway between them.

8. TEST CERTIFICATE

On completion of an electrical installation, a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as given in Appendix in addition to the test certificate required by the local Electric Supply Authorities.

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CHAPTER – 11

DRAWINGS

The contractor shall submit one complete set of originals on R.T.F., 3 copies on Compact disc (CD) and further SIX copies of drawings to the Architect/ Client after completion of the work.

These drawings must give the following informations:

a) Location of all equipments viz. transformers, H.T.Panel, L.T.Panel, Battery Bank, Capacitors and earthing stations etc.

b) Cable routes clearly indicating the sizes & number of cables.

c) Earthing layout - indicating the type of earth station & size of earth conductor.

d) Wiring diagram of H.T. & L.T. Panels.

e) Bus trunking route clearing indicating the sign and rating of the duct.

f) Complete single line diagram for Normal and Emergency supplies.

g) Any other information the Architect/ Engineer-in-charge may deam fit.

No completion certificate will be issued until the drawings are submitted. The drawings will be prepared and submitted by the contractor without any extra charge.

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APPENDIX A

TERMINOLOGY

This appendix indicates some of the commonly used and important terms, relevant for the Internal EI works.

1. **Exposed conductive part** - A conductive part of electrical equivalent, which can be touched and which is not normally live, but which may become the earth potential.

2. **Direct contact** - Contact of persons or livestock with live parts which may result in electrical shock.

3. **Indirect Contact** - Contact of persons or livestock with exposed conductive parts made live by a fault and which may result in electric shock.

4. **Live Part** - A conductor or conductive part intended to be energized in normal use, including a neutral conductor but, by convention, not a PEN conductor.

5. **Touch Voltage** - The potential difference between a grounded metallic structure and a point on the earth surface separated by a distance equal to the normal maximum horizontal reach of approximately 1 meter.

6. **Danger** - Danger to health or danger to life or limb from shock, burn or injury from mechanical movement to persons (and livestock where present), or from fire attendant upon the use of electrical energy.

7. **Earth** - The conductive mass of the earth, whose electric potential at any point is conventionally taken as zero.

8. **Earth electrode** - A conductor or group of conductors in intimate contact with and providing an electrical connection to earth.

9. **Earth fault loop impedance**- The impedance of the earth fault current loop (phase to earth loop), starting and ending at the point of earth fault.

10. **Earth leakage current** - A current which flows to earth, or to extraneous conductive parts, in a circuit which is electrically sound.

11. **Earth conductor** - A protective conductor connecting the main earth terminal to an earth electrode.

12. **Residual current** - The algebraic sum of the instantaneous values of current flowing through all the live conductors of a circuit at a point of the electrical installation.

13. **Residual current device (RCD) -** A mechanical switching device, intended to cause the opening of the contacts when the residual current attains a given value under the specified conditions.

14. **Switchboard**- An assembly of switchgear with or without instruments, but the term does not apply to a group of local switches in a final circuit.

15. **Switchgear** - An assembly of main and auxiliary switching apparatus for operation, regulation, protection or other control of electrical installations.

APPENDIX - B

IMPORTANT INDIAN STANDARDS

	STANDARDS	TITLE
(1)	IS:732 - 1989	Code of practice for electrical wiring installations
(2)	IS:4648 - 1968	Guide for electrical layout in residential buildings.
(3)	IS:8061 - 1976	Code of practice for design, installation and maintenance of service lines upto and including 650 V.
(4)	IS:8884 - 1978	Code of practice for installation of electric bells and call system.
(5)	IS:5578 - 1985	Guide for marking of insulated conductor
(6)	IS:11353- 1985	Guide for uniform system of marking and identification of conductors and apparatus terminals.
(7)	IS:5728 - 1970	Guide for short-circuit calculations.
(8)	IS:7752(Part-1)-1975	Guide for improvement of power factor in consumer installation : Low and medium supply voltages.
(9)	IS:3646(Part-1)-1966	Code of practice for interior illumination: Principles for good lighting and aspects of design.
(10)	IS:3646(Part-2)-1966	Code of practice for interior illumination: Schedule of illumination and glare index.
(11)	IS:3646(Part-3)-1968	Code of practice for interior illumination: Calculation of coefficients of utilization by the BZ method. lighting.
(12)	IS:2672 - 1966	Code of practice for library lighting.
(13)	IS:10118(Part-1)-1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: General.
(14)	IS:10118(Part-2)-1982	Code of practice for selection, installation and maintenance of switchgear and controlgear.

(15) IS:10118(Part-3)-1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: Installation.
(16) IS:10118(Part-4)-1982	Code of practice for selection, installation and maintenance of switchgear and controlgear: Maintenance.
(17) IS:4146 - 1983	Application guide for voltage transformers
(18) IS:4201 - 1983	Application guide for current transformers
(19) IS:5547 - 1983	Application guide for capacitor voltage transformers
(20) IS:2309 - 1989	Code of practice for the protection and allied structures against lightning
(21) IS:3043 - 1987	Code of practice for earthing.
(22) IS:5216(Part-1)-1982	Guide for safety procedures and practices in electrical work: General
(23) IS:5216(Part-2)-1982	Guide for safety procedures and practices in electrical work: Life saving techniques
(24) IS:3696(Part-2)-1966	Safety code for scaffolds and ladders: Ladders
(25) IS:374 - 1979	Electric ceiling type fans and regulators
(26) IS:2997 - 1964	Air circulator type electric fans and regulators.
(27) IS:11037- 1984	Electronic type fan regulators.
(28) IS:12155- 1987	General and safety requirements for fans and regulators for household and similar purposes.
(29) IS:4237 - 1983	General requirements for switchgear and control gear for voltages not exceeding 1000 V ac or 1200 V dc.
(30) IS:6875(Part-1)-1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC : General requirements and tests.

(31) IS:6875(Part-2)-1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC : Push- buttons and related control switches.
(32) IS:6875(Part-3)-1980	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V AC and 1200 V DC: Rotary control switches.
(33) IS:10027-1981	Composite units of air-break switches and rewireable type fuses for voltages not exceeding 650 V AC.
(34) IS:4064(Part-1)-1978	Air break switches, air break disconnectors, air-break switch disconnectors and fuse- combination units for voltages not exceeding 1000 V AC or 1200 V DC : General requirements
(35) IS:2675 - 1983	Enclosed distribution fuse boards and cutouts for voltages not exceeding 1000V
(36) IS:8828 - 1978	Miniature air break circuit breakers for voltages not exceeding 1000 volt.
(37) IS:13032- 1991	Miniature circuit breaker boards for voltages upto and including 1000 volts AC.
(38) IS:12640- 1988	Residual current operated circuit breakers.
(39) IS:2959 - 1985	Contactors for voltages not exceeding 1000 V AC or 1200 V DC
(40) IS:8623(Part-1)-1977	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC : General requirements.
(41) IS:8623(Part-2)-1980	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200 V DC : Particular requirements for busbar trunking system (busways).
(42) IS:694 - 1990	PVC Insulated cables for working voltages upto and including 1100 V
(43) IS:1554(Part-1)-1988	PVC insulated (heavy duty) electric cables: For working voltages upto and including 1100 V
(44) IS:3961(Part-5)-1968	Recommended current ratings for cables: PVC insulated light duty cables.

(45) IS:4288 - 1988 — PVC insulated (heavy duty) electric cables with solid aluminum conductors for voltages upto and including 1100 V

(46) IS:9537(Part-1)-1980 — Conduits for electrical installations : General requirements.

(47) IS:9537(Part-2)-1981 — Conduits for electrical installations : Rigid steel conduits

(48) IS:3480 - 1966 — Flexible steel conduits for electrical wiring.

(49) IS:2667 - 1988 — Fittings for rigid steel conduits for electrical wiring

(50) IS:3837 - 1976 — Accessories for rigid steel conduits for electrical wiring

(51) IS:5133(Part-1)-1969 — Boxes for enclosure of electrical accessories: Steel and cast iron boxes.

(52) IS:2412 - 1975 — Link clips for electrical wiring

(53) IS:371 - 1979 — Ceiling roses

(54) IS:3854 - 1988 — Switches for domestic and similar purposes

(55) IS:4615 - 1968 — Switch socket outlets (non-interlocking type).

(56) IS:4160 - 1967 — Interlocking switch socket outlet.

(57) IS:1293 - 1988 — Plugs and socket outlets of rated voltage up to and including 250 volts and rated current upto and including 16 amperes

(58) IS:418 - 1978 — Tungsten filament general service electric lamps.

(59) IS:2418(Part-1)-1977 — Tubular fluorescent lamps for general lighting service: Requirements and tests .

(60) IS:1258 - 1987 — Bayonet lamp holders

(61) IS:3323 - 1980 — Bi-pin lamp holders for tubular fluorescent lamps

(62) IS:3324 - 1982 — Holders for starters for tubular fluorescent lamps.

(63) IS:2215 - 1984 Starters for fluorescent lamps

(64) IS:1534(Part-1)-1977 Ballast for fluorescent lamps: For switch start circuits.

(65) IS:1569 - 1976 Capacitors for use in tubular fluorescent high pressure mercury and low pressure sodium vapor discharge lamp circuits.

(66) IS:1913(Part-1)-1978 General and safety requirements for luminaries: Tubular fluorescent lamps

(67) IS:10322(Part-1)-1982 Luminaries : General requirements.

(68) IS:10322(Part-2)-1982 Luminaires : Constructional requirements

(69) IS:10322(Part-5/Sec-1) Luminaires : Particular requirements: Recessed luminaries.

(70) IS:1777 - 1978 Industrial luminaries with metal reflectors

(71) IS:302 - 1979 General and safety requirements for household and similar electrical appliances .

(72) IS:2268 - 1988 Electric call bells and buzzers for indoor use.

(73) IS:6236 - 1971 Direct recording electrical measuring instruments.

(74) IS:1248(Part-1)-1983 Direct acting indicating analogue electrical measuring instruments and their accessories: General requirements.

(75) IS:1248(Part-2)-1983 Direct acting indicating analogue electrical measuring instruments and their accessories. Ammeters and voltmeters.

(76) IS:722(Part-1)-1988 AC electricity meters: General requirements and tests.

(77) IS:2992 - 1987 Insulation resistance testers hand operated, (Magneto-generator type).

(78) IS:2551 - 1982 Danger notice plates

(79) IS:2448(Part-1)-1963 Adhesive insulating tapes for electrical purposes: Tapes with cotton textile substrates

(80) IS:1885(Part-1)-1961 Electrotechnical vocabulary: Fundamental definitions

(81) IS:1885(Part-16/Sec-1)	Electrotechnical vocabulary: Lighting: General -1968 aspects
(82) IS:1885(Part-16/Sec-2)	Electrotechnical vocabulary: Lighting: General -1968 illumination, lighting fittings and lighting for traffic and signalling.
(83) IS:1885(Part-17)-1979	Electrotechnical vocabulary: Switchgear and controlgear
(84) IS:1885(Part-32)-1971	Electrotechnical vocabulary: Cables, conductors and accessories for electricity supply.

APPENDIX-C

SAFETY PROCEDURE

1. The Indian Electricity Rules 1956, as amended upto date, are to be followed in their entirety. Any installation or portion of installation which does not comply with these rules should be got rectified immediately.

2. The detailed instructions on safety procedures given in B.I.S. Code No. 5216-1969-"Code of Safety Procedures and Practices in Electrical Works" shall be strictly followed.

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

4. The electrical switchgears and distribution boards should be clearly marked to indicate the areas being controlled by them.

5. Before energising on an installation after the work is completed, it should be ensured that all tools have been removed and accounted, no person is present inside any enclosure of the switch board etc. any earthing connection made for doing the work has been removed.

APPENDIX - D

LIST OF APPROVED MAKES OF MATERIALS

S. No.	Description	Makes
1.	Air Circuit Breaker (ACB)	1. L&T 2. ABB 3. Siemens 4. Schneider 5. GE
2.	Moulded Case Circuit Breaker (MCCB)	1. L&T 2. ABB 3. Siemens 4. Legrand 5. Schneider 6. GE
3.	MCB Distribution Board & Isolator	1. L&T 2. ABB 3. Siemens 4. Legrand 5. Schneider 6. GE
4.	MCB	1.Legrand 2. Seimens 3. Haiger 4. ABB 5. Schneider 6. GE
5.	FUSE SWITCH DISCONNECTOR	1. Larsen & Toubro 2. Siemens

S. No.	Description	Makes
6.	Electrical. Panels	1. A to Z Systems 2. Amptech 3. Adlec 4. Advance Panels 5. Jakson 6. RST Electrical 7. SUGEL 8. Vidhyut Control 9. Spectrum Automation 10. ECS 11. Neptune 12. SPC 13. Surendra Engg. 14. India Tech
7.	Lugs	1. Dowell's
8.	XLPE Aluminium Conductor Armoured cables upto 1100 V Grade	1. Finolex 2. Capcab 3. Bonton 4. Lapp Cable 5. KEI 6. RR Kabel 7. Bonton 8. World cab 9. Batra Henley 10. ESC

9.	Transformer	1. UNIVERSAL 2. VOLT-AMP 3. SUDHIR 4 L&T 5. EAE
9.	Rising Mains/ Bus Ducts	1. BBI 2. GE 3. ABB 4 CSE 5. EAE
10.	HT Panels	1. SUDHIR 2. UNIVERSAL 3. L&T

NOTES: The Contractor shall get the samples of all the items not covered in this list, approved from the Consultant/owner before commencing the supply.