



**INDIAN ASSOCIATION FOR THE
CULTIVATION OF SCIENCE**

**2A & 2B RAJA S C MULICK ROAD
KOLKATA 700 032**

Name of Work: Supply, Installation, Testing & Commissioning of Electrical Works for 2 X 500 kVA & 1 X 250 kVA D.G. Sets including arrangement of AMF cum Auto-Synchronisation and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata.

(TECHNICAL BID)

**CONSULTANT
ENERGY INDIA
1, BRITISH INDIAN STREET
OLD BLOCK, 1ST. FLOOR
KOLKATA – 700 069.**

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NOTICE INVITING TENDER

NIT No. : IACS/EL/CG/2015-2016/38 Dated :14/01/16

Sealed item rate tenders in three envelopes system (viz. **Eligibility bid, Technical bid & Price bid**) are hereby invited by the 'The Registrar, Indian Association For The Cultivation Of Science, 2A & 2B, Raja S.C. Mullick Road, Jadavpur, Kolkata -700 032, West Bengal' on behalf of IACS from the eligible Bidders, who fulfil the minimum eligibility criteria as described below, for the work of "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata."

The tender shall be submitted through three sealed envelopes covered by a fourth envelop in sealed condition. The first envelop shall be marked as "Eligibility Bid", the Second Envelop shall be marked as 'Technical Bid' and the third envelop shall be marked as 'Price Bid'. The fourth envelop shall contain all the three envelopes (Eligibility Bid, Technical Bid & Price Bid) including the envelope containing Earnest Money Deposit (EMD). The name of work, NIT no., due date of opening of tender, bidder's name etc. should be mentioned on the top of the fourth envelope. The complete tender has to be submitted to the 'Receiving and Despatch Section' of IACS located on the 2nd floor of the Main Building of IACS.

Tender documents may be purchased from the office of the Electrical Engineering Section of IACS against payment of Rs. 1,000/- (non-refundable) from 11.00 A.M. to 2 P.M. from each working day. The physical sale of tender shall take place from 18.01.16 to 01.02.16 against the time schedule as mentioned above. The interested bidders fulfilling the eligibility criteria and agree with the terms & conditions of the tender may apply to the Registrar, IACS on their letterhead for issuance of tender documents. The complete tender document shall be made available in the website of IACS (www.iacs.res.in) which may be downloaded and submitted to the Receiving & Despatch Section of IACS (addressing the Registrar, IACS) in the same manner as mentioned above.

The Earnest Money Deposit (EMD) should be submitted through a separate envelope which should be placed inside the Envelop No. 4. The envelope containing the EMD will be opened first. If the EMD is found in order, then the eligibility bid (i.e. Envelop-1) will be opened on the same day pertaining to the bidders who will submit EMD in proper form & shape. In case, the EMD is not found in order, the bid document (s) pertaining to the said bidder (s) will be summarily rejected. The Technical Bid (i.e. Envelop-2) shall be opened only in respect of those bidders who will qualify in the Eligibility bid(s). The Price Bid will be opened in respect of only those bidder(s) who will qualify in the Technical Bid.

Any conditional tender including conditional rebate and incomplete tender document in any manner may be summarily rejected. The bids will be opened in presence of the intending bidders as per the specified time Schedule as mentioned in the NIT. However, if holiday is declared on the scheduled date of opening, the tender (Eligibility Bid/Technical Bid/Price Bid) will be opened on the next working day at the specified time schedule in presence of the intending bidders.

01. Estimated Cost of Work : Rs. 54,26,369/- (Rupees Fifty Four Lakhs Twenty Six Thousand Three Hundred & Sixty Nine only)
02. Time of Completion of work : 150 days from the date of execution of agreement
03. Issuance of the tender : Between 11:00am and 2:00pm on all working day against cash payment of Rs. 1000/- from 18.01.16 to 01.02.16.
04. Earnest Money : Rs. 1,08,530/- (Rupees One Lakh Eight Thousand Five Hundred & Thirty only) through crossed Demand Draft / Pay Order / Banker's Cheque of a scheduled bank payable at Kolkata, drawn in favour of 'Indian Association For The Cultivation Of Science'.
05. Pre-bid Meeting : A pre-bid meeting will be held on 03.02.16 at 4:00 p.m. at IACS with the prospective bidders.
06. Last date of Submission of Tender : 08.02.16 upto 2:00 pm
07. Date of Opening of the Tender (Eligibility Bid) : 08.02.16 at 3:00 pm

ELIGIBILITY CRITERIA FOR BIDDERS:

The minimum eligibility criteria for the bidders will be as follows:

1. Completion of 1(one) similar work of value not less than 80% of the estimated cost put to tender under Government, Semi-Government, PSU, Autonomous Body under the Central/any State Government or Private Organization of Repute (preferably large Multinational Company) in last 7 (Seven) years to be reckoned from the date of issue of the NIT.
2. Completion of 2(two) similar work of value not less than 60% each of the estimated cost put to tender under Government, Semi-Government, PSU, Autonomous Body under the Central / any State Government or Private Organization of Repute (preferably large Multinational Company) in last 7 (Seven) years to be reckoned from the date of issue of the NIT.
3. Completion of 3(three) similar work of value not less than 40% each of the estimated cost put to tender under Government, Semi-Government, PSU, Autonomous Body under the Central / any State Government or Private Organization of Repute (preferably large Multinational Company) in last 7 (Seven) years to be reckoned from the date of issue of the NIT.
4. In addition to the credentials in terms of financial limit stated above, the firms should have proper office / establishment in or around Kolkata with telephone, fax / internet facilities.

NOTE:

1. *The IACS authority is not bound to accept the lowest tender and reserves the right to accept or reject any or all the tenders received and to place order on one or more firms by segregating the total work without assigning any reason whatsoever.*
2. *Here 'Similar Work' shall include the Work of providing Synchronization arrangement between two DG sets of capacity not less than 350KVA each including providing Auto-load-sharing /Auto-load-Management including Supply, installation testing & Commissioning of MV Switchboard/MV Panel, cable laying, end termination of cables etc.*
3. *Security Deposit: The Security deposit shall be collected by deductions from the Running Account Bill of the Contractor at the rate mentioned below.*
 - a) *A sum @ 2.5% of the Gross Amount of the bill shall be deducted from each Running Bill as well as final bill of the Contractor. Such deductions shall be made unless the contractor has deposited the amount of security at the rate mentioned in cash or Government Securities or Fixed Deposit Receipts. This is in addition to the performance guarantee that the contractor is required to be deposited with IACS.*
 - b) *Security Deposit can be released against bank guarantee issued by a Schedule Bank on its accumulation to a minimum amount of Rs. 5 lakhs subject to the condition that amount of any bank guarantee except last one, shall not be less than Rs. 5 lakhs.*
 - c) *The Contractor shall deposit an amount equal to 5% of the tendered and accepted value of the work (without limit) as Performance Guarantee in the form of an irrecoverable bank guarantee bond of any scheduled bank or the State Bank of India in the prescribed form.*
4. *Earnest Money Deposit (EMD) will be adjusted as a part of the Security Deposit and shall be retained by IACS.*
5. *A pre-bid meeting will be held on 03.02.16 .with the prospective bidders in order to clarify the doubts/query etc. as may be raised in their minds after going through the tender documents.*
6. *A "minutes of the pre-bid meeting" will be published in our website (www.iacs.res.in) which will be treated as a part of the NIT.*
7. *All tailor made items, e.g. panels/ Bus Ducts/ Chimneys etc are subject to prior approval onsite inspection, factory inspection in stage wise as will be required by the site-in-charge of IACS for its acceptance.*
8. *Requirement of all License/ Permit documents to comply with all statutory formalities by the contractors/ Workers etc are to be forwarded to the employer(IACS) for record in office of the site-in-charge of IACS.*

9. *The work under this tender is a mixing of new work with the existing infrastructures of electrical network of IACS through which power is being distributed to various sophisticated and important laboratory equipments, therefore, power shut down has to be planned in consultation with IACS in a scheduled and phase wise manner with sufficient time in hand without jeopardising necessary safety and confirmation of long shut down for more than 7-8 hours/day.*

The Registrar,
Indian Association For The Cultivation Of Science,
2A & B, Raja S.C. Mullick Road,
Jadavpur, Kolkata – 700 032

Copy to:

- i. Director, IACS for kind information please
- ii. F&AO, IACS
- iii. In-Charge, Electrical Engineering Section , IACS
- iv. Engineer (Civil), IACS
- v. Workshop Superintendent-II, IACS
- vi. Receiving & Despatch Section, IACS
- vii. Security Officer, IACS

Sealed item rate tenders in three envelopes system (Eligibility bid, Technical bid & Price bid) are hereby invited by the 'The Registrar, Indian Association For The Cultivation Of Science, 2A & 2B, Raja S.C. Mullick Road, Jadavpur, Kolkata -700 032, West Bengal' on behalf of IACS from the eligible Bidders, who fulfill the minimum eligibility criteria as described below, for the work of "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata."

1. Estimated cost of the project is **Rs. 54,26,369/-** (Rupees Fifty Four Lakhs Twenty Six Thousand Three Hundred & Sixty Nine only).
2. Time for carrying out and completion of the work will be 150 days. Required agreement should be executed within 10 days from the date of issuance of 'Letter of Acceptance' / 'Work Order' and the date of commencement shall be reckoned from the date of execution of agreement.
3. Complete contract documents consisting of the plans, complete specification, the schedule of quantities of the above work to be done and the set of conditions of contracts to be complied with by the bidder whose tender may be accepted will also be found in the form of tenders.
4. Tenders documents (Non-transferable) may be obtained from the office of the Electrical Engineering Section, Indian Association For The Cultivation Of Science, 2A & B, Raja S.C. Mullick Road, Jadavpur, Kolkata - 700032, between 11.00 AM to 2-00 PM from 18.01.2016 to 01.02.2016 on payment of Rs. 1,000/- in cash (Non-refundable).

The tender shall be submitted through three sealed envelopes covered by a fourth envelop in sealed condition. The first envelop shall be marked as "Eligibility Bid", where the Second Envelop shall be marked as 'Technical Bid' and the third envelop shall be marked as 'Price Bid'. The fourth envelop shall contain all the three envelopes (Eligibility Bid, Technical Bid & Price Bid) and on the top of the envelop it shall bear the name of the work, NIT no., due date of tender opening, bidder's name etc. which should be submitted to the 'Receiving and Despatch Section' of IACS located on the 2nd floor of the Main Building of IACS on or before 08.02.2016 (upto 3.PM).

Envelope -1 : Documents related to experiences or credential in similar nature of works complying with the eligibility criteria as specified in the NIT.

Envelope -2 : 'Technical Bid' along with photo copies of following

documents viz.VAT/ CST registration certificate, PAN/TAN, Professional Tax Receipt, Service Tax registration certificate, Trade License, Valid Electrical Contractor's License, valid Supervisor's License etc.

Envelope -3 : The 'Price Bid' in duplicate along with commercial terms and conditions including bank details like Beneficiary Name, Bank name, Branch Name, Branch Code, Account no, IFSC Code, MICR Code.

EMD Envelope : Shall contain only the EMD in proper form and shape

5. The Earnest Money amounting to Rs. 1,08,530/- in the form of crossed Demand Draft / Pay Order / Banker's Cheque of a scheduled bank & drawn in favour of "Indian Association For The Cultivation Of Science" payable at Kolkata should be enclosed with the Bid documents in a separate sealed cover. The sealed envelope containing the EMD should be placed inside the fourth envelop. The Bid documents will be summarily rejected if the EMD is not enclosed and submitted in proper form & shape.
6. The Bidders shall quote rates both in figures and words. The amount should be worked out for each item of work and to be written in both figures and words. During checking, if differences between the quoted rates in words and figures or in the amount worked out, the following procedure shall be followed:
 - a) When there is a difference between the rates in figures and in words, the rate which corresponds to the amounts worked out by the bidder shall be taken as correct.
 - b) When the amount of any item is not worked out by the contractor or it does not correspond with the rate written either in figures or words, then the rate quoted by the bidder in words shall be considered as correct.
 - c) When the rate quoted by the bidder in figures and in words tallies but the amount is not worked out correctly, rate quoted by the bidder shall be taken as correct and not the amount.

The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected amount the bid will be rejected, and the Earnest Money Deposit shall be forfeited.

7. The acceptance of a tender will rest upon the Competent Authority of IACS, Kolkata. The IACS Authority does not bind himself/herself to accept the lowest tender and reserves the right to accept the whole or any part of the tender and the tenderer shall be bound to perform the same at the rates quoted.
8. Canvassing in connection with the tenders is strictly prohibited and the tenders submitted by the Contractor who resort to canvassing are liable for rejection.
9. Tender submitted shall remain valid for a period of 60 days from the date of opening of the eligibility bid for the purpose of acceptance and award of work. If any bidder withdraws his tender before the said period, then IACS shall be at liberty to forfeit the EMD submitted with the tender.
10. The tenderer should go through all the technical specifications, drawings, fully understand the engineering aspects etc. before quoting. Having any query or doubt may be consulted with the Engineer in Charge. If there is any phenomenal change/deviation from the BOQ etc. should obtain written clearance from the Engineer in Charge. But in no case this may influence the tendered rate after the award of the work order. No claim whatsoever will be entertained for any alleged ignorance thereof.
11. Before tendering, the tenderers shall inspect the site to fully acquaint himself/herself about the condition in regard to accessibility of site, nature and extent of ground, working condition of site and locality including stacking of materials, installations of plants and equipment etc, condition affecting accommodations and movement etc. required for the satisfactory execution of the work contract. No claim whatsoever on such account shall be entertained by the employer in any circumstances.
12. Earnest money may be forfeited if the Contractor fails to commence the work within the stipulated time (10 days) as per the awarded work order.
13. Except writing rates and amount, the tenderer should not write any conditions or make any changes, additions, deletions, alterations and modifications in the printed form of tenders. Conditional Tender will be rejected.
14. An unconditional rebate which may be offered during tender submission will be acceptable and shall be considered during tender evaluation. Bidders who are desirous to offer rebate the same should be brought out separately in the covering letter and submitted along with the tender. However, after opening of the tender, rebate may be considered only from the lowest bidder.

15. VAT, Sales Tax or any other tax on material or on finished works like works contract tax, turnover tax, labour welfare cess etc in respect of this contract shall be payable by the contractor and the IACS will not entertain any claim whatsoever.
16. The contractor shall give a list of family members or relatives working with the IACS, if any, along with their designation and addresses.
17. No employee of the IACS is allowed to work as a contractor for a period of two years of his retirement from IACS service without the prior permissions from IACS. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be such a person who had not obtained a written permission of the IACS as aforesaid before submission of tender or engagement in the contractor's service.
18. It will be obligatory on the part of the bidder to stamp and sign the tender documents for all the component parts and that, after the work is awarded, he will have to enter into a contract agreement for each component with the IACS.
19. The notification of award of work will be made in writing to the successful bidder by IACS.

The Registrar,
Indian Association For The Cultivation Of Science,
2A & B, Raja S.C. Mullick Road,
Jadavpur, Kolkata – 700 032

FORM OF TENDER

(To be filled up by the Bidder on their Letter Head)

To,
The Registrar,
Indian Association For The Cultivation Of Science,
2A & B, Raja S.C. Mullick Road,
Kolkata – 700 032.

Date :

Re : Tender for“Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata.”

Sir,

1. I/We have examined and have no reservation to the tender documents including the addenda no. (Reference and date of addenda, clarification issued after pre-bid meeting along with minutes)
2. I/We do hereby offer to perform, provide, execute, complete and maintain the works in conformity with the Drawing, Conditions of Contract, Special Conditions of Contract, Technical Specifications, Bill of Materials for the sum of Rs.(Rupees.) at the respective rates quoted in the schedule of works.
3. I/We have satisfied myself/ourselves as to the site conditions, modification/alteration requirement at site, examined the drawing and all aspects of the tender conditions, subject to above
4. I/We do hereby agree, should this tender be accepted in Whole or Part, to :
 - a) Abide by and fulfill all the terms and provisions of the said conditions annexed hereto.
 - b) Complete the works withindays as stipulated in the tender documents.
5. I/We have deposited the Earnest Money of Rs. in the form of which will not bear any interest and liable for forfeiture:

- a) If our offer is withdrawn within the 60 days validity period of acceptance.
 - b) If the contract is not executed within days from the date of receipt of the letter of acceptance.
 - c) If the work is not commenced within days after issue of work order.
6. I/We understand that you are not bound to accept the lowest evaluated bid or any other tender that you may receive.
7. I/We also make a specific note on clauses of NIT and Instruction to Bidders under which the contract is governed.
8. Name of Partners / Directors of our firm:
- 1.
 - 2.
 - 3.
 - 4.

Signature : -----

Designation: -----

(Certified true copy of Power of attorney should be attached)

Date : -----

Witnesses :

1. Signature:

Name :

Address:

2. Signature:

Name :

Address:

ARTICLES OF AGREEMENT
(ON NON-JUDICIAL STAMP PAPER OF RS.100.00)

ARTICLES OF AGREEMENT made this _____ day of _____ TwoThousand Sixteen between **Indian Association for the Cultivation of Science**, a society under the Society Registration Act 1860 (hereinafter referred to as the Employer which expression shall include its successors and assigns and all the persons for the time being in management of the Society) having its office at 2A & 2B Raja S C Mullick Road, Jadavpur, Kolkata 700 032 (and other places, if any) of the **ONE PART** through the authorized officer (Name & Designation)

AND

M/s. _____ having its registered office at _____ (thereinafter referred to as the 'CONTRACTOR') of the OTHER PART.

WHEREAS the Employer is desirous of "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata." (Hereinafter called the 'Works').

AND WHEREAS the Employer in order to effectively carry out "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata." engaged M/s. Energy India, 1, British Indian Street, Old Block, 1st. Floor, Kolkata – 700069. (hereinafter referred to as "CONSULTANT") to prepare plans, drawings and specifications description of work to be executed for construction of the said works of the project and to assist in concerned technical matters.

AND WHEREAS the Employer has caused the plans, drawings and specifications, priced schedule of quantities of the said work to be constructed at Jadavpur, Kolkata as per conditions of the contract and special conditions prepared with the assistance of the said Consultant/Consultant subject to which the offer of the Contractor shall be accepted.

AND WHEREAS the tender of the Contractor for "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata." has been approved by the Employer.

AND WHEREAS the contractor has deposited with the Employer _____ as Security deposit (Performance Bank Guarantee) for the due performance of the agreement. AND WHEREAS the Employer has issued work order therefore to the contractor.

AND WHEREAS said drawings no. _____ inclusive of the specifications, priced schedule of quantities, conditions of contract and special conditions (hereinafter collectively referred to as the said condition) have been signed by the parties hereto and the contractor has agreed to execute the works upon and subject to the said conditions.

NOW IT IS HEREBY AGREED AS FOLLOWS :

1. In consideration of the payments to be made to the contractor as hereinafter provided the contractor shall upon and subject to the said conditions execute and complete the works shown upon the said drawings etc and such further detailed drawings as may be furnished to the contractor by the said Employer through the Consultant as described in the said specifications and _____ the said priced schedule of quantities.
2. The Employer will pay to the Contractor the sum of Rs. _____ (Rupees _____) (hereinafter called the contract sum) or such other sum as shall become payable hereunder at the times and in the manner specified in the said conditions. However, the actual sum will be paid on the actual value of work done, irrespective of the contract sum.
3. The term 'the Consultant' in the said conditions shall mean the saidand in the event of the said Consultant/Consultant ceasing to be the Consultant/Consultant for the purpose of this contract such other person or persons as shall be nominated for the purpose by the Employer.

4. The plans, agreement and documents above mentioned shall form the basis of this contract and all disputes to be decided in the manner prescribed in the conditions attached hereto.
5. The said contract comprises the "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata." as above mentioned, and all subsidiary works connected therewith within the same site as may be ordered to be done from time to time by the said Employer even though said works may not be shown on the drawings or described in the said specifications or the priced schedule of quantities.
6. Notwithstanding what are stated in the special condition, conditions of contract and hereinbefore stated the Employer through the Consultant reserves to himself the right to alter the drawings and nature of the work and of adding to or omitting any items of works from or of having portions of the same carried out departmentally or otherwise and such alterations or variations shall be carried out without prejudice to this contract.
7. The said conditions shall be read and be treated as forming part of this agreement and the parties hereto will respectively be bound thereby and to abide by and submit themselves to the conditions and stipulations and perform the same on their parts to be respectively observed and preferred.
8. Any dispute arising under this agreement shall be referred to the arbitration to a sole arbitrator appointed with consent of the Employer and the contractor as indicated in the Article of the general conditions. The award of the arbitrator shall be final and binding on both parties.
9. The following documents shall be part of this agreement :
 - a. Tender document under NIT
 - b. Offer / Quotation accepted by the Employer
 - c. IACS work order
 - d. GCC and SCC
 - e. Drawing, Sketches or Layouts
 - f. Minutes of Pre-bid meeting

IN WITNESS WHEREOF, the parties hereto have executed these presents the day and year first hereinabove written.

WITNESS

EXECUTANTS

1.

1. EMPLOYER

2.

2. CONTRACTOR

* Common Seal

* In case of the Company, the common seal be affixed pursuant to resolution of Board of Directors in accordance with Articles of Association of the Company the directors etc as the case may be affixing common seal may initial in token thereof and also by putting their names.

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FOR GENERAL CONDITIONS OF CONTRACT

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GENERAL CONDITIONS OF CONTRACT

Except where provided for in the description of the individual items in the schedule of quantities and in the specifications and conditions laid down hereinafter and in the Drawings, the work shall be carried out as per standard specifications and under the direction of Employer/Consultant.

1.0 INTERPRETATION

In construing these conditions, the specifications, the schedule of quantities, tender and Agreement, the following words shall have the meaning herein assigned to them except where the subject or context otherwise requires :

- i) *Employer* : The term Employer shall denote for Indian Association for the Cultivation of Science, 2A & 2B Raja S C Mullick Road, Kolkata 700 032 or any of its employees representative authorised on their behalf.
- ii) *Consultant* : The term Consultant shall mean Energy India, 1, British Indian Street, Old Block, 1st Floor, Kolkata – 700 069 or in the event of his/their ceasing to be the Consultant for the purpose of this contract such other person/s as the Employer shall nominate for the purpose.
- iii) *Site Engineer* : The term Site Engineer shall mean the person/s appointed by the Employer to superintend the work.
- iv) *Contractor*: The term contractor shall mean _____ and his/their heirs, legal representatives, assigns and successors.
- v) *Site* : The site shall mean the site where the works are to be executed as shown on the site plan.
- vi) *Drawings*: The work is to be carried out in accordance with drawings, specifications, the schedule of quantities and any further drawings which may be given by the Employer during execution of the work. A set of drawings is provided with the tender to give the general idea about the total construction.

All drawings relating work given to the contractor together with a copy of schedule of quantities are to be kept at site and the Employer/Consultant shall be given access to such drawings or schedule of quantities whenever necessary.

In case any detailed Drawings are necessary contractor shall prepare such detailed drawings and/or dimensional sketches therefor and have it confirmed by the Employer/Consultant prior to taking up such work.

The contractor shall ask in writing for all clarifications on matters occurring anywhere in drawings, specifications and schedule of quantities or to additional instructions at least 10 days ahead from the time when it is required for implementation so that the Employer may be able to give decision thereon.

- vii) The "Works" shall mean the work or works to be executed or done under this contract.
- viii) "Act of Insolvency" shall mean any act as such as defined by the Presidency Towns Insolvency Act or in Provincial Insolvency Act or any amending statutes.
- ix) "The Schedule of Quantities" shall mean the schedule of quantities as specified and forming part of this contract.
- x) "Priced Schedule of Quantities" shall mean the schedule of quantities duly priced with the accepted quoted rates of the contractor.
- xi) "Notice in writing" or "written notice" shall mean a notice written, typed or in printed characters sent (unless delivered personally or otherwise proved to have been received) by registered post to the last known private or business address or registered office address and shall be deemed to have been received when in the ordinary course of post it would have been delivered.

2.0 SCOPE OF THE WORK

The work consists of "Supply, Installation, Testing and Commissioning of Electrical Works for 2X500KVA & 1X250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata." in accordance with the "drawings" and "Schedule of Quantities" within the scope of this tender. It includes furnishing all materials, labour, tools and equipment and management necessary for the incidental to the construction and completion of the work. All work, during its progress and upon completion, shall conform to the lines, elevations and grades as shown on the drawings furnished by the Employer/Consultant. Should any detail essential for efficient completion of the work be omitted from the drawings and specifications it shall be the responsibility of the contractor to inform the Employer/Consultant and to furnish and install such detail with Employer's/Consultant' concurrence, so that upon completion of the proposed work the same will be acceptable and ready for use.

Employer/Consultant may in their absolute discretion issue further drawings and/or written instructions, details, directions and explanations, which are, hereafter collectively referred to as "The Employer's/ Consultant's instructions" in regard to :

- a) The variation or modification of the design quality or quantity of works or the addition or omission or substitution of any work.
- b) Any discrepancy in the drawings or between the schedule of quantities and/or drawings and/or specification.
- c) The removal from the site of any defective material brought thereon by the contractor and the substitution of any other material thereof.
- d) The demolition removal and/or re-execution of any work executed by the contractor/s.
- e) The dismissal from the work of any persons employed thereupon.
- f) The opening up for inspection of any work covered up.
- g) The rectification and making good of any defects under clauses hereinafter mentioned and those arising during the maintenance period (defects liability period).

The contractor shall forthwith comply with and duly execute any work comprised in such Employer's/Consultant' instructions, provided always that verbal instructions, directions and explanations given to the contractor's or his representative upon the works by the Employer/Consultant shall if involving a variation be confirmed in writing to the contractor/s within seven days. No works for which rates are not specifically mentioned in the priced schedule of quantities, shall be taken up without written permission of the Employer/Consultant. Rates of items not mentioned in the priced schedule of quantities shall be fixed by the Employer in consultation with the Consultant as provided in Clause "variation".

The contractor shall set up a field laboratory with necessary equipments for day to day testing of materials like grading of coarse and fine aggregates, silt content and bulkage of sand crushing strength of concrete etc. Such laboratory shall be set up at site during mobilization period so that the field laboratory is available from the date of commencement of work.

Regarding all factory made products for which ISI marked products are available, only products bearing ISI marking shall be used in the work. Other products should be supplied as per the brand name mentioned in the Technical Specifications.

3.0 DETAILED DRAWINGS AND INSTRUCTIONS

The Employer through its Consultant shall furnish with reasonable promptness additional instructions by means of drawings or otherwise necessary for the proper execution of the work. All such drawings and instructions shall be consistent with the Contract Documents, true developments thereof, and reasonably inferable there from.

The work shall be executed in conformity therewith and the Contractor shall not work without proper drawings and instructions.

Immediately after receipt of the work order of the contract the contractor shall prepare a progress schedule and submit the same to the Employer through the Consultant for approval which shall indicate the dates for the starting and completion of the various stages of constructions.

4.0 COPIES FURNISHED

The Contractor on the signing hereof shall be furnished by the Employer through its Consultant free of charge with a copy of the priced schedule of quantities/rates, two copies of each of the said drawings and one copy of specifications and two copies of all further drawings issued during the progress of the work. Any further copies of such drawings required by the Contractor shall be supplied on payment of the charges thereof by the contractor.

5.0 OWNERSHIP OF DRAWING

All drawings, specification and copies thereof furnished by the Employer through its Consultant are the property of the Employer. They are not to be used on other work, and with the exception of the signed contract set, are to be returned to the Employer on request at the completion of the work.

6.0 ROYALTIES & PATENTS

The contractor shall pay all royalties and licence fees. He shall defend all suits or claims for infringement of any patent rights and shall save the Employer harmless from loss on account thereof.

7.0 SUPERINTENDENCE SUPERVISION

The Contractor shall give all necessary personal Superintendence during the execution of the work and this obligation and liability will continue until expiration of the 'Maintenance Period' (Retention Period). The contractor shall also during the whole time of work when in progress shall employ a competent representative who shall be constantly in attention at the site while his men are at work. Any directions, explanations, instructions or notices given by the Employer or the Consultant to such representative shall be deemed to have been given and duly served on the contractor.

8.0 FAILURE BY CONTRACTORS TO COMPLY WITH EMPLOYER'S

If the contractor after receipt of written notice from the Employer requiring compliance within ten days fails to comply with such further drawings and/or Employer's instructions, the Employer through the Consultant or other person, may employ other person to execute any such work whatsoever that may be necessary to give effect thereto and pay all cost incurred in connection therewith and same shall be recoverable from the contractor by the Employer as a debt or shall have right to deduct same from any money due or to become due to the contractor.

9.0 SITE VISIT BY THE TENDERER

Intending tenderer shall visit the site and make himself thoroughly acquainted with the local site condition, nature and requirements of the works, facilities of transport condition, effective labour and materials, access and storage for materials and removal of rubbish. The tenderer shall provide in their tender for cost of carriage, freight and other charges as also for any special difficulties and including police restriction for transport etc for proper execution of work as indicated in the drawings. The successful tenderer will not be entitled to any claim of compensation for difficulties faced or losses incurred on account of any site condition which existed before the commencement of the work or which in the

opinion of the Employer/Consultant might be deemed to have reasonably been inferred to be so existing before commencement of work.

10.0 TENDERS

The entire set of tender paper issued to the tenderer should be submitted fully priced and also signed on the last page together with initials on every page. Initial/signature will indicate the acceptance of the tender papers by the tenderer.

The schedule of quantities shall be filled in as follows :

- i) The 'Rate' column to be legibly filled in ink in both English figures and English words.
- ii) Amount column to be filled in for each item and the amount for each sub head as detailed in the "Schedule of Quantities".
- iii) All corrections are to be initialed.
- iv) The 'Rate Column' for alternative items shall be filled up.
- v) The 'Amount' column for alternative items of which the quantities are not mentioned shall not be filled up.
- vi) In case of any errors/omissions in the quoted rates, the rates given in the tender marked "Original" shall be taken as correct rates.
- vii) When there is difference between the rates in figures and in words the rate which correspond to the amounts worked out by the contractor shall be taken as correct. No modifications, writings or corrections can be made in the tender papers by the tenderer, but may at his option offer his comments or modifications in a separate sheet of paper attached to the original tender papers.

The Employer reserves the right to reject the lowest or any tender and also to discharge any or all the tenders for each section or to split up and distribute any item of work to any specialist firm or firms, without assigning any reason.

The tenderers should note that the tender is strictly on the item rate basis and their attention is drawn to the fact that the rates for each and every item should be correct, workable and self-supporting. If called upon by the Employer/Consultant detailed analysis of any or all the rates shall be submitted. The Employer/Consultant shall not be bound to recognize the contractor's analysis.

The works will be paid for as "measured work" on the basis of actual work done.

All items of work described in the schedule of quantities are to be deemed and paid as complete works in all respects and details including preparatory and finishing works involved, directly, related to and reasonably detectable from the drawings, specifications and schedule of quantities and no further extra charges will be allowed in this connection. In the case of lump-sum charges in the tender in respect of any item of works, the payment of such items of work will be made for the actual work done on the basis of lump-sum charges as will be assessed to be payable by the Employer/Consultant.

The Employer has power to add to omit from any work as shown in drawings or described in specifications or included in schedule of quantities and intimate the same in writing but no addition, omission or variation shall be made by the contractor without authorization from the Employer. No variation shall vitiate the contract.

The tenderer shall note that his tender shall remain open for consideration for a period of 60 days from the date of opening of the tender.

11.0 SCHEDULE FOR COMPLETION OF WORK

The contractor shall submit a time and progress chart in a form approved by the Employer through its Consultant within fifteen days from the date of issue of work order or the date on which the contractor is instructed to take possession of the site, whichever is later.

A Bar Chart showing major activities along with the target dates for completion has been given in the tender vide Annexure-II and the contractors shall have to follow the same.

The contractors shall have to put all their resources and endeavour to complete the building, if possible, earlier than the schedule time shown in the programme. Keeping the general target dates as given in bar chart of the tender, the contractors shall have to prepare detailed work programme showing in addition to the items already indicated in the programme, other items, the completion of which would effect the overall time schedule of the programme. This work programme shall clearly indicate the

completion of Project. The contractors shall have to prepare their own material in flow according to the final Network Programme as accepted by Employer. The work programme shall have to be updated at regular intervals and modified programme shall be submitted to the Consultant/Employer for approval. In no

case the overall date for the completion of important items as indicated in the programme should be changed without prior consent of Consultant/Employer.

12.0 CO-OPERATION

The contractor will be required to consult and co-operate with other contractors whose work may be affected by the work under this contract.

13.0 TREASURE TROVE ETC.

Any treasure trove, coin or object antique which maybe found on the site shall be the property of the Employer and shall be handed over to the Employer.

14.0 PERMITS AND LICENCES

Permits and licenses for release of materials which are under Government control will be arranged by the contractor. The Employer will render necessary assistance, sign any forms or applications that may be necessary.

15.0 GOVERNMENT AND LOCAL RULES

The contractor shall conform to the provisions of all local Bye-laws and Acts relating to the work and to the Regulations etc of the Government and Local Authorities and of any company with whose system the structure is proposed to be connected. The contractor shall give all notices required by said Act, Rules, Regulations and Bye-laws etc and pay all fees payable to such authority/authorities for execution of the work involved. The cost, if any, shall be deemed to have been included in his quoted rates, taking into account all liabilities for licenses, fees for footpath encroachment and restorations etc and shall indemnify the Employer against such liabilities and shall defend all actions arising from such claims or liabilities.

16.0 TAXES AND DUTIES

The tenderers must include in their tender prices quoted for all duties royalties, cess and VAT or any other taxes or local charges if applicable. The rates shall also include sales tax on works contract as per State Government norms.No extra claim on this account will in any case be entertained.

17.0 POSSESSION PRIOR TO COMPLETION

The Employer shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be an acceptance of any work not completed in accordance with the contract Agreement.

18.0 EXCEPTED MATTERS

If the dispute or differences pertain to the undernoted matters the decision in writing of the Officer designated in and signing the contract documents shall be final, conclusive and binding on the parties.

- i) Instructions.
- ii) Transactions with Local Authorities.
- iii) Proof of quality of materials.
- iv) Assigning or under letting of the contract.
- v) Certificate as to the causes of delay on the part of the contractor and justifying extension of time.
- vi) Rectifying of defects pointed out during the Defects Liability Period.
- vii) Notice to the contractor to the effect that he is not proceeding with due diligence.
- viii) Certificate that the contractor has abandoned the contract.
- ix) Notice of determination of the contract by the Employer.

19.0 QUANTITY OF WORK TO BE EXECUTED

The quantities shown in the Schedule of Quantities are tentative to cover the entire new structure indicated in the drawings but same may vary on the basis of actual requirement at site. As such no claim on this ground will be entertained by the Employer. The Employer reserves the right to execute only a part or the whole or any excess of the work thereof without assigning any reason thereof. The rate quoted shall remain valid for any variation of quantity against individual item to any extent.

20.0 OTHER PERSONS ENGAGED BY THE EMPLOYER

The Employer reserves the right to execute any part of the work included in this contract or any work which is not included in this contract by other Agency or persons and contractor shall allow all reasonable facilities and use of his scaffolding for the execution of such work. The main contractor shall extend all cooperation in this regard.

21.0 LABOUR & PAYMENT OF WAGES TO LABOUR

No labour below the age of 14 years shall be employed on the work.

Payment of Wages to Labour

- a) The contractor shall pay to labour employed by him either directly or through specialized firms, wages not less than fair wages as applicable within the State of West Bengal or as per the provision of the Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules 1971 wherever applicable.
- b) The contractor shall notwithstanding the provision of any contract of the contrary cause to pay fair wages to labour indirectly engaged on the work, including any engaged by his specialized firms in connection with the said work, as if the labour has been immediately employed by him.
- c) In respect of all labour directly or indirectly employed in the work for performance of the contractor's part of this agreement the contractor shall comply with or cause to be complied with the Labour Regulations as mentioned in Sub-para (a) above made from time to time in regard to payment of wage, wage period, deductions from wages, recovery of wages not paid and deductions unauthorized made, maintenance of wage books or wage slips, publication of scales of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the contract Labour (Regulation and Abolition) Act 1970 and the Contract labour (regulation and Abolition) rules 1971 wherever applicable.
- d) The Employer concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason non-fulfilment of the conditions of the contract for the benefit of the workers non-payment of wages or of deductions made from his or their wages which are not justified by their terms of contract or non-observance of the Regulations as mentioned above.
- e) The contractor shall comply with the provisions of Wages Act, 1936, minimum wages Act, 1945. Employees Liability Act, 1938, Industrial Dispute Act, 1947. Maternity benefit Act, 1961 and the Contract Labour (Regulations and Abolition) Act, 1970 or the modification thereof or any other Laws relating has been immediately employed by him.

- f) The contractor shall indemnify the Employer against payment to be made under and for the observance of the laws aforesaid and the CPWD Contractors 'Labour Regulations having application within the State of West Bengal without prejudice to his right to claim indemnity from his sub-contractors.
- g) The Regulation aforesaid shall be deemed to be a part of his contract and any breach thereof shall be deemed to be breach of this contract.

22.0 EARNEST MONEY AND SECURITY DEPOSIT

EARNEST MONEY:

The tenderer will have to deposit an amount of Rs1,08,530/- only in the form of crossed Demand Draft/ Pay Order/Banker's Cheque payable at Kolkata and drawn in favour of Indian Association for the Cultivation of Science at the time of submission of tender as Earnest Money. The Employer is not liable to pay any interest on the Earnest Money. The Earnest Money of the unsuccessful tenderers will be refunded without any interest soon after the decision to award the work is taken or after the expiry of the validity period of the tender.

SECURITY DEPOSIT:

- a) The security deposit shall be collected by deductions from the running bill of the contractors at the rate mentioned below:
- b) A sum @ 2.5% of the gross amount of the bill shall be deducted from each running bill as well as from the final bill of the contractor.
- c) Security deposit can be released against bank guarantee issued by a schedule bank on its accumulation to a minimum amount of Rs. 5 lakhs subject to the condition that amount of any bankguarantee except last one, shall not be less than Rs. 5 L.
- d) The Bank Guarantee submitted against Security Deposit shall initially be valid up to the stipulated date of completion of the work plus maintenance period.
- e) The contractor shall deposit an amount equal to 5% of the tendered value of the work as performance guarantee in the form of an irrevocable bank guarantee bond of any Scheduled Bank in accordance with the prescribed form or in the form of Government security, fixed deposit receipt etc within 7 days of the issue of LOA/Work Order. This period can be further extended by the Engineer-in- Charge up to a maximum period of 7 days on written request of the contractor with late fee @ 0.1% per day, of Performance Guarantee amount. After recording the

completion certificate for the work by the competent authority, the performance guarantee (PBG) shall be returned to the contractor on completion of the retention period without any pending complaint but without interest.

- f) The Security Deposit may be refunded 30 (thirty) days after the end of defects liability period provided he has satisfactorily carried out all the work and attended to all defects in accordance with the conditions of the Contract where no pending issue will be in existence.

23.0 CONTRACTOR TO PROVIDE EVERYTHING NECESSARY

The contractor shall provide everything necessary for the proper execution of the work according to the intent and meaning of the drawings, schedule of quantities and specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from and if the contractor finds any discrepancies therein he shall immediately and in writing, refer the same to the Employer/Consultant whose decision shall be final and binding. The contractor shall provide himself for ground and fresh water for carrying out of the works at his own cost. The Employer shall on no account be responsible for the expenses incurred by the contractor for hired ground or fresh water obtained from elsewhere.

The rates quoted against individual items will be inclusive of everything necessary to complete the said items of work within the contemplation of the contract, and beyond the unit price no extra payment will be allowed for incidental or contingent work, labour and/or materials inclusive of all taxes and duties whatsoever except for specific items, if any, stipulated in the tender documents.

The contractor shall supply, fix and maintain at his own cost, for the execution of any work, all tools, tackles, machineries and equipments and all the necessary centering, scaffolding, staging, planking, timbering, strutting, shoring, pumping, fencing, boarding, watching and lighting by night as well as by day required not only for the proper execution and protection of the said work but also for the protection of the public and safety of any adjacent roads, streets, walls, houses, buildings, all other erections, matters and things and the contractor shall take down and remove any or all such centering, scaffolding, planking, timbering, strutting, shoring etc as occasion shall be required or when ordered so to do and shall fully reinstate and make good all matters and things disturbed during the execution of works to the satisfaction of the Employer/Consultant.

The contractor shall also provide such temporary road on the site as may be necessary for the proper performance of the contract, and for his own convenience but not otherwise. Upon completion, such roads shall be broken up and levelled where so required by the drawings unless the Employer shall otherwise direct.

The contractor shall at all times give access to workers employed by the Employer or any men employed on the buildings and to provide such parties with proper sufficient and if required, special scaffolding, hoists and ladders and provide them with water and lighting and leave or make any holes, grooves etc in any work, where directed by the Employer as may be required to enable such workmen to lay or fix pipes, electrical wiring, special fittings etc. The quoted rates of the tenderers shall accordingly include all these above mentioned contingent works.

24.0 TIME OF COMPLETION EXTENSION OF TIME & PROGRESS CHART

24.1 Time of Completion: The entire work is to be completed in all respects within the stipulated period. The work shall be deemed to be commenced from the date of execution of agreement. Time is the essence of the contract and shall be strictly observed by the contractor.

The work shall not be considered as complete until the Employer/Consultant have certified in writing that this has been completed and the Defects Liability Period shall commence from the date of such certificate.

24.2 Extension of Time : If in the opinion of the Employer/Consultant the works be delayed (a) by reason of any exceptionally inclement weather, or (b) by reason of instructions from the Employer in consequence of proceedings taken or threatened by or disputes, with adjoining or neighbouring Employers or (c) by the works, or delay of other contractors or tradesmen engaged or nominated by the Employer and not referred to in the specification or (d) by reason of authorized extra and additions or (e) by reason of any combination of workmen or strikes or lock-out affecting any of the building or trades or (f) from other causes which the Employer may consider are beyond the control of the contractor, the Employer at the completion of the time allowed for the contract shall make fair and reasonable extension of time for completion in respect thereof. In the event of the Employer failing to give possession of the site upon the day specified above the time of completion shall be extended suitably.

In case of such strikes or lockouts, as are referred to above, the contractor shall

immediately give the Employer, written notice thereof. Nevertheless, the contractor shall use his best endeavours to prevent delay and shall do all that may be reasonably required, to the satisfaction of the Employer to proceed with the works and on his doing so that it will be ground of consideration by the Employer for an extension of time as above provided. The decision of the Employer as to the period to be allowed for an extension of time for completion hereunder (which decision shall be final and binding on the contractor) shall be promulgated at the conclusion of such strike or lock-out and the Employer shall then, in the event of an extension being granted, determine and declare the final completion date. The provision in clause 61 with respect to payment of liquidated damages shall, in such case, be read and construed as if the extended date fixed by the Employer were substituted for and the damage shall be deducted accordingly.

24.3 Progress of Work : During the period of construction the contractor shall maintain proportionate progress on the basis of a Programme Chart submitted by the contractor immediately before commencement of work and agreed to by the Employer/Consultant. Contractor should also include planning for procurement of scarce material well in advance and reflect the same in the Programme Chart so that there is no delay in completion of the project.

25.0 TOOLS, STORAGE OF MATERIALS, PROTECTIVE WORKS AND SITE OFFICE REQUIREMENTS

The contractor shall provide, fix up and maintain in an approved position proper office accommodation for the contractor's representative and staff which offices shall be open at all reasonable hours to receive instruction notices or communications and clear away on completion of the works and make good all work disturbed.

All drawings maintained on the site are to be carefully mounted on boards of appropriate size and covered with a coat of approved varnish. They are to be protected from ravages of termites, ants, and other insects.

The contractor shall provide, fix up and maintain a telephone connection in their site office which should be available to the PMC free of cost for their office use.

The contractor shall provide at his own cost all artificial light required for the work and to enable other contractors and sub-contractors to complete the work within the specified time.

The contractor shall provide a suitable temporary hut for the watchmen and clear away the same when no longer required and to provide all necessary attendance, lights etc required.

The contractor shall arrange for temporary latrines for the use of workers and field staff and keep the same in a clean and sanitary condition to the satisfaction of the Public Health Authorities and shall cause such latrines and soil to be cleared away whenever necessary and shall make good all the works disturbed by these convenience.

Every precaution shall be taken by the contractor to prevent the breeding of mosquitoes on the works during the construction, and all receptacles, cistern, water tanksetc used for the storage of water must be suitably protected against breeding of mosquitoes. The contractor shall indemnify the Employer against any breach of rules in respect of anti-malarial measures.

The contractor shall not fix or place any placards or advertisement of any description or permit the same to be fixed or placed or upon any boarding gantry, building structure other than those approved by the Employer.

Protective Measures : The contractor from time to time of being placed in possession of the site must make suitable arrangements for watching, lighting and protecting the work, the site and surrounding property by day, by night, on Sundays and other holidays.

Contractor shall indemnify the Employer against any possible damage to the building, roads, or members of the public in course of execution of the work.

The contractor shall provide necessary temporary enclosures, gates, entrances etc for the protection of the work and materials and for altering and adopting the same as may be required and removing on completion of the works and making good all works disturbed.

Storage of Materials : The contractor shall provide and maintain proper sheds for the proper storage and adequate protection of materials etc and other work that may be executed on the site including the tools and materials of nominated sub-contractors and remove same on completion.

So also reinforcement bars are to be stored above the ground level to prevent the same from getting rusted.

Tools : All instruments found necessary on the works shall be provided by the contractor for the due performance of this contract as instructed by the Site Engineer.

All measuring tapes shall be of steel and suitable scaffolding and ladders that may be required for safely taking measurement and shall be supplied by the contractor.

Technicians and Supervisors on the works shall carry with them always a one metre or two metre steel tape, a measuring tape of 30 metres, a spirit level, a plumb bob and a square and shall check the work to see that the work is being done according to the drawing and specifications. The Site Engineer will use any or all measuring instruments or tools belonging to the contractors as he chooses for checking the works executed or being executed on the contract.

Technicians and supervisors of the electrical contractor shall always carry with them measuring tape (30 metres) one test lamp with leads and one neon tester, multi meter,

Tong tester etc and make available to the Consultant/Employer all the measuring instruments and tools that are required for checking the work.

The contractor should cover in his rates for making provisions for all reasonable facilities for the use of his scaffolding, tools and plant etc by nominated sub-contractors for their work.

26.0 NOTICE AND PATENTS OF APPROPRIATE AUTHORITY AND EMPLOYER

The contractor shall conform to the provisions of any Acts of the Legislature relating to the work, and to the Regulations and Bye-laws of any authorities, and/or any water, lighting and other companies, and/or authorities with whose systems the structures were proposed to have connection and shall before making any variations from the drawings or specification that may be associated to so conform, give the Employer/ Consultant written notices specifying the variations proposed to be made and the reasons for making them and apply for instruction thereon. The Employer/Consultant on receipt of such intimation, shall give a decision within a reasonable time.

The contractor/s shall arrange to give all notices required for by the said Acts, Regulations or Bye-laws to be given to any authority and to pay to such authority or to any public officer all fees that may be properly chargeable in respect of the work and lodge the receipts with the Employer.

The contractor shall indemnify the Employer against all claims in respect of patent rights, royalties, damages to buildings, roads or members of public in course of execution of work and shall defend all actions arising from such claims and shall keep the Employer saved harmless and indemnified in all respects from such

actions, costs and expenses.

27.0 CLEARING SITE AND SETTING OUT WORKS

The site shown on the plan shall be cleared of all obstructions, loose stone, and materials rubbish of all kinds. All holes or hollows whether originally existing or produced by removal or loose stone or materials shall be carefully filled up with earth well rammed and levelled off as directed at his own cost.

The contractor shall set out the works and shall be responsible for the true and perfect setting out of the work and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time, any error shall appear during the progress of any part of the work irrespective of the fact that the layout had been approved by the Employer/Consultant, the contractor shall at his own expenses rectify such error, if called upon to the satisfaction of the Employer. The contractor shall further set out the works to the alternative positions at the site until one is finally approved and the rates quoted in his tender should include for this and no extra on this account will be entertained.

28.0 CONTRACTOR IMMEDIATELY TO REMOVE ALL OFFENSIVE MATTERS

All soil, filth or other matters of any offensive nature taken out of any trench, sewer, drain, cesspool or other place shall not be deposited on the surface but shall be at once carted away by the contractor to place provided by him.

The contractor shall keep the foundations and works free from water and shall provide and maintain at his own expenses electrically or other power driven pumps and other plants to the satisfaction of the Employer for the purpose, until the building is handed over to the Employer. The contractor shall arrange for the disposal of the water so accumulated to the satisfaction of the Employer and local authority and no claims will be entertained afterwards if he does not include in his rates for the purpose.

29.0 ACCESS TO EMPLOYER

Any authorised representative of the Employer shall at all reasonable times have free access to the works and/or to the workshops, factories or other places where materials are being prepared or constructed for the work and also to any place where the materials are lying or from where they are being obtained, and the contractor shall give every facility to the Employer or their representatives

necessary for inspection and examination and test of the materials and workmanship. Except the representatives of the Employer no person shall be allowed at any time without the written permission of the Employer.

30.0 MATERIALS, WORKMANSHIP, SAMPLES, TESTING OF MATERIALS

All the works specified and provided for in the specifications or which may be required to be done in order to perform and complete any part thereof shall be executed in the best and most workmanlike manner with materials of the best and approved quality of the respective kinds in accordance with the particulars contained in and implied by the specifications and as represented by the drawings or according to such other additional particulars, and instructions as may from time to time be given by the Employer/Consultant during the execution of the work, and to his entire satisfaction.

As directed by the Employer/Consultant the contractor shall have to carry out tests on materials and workmanship in approved materials testing laboratories or as prescribed by the Employer/Consultant at his own cost to prove that the materials etc, under test conform to the relevant I.S. Standards or as specified in the specifications. All the samples shall be supplied by the contractor at his own cost as directed by the Employer/Consultant. The necessary charges for preparation of mould (in case of concrete cube) transporting, testing etc, shall have to be borne by the contractor. No extra payment on this account should in any case be entertained. The contractor shall provide all assistance, instruments, machine labour and materials for examining measuring and testing of work and the quality, weight or quantity of any materials used and supply samples before incorporation in the work for testing as may be selected and required by the Employer/Consultant. Tests of all materials should be carried out as per latest I.S. specifications. Sequence of testing of all materials shall be as advised by the Employer/Consultant.

All the materials (except where otherwise described) stores and equipment required for the full performance of the work under the contract must be provided through normal channels and must include charge for import duties, sales tax, octroi and other charges and must be the best of their kind available and the contractor/s must be entirely responsible for the proper and efficient carrying out of the work. The work must be done in the best workmanlike manner. Samples of all materials to be used must be submitted to the Employer/Consultant when so directed by the Employer/Consultant and written approval from Employer/Consultant must be obtained prior to placement of order.

During the inclement weather the contractor shall suspend concreting and plastering for such time as the Employer/Consultant may direct and shall protect from injury all work when in course of execution. Any damage (during constructions) to any part of the work for any reasons due to rain, storm, or neglect of contractor shall be rectified by the contractor in an approved manner at no extra cost.

Should the work be suspended by reason of rain, strike, lock-outs or any other cause, the contractor shall take all precautions necessary for the protection of work and at his own expenses shall make good any damage arising from any of these causes.

The contractor shall cover up and protect from damage, from any cause, all new work and supply all temporary/doors, protection to windows, and any other requisite protection for the execution of the work whether by himself or special tradesmen or nominated sub-contractor and any damage caused must be made good by the contractor at his own expenses.

31.0 REMOVAL OF IMPROPER WORK

The Employer shall during the progress of the work have power to order in writing from time to time the removal from the work within such reasonable time or times as may be specified in the order of any materials which in the opinion of the Employer/Consultant are not in accordance with specification or instructions, the substitution or proper re-execution of any work executed with materials or workmanships not in accordance with the drawings and specifications or instructions. In case the contractor refuses to comply with the order the Employer shall have the power to employ and pay other agencies to carry out the work and all expenses consequent thereon or incidental thereto as certified by the Employer/Consultant shall be borne by the contractor or may be deducted from any money due to or that may become due to the contractor. No certificate which may be given by the Employer/Consultant shall relieve the contractor from his liability in respect of unsound work or bad materials.

32.0 DUTIES OF SITE ENGINEER/PROJECT MANAGEMENT CONSULTANT (PMC)

- i) Duties of Site Engineer/PMC: To issue/modify/revise details, drawings and specifications for the implementation of the project in Consultation with the Employer/Consultant. Site Engineer/PMC shall have authority to approve/disapprove any materials or workmanship or rates and shall have authority to order start/stop/modify any aspect of the project. Site Engineer/PMC shall under all normal circumstances issue instructions through Employer/Consultant.
- ii) The duties of Site Engineer/PMC are to watch and supervise the works and to examine any materials to be used or workmanship employed in connection with the works. They shall have no authority to relieve the contractor of any of his duties or obligations under the contract nor except as expressly provide hereunder to order any work involving delay or any extra payment by the Employer nor to take any variation of or in the works.
- iii) Any written instructions or written approval given by Site Engineer/PMC to the contractor within the terms of such delegation (but not otherwise) shall bind the contractor and the Employer as though it had been given by Employer.

33.0 SITE STORING FACILITY OF THE CONTRACTOR

The contractor shall provide, erect, and maintain at his cost a separate simple watertight store accommodation for storing of valuable materials in pilfer proof manner at site. The Contractor shall be responsible for the safe custody of all the materials/machineries etc on behalf of the employer for the items already paid to them (partly or fully) till the same are handed over on completion of the work. The accommodation shall be demolished when directed.

34.0 CONTRACTOR'S EMPLOYEES

The contractor shall employ technically qualified and competent supervisors for the work who shall be available (by turn) throughout the working hours to receive and comply with instructions of the Employer/Consultant. The contractor shall engage at least one full time competent and experienced Engineer as Site-In charge for execution of the work. The contractor shall employ in connection with the work persons having the appropriate skill or ability to perform their job efficiently.

The contractor shall employ local labourers on the work as far as possible.

No labour below the age of FOURTEEN years and who is not an Indian National shall be employed on the work.

Any labour supplied by the contractor to be engaged on the work on day-work basis either wholly or partly under the direct order or control of the Employer or his representative shall be deemed to be a person employed by the contractor.

The contractor shall comply with the provisions of all labour legislation including the requirements of

- a) The Payment of Wages Act
- b) Employer's Liability Act
- c) Workmen's Compensation Act.
- d) Contract Labour (Regulation & Abolition) Act, 1970 and Central Rules 1971.
- e) Apprentices Act 1961.
- f) Any other Act or enactment relating thereto and rules framed there under from time to time.

The contractor shall keep the Employer saved harmless and indemnified against claims if any of the workmen and all costs and expenses as may be incurred by the Employer in connection with any claim that may be made by any workmen.

The contractor shall keep the Employer saved harmless and indemnified against claims if any of the workmen and all costs and expenses as may be incurred by the Employer in connection with any claim that may be made by any workmen.

The contractor shall comply at his own cost with the order of requirement of any Health Officer of the State or any local authority or of the Employer regarding the maintenance of proper environmental sanitation of the area where the contractor's labour are housed or accommodated, for the prevention of small pox, cholera, plague, typhoid, malaria and other contagious diseases. The contractor shall provide, maintain and keep in good sanitary condition adequate sanitary accommodation and provide facilities for pure drinking water at all times for the use of men engaged on the works and shall remove and clear away the same on completion of the works. Adequate precautions shall be taken by the contractor to prevent nuisance of any kind on the works or the lands adjoining the same.

The contractor shall arrange to provide first-aid treatment to the labours engaged on the works. He shall within 24 hours of the occurrence of any accident at or about the site or in connection with execution of the works, report such accident to the Employer and also to the competent authority where such report is required by law.

35.0 DISMISSAL OF WORKMEN

The contractor shall on the request of the Employer immediately dismiss from works any person employed thereon by him, who may in the opinion of the Employer be unsuitable or incompetent or who may misconduct himself. Such discharges shall not be the basis of any claim for compensation or damages against the Employer or any of their officer or employee.

36.0 ASSIGNMENT

The whole of the works included in the contract shall be executed by the contractor and the contractor shall not directly or indirectly transfer, assign or underlet the contract or any part, share or interest therein nor, shall take a new partner, without written consent of the Employer and no subletting shall relieve the contractor from the full and entire responsibility of the contract or from active superintendence of the work during their progress.

37.0 NOMINATED SUB-CONTRACTOR

All specialists, Merchants, Tradesmen and others executing any work or supply and fixing any goods for which prime cost prices or provisional sums are included in the Schedule of Quantities/ Rates and/or specifications who may be nominated or selected by the Employer are hereby declared to be sub-contractors employed by the contractor and are herein referred to as nominated sub-contractors.

No nominated sub-contractor shall be employed on or in connection with the works against whom the Employer shall make reasonable objection or save where the Employer and contractor shall otherwise agree who will not enter into a contract provided :

- a) That the nominated sub-contractor shall indemnify the contractor against the same obligations in respect of the sub-contract as the Contractor is under in respect of this contract.
- b) That the nominated sub-contractor shall indemnify the contractor against claims in respect of any negligence by the sub-contractor, his servants or agents or any misuse by him or them of any scaffolding or other plants the property of the contractor or under any workmen's compensation Act in force.

- c) Payment shall be made to the nominated sub-contractor by the contractor within fourteen days of his receipt of the Consultant certificate provided that before any certificate is issued the contractor shall upon request furnish to the Consultant proof that all nominated sub-contractor's accounts included in previous certification have been duly discharged, in default where of the Employer may pay the same upon a certificate of the Consultant and deduct the amount thereof from any sums due to the contractor. The exercise of this power shall not create privities of contract between the Employer and the sub-contractor.

38.0 DAMAGE TO PERSONS AND PROPERTY INSURANCE ETC

The contractor shall be responsible for all injury to the work or workmen to persons, animals or things and for all damages to the structural and/or decorative part of property which may arise from the operations or neglect of himself of any sub-contractor or of any of his or a sub-contractor's employees, whether such injury or damage arise from carelessness, accident or any other cause whatsoever in any way connected with the carrying out of this contract. The clause shall be held to include interalia, any damage to buildings whether immediately adjacent or otherwise, and any damage to roads, streets, foot paths or ways as well as damages caused to the buildings and the works forming the subject of this contract by rain, wind or other inclemency of the weather. The contractor shall indemnify the Employer and hold harmless in respect of all and any expenses arising from any such injury or damages to persons or property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of compensation or damages consequent upon such claim.

The contractor shall reinstate all damage of every sort mentioned in this clause, so as to deliver the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damages to the property or third parties.

The contractor shall effect the insurance necessary and indemnify the Employer entirely from all responsibility in this respect. The insurance must be placed with a company approved by the Employer and must be effected jointly in the name of the contractor and the Employer (the name of the latter being placed first in the policy i.e IACS A/C _____ (Contractor's Name) and the policy lodged with the latter. The scope of insurance is to include damage or loss to the contract itself till this is made over in a complete state. Insurance is compulsory and must be effected from the very initial stage. The contractor shall also be responsible for anything which may be excluded from damage to any property arising out of incidents, negligence or defective carrying out of this

contract i.e. the **Contractors' All Risk Insurance** shall have extension for covering cross liability arising, if any, during execution of work relating to Air Conditioning, Electrification, Erection of Lift etc.

The Employer shall be at liberty and is hereby empowered to deduct the amount of any damages, compensations, costs, charges and expenses arising or accruing from or in respect of any such claim or damages from any sums due or to become due to the contractor.

39.0 INSURANCE

Unless otherwise instructed the contractor shall insure the works and keep them insured until the virtual completion of the contract against loss or damage by fire and/or earthquake, flood. The insurance must be placed with a company approved by the Employer, in the joint names of the Employer and the contractor for such amount and for any further sum if called to do so by the Employer, the premium of such further sum being allowed to the contractor as an authorized extra. The contractor shall deposit the policy and receipt for premiums paid with the Employer within 21 (twenty one) days from the date of issue of work order unless otherwise instructed.

40.0 ACCOUNTS RECEIPTS & VOUCHERS

The contractor shall, upon the request of the Employer furnish them with all the invoices, accounts, receipts and other vouchers that they may require in connection with the works under this contract. If the contractor shall use materials less than what he is required under the contract, the value of the difference in the quantity of the materials he was required to use and that he actually used shall be deducted from his dues. The decision of the Employer shall be final and binding on the contractor as to the amount of materials the contractor is required to use for any work under this contract.

41.0 MEASUREMENT OF WORKS

The contractor will record and submit measurement for verification of the representative of the Employer. The contractor should submit their bill with such measurements.

The Engineer-in-Charge shall on receipt of the bill from the contractor, intimate him that he requires the measurements of the work to be verified at site and the

contractor shall forthwith attend or send a qualified Agent to assist the E-in-C's representative in taking such measurements and calculation and to furnish particular or to give all assistance required by either of them.

Should the contractor not attend or neglect or omit to send such Agent then the measurements taken by the Engineer-in-Charge or his representative shall be taken to be the correct measurements of the works. The contractor or his Agents may at the time of measurements take such notes and measurement as he may require.

It shall be ensured that the method of measurement is in accordance with the contract. The precision in measurements shall be as laid down in IS 1200. Any points of disagreement with the contractor pertaining to measurements shall be promptly referred to the decision of the Competent Authority.

Extra/deviated items, as claimed by the contractor, shall not be recorded in Measurement Book until they are approved by the Competent Authority.

In case some allegedly extra/deviated item is carried out by the contractor while complying with approved drawings and specifications and the same is to be covered up, the Engineer-in-Charge shall check the item and its specification and record its measurements but simultaneously enter up the provision that their admittance is subject to the approval by the Competent Authority. Both the measurements and the provision shall be got signed by the contractor.

42.0 CONCEALED WORK

The contractor shall give due notice to the Employer whenever any work is to be buried in the earth, concrete or in the bodies of walls or otherwise, becoming inaccessible later on, in order that the work may be inspected and correct dimensions taken before such burial, in default whereof the same shall, at the opinion of the Employer be either opened up for measurement at the contractor's expense or no payment may be made for such materials, should any dispute or difference arise after the execution of any work as to measurements etc or other matters which cannot be conveniently tested or checked, the notes of the employer shall be accepted as correct and binding on the contractor.

43.0 PAYMENTS

All bills shall be prepared by the contractor in the printed form prescribed by the Employer/Consultant after the measurements are endorsed as mentioned in Clause No. 41 (Measurement of Works). Maximum one Interim/RA Bill shall be prepared

in each month subject to minimum value for interim certificate which shall not be more than 75% of the full value (but not less than Rupees one lakh in agregat) of the item executed as accepted in the tender documents.

The bills in proper forms must be duly accompanied by detailed measurements in support of the quantities of work done and must show deductions for all previous payments, retention money, etc.

The Employer/Consultant shall issue a certificate after due scrutiny of the contractor's bill stating the amount due to the contractor. The Employer will have the discretion to amend the certificate of Consultant if considered necessary and the contractor shall be entitled to payment thereof.

The Employer will deduct retention money as described in Clause 22 of these conditions. The refund of retention money will be made as specified in the said clause.

If the Employer has supplied any materials or goods to the contractor, the cost of any such materials or goods will be progressively deducted from the amount due to the contractor in accordance with the quantities consumed in the work.

All the interim payments shall be regarded payments by way of advance against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad, unsound, and imperfect or unskilled work to be removed and taken away and reconstructed, or re-erected or be considered as an admission of the due performance of the contract, or any part thereof in any respect or the accruing of any claim, nor shall, it conclude determine or affect in anyway the power of the Employer under these conditions or any of them as to the final settlement and adjustment of the accounts or otherwise or in any other way vary or affect the contract. The final bill shall be submitted by the contractor within one month of the date fixed for completion of the work or of the date of certificate of completion furnished by the Consultant and payment shall be made within four months from the date of receipt of the final bill by the Consultant.

FINAL CERTIFICATE AND PAYMENT

On completion of the work, the contractor shall be furnished with a certificate by the Employer of such completion, nor shall the work be considered completed until the contractor shall have removed from the premises on which the work shall be executed all scaffolding surplus materials and rubbish and cleaned of the dirt from all work executed.

The final bill shall be accompanied by a certificate of completion from the

Employer. Payments of final bill shall be made after deduction of Retention Money as specified in Clause 22 of these conditions, which sum shall be refunded after the completion of the Defects Liability Period after receiving the Employer's certificate that the contractor has rectified all defects to the satisfaction of the Employer/ Consultant. The acceptance of payment of the final bill by the contractor would indicate that he will have no further claim in respect of the work executed. Contractor will have to submit no claim certificate along with Final Bill.

44.0 VARIATION/DEVIATION

The contractor may when authorised and shall, when directed in writing by the Employer and or omit, or vary the works shown in the drawings or described in the specifications or included in the priced schedule of quantities. The contractor on his own accord shall make no addition, omission or variation without such authorisation or direction. A verbal authorisation or direction by the Employer shall when confirmed correctly by the contractor in writing within 8 days shall be deemed to have been given in writing.

The contractor shall send to the Employer once in every month a statement giving particulars, as full and detailed as possible, of all claims for any additional payment to which the contractor may consider himself entitled and of all extra or additional work ordered by the Employer which he has executed during the preceding month.

No final interim claim for payment for any such work or expense will be considered which has not been included in such a statement provided always that the Consultant shall be entitled after taking employer's sanction to authorise payment to be made for any such work or expense, notwithstanding the contractor's failure to comply with this condition, if the contractor has, at the earliest practicable opportunity, notified the Consultant in writing that he intends to make a claim for such work.

The rates for additional, altered, substituted work shall be arrived at in accordance with the following rules :

- i) The net rates of prices in the contract schedule shall determine the valuation of (the rates for) the extra work (items) where such extra work is of similar character and is executed under similar conditions as the work priced therein.

- ii) If the rates for the extra, altered or substituted (deviated) work are not provided for (available) in the contract schedule, they shall to the extent possible be derived out of rate given in that schedule for similar or near similar items. For the purpose of such deviation, where necessary and when so directed, the contractor shall furnish detailed analysis for the said similar or near similar items in the contract schedule. For such portions of the analysis, for the extra, altered or substituted (deviated) work for which prices cannot be abstracted from the corresponding analysis of rates for the said similar or near similar items in the contract schedule, market rates substantiated by purchase bills/vouchers dependable printed price schedules of building materials of different types shall be adopted, using factors and constants for quantum of material, labour T & P and sundries from standard analysis of rates adopted by the CPWD Works manual 2014 and adding 15% over towards profits and overheads. When called upon to do so the contractor shall submit the required purchase bill/vouchers.
- iii) In respect of a contract which incorporates more than one schedule the rate applicable in case (i) above if not provided for in the schedule pertaining to the work in which the addition, alteration or substitution (deviation) occurs shall be taken as the lowest applicable rate in other schedule. Similarly in case (ii) above if similar or near similar items cannot be found in the schedule pertaining to the work in which the addition, alteration or substitution (deviation) occurs, similar or near similar items from the other schedule shall be adopted.
- iv) In the case of additional, altered or substituted (deviated) work for which rates cannot be reasonably be derived as at (ii) and (iii) above, the rates shall be worked out adopting market prices, substantiated by purchase bill/vouchers, using factors and constants for quantum of materials, labour, T & P and sundries from standard analysis of rates adopted by the CPWD Works manual 2014 and addition 15% towards profit and overheads. When called upon to do so the contractor shall submit his purchase bills/vouchers to the Employer.
- v) The tender rates will hold good for any increase and decrease in the tender quantities upto a variation of 25% in aggregate and 40% on item wise cost. For variation beyond the above limit the rates for the respective items for quantity beyond the limits mentioned above may be worked out on market rates.
- vi) The question as to what particular items, being similar or near similar to the additional, altered or substituted (deviated) work in the contract schedule are to be adopted for deviation of rates for the additional, altered or substituted (deviated) work and whether the said rates cannot be derived from similar or near similar items in the contract schedule will be decided by the Employer.

- vii) In case (ii) to (iv) the contractor is required to submit his analysis of rates adopting the principles enunciated and the Consultant, after scrutinizing the analysis and other papers furnished will allow such rates as he considers reasonable after obtaining Employer's sanction.
- viii) Where extra work is of such a nature that it cannot be properly measured or valued the contractor shall be allowed day work priced at the net rates stated in the tender or the priced schedule of quantities or if not so stated then in accordance with the minimum local day work rates and wage for the district notified by the concerned authority provided that in either case if required by the Employer/Engineer-in-Charge, vouchers, muster rolls and other documents, required for proper verification of the labour employed and the materials deployed on the said work and the costs thereof be delivered to the Employer or his representative on or before the end of the week following that in which the work has been executed.

The question as to whether extra work is of such nature that it cannot be properly measured or valued will be decided by the Employer. The margin to be allowed on actual costs to the contractor towards profit and overhead shall be 15%.

45.0 SUBSTITUTION

Should the contractor desire to substitute any materials and workmanship, he/they must obtain the approval of the Employer/Consultant in writing for any such substitution well in advance. Materials designated in this specifications indefinitely by such term as "Equal" or "Other approved" etc specific approval of the Employer/Consultant has been obtained in writing.

46.0 PREPARATION OF WORKS FOR OCCUPATION AND USE ON COMPLETION

The whole of the work will be thoroughly inspected by the contractor and deficiencies and defects put right. On completion of such inspection the contractor shall inform the Employer that he has completed the work and it is ready for inspection.

47.0 CLEARING SITE ON COMPLETION

On completion of the works the contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish and temporary works of every kind and leave the whole of the site and the works clean and in a workmanlike

condition to the satisfaction of the Employer/Consultant.

48.0. DEFECTS AFTER COMPLETION

The contractor shall make good at his own cost and to the satisfaction of the Employer for all defects or other faults which may appear within 12 months after completion of the work. In default the Employer may employ and pay other persons to amend and make good such damages, losses and expenses consequent thereon or incidental thereto shall be made good and borne by the contractor and such damages, loss and expenses shall be recoverable from him by the Employer or may be deducted by the Employer, in lieu of such amending and making good by the contractor, deduct from any money due to the contractor a sum equivalent to the cost of amending such work and in the event of the amount retained being insufficient, recover that balance from the contractor from the amount retained under Clause No. 22 together with any expenses the Employer may have incurred in connection therewith.

49.0 ESCALATION

The rate quoted shall be firm throughout the tenure of the contract (including extension of time, if any, granted) and will not be subject to any fluctuation due to increase in cost of materials or labour etc. However, any change of price due to change of Govt. Levy etc may be considered, if justified.

50.0 PRICE VARIATION

As per clause 49 as mentioned above.

51.0 IDLE LABOUR

Whatever the reasons may be, no claim for idle labour, additional establishment cost of hire and labour charges of tools and plants would be entertained under any circumstances.

52.0 SUSPENSION

If the contractor except on account of any legal restraint upon the Employer preventing the continuance of the work or in the opinion of the Employer shall

neglect or fail to proceed with due diligence in the performance of his part of the contract or if he shall more than once make default, the Employer shall have the power to give notice in writing to the contractor requiring the work be proceeded within a reasonable manner and with reasonable despatch, such notice purport to be a notice under this clause.

After such notice shall have been given the contractor shall not be at liberty to remove from the site of the works or from any ground contiguous thereto any plant or materials to subsist from the date of such notice being given until the notice shall have been complied with, If the contractor fails to start the work within 7 (seven) days after such notice has been given to proceed with the works as therein prescribed, the Employer may proceed as provided in Clause 53 (Termination of Contract by Employer).

53.0 TERMINATION OF CONTRACT BY EMPLOYER

performed by the contractor within three clear days after the notice shall have been given to the contractor in manner hereinafter mentioned requiring the contractor to observe or perform the same or shall use improper materials or workmanship in carrying on the works, or shall in the opinion of the Employer not exercise such diligence and make such due progress as would enable the work to be completed within due time agreed upon and shall fail to proceed to the satisfaction of the Employer after three clear days' notice requiring the contractor so to do shall have been given to the contractor as hereinafter mentioned, or shall abandon the contract, then and in any of the said cases, the Employer may notwithstanding previous waiver determine the contract by a notice in writing to the effect as hereinafter mentioned, but without thereby affecting the powers of the Employer of the obligations and liabilities of the contractor the whole of which shall continue in force as fully as if the contract, had not been so determined and as if the works subsequently executed had been executed by or on behalf of the contractor (without thereby creating any trust in favour of the contractor) further the Employer or his agent, or servants, may enter upon and take possession of the work and all plants, tools, scaffoldings, sheds, machinery, steam and other power, utensils and materials lying upon premises or the adjoining lands or roads and sell the same as his own property or may employ the same by means of his own servants and workmen in carrying on and completing the works or by employing any other contractors or other persons or person to complete the works, and the contractor shall not in any way interrupt or do any act, matter or things to prevent or hinder such other contractors or other persons or person employed from completing and finishing or using the materials and plants for the works when the works shall be completed, or as soon thereafter as conveniently may be, the

Employer shall give notice in writing to the contractor to remove his surplus materials and plants and should the contractor fail to do so within a period of 14 days after receipt by him the Employer may sell the same by Public Auction and shall give credit to the contractor for the amount so realised. Any expenses or losses incurred by the Employer in getting the works carried out by other contractors shall be adjusted against the amount payable to the contractor by way of selling his tools and plants or due on account of work carried out by the contractor prior to engaging other contractors or against the Security deposit.

54.0 WATER SUPPLY

The Contractor may use the existing facility of the water supply distribution, if not otherwise instructed.

55.0 POWER

The Contractor may use the existing facility of the power supply distribution, if not otherwise instructed. However, any amount of electrical power as may be required for the work under contract or for the use of the manpower etc, it should be applied by the contractor to IACS at least seven days in advance mentioning the purpose with quantum of power in kW/ kVA with supply of 415V/230V alongwith duration of requirement. Power will be supplied with kWhr contractor's meter and cable switches etc on chargeable basis to be deducted from the bills of contractor.

56.0 LAND FOR CONTRACTOR'S ESTABLISHMENT

For the purpose of construction of contractor's store yard, godowns, site office, etc, the contractor may utilize with the permission of the Employer/Consultant, portion of the land belonging to the Employer if available at such location as would not interfere with the execution of the works. The contractor shall for this purpose submit to the Consultant for his approval a plan or plans of the proposed layouts for the site facilities. The Consultant reserves the right to alter and modify the contractors' proposal as he may deem fit.

57.0 METHOD OF MEASUREMENT

Unless otherwise mentioned elsewhere in the tender measurement will be on the net quantities or work produced in accordance with upto date rules laid down by

the Indian Standard Institution. In the event of any dispute with regard to the measurement of the work executed, the decision of the Consultant/Employer shall be final and binding on the contractor.

58.0 ACTION WHERE NO SPECIFICATION

In the case of any class of work for which there is no such specification in Technical Specification, such work shall be carried out in accordance with the I.S. Specification and in the event of there being no I.S. specification, then in such case the work shall be carried out in all respects in accordance with the instructions and requirements of the Consultant/Employer.

59.0 CONTRACTOR NOT TO DEPOSIT MATERIALS IN A MANNER THAT MAY INCONVENIENCE TO THE PUBLIC

The contractor(s) shall not deposit materials on any site which will seriously inconvenience the public. The Consultant may require the contractor to remove any materials, which are considered by him to be a danger or inconvenience to the public or cause them to be removed at the contractor's cost.

60.0 LIQUIDATED DAMAGES

If the work is not completed to the satisfaction of the Employer/Consultant within the stipulated period, the contractor shall be bound to pay to the Employer a sum calculated as given below by way of liquidated damages and not as penalty during which the work remains un-commenced or unfinished after the expiry of the completion date.

- a) For contracts having stipulated time for completion not exceeding 6 months : 1% of the tendered amount per week or part thereof of delay subject to a maximum of 5% of the accepted sum in the tender.
- b) For contracts having stipulated time for completion exceeding 6 months but not exceeding 2 years (24 months) : 1% of the tendered amount for every two weeks or part thereof of delay subject to a maximum of 5% of the accepted sum in the tender.

61.0 ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

In any case in which under any clause or clauses of this contract, the contractor shall have rendered himself liable to pay liquidated damages amounting to the whole of his security de deposit (whether paid in one sum or deducted by installments) the Employer/Consultant shall have power to adopt any of the following courses as they may deem best suited to the interest of the Employer:-

- a) To rescind the contract(of which rescission notice in writing to the contractor under hand of the Employer/Consultant shall be conclusive evidence), and in which case the security deposit of the contractor shall stand forfeited and be absolutely at the disposal of the Employer.
- b) To employ labour paid by the Employer and to supply materials to carry out the work, or any part of the work, debiting the contractor with the cost of the labour and price of material (of the amount of which cost and price of a certificate of the Consultant/Employer shall be final and conclusive against the contractor) and crediting him with the value of the work done, in all respects in the same manner and at the same rates as if it had been carried out by the contractor under the terms of this contract the certificate of Consultant/Employer as to the value of the work done, shall be final and conclusive against the contractor.
- c) To measure up the work of the contractor, and to take such part thereof as shall be unexecuted, out of his hands, and to give it to another contractor to complete in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (of the amount of which excess the certificates in writing of the Consultant/Employer shall be final and conclusive) shall be borne and paid by the original contractor and may be deducted from any money due to him by the Employer under the contract or otherwise, or from his security deposit or the proceeds of sale thereof, or a sufficient part thereof.

In the event of any of above courses being adopted by the Employer/Consultant the contractor shall have no claim to compensation for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements, or make any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescind under the provision aforesaid, the contractor shall not be entitled to recover or be paid any sum or any work thereto for actually performed under this contract, unless, and until the Employer/Consultant will have certified in writing the performance of such work and the value payable in respect thereof, and he shall only be entitled to be paid the value so certified.

62.0 CONTRACTOR REMAIN LIABLE TO PAY COMPENSATION IF ACTION NOT TAKEN UNDER CLAUSE 61

In any case in which any of the powers conferred upon the Employer/Consultant by Clause 61 hereof, shall have become exercisable and the same shall not be exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such power shall notwithstanding be exercisable in the event of any future case of default by the contractor for which by any clause or clauses hereof he is declared liable to pay compensation amounting to the whole of his security deposit, and the liability of the contractor for past and future compensation shall remain unaffected in the event of the Employer/Consultant putting in force either of the powers (a) or (b) vested in him under the preceding clause, he may, if so desire, take possession of all or any tools, plants, materials and stores, in or upon the works, or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contract rates or in case of these not being applicable a current market rates to be certified by the Employer/Consultant whose certificate thereof shall be final, otherwise the Employer/Consultant may by notice in writing to the contractor or his clerk of the works, foreman or other authorized agent required him to remove such tools, plant materials or stores from the premises (within a time to be specified in such notice) and in the event of the contractor failing to comply with any such requisition the Employer/Consultant may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor at his risk in all respects and the certificate of the Employer/Consultant as to the expenses of any such removal and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

63.0 SUM PAYABLE BY WAY OF COMPENSATION

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

64.0. CHANGE IN CONSTITUTION OF THE FIRM

In the case of a tender by partners any change in the Constitutions of the Firm shall forthwith notified by the contractor to the Employer/Consultant for the information.

65.0 GUARANTEE FOR THE SPECIALISED WORKS

Wherever provision for submission of a guarantee has been advised, the same shall be submitted from the specialised agency alongwith a counter guarantee by the main contractor engaged for the work. The guarantee shall be furnished on a non-judicial stamp paper of appropriate value. If the contractor is required to submit guarantee/ guarantees for any item/items for a period of more than 12 months, the guarantee/ guarantees in case of those items shall remain valid even after expiry of the defect liability period of 12 months as stipulated in the contract.

66.0 SITE REGISTERS ETC.

The contractor will be required to maintain the Site Order book, Inspection Note etc registers at site of work and should produce the same for inspection of the Employer/Consultant whenever desired by them.

Typical pro-forma are enclosed (Refer Table I to VI)

- i) Table – I Pro-forma of Materials at Site Account
- ii) Table - II Pro-forma of Accounts of Secured advance (to be submitted along with bills if necessary)
- iii) Table - III Pro-forma of Hindrance to work
- iv) Table - IV Pro-forma of Running Account Bill
- v) Table - V Pro-forma of Secured advance on materials brought at site.
- vi) Table - VI Pro-forma of Memorandum for payment.

Contractor will have to submit their Running Account Bills in printed form shown in Table VI.

67.0 INCOME TAX / WORKS CONTRACT TAX

Statutory deduction of Income Tax/works contract tax shall be made from all interim and final payments as per extend statute.

68.0 AGREEMENT

The successful contractor will be required to enter into an agreement in accordance with the Draft Agreement form enclosed & the schedule of conditions within 10 working days from the date of the contractor is advised by the Employer/Consultant that his tender has been accepted (The date of issue of LOA) and he shall pay for all stamps & legal expenses incidental thereto. However, the written acceptance by the Employer of a tender will constitute a binding contract between the Employer and the person so tendering whether such formal agreement is or is not subsequently executed.

69.0 PERIOD OF WORKING HOURS

No work shall be done on Sunday & holidays without prior approval in writing of the Employer/ Consultant. Working hours on other days of the week shall be from sunrise to sunset. Work programme for completion of the project within the stipulated time of completion shall be prepared accordingly.

However, work period may be required to be extended to Sundays & holidays as per availability of Power Shut Down or for any other reason as will be deemed fit by the engineer-in-charge of site.

70.0 NO COMPENSATION FOR ALTERATION IN OR RESTRICTION OF WORK TO BE CARRIED OUT

If at any time after the commencement of the work, the Employer/ Consultant shall for any reason whatsoever not require the whole work thereof as specified in the tender to be carried out the Consultant/Employer shall give notice in writing of the fact to the contractor who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage with which he might have derived from the execution of the work in full, but which he did not derive in consequence of the full amount of the work not having been carried out; neither shall he have any claim for compensation by reason of any alterations having been made in the original specification, drawing, designs and instructions which shall involve any curtailment of the work as originally contemplated.

71.0 ARBITRATION

All disputes or differences of any kind whatsoever (except for excepted matters vide clause no. 18) which shall at any time arise between the parties hereto touching or concerning the works or the execution or maintenance thereof of this contract or

the rights touching or concerning the works or the execution of maintenance thereof of this contract or the construction remaining operation or effect thereof or to the rights or liabilities of the parties or arising out of or in relation thereto whether during or after determination foreclosure or breach of the contract (other than those in respect of which the decision of any person is by the contract expressed to be final and binding) shall after written notice by either party to the contract to the other of them and to the Employer hereinafter mentioned be referred for adjudication to a sole Arbitrator to be appointed as hereinafter provided.

For the purpose of appointing the sole Arbitrator referred to above, the Employer will send within thirty days of receipt of the notice to the contractor a panel of three names of persons who shall be presently unconnected with the organisation for which the work is executed.

The contractor shall on receipt of the names as aforesaid, select any one of the persons name to be appointed as a sole Arbitrator and communicate his name to the Employer within thirty days of receipt of the names. The Employer shall thereupon without any delay appoint the said person as the Sole Arbitrator. If the contractor fails to communicate such selection as provided above within the period specified, the Employer shall make the selection and appoint the selected person as the Sole Arbitrator.

If the Employer fails to send to the contractor the panel of three names as aforesaid within the period specified, the contractor shall send to the Employer a panel of three names of persons who shall all be unconnected with either party. The Employer shall on receipt of the named as aforesaid select any one of the persons names and appoint him as the Sole Arbitrator. If the Employer fails to select the person and appoint him as the Sole Arbitrator within 30 days of receipt of the panel and inform the contractor accordingly, the contractor shall be entitled to appoint one of the persons from the panel as the Sole Arbitrator and communicate his name to the Employer.

If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever another Sole Arbitrator shall be appointed as aforesaid.

The work under the Contract shall, however, continue during the arbitration proceedings and no payment due to be payable to the contractor shall be withheld on account of such proceedings.

The Arbitrator shall be deemed to have entered on the reference on the date he issued notice to both the parties fixing the date of the first hearing.

The Arbitrator may from time to time, with the consent of the parties, enlarge the time for making and publishing the award.

The Arbitrator shall give a separate award in respect of each dispute or difference referred to him. The Arbitrator shall decide each dispute in accordance with the terms of the contract and give a reasoned award. The venue of arbitration shall be such place as may be fixed by the Arbitrator in his sole discretion.

The fees, if any, of the Arbitrator shall, if required to be paid before the award is made and published, be paid half and half by each of the parties. The cost of the reference and of the award including the fees, if any, of the Arbitrator who may direct to and by whom and in what manner, such costs or any part thereof shall be paid and may fix or settle and amount of costs to be so paid.

The award of the Arbitrator shall be final and binding on both the parties, subject to aforesaid the provisions of the Arbitration & Conciliation Act, 1996 or any statutory modification or re-enactment thereof and the rules made thereunder and for the time being in force, shall apply to the arbitration proceeding under this clause.

The Employer and the contractor hereby also agree that arbitration under clause shall be a condition precedent to any right to action under the contract with regard to the matters hereby expressly agreed to be so referred to arbitration.

72.0 CLOSING OF CONTRACT

The Final bill shall be submitted within 30 days from the date of virtual completion of the work. It is also a term of the contract that if the contractor does not raise any claim in writing within 90 days from the date of cancellation, termination, completion or abandonment, the claim of the contractor shall be deemed to have been waived and absolutely barred and "Indian Association for the Cultivation of Science" shall be discharged and released of all its liabilities under the contract in respect of the claims. This contract shall be deemed to have closed on settlement of Final Bill for the work.

73.0 DECLARATION

I/We have inspected the site of works and have made me/us fully acquainted with the local conditions in and around the sites of works. I/We hereby declare that I/We have gone through the conditions laid down in the Notice Inviting Tender, General Conditions of Contract, Technical Specifications and understood the same and on the basis of the same I/We quoted our rates in the schedule of quantities attached with the tender documents.

I/We shall also uniformly maintain such progress with the work, as may be directed by the Employer/Consultant to ensure completion of same within the target date as mentioned in the tender document.

Witness :

Signature of Tenderer

Address : -----

Date : -----

PROFORMA FOR ACCOUNT OF SECURED ADVANCE REGISTER Table - II

Name of work :

Name of Contractor :

Agreement No. :

Description of Materials	Qty outstanding from previous bill	Deduct Qty utilised in works measured since previous Bill	Qty outstanding & Qty brought to sitesince previous bill	Signature of Contractor	Signature of Engineer-in- Charge	Signature of Engineer-in- Charge or his representative	Remarks
1	2	3	4	5	6	7	8

I. RUNNING ACCOUNT BILL

Table - IV

Name of work : Serial No. Of this Bill :

Name of Contractor : No. And Date of Previous Bill :

Agreement No. : Date of written order to commence :

Date of Completion :
as per agreement

Sl. No.	Item Description	Unit	As per Tender		Upto Previous R/A Bill		Upto Date (Gross)		Present Bill		Remarks
			Qty	Amount (Rs)	Qty	Amount (Rs)	Qty	Amount (Rs)	Qty	Amount (Rs)	

Net Value Since previous bill :

- Note: .
1. If part rate is allowed for any item, it should be indicated with reasons for allowing such a rate.
 2. If adhoc payment is made, it should be mentioned specifically

CERTIFICATE

The measurements on the basis of which the above entries for the running bill No.....
were made have been taken jointly on and are recorded at
pages To of measurement book No.

--

Signature and date of Contractor

Signature and date of Representative
of Engineer-in-Charge

The work recorded in the above mentioned measurements has been done at the site satisfactorily
as per tender drawings, conditions and specifications.

Engineer-in-Charge

III. MEMORANDUM FOR PAYMENT			Table – VI
R/A Bill No.....			
1.	Total value of work done since previous bill	(A)	Rs.
2.	Total amount of secured advance due since previous bill	(B)	Rs.
3.	Total amount due since previous Bill (A + B)	(C)	Rs.
4.	PVA on account of declaration in price of steel, cement and other materials and labour as detailed in separate statement enclosed	(D)	Rs.....
5.	Total amount due to the contractor (C + D) =	(E)	Rs.
<u>Deductions</u>			
i)	Secured Advance paid in the previous R/A Bill		Rs.....
ii)	Retention money on value of works as per accepted tender upto date amount		Rs.....
	Less already recovered		Rs.....
	Balance to be recovered		Rs.....
iii)	Mobilisation Advance if any		Rs.....
a)	Outstanding Amount (Principal + Interest) as on date		Rs.....
b)	To be recovered in this bill		Rs.....
iv)	Any other Departmental materials cost to be recovered as per contract		Rs.....

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v)	Any other departmental service charges to be recovered, if any, as per contract (water, power etc) ----Enclose Statement		Rs.....
	Total Deductions as per Contract	(F)	Rs.....
	<u>Adjustments, if any</u>		
1.	Amount less received by contractor in R/A Bill (as per statement by contractor)		Rs.....
2.	PVA		Rs.....
	Total amount of adjustment due since previous bill	(G)	Rs.....
	Net amount payable as per Contract (E-F+G)		Rs.....
	(Rupees) in words		

The Bill amount to Rs.....(both figures and words) has been scrutinised by us after due checking of the measurements of works as required and is recommended for payment.

Date : Signature of representative of Engineer-in-Charge

The bill amount to Rs.....certified by consultants has been scrutinised by me after due test checking of measurements of works as required and is recommended for payment for an amount of Rs.....

Date : Signature of Engineer-in-Charge

STATUTORY DEDUCTIONS :

1. Total amount due (E) : Rs.....
2. Less : I.T Payable : Rs.....
3. Less : S.T Payable : Rs.....

Net Payable : **Rs.....**

The figures given in the Memorandum for payable has been verified and the bill passed for payment of Rupees..... (in words)

Date :Signature of Engineer-in-Charge

APPENDIX

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Name of Work	: Supply , Installation, Testing & Commissioning of Electrical Works for 2 nos. 500kVA & 1no. 250kVA D.G. sets including arrangement of AMF cum Auto-Synchronisation and Exhaust Chimneys etc.
Location	: 2A & 2B Raja S C Mullick Road, Jadavpur, Kolkata-32
Scope of Work	: As above and as further detailed in the General Conditions of contracts
Defects Liability Period (Clause no.....)	: 12 Months from the date of virtual completion
Date of Commencement	: The date of execution of agreement shall be treated as the date of commencement. The site will be handed over to the contractor on the same day for commencement of work. However, if there is any hindrance to handover the site on the same day by IACS, the date of commencement will be treated as the date of actual handing over of the site to the contractor.
Time of completion	: 150 days.
Liquidated Damages	: As per clause No.60
Value of works for interim Certificate	: Not less than Rs. 1(One) Lakh.
Earnest Money (Clause No.22)	: Rs. 1,08,530/- by Bank Draft/Pay Order/Banker's Cheque.
Security Deposit (Clause No.22)	: Details as per Clause No. 22
Initial Security Deposit (PBG) (Clause No.22)	: 5% of the accepted tender value
Period of Honouring Certificate	: <ol style="list-style-type: none">1. One Month for R.A. Bill2. The final bill will be submitted by the contractor within one month from the date of virtual completion. Consultant/Consultant shall issue the certificate of payment within a period of one month, and payment shall be made within three months from the date of issue of certificate.

SAFETY CODE

Scaffolds

- i) Suitable scaffolds shall be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration work which can be done safely from ladders. When a ladder is used, it shall be of rigid construction made either of good quality wood or steel. The steps shall have a minimum width of 450 mm and a maximum rise of 300mm. Suitable hand holds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than 1/4 to 1(1/4 horizontal and 1 vertical).
- ii) Scaffolding or staging more than 4 m above the ground floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly bolted, braced or otherwise secured, at least 1 m 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 may be 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.
- iii) Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform, gangway or stairway is more than 4 m above ground level or floor level, they shall be closely boarded and shall have adequate width and be suitably fenced as described in (ii) above.
- iv) Every opening in the floor of a 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 1m. Wherever there are open excavations inground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.
- v) Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in length while the width between side rails in rung ladder shall in no case, be less than 290 mm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least 20 mm for each additional metre of length.
- vi) A sketch of the ladders and scaffolds proposed to be used shall be prepared and approval of the Engineer obtained prior to construction.

Other Safety Measures

- vii) All personnel of the contractor working within the plant site shall be provided with safety helmets. All welders shall wear welding goggles while doing welding work and all metal workers shall be provided with safety gloves. Persons employed on metal cutting and grinding shall wear safety glasses.
- viii) Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.

Excavation & Trenching

- ix) All trenches, 1.25 m or more in depth shall at all times be supplied with at least one ladder for each 30 m in length or fraction thereof. The ladder shall be extended from bottoms of the trench to at least 1 m above the surface of the ground. Sides of trenches which are 1.5 m or more 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 m of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
- x) The contractor shall take all measures on the site of the work to protect the public from accidents and shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any persons for injury sustained owing to neglect of the above precautions and to pay any such persons or which may with the consent of the contractor, be paid to compromise any claim by any such person.

Demolition

- xi) Before any demolition work is commenced and also during the process of the work :
 - a) All roads open areas adjacent to the work site shall either be closed or suitably protected.
 - b) No electric cable or apparatus which is to be a source of danger over a cable or apparatus used by the operator shall remain electrically charged.
 - c) All practical steps shall be taken to prevent danger to persons employed from the risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so over-loaded with debris or materials as to render it unsafe.

Personal Safety Equipment

xii) All necessary personal safety equipment as considered adequate by the engineer should be kept available for the use of the person employed on the site and maintain in a condition suitable for immediate use and the contractor should 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 goggles.

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

c) Those engaged in welding works shall be provided with welder's protective eyesight lids.

d) Stone breakers 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 manholes and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public.

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

i) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.

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

iii) Overalls shall be supplied by the contractor to the workmen and adequate facilities shall be provided to enable the working painters to wash during the cessation of work.

xiii) When the work is done near any public place where there is risk of drowning all necessary equipments should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

Hoisting Machine

- xiv) Use of hoisting machines and tackle including their attachments anchorage and supports shall conform to the following standards or conditions :
- 1.a) These shall be of good mechanical constructions sound material and adequate strength and free from patent defect and shall be kept in good repair and 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.
2. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of any hoisting machine including any scaffolding which or give signals to operator.
 3. In case of every hoisting machine and of every chain ring hook, shackle shovel and pulley block used in hoisting or as means of suspension the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load, each safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.
 4. In case of departmental machines, 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 machinery to site of work and get it verified by the Engineer concerned.
- xv) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards, hoisting appliances should be provided with such means as will reduce to the minimum of the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energised, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary, should be provided. The workers should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.
- xvi) All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition 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.
- xvii) These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

- xviii) To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer, Engineers of the Department or their representatives.
- xix) Notwithstanding the above clause from (i) to (xviii), there is nothing in these to exempt the contractor from the operations of any other Act or' Rule in force in the Republic of India.

PROFORMA FOR APPLICATION FOR EXTENSION OF TIME PERIOD

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE

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1.	Name of Contractor	:	
2.	Name of the work as given in the Agreement	:	
3.	Agreement No.	:	
4.	Estimated Tender Value	:	
5.	Date of commencement of work as per Agreement	:	
6.	Period allowed for completion of work as per Agreement	:	
7.	Date of completion stipulated in agreement	:	
8.	Period for which extension of time has been given previously	:	
	a) 1 st extension vide Consultant's/ Employer's	Month	Days
	b) 2 nd extension vide Consultant's/ Employer's	Month	Days
	c) 3 rd extension vide Consultant's/ Employer's	Month	Days
	d) 4 th extension vide Consultant's/ Employer's	Month	Days
	Total Extension previously given	:	
9.	Reason for which extensions have been previously given (copies of the previous applications should be attached)	:	
10.	Period for which extension is applied for	:	
11.	Hindrances on account of which extension is applied for with dates on which hindrances occurred and the period for which these are likely to last	:	
	a) Serial No	:	
	b) Date of Occurrence	:	
	c) Period of which it is likely to last	:	
	d) Period for which extension required for this particular hindrance	:	

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	e) Overlapping period if any	:
	f) Net Extension applied for	:
	g) Remarks, if any	:

12. Extension of time required for extra work :

13. Details of extra work and the amount involved :

a) Total value of extra work :

b) Proportionate period of extension of
time on estimated amount put to
tender :

14. Total extension of time required for 11 & 12

Submitted to the

Consultant/Employer.....

Date :

Signature of the Contractor

PROFORMA OF BANK GUARANTEE FOR PERFORMANCE GUARANTEE

1. We(hereinafter referred to as theBank) at the request of M/s.and address (hereinafter called theContractor) do hereby undertake to pay to Indian Association for the Cultivation of Science (hereinafter called the Employer) an amount not exceeding Rs.....(rupees.....) only for any breach in successful completion of "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata"as per the agreement to be executed between the Employer and the Contractor.
2. We.....(indicate name of Bank) do hereby undertake to pay the amount payable under this Guarantee without any demur, merely on a demand from the Employer stating that the amount claimed is due by way of loss or damage caused to or would do caused to or suffered by the Employer by reason of breach by the said contractor(s) of any of the terms and conditions contained in thesaid Agreement relating to"Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata". Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs..... (Rupees.....) only.
3. We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s)/ Supplier(s) in any suit or proceedings pending before any court or Tribunal relating thereto our liability under this present being absolute and unequivocal.The payment so made by us under this bond shall be as valid discharge of our liability for payment thereunder the contractor(s)/ suppliers shall have no claim against us for making such payment.
4. We,further agree that the (indicate the name of bank) Guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the employer only relating to the work of "Supply, Installation, Testing and Commissioning of Electrical Works for 2 X 500KVA & 1 X 250KVA DG Sets including arrangement of AMF cum Auto-Synchronising and Exhaust Chimneys etc. at IACS, Jadavpur, Kolkata".

Unless a demand or claim under this guarantee is made on us in writing on or before we shall be discharged from all liability under this guarantee thereafter.

5. We (indicate the name of Bank) further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and

conditions of the said Agreement or to extend time of performance by -----
----- the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reasons of any such variation, or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision have effect or so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s)/Supplier(s).
7. We..... (Name of the Bank) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

**SPECIAL CONDITIONS OF CONTRACT
FOR ELECTRICAL WORKS**

CHAPTER 1

SPECIAL CONDITIONS OF CONTRACT

1.1 **General :**

- 1.1.1 These Special Conditions of Contract supplement the General Instructions, General Conditions of Contract, Bill of Quantities and basic rates and Technical Specifications and tender drawings enclosed thereto, and shall be considered as part of the Tender Papers. Where the provisions of these Special Conditions of Contract are at variance with General Conditions of Contract, the Provisions of these Special Conditions of Contract shall prevail.
- 1.1.2 The several documents forming the tender are to be taken as mutually complementary to one another. Detailed drawings shall be followed in preference to small scale drawings and figured dimensions in preference to scaled dimensions.
- 1.1.3 If there are varying or conflicting provisions in the documents forming part of the contract, the Engineer-In-Charge shall be the deciding authority with regard to the intentions of the provisions and his decision shall be final and binding on the contractor.
- 1.1.4 The Employer reserves the right to exclude any of the Schedule items on reasons of the rates not being reasonable or subsequent change of design for evaluation of tender and deciding the contract during execution or work.
- 1.1.5 The Contractor may be required to carry out any addition or alteration work other than the specified in the schedule of work / bill of quantities as and when required, by the 'Employer' within the completion period of the project.

1.2 **Scope of Work**

- 1.2.1 The works to be governed by this contract shall cover delivery and transportation upto destination, safe custody at site, insurance, erection, testing and commissioning of the entire Electrical works.
- 1.2.2 The works to be under taken by the contractor will inter alia include the following:
- i) Preparation of detailed 'AS BUILT' drawings of electrical wiring installation, cable laying, erection/fixing of switchgear etc.
 - ii) Pre-commissioning tests as per relevant standard specifications, code of practice, Acts and Rules.
 - iii) Warranty obligation for Circuit Breaker, CT, Cables, Capacitor etc to be supplied by the Contractor.

- iv) All other earthwork and masonry works required to be done in connection with the electrical works.

1.3 Execution of work

1.3.1 All the works to be carried out as per the approved drawing and direction of the Engineer-In-Charge.

1.3.2 Water & Power supply: - It will be provided by IACS free of cost for the beneficial use of IACS only. However, the contractor shall have to arrange for utilizing the same at their cost and risk.

1.4 Period of Completion

1.4.1 Time is the essence of contract. Therefore, timely completion of project is very important. Normally no extension of time will be given. However, on account of delay if any, for the reason beyond the control of the contractor, necessary time extension may be granted if applied for by the contractor at least 15 days prior to the expiry of schedule time of completion.

1.4.2 No price variations shall be admissible on the contract rate for any item during the entire period of contract including extension periods. The Contractor shall not have any claim whatsoever in this regard except statutory variation of duties and Taxes imposed by Govt. of India/State Govt subsequent to the offer submitted by the contractor.

1.5 All the materials to be used in the execution of the contract shall be of the approved quality and of the class most suited for the purpose specified. The work shall also conform to the following Acts, Rules and Orders:

- i) Indian Factories Act
- ii) Indian Electricity
- iii) National Building Code
- iv) National Electrical Code
- v) Indian Standard Specifications

1.5.1 All erection work shall be of the best workmanship & quality to the entire satisfaction of the Employer. The Contractor shall ensure that the equipment and services under the scope of this contract whether manufactured or performed within the Contractor's premises or at his subordinate's premises or at the work site or at any other place are strictly in accordance with the provisions of this contract. For this purpose, if necessary the Contractor shall adopt necessary quality assurance programme to control such activities at all stages.

1.6 Electrical License

1.6.1 The work shall be carried out only by a Contractor holding a valid license issued by the State Government for carrying out the installation work of a voltage classes involved, under the direct supervision of the persons holding valid certificates issued or recognized by the State Government. The tenderer should furnish with his tender the particulars of the license with validity period held by him. The successful tenderer shall furnish the names and particulars of certificates of competency of supervisors and workmen with working permits of relevant part to be engaged for carrying out this work.

1.6.2 *The contractor shall not be allowed to engage sub-contractor directly or indirectly unless it is officially permitted by IACS.*

1.7 **Inspection**

1.7.1 The Contractor shall provide without any extra cost to the Employer all materials, equipment, tools, labour and maintenance of every kind which the Employer's Inspecting Engineer may consider necessary for any test and examination to be made at the Contractor's or the Sub-Contractor's (if approved) premises and at site and shall pay all cost attended thereon.

1.7.2 All the equipment and materials shall be tested / inspected by the Employer or its authorized Inspecting Engineer and approved before they are installed / used in the execution of the works covered in the contract. If the Contractor uses any equipment / materials without the prior approval of Employer, those are liable to be rejected. The Contractor shall furnish, as and when demanded by the Engineer-in-Charge the T.C. (Test Certificate) and G.C (Guarantee Card) for verification of quality and make of the materials.

1.7.3 The Inspecting Engineer or his authorized Representative shall have at all times access to the Contractor's premises and shall have the power to

- i) Inspect and examine the materials and workmanship of the work at any time at the site of erection
- ii) Reject any part of the work submitted by the Contractor as not being in accordance with the contract.
- iii) Reject the whole of the work including equipment tendered for inspection if after the inspection of such portion as he may, in his discretion think fit he is justified that the same is unsatisfactory.
- iv) Mark the rejected equipment with a rejection mark so that the same may be easily identified
- v) Re-inspect at the time of erection at site any equipment both previously inspected and approved by the inspecting Engineer at the Contractor or Sub-contractor's (if approved) premises. Notwithstanding any approval given earlier, the Contractor shall make good such rejections made based on such re-inspection at site to the satisfaction of the Engineer.

- vi) The decision of the Inspecting Engineer as regards to the acceptance or rejection of equipment / work shall be final and binding to the Contractor.

1.7.4 Consequence of Rejection

On the equipment / assemblies being rejected by the Inspecting Officer of the Employer at destination of the Contractor shall replace such rejected equipment/ assemblies of the forthwith but in any event not later than a period of 2 (two) weeks in the case of minor equipment and 4(four) weeks in case of a major equipment from the date of rejection. The Contractor shall bear all the costs of replacement including freight, etc., but without being entitled to any extra time on this account. The decision as to whether the equipment is to be classified as Minor or Major for the purpose of this clause shall be that of an Engineer and is not questionable.

1.8 Installation

- 1.8.1 All works connected with and inclusive of installation and erection under this contract shall be done in accordance with the standard and established methods of installation and erection of electrical equipment and shall comply with relevant Indian Electricity Rules, National Electrical Code, BIS Codes of Specifications and Standards. The work shall also be strictly in accordance with the instructions / recommendations of the manufacturers. **The equipment shall be leveled carefully before being fixed finally in position. All fragile and sensitive equipment shall be protected adequately and handled carefully during installation and erection.**

1.9 Commissioning Tests

- 1.9.1 As soon as the installations are ready for commissioning, the Contractor shall arrange for all the tests/ inspection as required by the relevant ISS and / or IE Rules and advise the Employer and others concerned. Employer shall depute their Inspecting Officer forwitnessing the tests and to carry out inspection independently and also jointly with other concerned agencies where ever necessary and only after the installation passes the required tests and inspection, it should be commissioned / energized. The contractor shall arrange all testing equipments/apparatus/instruments as will be required for conducting the tests without any extra cost.
- 1.9.2 Visual Inspection shall include checks for satisfactory workmanship, all connections, painting, cleanliness of all fittings etc., and compliance with Indian Electricity Rules.

- 1.9.3 The ammeters, voltmeters and energy meters shall be checked for their calibration, scale, accuracy, etc. for compliance with the specified requirement.
- 1.9.4 (i) Manufacturer's test Certificates shall be furnished on demand.
(ii) Certificates of compliance to routine test shall also be furnished.
(iii) Routine tests certificates are required to be submitted.
- 1.9.5 All cables shall be tested at manufacturer's works in compliance with relevant ISS. Allcables and connections after erection shall be tested as required by the employer for :
i) Pressure Test
ii) Insulation Resistance Test
- 1.9.6 Earth resistant shall be measured separately for each earth electrode and when they are connected together and to the equipment should be recorded.
- 2.0 *Warranty:* The contractor shall stand guarantee that all the equipments and the works executed under this contract shall be free from all defects and faults in materials, design, workmanship and manufacture and shall be acceptable standards for the contracted works and in full conformity to the technical specifications, drawings and other contract stipulations for a period of 12 months from the date of completion of the project or 15months from the date of supply of materials whichever is earlier.
- 3.0 *Completeness of tender:* All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various component of the work shall be deemed to have been included in the tender whether such items are specifically mentioned in the tender documents or not.
- 4.0 *Works to be done by the Contractor:* Unless and otherwise mentioned in the tenderdocuments, the following work shall be done by the contractor, and therefore, their cost shall be deemed to be included in their tender cost
- i) Cutting and making goods all damages caused during installation and restoring thesame to their original finish.
ii) Sealing of all floor openings provided by him for pipes and cables from fire safetypoint of view after laying of the same
iii) Painting at site of all exposed metal surfaces of the installation other than prepainted items like switch-gear, transformer etc. damages to finished surfaces ofthese items while handling and erection shall however be rectified to the satisfactionof the Engineer In-Charge.
- 5.0 *Tools for handling and erection:* - all tools and tackles required for handling of equipments and materials at site of works as well as for their assembly and

erection and also necessary testing instruments shall be responsibility of the contractor.

6.0 *Care of Building:* Care shall be taken by the Contractor to avoid damage to the building during execution of his part of the work. He shall be responsible for repairing of all damages and restoring the same to their original finish at his cost. He shall also remove at his cost all unwanted and waste materials arising out of his work from the site.

7.0 *Structural Alterations to Buildings :*

i) No structural member in the building shall be damaged / altered, without prior approval of the competent authority through the Engineer-in-charge.

ii) Structural provisions like openings, cutouts, if any, provided by the department for the work, shall be used. Where these require modifications, or where fresh provisions are required to be made, such contingent works shall be carried out by the Contractor at his cost.

iii) All such openings in floors provided by the Department shall be closed by the Contractor after installing the cables / conduits / rising mains etc. as the case may be, by any suitable means as approved by the Engineer-in-charge without any extrapayment.

iv) All chases required in connection with the electrical works shall be provided and filled by the Contractor at his own cost to the original Consultantural finish of the buildings.

8.0 Any concealed work must be given enough opportunity for inspection by the employer and after clearance of the said work concealment can be done.

CHAPTER 2

GENERAL TECHNICAL SPECIFICATION

1.0 Conformity to IE Act, IE Rules, and Standards:

- i) All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 1910 and Indian Electricity Rules, 1956 amended up to date.
- ii) The works shall also conform to relevant Indian Standard Codes of Practice (COP) for the type of work involved.
- iii) In all electrical installation works, relevant safety codes of practice shall be followed.
- iv) **Unless otherwise specified, the work shall be carried out as per CPWD General Specifications for Electrical Works (Internal & external) as applicable as per the Instruction of the Engineer-in-Charge or his authorized representative.**

2.0 Workmanship :

- i) Good workmanship is an essential requirement to be complied with. The entire work of manufacture / fabrication, assembly and installation shall conform to sound engineering practice involving highly skilled workers.
- ii) The work shall be carried out under the direct supervision of a highly experienced licensed SUPERVISOR, i.e. a person holding a certificate of competency issued by the State Govt. for the type of work involved, employed by the contractor, who shall rectify the defects pointed out by the Engineer-in-charge during the progress of work.

3.0 General requirements and components:

- i) Quality of Materials:
 - a) All the materials and equipments supplied by the contractor shall be new. They shall be of such design, size and materials as to satisfactorily function under the rated condition of operation and to withstand the environmental conditions at site.
 - b) All the components shall conform to relevant IS specification wherever existing materials with ISI certification marked shall be preferred if not otherwise mentioned the tender.
 - c) For items of materials for which makes are approved by the Dept., only such approved makes shall be permitted in the work in accordance to the preference of

the Engineer-in-Charge of the employer.

- d) **Commissioning on completion:** Before the workman leaves the work finally, the contractor must be sure that the installation is ready for commissioning after due testing.

4.0 Completion plan and completion certificate

- i) For all the works, completion certificate after completion of work as given in 'Appendix-A' shall be submitted to the Engineer In-Charge.
- ii) 'As built' drawing to be submitted along-with Test/completion certificate which is an essential part for consideration of final bill.

5.0 Testing & Installation:

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

- i) Insulation Resistance Test by appropriate class of Megger
- ii) Earth continuity test
- iii) Earth resistant test by earth Megger.

Testing shall be carried out for the completed installation in presence of the E-in-C or his authorized representative to their satisfaction. All test result shall be recorded and submitted to the Dept. All necessary test instruments for the test shall be arranged by the Contractor if so required by the E-in-C. Calibration certificates may require to be produced on demand by the E-in-C

6.0 Testing of Earth Continuity Path

The earth continuity conductor, including metal conduits and metallic enclosures of cables in all cases, 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.

Appendix A

Form of Completion Certificate

I/We certify that the installation detailed below has been technically supervised by me/us and tested and that to the best of my/our knowledge belief it complies with Indian Electricity Rules, 1956,

Electrical installation at _____

Voltage and system of supply _____

1. Particulars of work:

Signature and name of the Supervisor along with license no., SCC Part nos. & validity

Endorsed by the Agency:

M/s.....

(Signature of the contractor with Seal / Stamp)

License No.

Validity:

EQUIPMENT TECHNICAL SPECIFICATIONS

1. STANDARDS & CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition, the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/ or IEC Standards shall be Applicable.

BIS/ IEC certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current standards shall be applicable irrespective of those listed below:

Low voltage Switchgear and control gear specifications Part 1-General Part 2-Circuit Breakers Part 3-Switch Fuse Units Part 4-Contractors and Motor starters Part 5-Control Circuit Devices	IS 13947:1993
Electrical Relays for power system protection	IS 3231:1986
Low voltage Switchgear and control gear assemblies	IS 8623:1993
Marking of Switchgear busbars	IS 11353:1985
Degree of Protection of Enclosures for low voltage switchgear	IS 2147:1962
Code of Practice for selection, installation and maintenance of Switchgear	IS10118:1982

2. AMF CUM AUTO-SYNCHRONISING SYSTEM

2.1 *General Constructional Features* : The control panel shall be fabricated out of 2.0 mm thick sheet steel, totally enclosed, dust, damp and vermin proof free standing

floor mounted type & front operated. It shall be made into sections such that as far as feasible, there is no mixing of control, power, DC & AC functions in the same section and they are sufficiently segregated except where their bunching is necessary. Hinged doors shall be provided preferably double leaf for access for routine inspection from the rear. There is no objection to have single leaf hinged door in the front, all indication lamps, instruments meter etc. shall be flushed in the front. The degree of protection required will be IP-54 conforming to IS 2147.

- 2.2 *Terminal Blocks and Wiring:* Terminal blocks of robust type and generally not less than 15 Amps capacity, 250/500 V grade for DC upto 100 V and 660/ 1100 volts grade for AC and rest of the junction shall be employed in such a manner so that they are freely accessible for maintenance. All control and small wiring from unit to unit inside the panel shall also be done with not less than 2.5 sq.mm. Copper conductor PVC insulated and 660/ 1100 volts grade. Suitable colour coding can be adopted. Wiring system shall be neatly formed and run preferably, function wise and as far as feasible segregated voltage wise. All ends shall be identified with ferrules at the ends.
- 2.3 *Labelling:* All internal components shall be provided with suitable identification labels suitably engraved. Labels shall be fixed on buttons, indication lamps etc.
- 2.4 *Painting:* The entire panel shall be given primer coat after proper treatment and powder coating with 7 tanks process before assembly of various items.
- 2.5 *Equipment requirements:* The control cubical shall incorporate into assembly general equipment and systems as under:
- (a) Control system equipments and components such as relays, contactors, timers, etc. both for automatic operation on main failure and as well as for manual operation.
 - (b) Equipment and components necessary for testing generating set's healthiness with test mode and with load on mains.
 - (c) Necessary instruments and accessories such as voltmeter, power factor meter, KW meter, KWH meter, Ammeter, Frequency meter etc. in one energy analyzer unit with selector switch to obtain the reading of desired parameters.
 - (d) Necessary indication lamps, fuses, terminal blocks, push buttons, control switches etc. as required.
 - (e) Necessary engine/ generating set shut down devices due to faults /abnormalities.

- (f) Necessary visual audio alarm indication and annunciation facility as specified.
- (g) Necessary battery charger.
- (h) Necessary excitation control and voltage regulating equipment. (Alternatively provided on the Alternator itself).
- (i) Necessary overhead bus trunking terminations all internal wiring, connections etc. as required.
- (j) Breakers as specified in the schedule of work

2.6 *System Operation:* The above mentioned facilities provided shall afford the following operational requirements.

2.6.1 *Auto Mode:*

- (a) A line voltage monitor shall monitor supply voltage on each phase. When the mains supply voltage of CESC fails completely or falls below set value (variable between 80% to 85% of the normal value) on any phase, the monitor module shall initiate start-up of diesel engine through PLC. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall be incorporated in start-up initiation
- (b) The PLC system (32 I/O with 6 analog input) will monitor the power drawn from the incomer through transducers and based on the demand last recorded during incomer power fail, it will decide the logic for starting no. of DGs to meet the existing demand. If the demand is more than 50% of a single DG capacity, then the PLC will give command to both the DGs to start to meet the demand.
- (c) The Auto-Synchronising Controller (Easygen 3500) shall be used with every DG set to meet all functional requirements like start, stop, auto synchronise and auto load sharing and protections of the DGs.
- (d) When mains supply fails, the bus coupler breaker shall be always switched off. This will be switched on after either of the DG circuit breaker is connected to the load. In a condition, where both the two DG circuit breakers are closed and connected to load, then a Breaker Control Relay (LS-5) shall monitor and close the bus coupler breaker.
- (e) When the main supply is restored and is healthy as sensed by the line voltage monitor setting, both for under voltage and unbalance, the system

shall be monitored by a suitable timer which can be set between 1 minute to 5 minutes for the load to be transferred automatically to main supply.

- (e) The diesel alternator set reverts to standby for next operation as per (a), (b), (c) and (d) above.

2.6.2 *Manual Mode:*

- (a) In a manual mode, it shall be feasible to start-up the generator set by the operator on pressing the start push button.
- (b) Three attempt starting facility shall be operative for the start-up function.
- (c) Alternator circuit breakers close and trip operations shall also be through operator only by pressing the appropriate button on the panel and closure shall be feasible only after alternator has built up full voltage. If the load is already on 'mains', pressure on 'close' button shall be ineffective.
- (d) Engine shut down, otherwise due to faults, shall be manual by pressing a 'stop' button.

2.6.3 *Test Mode:*

- (a) When under 'test' mode pressing of 'test' button shall complete the start up sequence simulation and start the engine. The simulation will be that of mains failure. Sequence 1.6.1(a) and (b) shall be completed.
- (b) Engine shall build up voltage but the set shall not take load by closing of alternator circuit breaker. When the load is on the mains, monitoring of performance for voltage/ frequency etc. shall be feasible without supply to load.
- (c) If during test mode, the power supply has failed, the load shall automatically get transferred to alternator.
- (d) Bringing the mode selector to auto position shall shut down the set as per sequence of 1.6.1(d) provided main supply is ON. If the mains supply is not available at that time, the alternator shall take load as in (c) above.

2.7 *Engine shut down and alternator protection equipment:* Following shut down and protection system shall be integrated in the control panel.

- (a) *Engine:*
 - (i) Low lubricating oil pressure shut down. This shall be inoperative during start up and acceleration period.

- (ii) High coolant (water) temp. shut down.
- (iii) Engine over speed down

(b) *Alternator Protection:* Following protection arrangement shall be made:

- (i) Over Load
- (ii) Short Circuit
- (iii) Earth Fault
- (iv) Over/ Under Voltage

2.8. *Monitoring and Metering Facilities:*

- (a) Necessary energy analyzer unit for visual monitoring of mains, alternator and load voltage, current, frequency, KWH, power factor, etc.
- (b) A set of visual monitoring lamp indication for:
 - (i) Load On Set
 - (ii) Load on Mains
 - (iii) Set on test (Alternator on operation duty, Alternator on standby duty).
 - (iv) Set of lamp for engine shut down for over speed, low lub oil pressure and high coolant water temperature, overload trip of alternator, earth fault trip of alternator, engine lock out and failure to start etc. All these indications shall have an audio and visual alarm. When operator accepts the alarm, the hooter will be silenced and the fault indication will become steady until reset by operating a reset button.

2.9 *Operating Devices:* A set of operation devices shall be incorporated in the front of panel as under:

- (a) Master Engine Control Switch: This shall cut off in 'OFF' position DC control to the entire panel, thus preventing start-up of engine due to any cause. However, battery charger, lamp test button for testing the healthiness of indication lamps, DC volt meter / ammeter etc. shall be operative. It shall be feasible to lock the switch in OFF position for maintenance and shut down purposes.
- (b) Operation selector switch OFF/AUTO/MANUAL/TEST position.
- (c) Energy analyzer unit for display of various electrical parameters like voltage, current, frequency, KW, power factor, etc.
- (d) A set of push button as specified.
- (e) Relays, contactors, timers, circuit breakers as required.

- (f) Necessary battery charger with boost/ trickle selector, DC voltmeter and DC ammeter.

3. 415V M.V. PANEL:

- 3.1 *General Construction:* Panels/Boards shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, 4 wire system with neutral grounded at transformer. All Distribution panels shall be CPRI / ERDA / ANY OTHER International ACREEDATED labs tested design and manufactured by an approved manufacturer. CPRI certificate shall be made available.

The switchboard shall be floor mounted free standing totally enclosed and extensible type. The switch board shall be dust & vermin proof and shall be suitable for the climate conditions as specified. The design shall include all provisions for safety of operation and maintenance personnel. The general construction shall conform to IS 8623:1993 for factory assembled switch board. The degree of enclosure protection shall be IP 54 as per IS 13947 (Part-I). All switchgears shall be fully rated at an ambient of 50° C.

- 3.2 *Cubicle type Panel:* Cubical type panels shall be fabricated out of sheet steel not less than 2.0 mm thick. Wherever necessary, such sheet steel members shall be stiffened by angle iron frame work. General construction shall employ the principle of compartmentalization and segregation for each circuit. Unless otherwise approved, incomer and bus section panels or sections shall be separate and independent and shall not be mixed with sections required for feeders. Each section of the rear accessible type panel shall have hinged access doors at the rear. Overall height of the panel shall not exceed 2.4 meters. Operating levers, handle etc. of highest unit shall not be higher than 1.7 meters. Multi-tier mounting of feeder is permissible. The general arrangement for multi-tier construction shall be such that the horizontal tiers formed present a pleasing and aesthetic look. The general arrangement shall be approved before fabrication. Cable entries for various feeders shall be either from top or bottom. Through cable alleys located in between two circuit sections, either in the rear or in the front of the panel. All cable terminations shall be through gland plates. There shall be separate gland plate for each cable entry so that there will not be dislocation of already wired circuits when new feeders are added. Cable entry plates shall therefore be sectionalized. The construction shall include necessary cable supports for clamping the cable in the cable alley or rear cable chamber.

Cubicle panels with more than 1000 Amps bus shall be made of tested structural

modular sections.

3.3 **Bus Bar and Connections:** The bus bars shall be of Copper of high conductivity electrolytic quality and of adequate section. Current density for copper shall not exceed 150 amps/sq. cm. The bus bar system may comprise of a system of main horizontal bus bars and ancillary vertical bus bars run in bus bar alleys on either side of which the circuit could be arranged with front access cable entries. In the case of rear access, horizontal bus system shall run suitably either at the top or bottom. All connections to individual circuits from the bus bar shall preferably be solid connections; however flexible connections shall also be permitted as per recommendations of the Panel Manufacturer. All bus bars and connections shall be suitably sleeved / insulated in approved manner. The temperature rise shall be as per IEC -61439-1/2 with ambient of 50 deg C.

3.4 **L T Switchgears:**

3.4.1 **Air Circuit Breaker(ACB):**

All Air Circuit Breakers shall be 3/4 pole with minimum 50 KA breaking capacity (35 MVA at 433V) conforming to IS 13947 (Part-II). Rated current shall be as per capacities Specified. The equipment shall be complete with the following: -

- (a) Necessary circuit breaker carriage with 3 position (isolate, test, service) drawout mechanism.
- (b) Necessary isolating plugs and sockets.
- (c) Necessary mechanism interlock and automatic safe shutters gear with arrangement for pad locking.
- (d) Necessary independent manual spring mechanism with mechanical On/Off indication as well as electrical On/Off indication.
- (e) ACB shall be provided with microprocessor based releases having built- in over load, short circuit, Instantaneous& earth fault protection (LSIG) with front Current Display panel. Microprocessor release shall be EMI (Electro Magnetic Induction)/ EMC (Electro Magnetic Compatible) certified.
- (f) The 4 pole breaker neutral shall be fully rated with adjustable settings from 50% to 100% of In.
- (h) ACB terminals shall be suitable/ suitably brought out for direct aluminium termination as per IS 13947 Part-II.

3.4.2 *Moulded Case Circuit Breaker (MCCB):*

All MCCBs shall be current limiting type with features of load line reversibility and suitable for Horizontal/Vertical mounting without any derating MCCBs shall have positive isolation as per IEC 60947. The MCCB shall be employ maintenance free minimum let- through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The MCCBs shall conform to the latest applicable standards (IEC 60947).All circuit breakers shall have a rated nominal voltage of 415V AC (50Hz).

Breaking Capacity shall be $I_{cs} = I_{cu} = 50 \text{ KA}$ & I_{cw} shall not be less than 50kA.

Rated impulse withstand voltage shall be 8 KV.

- (a) The breaker shall be provided with the facility for padlocking and door interlocking.
- (b) The MCCBs shall be used with terminal spreaders.
- (c) Operating mechanism shall be of the quick make quick break type, with the speed of operation independent of the operator, and mechanically trip free from the operating handle so as to prevent the contacts from being held closed against short-circuit and overload conditions. The operating mechanism shall be constructed to operate all poles in a multi-pole breaker simultaneously during opening, closing and tripped conditions.
- (d) The circuit breaker rating, the "push to trip" button, outgoing circuit identification and the contact position indication must be clearly visible and accessible from the front, through the front panel or the door of the switchboard.
- (e) All MCCB shall have LSI protection in built with adjustable short circuit and should have Thermal memory.

3.5 *Incomer / Termination:* Incomer termination shall be suitable for receiving bus trunking / underground cables. Cable terminations shall invariably be through terminal blocks (Polyamide or superior) or brought out solid terminals.

3.6 *Multifunctional Meters:* All the meters shall be of digital type and shall conform in all respects to International standards – IEC 61557-12, IEC 62053-22, IEC 62053-23 or the relevant Indian standards with latest amendments thereof. Multi-Functional Meter should be capable of multi measuring and monitoring of electrical parameters, energy metering, quality of energy analysis and

transmission of this information through integrated Ethernet communication port.

The multifunction meters shall be of high accuracy type and shall have the following levels of accuracy:

- i. Voltage $\leq 0.3 \%$
- ii. Current $\leq 0.2 \%$
- iii. Power $\leq 0.5 \%$
- iv. Power factor $\leq 0.5 \%$

3.7 *Control Supply:* 230/110V AC supply be provided for the switchgear. Suitable control transformer shall be provided to derive 110V AC control supply voltage. All inter panel wiring required shall be included in the scope.

3.8 *Indicating Lamps:* On all the incomers of M.V panels, ON/OFF indicating LED lamps shall be provided and shall be suitable for operation on AC supply. Phase indicating LED lamps shall be associated with necessary ON/OFF toggle switch.

3.9 *Small Wiring :* All small wiring for Controls, Indication etc. shall be with suitable FRLS/ HFFR (halogen free fire retardant) 2.5 sq.mm.copper conductor cables. Wiring shall be suitably protected within switch board. Runs of wires shall be neatly bunched, suitably supported and clamped. Means shall be provided for easy identifications of the wires. Where wires are drawn through steel conduits, the works shall conform to CPWD General Specifications for Electrical Works (Part I- Internal), 2013 and IS 732 as the case may be. Identification ferrules shall be used at both ends of the wires. All control wiring meant for external connections are to be brought out of terminal board.

3.10 *Terminal Blocks:*Terminals blocks for CT and PT secondary leads shall be provided with test links and isolating facilities. CT terminals shall have shorting facility.At least 20% spare terminals shall be provided.

4. AIR INSULATED BUS TRUNKING SYSTEM

4.1 *General Construction:* The enclosure will be made from CRCA sheet steel powder coated to shade RAL 7932. Enclosure will be rectangular in shape. Busbars will be placed over insulators (class-F) located every 250mm along its length. Bus bars

will be of Copper conductors of 99.9% purity and ETP grade with radialised edges. Cross section of Neutral bus bar will be same as Phase bus bar. The enclosure will have protection degree IP-54 as per IEC.

4.2 *Technical Characteristics:*

- a. Bus trunking will be designed to withstand short circuit current of 50kA for 1 sec.
- b. Bus bar system shall be designed for an ambient temperature of 40 deg. C and temperature rise restricted to 55 deg.C max. above ambient on conductors above ambient. Temperature rise of the enclosure 40 deg C max. Temperature

5. **DISTRIBUTION BOARD**

These totally enclosed metal clad type Distribution Boards with hinged lids shall be in accordance with I.S. 2147 - 1952 and 2675 - 1966 and B.S. 214 and shall be of welded construction and fabricated from rust proofed sheet steel and finished with anticorrosive stove enamel paint and have provision for fixing on wall and have earthing terminals/terminals.

Power Distribution Boards (415 volts TPN) shall be constructed from I6 SWG sheet steel and Branch Distribution Boards (230 volts SPN from I8 SWG sheet steel).

The MCB shall be mounted on Din rails supports of proper dielectric & mechanical strength. If fuses/fuse banks are used these shall be mounted on moulded DMC/SMC or ebonite supports of proper dielectric and mechanical strength. TPN units should have phase separation barriers.

Cables shall be connected to a terminal by crimped lugs.

Where two or more B.D.B's feeding low voltage circuits are fed from different phases of a medium voltage supply, these B.D.B's shall be installed at least two metres apart or otherwise in a different direction to prevent access to the both DBs at a time.

All three phase power distribution boards shall be properly earthed as per relevant I.E.rules and provided with suitable Danger Board. All SPN B.D.B's shall be properly earthed with one number I0 SWG galvanised iron wire each or with insulated copper PVC wire of adequate ratings in case of concealed wiring as per the specifications.

6. L T CABLE AND CABLE LAYING

6.1 TYPES OF CABLES

6.1.1 The cables for applications for low and medium voltage (upto and including 1.1KV) supply shall be one of the following: -

- (i) PVC insulated and PVC sheathed, conforming to IS:1554 (Part-1)- 1988
- (ii) Cross linked polyethylene insulated, PVC sheathed (XLPE), conforming to IS: 7098 (Part-1)- 1988.

6.2 INSTALLATION

6.2.1 General

(i) Cables with kinks, straightened kinks or any other apparent defects like defective armouring etc. shall not be installed.

(ii) Cables shall not be bent sharp to a small radius either while handling or in installation. The minimum safe bending radius for PVC/XLPE (MV) cables shall be 12 times the overall diameter of the cable. The minimum safe bending radius for PILCA/XLPE (HV) cables shall be as given in Table-II. At joints and terminations, the bending radius of individual cores of a multi core cable of any type shall not be less than 15 times its overall diameter.

(iii) The ends of lead sheathed cables shall be sealed with solder immediately after cutting the cables. In case of PVC cables, suitable sealing compound/tape shall be used for this purpose, if likely exposed to rain in transit storage. Suitable heat shrinkable caps may also be used for the purpose.

6.2.2 Route

Before the cable laying work is undertaken, the route of the cable shall be decided by the Engineer-in-Charge considering the following.

(i) While the shortest practicable route should be preferred, the cable route shall generally follow fixed developments such as roads, foot paths etc. with proper offsets so that future maintenance, identification etc. are rendered easy. Cross country

run merely to shorten the route length shall not be adopted.

(ii) Cable route shall be planned away from drains and near the property, especially in the case of LV/MV cables, subject to any special local requirements that may have to be necessarily complied with.

(iii) As far as possible, the alignment of the cable route shall be decided after taking into consideration the present and likely future requirements of other services including cables enroute, possibility of widening of roads/lanes etc.

(iv) Corrosive soils, ground surrounding sewage effluent etc. shall be avoided for the routes.

(v) **Route of cables of different voltages.**

(a) Whenever cables are laid along well demarcated or established roads, the LV/MV cables shall be laid farther from the kerb line than HV cables.

(b) Cables of different voltages, and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted such that this requirement cannot be met, LV/MV cables shall be laid above HV cables.

(c) Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

6.2.3 Proximity to communication cables

Power and communication cables shall as far as possible cross each other at right angles. The horizontal and vertical clearances between them shall not be less than 60cm.

6.3 METHODS OF LAYING

The cables shall be laid direct in ground, pipe, closed or open ducts, cable trays or on surface of wall etc. The method(s) of laying required shall be specified in the tender schedule of work.

6.3.1 Laying direct in ground

6.3.1.1 General

This method shall be adopted where the cable route is through open ground, along roads/lanes, etc. and where no frequent excavations are likely to be encountered

and where re-excavation is easily possible without affecting other services.

6.3.1.2 Trenching

(i) Width of Trench

The width of the trench shall first be determined on the following basis:

- (a) The minimum width of the trench for laying a single cable shall be 35cm
- (b) Where more than one cable is to be laid in the same trench in horizontal formation, the width of the trench shall be increased such that the inter-axial spacing between the cables, except where otherwise specified, shall be at least 20cm.
- (c) There shall be a clearance of at least 15cm between axis of the end cables and the sides of the trench.

(ii) Depth of trench

The depth of the trench shall be determined on the following basis

- (a) Where the cables are laid in a single tier formation, the total depth of trench shall not be less than 75cm for cables upto 1.1KV and 1.2m for cables above 1.1KV.
- (b) When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of the trench in (ii) a above shall be increased by 30cm for each additional tier to be formed.

(iii) Excavation of trenches

- (a) The trenches shall be excavated in reasonably straight lines. Wherever there is a change in the direction, a suitable curvature shall be adopted complying with the requirements of clause 2.6.1(ii).
- (b) Where gradients and changes in depth are unavoidable, these shall be gradual.
- (c) The bottom of the trench shall be level and free from stones, brick bats etc.
- (d) The excavation should be done by suitable means-manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
- (e) Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation. Wherever

trickd, tiles or protective covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.

(f) Existing property, if any, exposed during trenching shall be temporarily supported adequately as directed by the Engineer-in-Charge. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled in accordance with clause 2.6.7.4.

(g) It there is any danger of a trench collapsing or endangering adjacent structures, the sides may be left in place when back filling the trench.

(h) Excavation through lawns shall be done in consultation with the Department concerned.

6.3.1.3 Laying of cable in trench

(i) Sand cushioning

(a) The trench shall then be provided with a layer of clean, dry sand cushion of not less than 8cm in depth, before laying the cables therein.

(b) However, sand cushioning as per (a) above need not be provided for MV cables, where there is no possibility of any mechanical damage to the cables due to heavy or shock loading on the soil above. Such stretches shall be clearly specified in the tender documents.

© Sand cushioning as per (a) above shall however be invariably provided in the case of HV cables.

(ii) Testing before laying

All the time of issue of cables for laying, the cables shall be tested for continuity and insulation resistance (See also clause 2.8.1)

(iii) The cable drum shall be properly mounted on jacks, or on a cable wheel at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum without failure, and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating.

(iv) The cable shall be pulled over on rollers in the trench steadily and uniformly

without jerks and strain. The entire cable length shall as far as possible be laid off in one stretch. PVC/XLPE cables less than 120sq.mm. size may be removed by “Flaking” i.e. by making one long loop in the reverse direction.

Note: - For short runs and sizes upto 50sq.mm. of MV cables, any other suitable method of direct handing and laying can be adopted without strain or excess bending of the cables.

(v) After the cable has been so uncoiled, it shall be lifted slightly over the rollers beginning from one end and by helpers standing about 10m apart and drawn straight. The cable shall then be lifted off the rollers and laid in a reasonably straight line.

(vi) **Testing before covering**

The cables shall be tested for continuity of cores and insulation resistance (Refer clause 2.8.1) and the cable length shall be measured, before closing the trench. The cable end shall be sealed /covered as per clause 2.6.1 (iii)

(vii) **Sand covering**

Cables laid in trenches in a single tier formation shall have a covering of dry sand of not less than 17cm above the base cushion of sand before the protective cover is laid.

In the case of vertical multi-tier formation, after the first cable has been laid, a sand cushion of 30cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30cm as stated above. Cables in the top most tiers shall have final sand covering not less than 17cm before the protective cover is laid.

Sand covering as per (a) and (b) above need not be provided for MV cables where a decision is taken by the Engineer-in-Charge as per sub clause (i)(b) above, but the inter tier spacing should be maintained as in (b) above with soft soil instead of sand between tiers and for covering.

Sand cushioning as per (a) and (b) above shall however be invariably provided in the case of HV cables.

(viii) **Extra loop cable**

(a) At the time of original installation, approximately 3m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus

cable shall be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-Charge.

(b) Where it may not be practically possible to provide separation between cables when forming loops of a number of cables as in the case of cables emanating from a substation, measurement shall be made only to the extent of actual volume of excavation, sand filling etc. and paid for accordingly.

(ix) **Mechanical protection over the covering**

(a) Mechanical protection to cables shall be laid over the covering in accordance with (b) and (c) below to provide warning to future excavators of the presence of the cable and also to protect the cable against accidental mechanical damage by pick-axe blows etc.

(b) Unless otherwise specified, the cables shall be protected by second class brick of nominal size 22cmX11.4cmX7 cm or locally available size, placed on top of the sand (or, soil as the case may be). The bricks shall be placed breadth-wise for the full length of the cable. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and project at least 5cm over the sides of the end cables.

(c) Where bricks are not easily available, or are comparatively costly, there is no objection to use locally available material such as tiles or slates or stone/cement concrete slabs. Where such an alternative is acceptable, the same shall be clearly specified in the tender specifications.

(d) Protective covering as per (b) and (c) above need not be provided only for MV cables, in exceptional cases where there is normally no possibility of subsequent excavation. Such cases shall be particularly specified in the Tender specifications.

(e) The protective covering as per (b) and (c) above shall, however invariably be provided in the case of HV cables.

6.3.1.4 Back filling

(i) The trenches shall be then back-filled with excavated earth, free from stones or other sharp ended debris and shall be rammed and watered, if necessary in successive layers not exceeding 30cm depth.

(ii) Unless otherwise specified, a crown of earth not less than 50mm and not exceeding 100mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of the earth however, should not exceed 10 Cms so as

not to be a hazard to vehicular traffic.

(iii) The temporary re-statements of roadways should be inspected at regular intervals, particularly during wet weather and settlements should be made good by further filling as may be required.

(iv) After the subsidence has ceased, trenches cut through roadways or other paved areas shall be restored to the same density and materials as the surrounding area and –re-paved in accordance with the relevant building specifications to the satisfaction of the Engineer-in-Charge.

(v) Where road beams or lawns have been cut out of necessity, or kerb stones displaced, the same shall be repaired and made good, except for turfing /asphalting, to the satisfaction of the Engineer-in-Charge and all the surplus earth or rock shall be removed to places as specified.

6.3.2 Laying in pipes / closed ducts

6.3.2.1 In locations such as road crossing, entry in to buildings, paved areas etc. cables shall be laid in pipes or closed ducts. Metallic pipe shall be used as protection pipe for cables fixed on poles of overhead lines.

6.3.2.2

(i) Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used for cables in general; however only GI pipe shall be used as protection pipe on poles.

(ii) The size of the pipe shall not be less than 10cm in diameter for a single cable and not less than 15cm for more than one cable.

(iii) Where steel pipes are employed for protection of single core cable feeding AC load, the pipe should be large enough to contain both cables in the case of single phase system and all cables in the case of poly phase system.

(iv) Pipes for MV and HV cables shall be independent ones.

6.3.2.3

(i) In the case of new construction, pipes as required (including for anticipated future requirements) shall be laid alongwith the civil works and jointed according to the CPWD Building Specifications.

(ii) Pipes shall be continuous and clear of debris or concrete before cables are drawn. Sharp edges if any, at ends shall be smoothed to prevent damage to cable sheathing.

(iii) These pipes shall be laid directly in ground without any special bed except for SW pipe which shall be laid over 10cm thick cement concrete 1:5:10 (1 cement:5 coarse sand:10 graded stone aggregate of 40mm nominal size) bed. No sand cushioning or tiles need be used in such situations.

6.3.2.4 Road crossings

(i) The top surface of pipes shall be at a minimum depth of 1m from the pavement level when laid under roads, pavements etc.

(ii) The pipes shall be laid preferably askew to reduce the angle of bend as the cable enters and leaves the crossing. This is particularly important for HV cables.

(iii) When pipes are laid cutting an existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layers with watering as required to ensure proper compaction. A crown of earth not exceeding 10cm should be left at the top.

(iv) The temporary re-instatements of roadways should be inspected at regular intervals, particularly after a rain, and any settlement should be made good by further filling as may be required.

(v) After the subsidence has ceased, the top of the filled up trenches in roadways or other paved areas shall be restored to the same density and material as the surrounding area in accordance with the relevant CPWD Building Specifications to the satisfaction of the Engineer-in-Charge.

6.3.2.5 Manholes shall be provided to facilitate feeding/drawing in of cables with sufficient working space for the purpose. They shall be covered by suitable manhole covers. Sizes and other details shall be indicated in the Schedule of work.

6.3.2.6 Cable entry into the building

Pipes for cable entries to the building shall slope downwards from the building. The pipes at the building end shall be suitably sealed to avoid entry of water, after the cables are laid.

6.3.2.7 Cable-grip / draw-wires, winches etc. may be employed for drawing cables through pipes / closed ducts.

6.3.2.8 Measurement for drawing/ laying cables in pipes/ closed duct shall be on the basis of the actual length of the pipe / duct for each run of the cable, irrespective of the length of cable drawn through.

6.3.3 Laying in open ducts

6.3.3.1 Open ducts with suitable removable covers (RCC slabs or chequered plates) are generally provided in sub-stations, switch rooms, plant rooms, workshops etc. for taking the cables. The cable ducts should be of suitable dimensions for the number of cables involved.

6.3.3.2

(i) Laying of cables with different voltage ratings in the same duct shall be avoided. Where it is inescapable to take HV & MV cables same trench, they shall be laid with a barrier between them or alternatively, one of the two (HV &MV) cables may be taken through pipe(s).

(ii) Splices or joints of any type shall not be permitted inside the ducts.

6.3.3.3

(i) The cables shall be laid directly in the duct such that unnecessary crossing of cables is avoided.

(ii) Where specified, cables may be fixed with clamps on the walls of the duct or taken in hooks/brackets/troughs in ducts.

6.3.3.4

Where specified, ducts may be filled with dry sand after the cables are laid and covered as above, or finished with cement plaster, specially in high voltage applications.

6.3.4 Laying on surface

6.3.4.1

This method may be adopted in places like switch rooms, workshops, tunnels, rising (distribution) mains in buildings etc. This may also be necessitated in the works of additions and/or alterations to the existing installation, where other methods of laying may not be feasible.

6.3.4.2

Cables may be laid in surface by any of the following methods as specified:

- (a) Directly clamped by saddles or clamps,
- (b) Supported on cradles,
- (c) Laid on troughs/trays, duly clamped.

6.3.4.3

- (i) The saddles and clamps used for fixing the cables on surface shall comply with the requirements given in Table-III.
- (ii) Saddles shall be secured with screws to suitable approved plugs. Clamps shall be secured with nuts on to the bolts, grouted in the supporting structure in an approved manner.
- (iii) In the case of single core cables, the clamps shall be of non-magnetic material. A suitable non-corrosive packing shall be used for clamping unarmoured cables to prevent damage to the cable sheath.
- (iv) Cables shall be fixed neatly without undue sag or kinks.

6.3.4.4

The arrangement of laying the cables in cradles is permitted only in the case of cables of 1.1KV grade of size exceeding 120sq.mm. In such cases, the cables may be suspended on MS flat cradles of size 50mmX5mm which in turn shall be fixed on the wall by bolts grouted into the wall in an approved manner at a spacing of not less than 60cm.

6.3.4.5

All MS components used in fixing the cables shall be either galvanized or given a coat of red oxide primer and finished with 2 coats of approved paint.

6.3.5 Laying on cable tray

6.3.5.1

This method may be adopted in places like indoor substations, air-conditioning plant rooms, generator rooms etc. or where long horizontal runs of cables are required within the building and where it is not convenient to carry the cable in open ducts. This method is preferred where heavy sized cables or a number of cables are required to be laid. The cable trays may be either of perforated sheet type or of ladder type.

6.3.5.2 Perforated type cable tray

(i) The cable tray shall be fabricated out of slotted/perforated MS sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanized or painted as specified. Alternatively, where specified, the cable tray may be fabricated by two angle irons of 50mmX50mmX6mm as two longitudinal members, with cross bracings between them by 50mmX5mm flats welded/bolted to the angles at 1 m spacing. 2mm thick MS perforated sheet shall be suitably welded/bolted to the base as well as on the two sides.

(ii) Typically, the dimensions, fabrication details etc. are shown in figure 3A,B and C.

(iii) The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler plates and cable tray shall be scraped and removed before the installation.

(iv) The maximum permissible uniformly distributed load for various sizes of cables trays and for different supported span are given in Table IV. The sizes shall be specified considering the same.

(v) The width of the cable tray shall be chosen so as to accommodate all the cables in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to

800mm.

(vi) Factory fabricated bends, reducers, tee/cross junctions, etc. shall be provided as per good engineering practice. (Details are typically shown in figure 3). The radius of bends, junctions etc. shall not be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.

(vii) The cable tray shall be suspended from the ceiling slab with the help of 10mm dia MS rounds or 25mmX5mm flats at specified spacing (based on Table III). Flat type suspenders may be used for channels upto 450mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angles 50mmX50mmX5mm at the bottom end as specified. These shall be grouted to the ceiling slab at the other end through an effective means, as approved by the Engineer-in-Charge, to take the weight of the cable tray with the cables.

(viii) The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.

(ix) The cable tray shall be bonded to the earth Terminal of the switch bonds at both ends.

(x) The cable trays shall be measured on unit length basis, along the center line of the cable tray, including bends, reducers, tees, cross joints, etc. and paid for accordingly.

6.3.5.3 Ladder type cable tray

(i) The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a center to center spacing of 250cm.

(ii) Alternatively, where specified, ladder type cable trays may be fabricated out of 50mmX50mmX6mm (minimum) angle iron for longitudinal members, and 30mmX6mm flat for rungs.

(iii) Typical details of fabrication and dimensions of both the types of trays are shown in figure 4A,B,C and D.

(iv) The maximum permissible loading, jointing of channel sections, width of the cable tray, provision of elbows, bends, reducers, horizontal tee/ cross junctions etc. suspension of cable tray from the ceiling slab; painting and measurement of the cable tray shall be as per sub-clauses (ii) to (x) below clause 2.6.11.2, except that the overall width of

one cable tray may be limited to 800mm.

6.3.5.4 Cables laid on cable trays shall be clamped on to the tray at suitable intervals

6.4 JOINTING

6.4.1 Location

(i) Before laying a cable, proper locations for the proposed cable joints, if any, shall be decided, so that when the cable is actually laid, the joints are made in the most suitable places. As far as possible, water logged locations, carriage ways, pavements, proximity to telephone cables, gas or water mains, inaccessible places, ducts, pipes, racks etc. shall be avoided for locating the cable joints.

(ii) Joints shall be staggered by 2m to 3m when joints are to be done for two or more cables laid together in the same trench.

6.4.2 Joints pits

(i) Joint pits shall be of sufficient dimensions as to allow easy and comfortable working. The sides of the pit shall be well protected from loose earth falling into it. It shall also be covered by a tarpaulin to prevent dust and other foreign matter being blown on the exposed joints and jointing materials.

(ii) Sufficient ventilation shall be provided during jointing operation in order to disperse fumes given out by fluxing.

6.4.3 Safety precaution

(i) A caution board indicating "CAUTION – CABLE JOINTING WORK IN PROGRESS" shall be displayed to warn the public and traffic where necessary.

(ii) Before jointing is commenced, all safety precautions like isolation, discharging, earthing, display of caution board on the controlling switchgear etc. shall be taken to ensure that the cable would not be inadvertently charged from live supply. Metallic armour and external metallic bonding shall be connected to earth. Where "Permit to work" system is in vogue, safety procedures prescribed shall be complied with.

6.4.4 Jointing materials

(i) Jointing materials and accessories like conductor ferrules, solder, flux, insulating and protective tapes, filling compound, jointing boxes, heat shrinking joint kit etc. of right quality and correct sizes, conforming to relevant Indian Standards, wherever they exist, shall be used.

(ii) The design of the joint box and the composition of the filling compound shall be such as to provide an effective sealing against entry of moisture in addition to affording proper electrical characteristic to joints.

(iii) Where special type of splicing connector kits or epoxy resin spliced joints or heat shrinkable jointing kits are specified, materials approved for such application shall be used. Storing as well as jointing instructions of the manufacturer of such materials shall be strictly followed.

6.4.5 Joints

Jointing work shall be carried out by a licensed/ experienced (where there is no licensing system for jointers) cable jointer.

6.4.6 Cable work with joints

(i) About 3m long surplus cable shall be left on each side of joints as laid down in clause 1.6.7.3 (viii).

(ii) Insulation resistance of cables to be jointed shall be tested as per clause 1.8.1. Unless the insulation resistance values are satisfactory, jointing shall not be done.

(iii) Cores of the cables must be properly identified before jointing.

(iv) Where cable is to be jointed with the existing cable, the sequence should be so arranged as to avoid crossing of cores while jointing.

(v) Whenever the aluminium conductor is exposed to outside atmosphere, a highly tenacious oxide film is formed which makes the soldering of aluminium conductor difficult. This oxide film should be removed by using appropriate type of flux.

(vi) The clamps for the armour shall be clean and tight.

6.4.7 Jointing procedure

While it would be necessary to follow strictly the instructions for jointing furnished by the manufacturers of cables and joint kits, a brief on the jointing procedures is given

for general guidance in Appendix F.

6.5 TESTING

6.5.1 Testing before laying

All cables, before laying, shall be tested with a 500V megger for cables of 1.1KV grade, or with a 2500/5000V megger for cables of higher voltage. The cable cores shall be tested for continuity, absence of cross phasing, insulation resistance from conductors to earth / armour and between conductors.

6.5.2 Testing before backfilling

All cables shall be subjected to the above mentioned tests, before covering the cables by protective covers and back filling and also before taking up any jointing operation.

6.5.3 Testing after laying

(i) After laying and jointing, the cable shall be subjected to a 15 minutes pressure test. The test pressure shall be as given in Table VI. DC pressure testing may normally be preferred to AC pressure testing.

(ii) In the absence of facilities for pressure testing as above, it is sufficient to test for one minute with 1000V megger for cables of 1.1KV grade .

7.0 EARTHING

7.0 Scope

This chapter covers the essential requirements of earthing system components and their installation. This shall be read with Appendix G which lays down criteria for their design. For details not covered in these Specifications, IS Code of Practice on Earthing (IS: 3043-1987) shall be referred to.

7.1 Application

i) The electrical distribution system in the Department 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 / external electrical installations.

ii) Earthing system is also required for lightning protection, computer installations and hospital operation theaters, etc. for functional reasons.

iii) 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. These shall be complied with.

iv) Though this chapter and appendix G form part of the Specifications for Internal EI works, these requirements shall be complied within works of earthing for other applications also.

7.0 Materials

7.2.1 Earth Electrodes

7.2.1.1 Types

The type of earth electrode shall be any on the following, as specified.

- a) Pipe earth electrode.
- b) Plate earth electrode.
- c) Strip or conductor earth electrode.

7.2.1.2 Electrode materials and dimensions

- i) The materials and minimum sizes of earth electrodes shall be as per Table 4.1
- ii) GI pipe electrodes shall be cut tapered at the bottom, and vided with holes of 12mm dia, drilled not less than 7.5cm from other upto 2m of length from the bottom.
- iii) The length of the buried strip or conductor earth electrode shall be not less than 15m. This length shall suitably be increased if necessary, on the basis of the information available about soil resistance, so that the required earth required earth resistance is obtained. Prior approval of the Engineer-in-charge shall be taken for any such increase in length.

7.2.2 Earthing Conductor

- i) The earthing conductor (protective conductor from earth electrode upto 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.
- ii) The size of earthing conductor shall be specified, but this shall not be less than the following.
 - a) 5mm dia (6 SWG) for GI, or 4mm dia (8 SWG) for copper wire,
 - b) 25mm X 4mm in the case of GI strip, or,
 - c) 20mm X 3mm in the case of copper strip.
- iii) Earthing conductor larger than the following sectional areas need not to be used, unless otherwise specified.
 - a) 150sq.mm. in case of GI, or
 - b) 100sq.mm. in case of copper.

7.2.3 Earth Bus

- i) Two copper strips, each of size 50mm X 5mm shall be provided as earth bus in a 11KV sub-station and / or diesel generating station irrespective of the capacity of the transformer / panel / generating set, etc. shall be connected to these two strips of earth bus. The two strips of the earth bus shall be bonded together.
- ii) The neutral earth leads of the transformer and / or generator alternator shall not be connected to this earth bus. They shall be connected directly to individual earth electrodes.

7.2.4 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.

7.2.5 Protective (Earth continuity / Loop earthing) Conductor

- i) The material and size of protective conductors shall be as specified.
- ii) The minimum cross sectional area of a protective conductor (not contained within a cable or flexible cord) shall be: -

- a) 2mm dia (14SWG) in case of copper,
 - b) 2.5mm dia (12 SWG) in case of GI, or,
 - c) 2.24mm dia (13 SWG) in case of aluminium.
- iii) Unless otherwise specified, GI conductor should not be ordinarily used as protective conductor within any circuit, beyond a DB downstream.

7.3 Installation

- i) Normally an earth electrode shall not be located closer than 1.5m from any building. Care should 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 prior approval of the Engineer-in-charge.
- ii) The location of the earth electrode will be such that the soil has a reasonable chance of remaining moist as far possible. Entrances, pavements and road, ways, should be avoided for locating earth electrodes.

7.3.1 Electrodes

7.3.1.1 Various types of electrodes

- i) a) Pipe electrode shall be buried in the ground vertically with its top at not less than 20cm below the ground level. The installation shall be carried out as shown in Drawing.
 - b) In locations where the full length of pipe electrode is not possible to be installed due to meeting a water table, hard soil or rock, the electrode may be reduced length, provided the required earth resistance result is achieved with or without additional electrodes, or any alternative method of earthing may be adopted, with the prior approval of the Engineer-in-charge. Pipe electrodes may also be installed in horizontal formation in such exceptional cases.
 - ii) Plate electrode shall be buried in ground with its faces vertical, and its top not less than 3m below the ground level. The installation shall be carried out as shown in Drawing.
 - iii) When more than one electrode (plate / pipe) is to be installed, a separation of not less than 2m shall be maintained between two adjacent electrodes.
- a) The strip or conductor electrode shall be buried in trench not less than 0.5m deep.

- b) If conditions necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straight trench where feasible, or preferably in number of trenches radiating from one point.
- c) If the electrode cannot be laid in a straight length, it may be laid in a zig-zag manner with a deviation upto 45 degrees from the axis of the strip. It can also laid in the form of an arc with curvature more than 1m or polygon.

7.3.1.2 Artificial treatment of soil:

When artificial treatment of soil is to be resorted to, the same shall be specified in the schedule of work. The electrode shall be surrounded by charcoal/ coke and salt as indicated in Drawing. In such cases, excavation for earth shall be increased as per the dimensions indicated in these figures.

7.3.1.3 Watering arrangement

- i) In the case of plate earth electrodes, a watering pipe 20mm dia. Medium class of pipe shall be provided and attached to the electrodes as shown in Drawing. A funnel with mesh shall be provided on the top of this pipe for watering the earth.
- ii) In the case of pipe electrodes, a 40mm X 20mm reducer shall be used for fixing the funnel with mesh.
- iii) The watering funnel attachment shall be housed in a masonry enclosure of size not less than 30cm X 30cm X 360cm.
- iv) A cast iron/MS frame with MS Cover, 6mm thick, and having locking arrangement shall be suitably embedded in the masonry enclosure.

7.3.2 Earthing Conductor (Main earthing lead)

- i) 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.
- ii) In the case of pipe earth electrode, wire type earthing conductor shall be secured as indicated in Drawing using a through bolt, nuts and washers and terminating socket.
- iii) A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth

electrode. Galvanised “C” shaped strips, bolts, washers, nuts and checknuts of adequate size shall be used for the purpose.

- iv) The earthing conductor from the electrode up to the building shall be protected from mechanical injury by a medium class, 15mm dia. GI pipe in the case of wire, and by 40mm dia, medium class GI pipe in the case of strip. The protection pipe in ground shall be buried at least 30cm deep (to be increased to 60cm in case of road crossing and pavements). The proportion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.
- v) The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by:
 - a) soldered or preferably crimped lug, bolt, nut and washer in the case of wire, and
 - b) Bolt, nut and washer in case of strip conductor.

In the case of substations or alterations, the termination shall be made on the earthing terminal of the neutral point on the equipment and / or the earth bus, as the case may be.

7.3.3 Earth Bus and Main Earthing Terminal

- i) In the case of substations and generating stations, two numbers copper/GI (as specified) earth bus shall be provided, duly connected to two numbers of independent electrodes, exclusively for equipment (body) earthing of substation or generating station equipments.
- ii) In all other installations, main earthing terminal shall be provided at the main switch board. This may be in the form of earth stud or single earth bar depending on the type of switch board.
- iii) Following conductors shall be terminated on to the main earthing terminal.
 - a) Earth connection from electric supply company (where provided)
 - b) Earthing conductor from electrode.
 - c) Protective conductors.
 - d) Equi-potential bonding conductors.

7.3.4 Protective (Loop earthing / earth continuity) conductor

- i) 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 conductors(s)
- ii) Two protective conductors shall be provided for a switch board carrying a 3 phase switchgear thereon.
- iii) All the mountings of industrial type switch boards shall be bonded to the earth stud / earth bar using a protective conductor looping from one to another. Loop earthing of individual units will not be however necessary in the case of cubicle type switchboards.
- iv) The earth conductor in every distribution board (DB) shall be securely connected to the earth stud / earth bar of the corresponding switchboard by a protective conductor.
- v) 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 up to the DB.
- vi) 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. Where the switch boxes are on non-metallic type, these shall be looped at the socket earth terminals, or at an independent screwed connector inside the switch box. Twisted earth connections shall not be accepted in any case.
- vii) Double earthing strips in rising mains, bus trunking etc. shall be securely connected to the earth bar / earth stud at the sending and switch board. In the case of overhead busbar systems, protective conductors shall be provided in addition to feeder cable armouring connections.

7.4 Earth Resistance

- i) 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. In rocky soil the resistance may be upto 8 ohms.
- ii) Where the above stated earth resistance is not achieved, necessary improvement shall be made by additional provisions, so such additional electrode(s), different type of electrode, or artificial chemical treatment of soil etc., as may be directed by the Engineer-in-charge.

7.5 Marking

- i) Earth bars / terminals at all switch boards shall be marked permanently, either as “E” or as symbol.
- ii) Main earthing terminal shall be marked “SAFETY EARTH-DO NOT DISCONNECT”.

7.6 Use of Residual Current Devices (RCDs)

Application of RCDs (also known RCCBs) IS:12640-1988 shall be specified in individual cases keeping in view the type, use, importance, system of earthing and nature of electrical installations to be protected by RCCBs, requirements of the local electric supply company, etc. The sensitivity shall be 30mA, 100mA, 300mA or 500mA as specified.

7.7 DG EXHAUST PIPING & SUPPORT STRUCTURE

- a. The exhaust piping shall be fabricated from ‘B’ Class MS pipes of suitable thickness as per IS 3589. Pipe shall be thoroughly cleaned of rust and painted with heat resistant paint after fabrication and erection.
- b. Flexible expansion joint of multiple corrugated stainless steel shall be provided between engine exhaust manifold and exhaust piping.
- c. The exhaust piping and the residential type silencers shall be insulated using 50mm thick thermal lagging of mineral wool covered with chicken mesh inside the container & upto the exhaust stack. The outside shall be neatly wrapped with 24 SWG aluminium sheet cladding.
- d. The Support Structure of the self-standing exhaust Chimney shall be fabricated using suitable MS Flat, ISMC, ISA Steel sections. The complete structure to be painted with two coats of zinc chromate primer and two coats of approved enamel paint.
- e. The shipping sections of the stack shall be welded at site and erected over the MS frame work. The entire length including the flanges, bolts and washers shall be aluminised inside and outside to inhibit corrosion.
- f. The exhaust system should be guaranteed to reduce the exhaust noise to a level not greater than 75 dB at 1 meter from exhaust outlet.
- g. The muffler and the exhaust piping shall include lagging to maintain a surface temperature not exceeding 65 deg. C.
- h. The exhaust pipe shall be provided with Rain Caps and bird Cowl.

LIST OF APPROVED MAKES

SR. NO.	ITEM	MAKES
1.	415V Panels,GRP/ Air Insulated Bus Ducts and Wall mounted DBs	: CPRI Type Tested (within last five years) Panel Buildershaving Nine Tank Powder Coating Process.
2.	Air Circuit Breakers	: Schneider(MVS), ABB (E-max), Siemens (3WL), L&T (U-Power)
3.	MCCBs	: Schneider (CVS), ABB (T-max), Siemens (3VL), L&T (D-Sine)

4.	MCBs	: Schneider, Legrand, Hager,
5.	Power Contactor	: Schneider, ABB, Siemens,L&T
6.	Auxiliary Relays / Timers	: Schneider, ABB, Siemens, L&T
7.	Digital Multifunctional Meters	: Schneider, Secure Meters, L&T
8.	Analog Voltmeters / Ammeters	: AE, Meco, Rishabh,
9.	Annunciators	: Minilec, EAPL, JVS,
10.	Selector Switch	: Kaycee, L&T,
11.	LED Lamps & Push Button	: Schneider, Siemens, L&T
12.	DG Synchronising Relays	: Woodward
13.	Programmable Logic Controller	: Siemens, Schneider, ABB
14.	Current Transformers	: AE, Kappa, Rishabh
15.	Battery Charger	: HBL-Nife, Amararaja, Micro
16.	Terminal Blocks	: Phoenix, Connectwell, Elmex
17.	XLPE insulated MV Cable	: Polycab, KEI, Universal, Gloster, CCI
18.	Cable Gland and Lug	: Dowells, Commet, Jainson
19.	Cable Jointing Kit	: Raychem, M-Seal, 3M
20.	Control Cables	: Polycab, Havells, Finolex

Note: Any material used as per approved make list is however subject to final approval by Engineer-in-charge of IACS during execution of the work. In case no specific make is mentioned, only ISI marked items are to be used in consultation with Engineer-in-Charge.