TENDER DOCUMENT

TENDER No: SRO/CON/ETS/018 DATED 22.02.2019

FOR

Tender for "Supply of HT&LT cables for the project of Construction of RGCB Bio Innovation Center at Akkulam in Thiruvananthapuram District, Kerala State Phase I - Construction of Hostel block and Research Block with Animal Research Facility, and connected Infrastructure (Composite contract) - Pkg. - 4 A2".

VOLUME - II

ADDITIONAL PURCHASE CONDITIONS

CLIENT DOCUMENTS
ADDITIONAL PURCHASE OF CONTRACT (APC)

1.0 The following Additional Purchase Conditions of Contract shall be read in conjunction with General Purchase Conditions (GPC). If there are any provisions in these Special Conditions of Contract, which are at variance with the provisions of General Purchase Conditions (GPC), the provisions in these Additional Purchase Conditions shall take precedence.

2.0 Introduction

Consortium of Architect Hafeez Contractor and M/s Iyer and Mahesh, a PMC engaged by RGCB, intends to undertake the Construction of RGCB Bio Innovation Center at Akkulam in Thiruvananthapuram District, Kerala State Phase I.

3.0 Scope of work/ Supply:

The project site for the work is readily available.

The brief scope of work/Supply included in this tender shall include (but not limited to) for Construction of RGCB Bio Innovation Center at Akkulam in Thiruvananthapuram District, Kerala State Phase I – Construction of Research Block with Animal House, Hostel Buildings, and Allied Infrastructure Facilities- Supply of HT & LT cables - Pkg - 4A2" (hereinafter referred to as “Work/ Supply”) as per Technical specifications, BOQ, Instructions and Terms and conditions given in Tender Documents.

4.0 Order of Precedence

i) NIT
ii) APC
iii) BOQ, Technical Specifications
iv) EPI GPC

5.0 Schedule of completion and Taking over

a) The entire supply as per offer shall be completed within 06 (Six ) months from the 10th day of issue of LOI. The time of completion is firm and final and supersedes any other time mentioned elsewhere in any clause(s) of tender document.

b) The period of completion given includes the time required for mobilization and testing as well, rectifications, if any, re-testing and completion in all respects to the entire satisfaction of the RGCB/ARCHITECT/EPI including the monsoon season.

c) As soon as the project is finally completed, the Contractor shall inform EPI and EPI shall in turn inform to Architect. Architect shall nominate a Board of Officers for checking/verification of completed work as per the scope of work for final taking over the project.

d) The final bill will be submitted by the contractor within 90 days from the date of acceptance of completion of work/ Supply accompanied by the following documents:
i) Completion certificate issued by the RGCB/ARCHITECT/EPI specifying the completion of the supplies.
ii) Computerized stage wise payments.
iii) No claim certificate by the supplier.

6.0 SPECIFICATIONS

The specification of material shall be followed as per technical specification provided in volume -2 of this tender document.

7.0 Quantity Variation:

a) Quantity mentioned in BoQ are tentative only. The bidders/ Party are require to supply as per the indent BOQ raised by Project-In-Charge from time-time.

b) The rates quoted by the bidder shall remain firm up to a quantity variation upto any extent for individual items. However the total value of contract variation is limited to +/- 50%.

c) The bidders/ Party shall raise their supply/ purchase order to manufacturer based on Indent BoQ request from Project-In-Charge only.

8.0 PERFORMANCE GUARANTEE:

GPC Clause no 18.0 for performance guarantee and security deposit clause no 9.0 modified as here under

In the event of award of “Works/Supply”, PARTY shall submit to EPI, Crossed Demand Draft / Bank Guarantee from a Nationalized Bank / Scheduled Bank towards performance guarantee @ 5% (Five Percent Only) of the contract value of the accepted tender within 15 days from the date of LOI and shall be valid up to DLP period, failing which EPI at their discretion may revoke the LOI & forfeit the EMD furnished along with tender. In case the time for completion of work/supply gets extended, the contractor shall get the validity of Performance Guarantee extended to cover such extended time for completion of supply. The performance guarantee shall be returned to the contractor (without any interest) on completion of DLP as mentioned in the Memorandum.

9.0 EMD (Earnest Money Deposit)

The bid must be accompanied by an Earnest Money Deposit (EMD) of Rs.71,000.00 (Rupees Seventy One Thousand Only). The EMD can be either in the form of Crossed Demand Draft or Pay Order of any Nationalized Bank/Scheduled Bank for the full amount payable favouring “Engineering Projects (India) Ltd.”, payable at Chennai or in the form of Bank guarantee (for EMD) of any Nationalized Bank/Scheduled Banks, in accordance with the prescribed Performa, favouring “Engineering Projects (India) Ltd.”. The EMD shall be valid for minimum period of 90 days (Ninety) from the last day of submission of tender. Tenders submitted without EMD or inadequate amount of EMD shall be rejected. The bid shall be valid for 90 days from date of opening of Price Bid.

EMD of the unsuccessful and successful bidders shall be returned after placement of work order (after confirmation of performance guarantee by the bankers of successful bidder).
10.0 Payment Terms and Conditions:

10.1 The Clause No.4 and sub clauses 4.1, 4.2 of GPC shall be replaced as under:

Unless otherwise agreed upon between the parties, payment for delivery of the stores will be made on submission of bills in accordance with instruction given in the purchase order through RTGS in accordance with the following procedure.

Supply of item - 80% of the item rate
Completion of scope of supply - 20% of the item rate

10.2 Supplier should submit the following details before submission of first supply bill as mentioned below:

i) Name of the Bank and branch with address
ii) Account number and type of the account:
iii) Name of the account holder
iv) IFSC Code:
v) GST Number and details

10.3 The rates quoted by the bidder shall be inclusive of all taxes (including GST- % of GST which is to be clearly mentioned), freight, packing & forwarding, excise duties and other charges as applicable on FOR site delivery basis **including unloading of the materials at site.**

11.0 TAXES AND DUTIES: Price Quoted by the bidders should be inclusive of GST. GST shall be reimbursed to the bidder only on proof of submission of documentary evidence and ITC appeared in the name of EPI.

i) The Bidder/ Supplier must be registered with GST and should have valid GSTIN number.

ii) The Invoice shall be raised on EPI as per GST Complaint Invoices. Failure to provide Tax Invoices in desired format or nonpayment of taxes or non-filling of GST returns/ mismatch of Invoices would lead to non-availability of Input Tax Credit to EPI. Thereby is to be borne by bidder and EPI shall deduct such amount along with Interest/penalty/late fees, etc., if any paid by EPI on account of disallowance of ITC, from the next payment/dues due to supplier. Bidder while quoting the rates in the tender must also consider the ITC

iii) In case any tax/duty is not applicable, the bidder has to either write NIL or NA. In case of any reduction in rate of GST or other taxes in future or the project getting exemption status prior to the late date of bid submission or afterwards, the subcontractor shall pass on the benefit to EPIL immediately, failing which EPIL shall have the right to recover the differential amount from the amounts due to the sub-contractor. Further, in case of any increase in rate of GST or other taxes in future or the project losing exemption status prior to last date of bid submission or afterwards, the said increase of taxes shall be paid/reimbursed to the subcontractor, subject to the condition that the client

iv) Transit Insurance will be in EPIL scope however all documents related to transit insurance will be provided by the bidder. The cost towards this will be deducted on prorate basis.

v) Receiving date of invoice shall be considered for process, along with the MRC (Material Receipt with relevant documents)
vi The Bidder shall issue E-way bill under GST as per the rules prescribed under GST Law and requirements if any under GST rules shall also be complied with.

12.0 Warranty Period- GPC clause no 17.0 stands good, In addition to that

Any defects noticed during the warranty period shall have to be rectified by the supplier free of cost, failing which the action taken for rectification by EPIL /RGCB shall be final and recovered from the available dues of the supplier.

13.0 Liquidated Damages/Compensation: Clause no. 13.0 of GPC stands modified as under:

The PARTY shall be responsible for timely completion of the “Works” within the contractual completion period. **Liquidated Damages/Compensation** @ 1.5% per month of delay to be computed on per day basis on the value of incomplete work for delay. Total value shall not exceed 10% of the Contract Value of work.

14.0 Disqualification

The tenderers may note that they are liable to be disqualified and not considered for the opening of Price Bid if:

a) Representation in the forms, statements and attachments submitted in the pre-qualification document are proved to be incorrect, false and misleading.

b) They have record of poor performance during the past 10 (ten) years such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the Supplier, inordinate delay in completion, consistent history of litigation / arbitration awarded against the Supplier or any of its constituents or financial failures due to bankruptcy etc. in their ongoing / past projects.

c) They have submitted incompletely filled in formats without attaching certified supporting documents and credentials to establish their eligibility to participate in the Tender.

d) If the tenderers attempt to influence any member of the selection committee. EPI reserves its right to take appropriate action including disqualification of tenderer(s) as may be deemed fit and proper by EPI at any time without giving any notice to the contractor in this regard. The decision of EPI in the matter of disqualification shall be final and binding on the Tenderers.

15.0 GPC clause no 20.0, 21.0 and 22.0 for spare parts, drawings and Literature of Equipment stands deleted

16.0 Insurance: GPC clause of 5.0 regarding Insurance, shall be modified as below

Insurance policy will be arranged by the Buyer and the payment towards insurance will be deducted on pro-rata basis on submission of bill (Tentatively @ %)

17.0 ARBITRATION: Modification of arbitration’s clause no 23.0 of GPC

General Purchase Conditions (GPC) **modified in** (Enclosed Annexure – II)
18.0 **JURISDICTION:**
General Purchase Conditions (GPC) 24.0 is amended as, the courts in **Chennai** alone will have jurisdiction to deal with matters arising from the contract.

19.0 **Format of Bank Guarantee:**
Bank Guarantee related to EMD and Performance Bank Guarantee are enclosed as Annexure-A.

20.0 **List of Approved Make:**

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<th>MAKES/BRANDS NAME</th>
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<tbody>
<tr>
<td>HT &amp; LT Cables</td>
<td>Polycab / Gloster / Havells / Finolex / V-Guard</td>
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</table>

21.0 **General Purchase Condition:**
The Supplier General Purchase Condition is enclosed in volume -1 of this contract. All other GPC conditions stands good for the clauses not covered in this Additional purchase condition.
CONCILIATION AND ARBITRATION

Modification of arbitration’s clause no 76.0 of GCC as follows

General Conditions of Contract (GCC) Sub Clause no.76.1 and 76.3 of Arbitration Clause no.76.0 are amended as given below. Sub Clause no.76.2 will remain the same.

Before resorting to arbitration as per the clause given below, the parties if they so agree may explore the possibility of conciliation as per the provisions of Part-III of the Arbitration and Conciliation Act, 1996. When such conciliation has failed, the parties shall adopt the following procedure for arbitration:

1. Except where otherwise provided for in the contract, any disputes and differences relating to the meaning of the specifications and materials used in the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, specifications, estimates, instructions or these conditions or otherwise concerning the works or the execution or failure to execute the same whether arising during the progress of the work or after the completion or abandonment thereof shall be referred to the Sole Arbitration of the Chairman and Managing Director (CMD) of Engineering Projects (India) Limited (EPI), or any other person discharging the functions of CMD of EPI is unable to act, to the Sole Arbitration of some other person appointed by the CMD of EPI or such person discharging the functions of CMD of EPI. There will be no objection if the arbitrator so appointed is an employee of Engineering Projects (India) Ltd. However, such an employee shall not have directly dealt with the said contract or the works there under on behalf of EPI. Such Arbitrator shall be appointed within 30 days of the receipt of letter of invocation of arbitration duly satisfying the requirements of this clause.

2. If the arbitrator so appointed resigns his appointment, is unable or unwilling to act due to any reason whatsoever, or dies, the Chairman & Managing Director aforesaid or in his absence the person discharging the duties of the CMD of EPI may appoint a new arbitrator in accordance with these terms and conditions of the contract, to act in his place and the new arbitrator so appointed may proceed from the stage at which it was left by his predecessor.

3. It is a term of the contract that the party invoking the arbitration shall specify the Dispute / differences or questions to be referred to the arbitrator under this clause together with the amounts claimed in respect of each dispute.

4. The arbitrator may proceed with the arbitration ex-parte, if either party, in spite of a notice from the arbitrator, fails to take part in the proceeding.

5. The work under the contract shall continue, if required, during the arbitration proceedings.
6. The arbitrator shall make speaking Award and give reasons for his decisions in respect of each dispute/claim along with the sums awarded separately on each individual item of dispute or difference or claims. The Arbitrator shall make separate award on each reference made to him.

7. The award of the arbitrator shall be final, conclusive and binding on both the parties.

8. Subject to the aforesaid, the provisions of the Arbitration and Conciliation Act, 1996 or any statutory modifications or re-enactment thereof and the Rules made there under and for the time being in force shall apply to the arbitration proceedings and Arbitrator shall publish his Award Accordingly.

Note: Notwithstanding anything contained here in above, this clause shall not be applicable where the dispute is between EPI and another Public Sector Enterprise or Govt. Department for which a separate Arbitration Clause is provided vide Clause No. A given below:

A. ARBITRATION BETWEEN PUBLIC SECTOR ENTERPRISES INTERSE/ GOVERNMENT DEPARTMENTS.

1. In the event of any dispute or difference relating Interpretation and application of the provisions of the contract, such dispute or difference shall be referred by either party to the arbitration as per the instructions (Office Memorandum/Circulars) issued by Govt. of India from time to time with regard to arbitration between one Govt. Deptt and another, one Govt. Deptt. and a Public Sector Enterprise and Public Sector Enterprises inter se.

2. Subject to any amendment that may be carried out by the Government of India from time to time the procedure to be followed in arbitration shall be as is contained D.O. No. DPE/4(10)/2001-PMA-GL1 dated 22/01/2004 of Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises or any modification issued in this regard.
PROFORMA FOR BANK GURANTEE IN LIEU OF EARNEST MONEY DEPOSIT

In consideration of Chairman & managing Director, Engineering Projects (India) Limited, (A Govt. of India Enterprise), Core-3, Scope Complex, Lodhi Road, New Delhi Pin-110003. (hereinafter called the EPI) having agreed to accept bank Guarantee of Rs ................. in lieu of EARNEST MONEY DEPOSIT from ....................................................... (hereinafter called the Supplier/ Contractor/Sub-Contractor, which expression shall include its heirs, successors and assignees) in respect of the Tender for ........................................................................................................

We, ........................................ bank having its registered/head office at ................................... (hereinafter referred to as the Bank) do hereby agree and undertake to pay to EPI without demur or protest an amount not exceeding Rs.......................... on demand by EPI.

We the above said Bank further agree and undertake to pay the said amount of Rs.......................... without any demur on demand within 48 hours. Any demand made on the Bank by EPI shall be conclusive as regards the amount due and payable by the Bank under this guarantee.

We the above said Bank further agree that the guarantee herein contained shall be in full force and in effect until ............................................................... date ........................................

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

We, the above said Bank, further agree that EPI shall have full liberty, without our consent and without affecting in any manner our obligation to verify, modify or delete any of the conditions.

We, the above said Bank, lastly undertake not to revoke this guarantee during its currency except with the prior consent of EPI in writing.

Dated........................this day of..............200.

For and on behalf of the Bank

NOTE: on a Non-Judicial stamp paper of Rs. 100/- (Rupees One hundred only)
PROFORMA FOR PERFORMANCE BANK GUARANTEE

To

The Chairman & Managing Director,
Engineering Projects (India) Ltd.,
(A Govt. of India Enterprise),
Core-3, Scope Complex,
7, Institutional Area,
Lodhi Road,
New Delhi—110 003.

Dear Sir,

In consideration of the Chairman & Managing Director, Engineering Projects (India) Limited, (A Govt. of India Enterprise), Core-3, Scope Complex, 7, Institutional Area, Lodhi Road, New Delhi – 110 003 (hereinafter called ‘EPI’ which expression shall include its successors and assigns) having awarded to ................... (hereinafter referred to as ‘the Supplier/ Contractor/ Sub-Contractor’ which expression shall wherever the subject or context so permits include its successors and assigns) a Supply Contract/Contract / Sub-Contract No. ................. in terms inter alia, of EPI Letter No. ..........dated...and the General Conditions of Contract/ General Purchase Conditions of EPI and upon the condition of the Supplier’s/ Contractor’s/ Sub-Contractor’s furnishing security for the performance of the Supplier’s/ Contractor’s/ Sub-Contractor’s obligations and/or discharge of the Supplier’s/ Contractor’s/ Sub-Contractor’s liability under and/or in connection with the said Supply Contract/ Contract/ Sub-Contract up to a sum of Rs............(Rupees.................. only) amount to........percent of the total Supply Contract/ Contract/ Sub-Contract Value.

1. We...........................................................................................................................(hereinafter called ‘the Bank’ which expression shall include its successors and assigns) hereby jointly and severally undertake the guarantee to payment to EPI in rupees forthwith on demand in writing and without protest or demur or any and all monies anywise payable by the Supplier/ Contractor/ Sub-Contractor to EPI under in respect of or in connection with the said Supply Contract/ Contract/ Sub-Contract inclusive of all EPI’s losses and damages and costs, charges and expenses and other moneys anywise payable in respect to the above as specified in any notice of demand made by the EPI to the Bank with reference to this guarantee up to and aggregate limit of Rs......................(Rupees..........................................................only).
2. We……………….. Bank further agree that EPI shall be sole judge of and as to whether the said Supplier/ Contractor/ Sub-Contractor has committed any breach or breaches of any of the terms and conditions of the said Supply Contract/ Contract/ Sub-Contract and the extent of loss, damage, cost, charges and expenses caused to or suffered by or that may be caused to or suffered by EPI on account thereof and the decision of EPI that the said Supplier/ Contractor/ Sub-Contractor has committed such breach or breaches and as to the amount or amounts of loss, damage, costs, charges and expenses caused to or suffered by EPI from time to time shall be final and binding on us.

3. EPI shall be at liberty without reference to the Bank and without effecting the full liability of the Bank hereunder to take any other security in respect of the Supplier's/ Contractor's/ Sub-Contractor's obligations and/or liabilities under or in connection with the said Supply Contract/ Contract/ Sub-Contract and to vary the forms vis-à-vis the Supplier/ Contractor/ Sub-Contractor of the said Supply Contract/ Contract/ Sub-Contract or to grant time and/or indulgence to the Supplier/ Contractor/ Sub-Contractor or to reduce or to increase or otherwise vary the prices of the total Supply Contract/ Contract/ Sub-Contract Value or to release or to forbear from enforcement of all or any of the security and/or any other security(ies) now or hereafter held by the EPI and no such dealing(s) reduction(s) increase(s) or other indulgence(s) or arrangements with the Supplier/ Contractor/ Sub-Contractor or release or forbearance whatsoever shall absolve the bank of the full liability to EPI hereunder or prejudice rights of EPI against the bank.

4. The guarantee/undertaking shall not be determined or affected by the liquidation or winding up, dissolution, or change of constitution or insolvency of the Supplier/ Contractor/ Sub-Contractor but shall in all respects and for all purposes be binding and operative until payment of all moneys made to EPI in terms thereof.

5. The Bank hereby waives all rights at any time inconsistent with the terms of this guarantee/undertaking and the obligations of the Bank in terms hereof shall not be anywise affected or suspended by reasons of any dispute or disputes having been raised by the Supplier/ Contractor/ Sub-Contractor (whether or not pending before any arbitrator, Tribunal or Court) of any denial or liability by the Supplier/ Contractor/ Sub-Contractor stopping or preventing or purporting to stop or prevent any payment by the Bank to the EPI in terms hereof.

6. The amount stated in any notice of demand addressed by EPI to Bank as liable to be paid to EPI by the Supplier/ Contractor/ Sub-Contractor or as suffered or incurred by the EPI on account of any losses or damages or costs, charges and/or expenses shall be conclusive evidence of the amount so liable to be paid to EPI or suffered or incurred by EPI as the case may be and shall be payable by the Bank to EPI in terms hereof.
7. This guarantee/undertaking shall be a continuing guarantee/undertaking and shall remain valid and irrevocable for all claims of EPI and liabilities of the Supplier/ Contractor/ Sub-Contractor arising up to and until midnight of…………….

8. This guarantee/undertaking shall be in addition to any other guarantee or security whatsoever that EPI may now or any time anywise may have in relation to the Supplier’s/ Contractor’s/ Sub-Contractor’s obligations of liabilities under and/or in connection with the said Supply Contract/ Contract/ Sub-Contract, and EPI shall have full authority to take recourse to or enforce this security in preference to any other guarantee of security which EPI may have or obtain and here shall be no forbearance on the part of EPI in enforcing or requiring enforcement of any other security and shall not have the effect of releasing the Bank from its full liability hereunder.

9. It shall not be necessary for EPI to proceed against the said Supplier/ Contractor/ Sub-Contractor before proceeding against the Bank and the guarantee herein contained shall be enforceable against the Bank notwithstanding any security which the EPI may have obtained or obtain from the Supplier/ Contractor/ Sub-Contractor, shall at the time when proceedings are taken against the said Bank hereunder be outstanding or unrealised.

10. We the said Bank undertake not to revoke this guarantee during its currency except with the consent of EPI in writing and agree that any change in the constitution of the said Supplier/ Contractor/ Sub-Contractor or the said bank shall not discharge our liability hereunder.

11. We ………….the said Bank further undertake that we shall pay forthwith the amount stated in the notice of demand without demur and protest notwithstanding any dispute/difference pending between the parties before the arbitrator Tribunal or Court and/or any dispute is being referred to arbitrator.

12. Notwithstanding anything contained herein above, our liability under this guarantee shall be restricted to Rs………………. (Rupees……………………………….) and this guarantee shall remain in force till……………… unless a claim is made on us within 3 months from that date, that is before all the claims under this guarantee shall be forfeited and we shall be relieved of and discharged from our liabilities hereunder.

Dated……………………………………. day of.……………………………………… 200

For and on behalf of Bank
Establishment of RGCB Bio Innovation Center at Akkulam in Thiruvananthapuram District, Kerala State
Phase. I – Construction of Research Block with Animal Research Facility, Hostel Buildings, Civil & Related MEP works including site development and connected Infrastructure (Composite Contract)

TENDER DOCUMENT

VOLUME – II

TECHNICAL SPECIFICATIONS
**Name of Work:** Establishment of RGCB Bio Innovation Center at Akkulam in Thiruvananthapuram District, Kerala State Phase I – Construction of Research Block with Animal Research Facility, Hostel Buildings, Civil & Related MEP works including site development and connected Infrastructure (Composite Contract)

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SECTION. C – ELECTRICAL WORKS

Technical Specification for Non DSR items

I. SPECIFICATION AND TECHNICAL PARTICULARS FOR UPS

1.1 Scope

The present special contract specifications constitute a call for best offers for the supply of Uninterruptible Power System(s) (hereinafter referred to as UPS) rated at 3X80 kVA in parallel redundant configuration, featuring Maintenance Free Sealed Lead Acid batteries housed in one or more external racks/cubicles and providing a minimum autonomy of 15 minutes.

The present specifications contain minimum requirements. All offers must be completed strictly in accordance therewith, either by confirming data or by filling in the spaces provided, where requirements are not met. Any deviations or exceptions to the minimum requirements must appear in the offer. Where no exceptions are shown, the requirements of the present specifications will be considered as accepted.

A redundant system can be created by connecting 3 complete units of the same type in parallel. This parallel redundant configuration shall have redundant batteries and a decentralized bypass. The load is shared amongst the units connected in parallel. Units with a central control module and/or central static bypass are not accepted.

2.0 RELEVANT REFERENCE STANDARDS

The choice of materials and components, engineering developments and the construction of the equipment must comply with current directives and standards.

The UPS will have a CE mark as specified by Directives 73/23, 93/68, 89/336, 92/31 and 93/68.

The UPS will be designed and produced according to the following specifications:

- IEC/EN 62040-1-1 "General and safety requirements for UPS used in operator access areas."
- EN 62040-2 “Electromagnetic compatibility (EMC) requirements”
- IEC/EN 62040-3 “Performance requirements and test methods”

3.0 DESCRIPTION OF SUPPLY

The purpose of the enclosed specification is to define minimum design, construction and testing criteria relating to the supply of Uninterruptible Power Systems (UPS).
3.1 Design Specifications

The Uninterruptible Power System (UPS) will include the following operational components:

- Full IGBT Rectifier/battery charger
- IGBT Inverter
- Maintenance bypass switch
- Static switch
- Batteries.

3.2 IGBT Rectifier/Battery charger

The IGBT Rectifier/Battery charger will have an input isolating switch and a PWM digital vector control system (DSP based) which, in addition to normal functions (AC/DC conversion), will automatically correct the input power factor to a value > 0.99 and limit the harmonic rejection to the mains at a THD$_l$ value < 3% at full output load, and a THDi value < 5% for any other condition.

For the battery charger function, this converter will include built-in fuses and a control circuit for the voltage and battery recharging current. The ripple current to the batteries will be less than 0.05 C$_{10}$. A microprocessor control function will perform the following operations:

- Test the battery by automatically performing a partial battery discharge at weekly intervals or at intervals defined by the user
- Adjust battery float voltage as a function of ambient temperature
- Calculate the remaining battery autonomy time during discharge
- Automatically compensate battery shutdown voltage as a function of the time for prolonged discharges.

3.3 IGBT Inverter

The IGBT inverter will have a PWM digital vector control system (DSP based), capable of converting DC voltage from the IGBT rectifier or battery into AC voltage. A rated output filter will create an output voltage sinusoidal envelope.

The control circuit, in addition to normal functions, will automatically adjust nominal output power in accordance with ambient temperature.
Inverter should be able to deliver full active power at Unity power factor (KVA=KW)

3.3.1 UPS compatibility to Load Power factor

UPS should support the full Power factor range (Lagging & leading) of load without any deration in power rating

3.4 Static bypass switch

The static bypass switch will feature a separate power input and will consist of the following:

- Static switches (SCR type), which can support overloads and short circuits downstream of the UPS
- A back-feed detection circuit as specified by IEC/EN 62040-1-1, clause 5.1.4
- A bypass and maintenance bypass input isolating switch with auxiliary indicator contact
- An output load switch.

The control logic will be handled by digital algorithms (using vector control techniques), similar to those used for the rectifier and the inverter. The static bypass shall be equipped with a back-feed protection device compliant with clause 5.1.4 of IEC/EN 62040-1-1; and a relay signal contact for the control of the external back-feed isolator to be installed on the bypass line upstream from the UPS.

3.5 Batteries

The VRLA, WET or NiCd batteries will feature an enclosure made of self-extinguishing material.

The batteries will be housed in one or more racks/cubicles and will be protected by fuses located on each pole and via a dedicated switch.
Batteries will have an operating life of 10 years and, in the event of total failure of the mains power source, will guarantee the supply of nominal UPS output power for a minimum autonomy of 15 minutes.

4.0 OPERATING MODES

This section describes the different operating modes of the Uninterruptible Power System.

The UPS, using the above-mentioned digital vectorial control (DSP system), will be able to operate both in double conversion and digital interactive modes.

The operating mode may be factory set by the manufacturer during testing or by the customer using the appropriate diagnostic and control software.

The IGBT inverter will be synchronised with the bypass line so that the load can be transferred from the inverter (conditioned line) to the bypass supply (direct line) and vice versa without any break in the supply to the load.

In all operating modes, the battery charger will provide the power necessary to keep the battery fully charged.

4.1 Double conversion operation

In this operating mode, under normal service conditions, the load will always be supplied from the inverter, guaranteeing maximum protection for the load.

Upon failure or reduction of the primary AC source, the load will be supplied by the battery through the inverter. During this phase, power will be drawn from the battery. Visible and audible signals will alert the user to this operating state. The remaining autonomy time will be calculated by a diagnostic algorithm.

Upon return of the primary AC source to within tolerance limits, the Uninterruptible Power System will recommence operating in normal mode.

In the event of an inverter overload, manual stop or failure or temporary overload downstream of the UPS, the load will be automatically transferred to the bypass supply source without interruption.

In the event of an overload with an unsuitable supply, the Uninterruptible Power System will not transfer the load but will continue to supply it from the inverter for a period of time dependent upon the extent of the overload and the characteristics of the UPS.

The user will be alerted of these anomalous operating conditions via the alarm.
4.2 Digital interactive mode

In this operating mode, under normal service conditions, the load will always be supplied from the direct line through the bypass static switch. The quality of the direct line will be monitored constantly using algorithms operated in real time by the DSP control system.

If the direct line is outside the permitted tolerances, the load will be automatically transferred to the conditioned line (inverter) without interruption.

In the absence of power supply to the direct and conditioned lines, the battery will supply power to the loads through the inverter. During this phase, power will be drawn from the battery and the battery charge will be reduced. Visible and audible signals will alert the user to this operating state. The remaining autonomy time will be calculated by a diagnostic algorithm.

When the quality and reliability of the direct line return within permitted limits, the UPS will automatically start supplying the load from the direct line.

4.3 Maintenance bypass switch

The UPS will be equipped with a bypass switch capable of transferring the load to the bypass supply without interruption so as to enable the UPS to be switched off and isolated for maintenance operations. The supply to the load will be maintained.

4.4 Controls and diagnostics

The controls for the electronic power supply modules will guarantee the following:

- A three-phase power supply which is ideal for the load
- Controlled battery recharging
- Minimum harmonic rejection to the upstream mains power supply (THDi<3% at full load, THDi<5% in any other condition).

The UPS will feature a digital vector control based on a DSP (Digital Signal Processor).

The special DSP algorithms must be designed to ensure rapid and flexible processing of the detected data, allowing rapid generation of controlled variables. It must also be possible to run the control for the electronic inverter devices in real time to:

- Improve short-circuit behaviour (300% I_n for 10 ms, 150% I_n up to 5 s)
- Have a synchronised (precise phase) angle between UPS output and bypass network, in the event of mains voltage distortion

- Highly flexible parallel operation.

5.0 Microprocessor control and diagnostics

Operation and control of the UPS should be provided through the use of microprocessor-controlled logic. Indications, measurements and alarms, together with battery autonomy, will be shown on a graphic liquid crystal display (LCD). The procedures for start up, shutdown and manual transfer of the load to and from bypass will be explained in clear step-by-step sequences on the LCD display.

Warning/fault: this page contains information regarding various anomalies concerning power converters such as the bypass, rectifier, inverter and booster/charger. In addition to this there is also warning and fault information relating to the battery and the load.

Events log: displays the date and time of important UPS events, alarms and other warnings.

Measurements: this page holds the full set of measurements for each functional block (rectifier, bypass, booster/charger, batteries, inverter and load).

Battery: displays the battery status/values including temperature, cell voltage, capacity and run time as well as commands for allowing the user to configure battery testing.

Tools: this page allows users to customize the settings of the LCD display and to select the desired language, choosing between 15 languages.

5.1 Controls

The UPS will be provided with the following controls:

- Inverter start
- Inverter stop
- Reset faults
- Buzzer/mute alarm

5.2 Measurements

The UPS will provide the measurements (voltage, current and frequency) for every single internal functional block and this information will be directly accessible on the display, via the measurements button.
5.3 Signals and alarms

The UPS must provide signals and alarms for every single functional block. These signals must be directly accessible via the display, by clicking the warning and fault button.

The UPS will also:

- Clearly display, upon mains failure, the remaining battery autonomy which will be a function of battery status and charge (discharge curve, degradation, operating temperature, etc)

- Have three serial RS232 ports for compatibility and communications with special peripheral units and for remote connections

- Be able to support remote graphic measurement and signalling software

- Be able to interface with a network monitoring system using SNMP slot-in cards

- Provide a telemonitoring function (see description under section 6.0 "Telemonitoring")

A voltage-free input will also be provided to disable the static switches and all power converters (EPO) in case of emergency.

Programmable I/O contacts (at least 4 voltage-free outputs and 2 inputs).

6.0 TELEMONITORING

This section defines the requirements of the system for remote monitoring and control from the Service Centre.

6.1 Monitoring and control from service centre

The system will be capable of analysing UPS operation and electrical supply in order to identify faults and thus prevent the occurrence of conditions likely to damage the equipment protected by the UPS.

The system will guarantee single or parallel UPS surveillance, 24 hours a day for 365 days a year by authorised technical personnel operating remotely. The system will provide a detailed, preventive analysis of connected UPS, without any of the disruption associated with an on-site visit.

The telemonitoring system will offer the following main features:

- Continuous monitoring and control of the performance of end-user UPS
• Bi-directional communications between end-user UPS, Authorised Service Centre and its authorised field service engineers

• Automatic location of Service Engineers in the event of anomalous UPS functioning (even at night and during public holidays)

• Possibility of using graphic software for remote in-depth analysis and control

• Periodic reports on UPS performance with advice from Service Centre engineers.

7.0 UNINTERRUPTIBLE POWER SYSTEM TECHNICAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit of measure</th>
<th>Specification data</th>
<th>Supplier’s data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.1 Input characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal voltage</td>
<td>(V)</td>
<td>400 V three-phase + N</td>
<td>..................</td>
</tr>
<tr>
<td>Tolerance on voltage</td>
<td>(%)</td>
<td>320 V ÷ 460 V</td>
<td>..................</td>
</tr>
<tr>
<td>Nominal frequency (60 Hz selectable)</td>
<td>(Hz)</td>
<td>50</td>
<td>..................</td>
</tr>
<tr>
<td>Tolerance on frequency</td>
<td>(%)</td>
<td>± 10</td>
<td>..................</td>
</tr>
<tr>
<td>Input power factor @ nominal voltage</td>
<td>(%)</td>
<td>&gt; 0.99</td>
<td>..................</td>
</tr>
<tr>
<td>Total harmonic distortion (THDi) @ full load</td>
<td>(%)</td>
<td>&lt; 3</td>
<td>..................</td>
</tr>
<tr>
<td>Total harmonic distortion (THDi) in all other conditions</td>
<td>(%)</td>
<td>&lt; 5</td>
<td>..................</td>
</tr>
<tr>
<td>Walk in /Soft start</td>
<td>(Sec)</td>
<td>10 (1 to 90)</td>
<td>..................</td>
</tr>
<tr>
<td>Rectifier Hold OFF (Sec)</td>
<td>(Sec)</td>
<td>10 (1 to 180 selectable)</td>
<td>..................</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit of measure</th>
<th>Specification data</th>
<th>Supplier’s data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>7.2 Inverter output characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal voltage (380/415 selectable)</td>
<td>(V)</td>
<td>400 three-phase + N</td>
<td>..................</td>
</tr>
<tr>
<td>Nominal frequency (60 Hz selectable)</td>
<td>(Hz)</td>
<td>50</td>
<td>..................</td>
</tr>
<tr>
<td>Nominal power @ 40°C</td>
<td>(kVA)</td>
<td>200</td>
<td>..................</td>
</tr>
<tr>
<td>Nominal Power @ 40°C</td>
<td>(kW)</td>
<td>200</td>
<td>..................</td>
</tr>
<tr>
<td>Automatic adjustment of nominal output power as a function of temperature</td>
<td>(%)</td>
<td>@ 25°C = 110%</td>
<td>..................</td>
</tr>
<tr>
<td></td>
<td>(%)</td>
<td>@ 30°C = 105%</td>
<td>..................</td>
</tr>
<tr>
<td></td>
<td>(%)</td>
<td>@ 40°C = 100%</td>
<td>..................</td>
</tr>
<tr>
<td>Output voltage stability in steady-state condition for input within permitted limits and load variations from 0 to 100%</td>
<td>(%)</td>
<td>± 1</td>
<td>..................</td>
</tr>
<tr>
<td>Stability in dynamic conditions for 100% load step variations</td>
<td>(%)</td>
<td>Complies with IEC/EN 62040-3, Class 1 (VFI, SS, 111)</td>
<td>..................</td>
</tr>
<tr>
<td>Load crest factor without derating</td>
<td></td>
<td>3:1</td>
<td>..................</td>
</tr>
<tr>
<td>Output voltage distortion with 100% linear load</td>
<td>(%)</td>
<td>&lt; 1</td>
<td>..................</td>
</tr>
<tr>
<td>Output voltage distortion with non-linear load as specified by IEC/EN 62040-3</td>
<td>(%)</td>
<td>&lt; 3</td>
<td>..................</td>
</tr>
<tr>
<td>Output frequency stability in synchronization with mains (± 2 ± 3 ± 4 selectable)</td>
<td>(%)</td>
<td>± 1</td>
<td>..................</td>
</tr>
</tbody>
</table>
### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit of measure</th>
<th>Specification data</th>
<th>Supplier's data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output frequency stability with internal clock</td>
<td>(%)</td>
<td>± 0.1</td>
<td>----------------</td>
</tr>
<tr>
<td>Frequency slew rate</td>
<td>(Hz/sec)</td>
<td>&lt; 1</td>
<td>----------------</td>
</tr>
<tr>
<td>Permitted overload:</td>
<td>(%)</td>
<td></td>
<td>----------------</td>
</tr>
<tr>
<td>for 10 minutes</td>
<td>(%)</td>
<td>125</td>
<td>----------------</td>
</tr>
<tr>
<td>for 60 seconds</td>
<td>(%)</td>
<td>150</td>
<td>----------------</td>
</tr>
<tr>
<td>Short circuit current:</td>
<td>(%)</td>
<td></td>
<td>----------------</td>
</tr>
<tr>
<td>. 300% I₀</td>
<td>(ms)</td>
<td>10</td>
<td>----------------</td>
</tr>
<tr>
<td>. 150% I₀</td>
<td>(s)</td>
<td>5</td>
<td>----------------</td>
</tr>
</tbody>
</table>

#### 7.3 Characteristics of electronic static changeover switch

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit of measure</th>
<th>Specification data</th>
<th>Supplier's data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal voltage (380/415 selectable)</td>
<td>(V)</td>
<td>400</td>
<td>----------------</td>
</tr>
<tr>
<td>Tolerance on voltage (± 5 ± 15 selectable)</td>
<td>(%)</td>
<td>±10</td>
<td>----------------</td>
</tr>
<tr>
<td>Nominal frequency (60 Hz selectable)</td>
<td>(Hz)</td>
<td>50</td>
<td>----------------</td>
</tr>
<tr>
<td>Tolerance on frequency (± 2 ± 3 ± 4 selectable)</td>
<td>(%)</td>
<td>±1</td>
<td>----------------</td>
</tr>
<tr>
<td>Permitted overload:</td>
<td>(%)</td>
<td></td>
<td>----------------</td>
</tr>
<tr>
<td>for 10 minute</td>
<td>(%)</td>
<td>125</td>
<td>----------------</td>
</tr>
<tr>
<td>. for 1 minute</td>
<td>(%)</td>
<td>150</td>
<td>----------------</td>
</tr>
<tr>
<td>. for 600 milliseconds</td>
<td>(%)</td>
<td>700</td>
<td>----------------</td>
</tr>
<tr>
<td>. for 100 milliseconds</td>
<td>(%)</td>
<td>1000</td>
<td>----------------</td>
</tr>
</tbody>
</table>

#### 7.4 UPS characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit of measure</th>
<th>Specification data</th>
<th>Supplier's data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum UPS cabinet dimensions WxHxD</td>
<td>(mm)</td>
<td></td>
<td>----------------</td>
</tr>
<tr>
<td>Noise level measured @ 1 meter and @ 100% load</td>
<td>(dBA)</td>
<td>70-72 dBA</td>
<td>----------------</td>
</tr>
<tr>
<td>AC/AC efficiency – double conversion mode @ 100% load</td>
<td>(%)</td>
<td>&gt;95</td>
<td>----------------</td>
</tr>
<tr>
<td>Efficiency in digital interactive mode @ 100% load</td>
<td>(%)</td>
<td>98</td>
<td>----------------</td>
</tr>
<tr>
<td>EMC compatibility as per EN 62040-2</td>
<td></td>
<td>Class C3</td>
<td>----------------</td>
</tr>
<tr>
<td>Degree of protection</td>
<td></td>
<td>IP 20</td>
<td>----------------</td>
</tr>
<tr>
<td>Frame colour</td>
<td></td>
<td>RAL…</td>
<td>----------------</td>
</tr>
</tbody>
</table>

The constructional and functional characteristics of UPS must be in line with the state-of-the-art technology in this field.

The supplying company must be able to provide proof that it is ISO 9001-2000 and ISO 14001 certified for design and manufacturing and for the provision of services.

The UPS will be guaranteed for one year during which time the Supplier will provide technical assistance.

The offer must include:

- a draft maintenance contract providing for 24 hour service with guaranteed minimum service call response time of 4 hours (references are required)
- the addresses of all Service Centers, divided according to geographical areas, and the number of engineers working for each center
• Indication of main telemonitoring installations in operation.

8.0 MISCELLANEOUS PROVISIONS

This section defines details of services, activities and means necessary to complete the supply of the Uninterruptible Power System.

8.1 Documentation

All technical documents issued by the Supplier, in particular the user handbook and the installation, maintenance and troubleshooting guides must be in English.

8.2 Spare parts

The Supplier may include a list of recommended spare parts in the offer for at least two and/or five years.

8.3 Packaging

The Supplier will ensure that all equipment is suitably packaged.

8.4 Shipment

The Supplier will ensure that the equipment is shipped to the specified address on the agreed date.

8.5 Commissioning

Commissioning costs will be payable by the Supplier who will be responsible for the work done and the personnel involved.

Technical personnel will be trained to meet the requirements of current work safety standards.

8.6 Service hot line

The Supplier will indicate the service centre nearest to the place of installation of the equipment supplied under the contract.

The service centre indicated must be able to provide routine maintenance services and must be able to respond to urgent calls at the terms and conditions specified by the Buyer.

II. SPECIFICATION AND TECHNICAL PARTICULARS FOR PLC BASED SYNCHRONIZATION SYSTEM

The system is for the synchronization of 2 Diesel Generators. A single and sophisticated system for generator Synchronization and AMF functionality of the transformer is considered.
The load dependent switching of the breakers is done by the PLC. The necessary electrical interlocks of the DG switchgear with the mains power and for the various feeders is done using the PLC. DG synchronization system to ensure more efficient running of DG’s as well as less fuel consumption per unit of running DG’s is considered. Generator Synchronising and protection module of approved make is to be used for the application. 2 nos. of synchronization modules are considered for the operation. One synchronization module per Generator is required. An Operator Display module for the visualization of the Process parameters on the PLC Panel itself is required. PC is to be connected to PLC over bus network. Bus is the Industrial network, which offers a high-speed data communication at a speed of 12 MBPS which ensures very smooth and trouble free data communication between different process elements. The system starts the DG’s automatically on the event of power failure or any unhealthy power condition on the mains power supply persists more than 5 seconds, such as: A. Failure of any of the phases B. Under voltage conditions (10% below normal voltage of 415V AC) C. Failure of any of the transformers or tripping of transformer protective relay. On failure of Grid supply, the mains ACB will be switched off and first DG, selected either depending on the average load for the last 15 minutes before the power failure or as per the pre-programmed sequence the Master DG will come immediately in line. The sequence and master DG’s can be altered any time later through the SCADA or Display. The transfer of the loads takes place only when the generator output reaches 90% of its rated voltage and frequency.

III. SPECIFICATION AND TECHNICAL PARTICULARS FOR CABLE MANAGEMENT SYSTEM

Wall trunking with cover shall be made up of Lead free Polyvinylchloride material as per EN 50085-2-1 and shall be ROHS complied. The trunking shall have smooth surface finish without sharp edges and Burrs. The trunking shall have IP 30 Protection against access to hazardous parts and shall be non-flame propagating. Wall trunking channels shall be made of lead free polyvinyl chloride with ROHS compliance. With a standard length of 2 meter, size 108.50mm height x 60 mm depth (or higher) suitable for fix any make switches and sockets. The system must have a base perforation so as to allow installation in the wall. The WDK 60110 cover must have slide external locking; and with 4 cover clips each in every 2 meter length for a better locking with base trunk. The trunking shall have all accessories like internal corner cover, external corner cover, T intersection cover,
flat angle cover etc for complete cable management. The wall trunking shall be of Cream in colour and the standard size of the wall trunking shall be of dimensions mentioned below.

IV. SPECIFICATIONS FOR 415V AUTOMATIC POWER FACTOR CORRECTION CAPACITOR BANKS AND CAPACITORS WITH HARMONIC SUPPRESSION FILTER

4.1 POWER FACTOR CAPACITORS – 270 kVAR & 190 kVAR

Following shall be the specifications of capacitors used in the banks:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rated Voltage (V)</td>
<td>: 415</td>
</tr>
<tr>
<td>2</td>
<td>Rated frequency (Hz)</td>
<td>: 50</td>
</tr>
<tr>
<td>3</td>
<td>Construction</td>
<td>: 2 layer film + foil</td>
</tr>
<tr>
<td>4</td>
<td>Guaranteed maximum reduction in kVAR rating after the following periods from the date of commissioning</td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>One Year</td>
<td>: 2%</td>
</tr>
<tr>
<td>b.</td>
<td>Two Years</td>
<td>: 5%</td>
</tr>
<tr>
<td>5</td>
<td>Guaranteed maximum loss in watts per kVAR</td>
<td>: 0.8 to 1W per kVAR</td>
</tr>
<tr>
<td>6</td>
<td>Container material for capacitor in bank</td>
<td>: Fully metal treated, powder coated hermetically sealed sheet steel housing</td>
</tr>
<tr>
<td>7</td>
<td>Impregnate</td>
<td>: Non-PCB non-hazardous</td>
</tr>
<tr>
<td>8</td>
<td>Earthing terminals</td>
<td>: 2 No, to be provided</td>
</tr>
<tr>
<td>9</td>
<td>Permissible over-voltage</td>
<td>: 10%</td>
</tr>
<tr>
<td>10</td>
<td>Permissible over-current</td>
<td>: 30%</td>
</tr>
<tr>
<td>11</td>
<td>Reference Standard</td>
<td>: IS: 2834</td>
</tr>
<tr>
<td>12</td>
<td>Reactor</td>
<td>: 7% harmonic block reactor needs to be provided in series with each Individual capacitor bank. It shall be designed for low temperature rise and low flux density. It shall be of high linearity.</td>
</tr>
</tbody>
</table>
4.2 APPROVAL AND CERTIFICATION

The banks and capacitors shall have CPRI test certificates.

4.2.1 APPROVAL BY ELECTRICAL INSPECTORATE

The bank shall be manufactured to comply with the requirements of the Electrical Inspectorate of the State. The Contractor shall be responsible to get the approval of the Electrical Inspectorate for the equipment and components supplied.

Following drawings and details shall be furnished:

a. Front view of the bank with arrangement of all compartments, compartment doors, handles, knobs, push buttons, indicating lamps and other components.

b. Typical cross sections of the bank to show the arrangement of bus bars, capacitors, fuses, contractors, interconnections and cable terminating facility with sizes of bus bars. Interconnections and clearances.

c. Drawings of bus bars with clearances and support details.

d. Ventilation arrangement inclusive of fan, if provided, with control arrangement.

e. Schematic wiring drawings of power, control, metering and protection circuits.

4.2.2 DRAWINGS

The Contractor shall prepare and furnish to the Employer detailed drawings of the bank and its parts with all the required information within fifteen days of the letter of intent. The manufacture shall be taken up only after receipt of the approved drawings from the Employer. The Contractor shall take action in this matter in such a manner that the process of submission of drawings and details and their approval by Employer are completed in time to adhere to the stipulated delivery period.

The drawings and details to be furnished for Employer’s approval shall include the following;

a. Front view, plan, end views and sectional views of the bank to clearly show all details relating to arrangement of various components, interconnections, clearances, etc.

b. Schematic wiring diagrams of the main and auxiliary circuits.

c. Bill of materials giving details of designation, make, type, ratings, etc of the various pieces of equipment mounted on the bank.
4.2.3 TESTS

All standard tests as specified in relevant Indian Standards shall be carried out by the manufacture on the bank and its parts. These tests are to be carried out in the presence of the representative of the Employer and detailed test reports are to be furnished to the Employer.

Following tests shall be carried out:

a. Verification of the bank as per the approved drawings.

b. Visual inspection of bank for compliance with specifications, workmanship, etc.

c. Operational tests on all the Switchgear.

d. Operational and accuracy tests on the protective gear such as relays, annunciation system, indicating lamps, etc. by injecting the required voltage/current into the circuits.

e. Insulation resistance measurements of power circuits.

f. Insulation resistance measurements of control circuits.

g. High voltage test using 2.5 kV for one minute between each pole and earth.

h. Insulation resistance measurements under items (c) and (d) are to be carried out after high voltage test also.

Test results shall be recorded and furnished to Client/Consultant.

4.2.4 INSPECTION

The Contractor shall intimate the Employer sufficiently in advance of the readiness of the bank for inspection and testing. The Contractor shall provide all required facilities to the Employer to carry out the inspection and witnessing of tests to the satisfaction of the latter.

4.2.5 SERVICE CONDITIONS

Equipment supplied shall be suitable for continuous operation under the conditions specified. If any further detail relating to service conditions is required the Contractor shall specifically request for such detail to the Employer.

4.2.6 APFC RELAY

APFC Relay shall be microprocessor controlled type and shall have automatic C/k ratio selection with step status indications and digital display of power factor. The controller shall provide protection by switching off the system when the harmonic distortion level increases.
specific levels. APFC relay shall be capable of being programmed to disconnect capacitor steps in the event of harmonic overload exceeding pre-set limits

4.2.7 GENERAL CONSTRUCTION

The bank consists of power factor capacitors connected to a common bus through individual sets of fuses and contactors. Each capacitor is to be switched in and out by means of its contactor. Only air-break contactors of double-break construction rated for uninterrupted duty as defined in IS: 2959 shall be used. The contractor shall have adequate number of auxiliary contacts. The operating coil voltage shall be 415V, 50Hz, AC unless otherwise specified. The contactor shall be of adequate duty classification. Every contactor shall have a minimum of 2 Nos. “NO” and 2 Nos. “NC” auxiliary contacts available for wiring control circuits. Each contactor shall be provided with ON and OFF indicating lamps.

The bank shall be of sheet-steel, totally enclosed, dust tight, vermin-proof, flush dead front, modular and fully compartmentalized construction. There shall be an independent compartment for each capacitor with its set of fuses and contactor. The indicating lamps and push buttons shall be provided by the side of the compartment door. Adequate shrouding shall be provided to prevent accidental contacts with parts which may remain live when the door is in open position. Each compartment has an independently interlocked door with padlocking facility. The bank shall be easily extensible at both ends.

The bank shall be complete with an integral base framework of adequate design and construction so that the board can be directly mounted using suitable foundation/anchoring bolts. Bolt holes shall be provided in the bottom framework for the foundation bolts.

It shall be suitable for functioning efficiently and continuously under the service conditions specified.

4.2.8 ENCLOSURE

The enclosures of the bank shall be made of cold rolled sheet steel up to 2.5mm thickness above which thickness hot-rolled steel may be used. The enclosure shall be of floor-mounting, free-standing and self-supporting type construction.

The enclosure shall be so designed and constructed as to prevent the entry of dust, water, insects and vermin. All doors, detachable cover, plates etc shall be provided with effective gaskets. The covers shall be provided with fasteners which would ensure tight closing of the covers by
properly compressing the gaskets. Ventilating louvers, if provided shall be provided with fine brass wire mesh screens.

The enclosures may be of double-front construction where access will be available into the bank both from front and rear. All handles, knobs, pushbuttons, indicating lamps, annunciations, meters and relays of switchgear shall be mounted in the front of the bank.

Every compartment in the bank shall be totally segregated from other compartments by sheet enclosure on all sides with insulating bushes for entry and exit of power and control wiring and interconnections.

Suitably inscribed plastic /bakelite designation labels shall be fixed on the compartment doors. Bus bar chambers shall be provided with screwed covers. Cables alleys meters and relay compartments and switchgear compartments shall be provided with hinged doors which shall be closed tight by means of captive screws with moulded plastic knobs. All the hinges shall be concealed type.

The covers and doors shall be properly stiffened by means of ribs or other stiffeners against wobbling.

The minimum thickness of cold-rolled sheet steel used for the fabrication of the bank shall be 2mm. The folded sections forming the base and vertical framework shall be fabricated out of steel having a minimum thickness of 3mm. Comparatively large covers and doors shall be fabricated using 3mm thick sheet steel.

The structure of the enclosure shall be strong and rigid and shall not suffer any distortion during transport, handling or erection. The different parts of the enclosure shall be able to withstand without any shake or vibration, the static and dynamic loading of various equipment installed in the enclosure. The bank shall be stable under all the required conditions of loading and operation. Adequate lifting hooks shall be provided.

The height of enclosure shall be the same throughout the bank.

The metalwork of the enclosure shall be fabricated to good quality finish with the surface level and smooth without any flaw. The corners shall be rounded.

The metalwork of the enclosure shall be fabricated in a shop with adequate facilities such as power-operated guillotine shears, press brakes, presses, powder-coating plant, etc. The metal work shall be powder coated after treatment.
All fabricated steel parts of the enclosure and framework shall be subjected to the following treatment before powder coating:

a. Degreasing using hot alkaline solution
b. Rinsing with cold water to remove all traces of alkaline solution.
c. Pickling using dilute sulphuric acid and pickling inhibitors to remove oxide, scale and rust formation
d. Rinsing with cold water to remove all traces of acidic solution.
e. Phosphate using zinc phosphate solution.
f. Rinsing with cold water to remove all traces of phosphate solution.
g. Passivating by rinsing in de-oxalate solution to neutralize traces of salts.
h. Drying with compressed air

V. TECHNICAL SPECIFICATIONS OF EXTERNAL LPS , STRUCTURAL EARTHING AND EQUIPOTENTIAL BONDING FOR BUILDINGS

APPLICABLE STANDARDS

IEC 62305: Protection against lightning
IEC 62305-1 ; Protection against lightning: General principles
IEC 62305-2 ; Protection against lightning: Risk management
IEC 62305-3 ; Protection against lightning: Physical damage to structures and life hazard
IEC 62305-4; Protection against lightning: Electrical and electronic systems within structures


5.1 FOUNDATION EARTHING:

Foundation earthing comprises conductors which are installed in the foundation below ground. The mesh size of the foundation earthing shall be 10m x 10m installed in the clean concrete layer at the bottom of the foundation. The mesh shall be firmly connected to the steel of the concrete with clamp (Type :250/A-FT , Art no :5313015 ) in each 1 meter.
The conductor of foundation earthing shall be galvanised solid tape with area cross section of 90 sq mm with 3mm min thickness (30x3 mm). The conductor shall be continuous at least 60 meter.

A separate dedicated GI strip shall be run on the columns and must be connected to the steel reinforced steel available in the columns. The conductor shall be ultimately connected to the mesh of the foundation earthing. The upper end of the dedicated conductor in the column must be connected to the roof air termination system.

Using the dedicated conductor in the beams and columns will ensure the electrical continuity between all steel conductors, thus reducing the effects of the lightning current.

The reinforced steel available inside the concrete shall be used for earth termination system and equipotential bonding for electrical system. All the rooms must have an extended local equipotential bonding point extended from the structural earthing. The component must be stainless steel (205/BM10-VA, Art No: 5420016)
The stainless steel bonding point from the structure must be connected to the local equipotential bonding bar which can accommodate at least 5 flat strips (1802/5-VA, Art no: 5015854)

5.2 AIRTERMINATION SYSTEM

The Airtermination system in the roof shall be according to Lightning protection Level (LPL) 2 with a mesh size of 10mx10m. The airtermination conductor shall be 8mm Aluminum round conductor. The conductor must be placed on top of plastic conductor holders (Type: 165/MBG) in each one meter. The airtermination system must be connected to the extended strip comes out from the columns.

5.3 EQUIUPOTENTIAL BONDING AND SURGE PROTECTION DEVICE

All the non live services such as metallic pipes should be connected directly to the equipotential bonding bar. Line wires shall be connected to equipotential bonding system as mentioned below.
Type of Network – 3 phase, 4 wire.

5.4 MAINS INCOMING PANEL (EB INCOMER AND DG INCOMER)

First Stage Protection at the LT panel of the power supply system

CLASS B/CLASS I (ACCORDING TO IEC 61643)

3 numbers of lightning arrester for the connection between Phase and Neutral and one number of lightning arrester between Neutral and Earth with optical indication for Line to neutral Lightning surge arrester with the following ratings and optical indication for Line to neutral SPDs

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Parameters</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Type</td>
<td>Encapsulated/Non-exhausting Spark Gap</td>
</tr>
<tr>
<td>2.</td>
<td>Nominal Voltage, Un</td>
<td>230V, 50/60 Hz</td>
</tr>
<tr>
<td>3.</td>
<td>Maximum Continuous operating Voltage Uc</td>
<td>320 V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>255 V</td>
</tr>
<tr>
<td>4.</td>
<td>Lightning Impulse Current</td>
<td>50 kA(10/350 μsec)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100 kA(10/350 μsec)</td>
</tr>
<tr>
<td>5.</td>
<td>Voltage Protection Level, Up</td>
<td>1.3 kV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3 kV</td>
</tr>
<tr>
<td>6.</td>
<td>Response Time</td>
<td>&lt;100 nano seconds</td>
</tr>
<tr>
<td>11.</td>
<td>Local Indication</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NA</td>
</tr>
</tbody>
</table>

Visual Indication of the arrester (Line to Neutral)

Healthy condition : Green Colour

Faulty condition : Red Colour

5.5 DISTRIBUTION BOARDS (UPS I/P PANELS, FLOOR DBS)

Class B+C/Class I+II (according to IEC 61643)

3 numbers of pluggable type surge arrester with inbuilt thermal disconnector & provision for inbuilt indication for defective arresters to connect between Line and Neutral and one number arrester Spark Gap type to connect between Neutral and Earth of following ratings including base element & pluggable arresters.
### Specifications

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Parameters</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Line to Neutral</td>
</tr>
<tr>
<td>1</td>
<td>Type</td>
<td>Single MOV with built in thermal fuse</td>
</tr>
<tr>
<td>2</td>
<td>Nominal Voltage, Un</td>
<td>230V, 50/60 Hz</td>
</tr>
<tr>
<td>3</td>
<td>Maximum Continuous Operating Voltage, Uc</td>
<td>≥ 320 Volt</td>
</tr>
<tr>
<td>4</td>
<td>Nominal Discharge Current $I_n$</td>
<td>30 KA(8/20 μsec)</td>
</tr>
<tr>
<td>5</td>
<td>Maximum Discharge Current $I_{max}$</td>
<td>50 KA (8/20 μsec)</td>
</tr>
<tr>
<td>6</td>
<td>Lightning Impulse Current</td>
<td>7 KA(10/350 μsec)</td>
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<tr>
<td>7</td>
<td>Voltage Protection Level</td>
<td>≤ 1300 volts</td>
</tr>
<tr>
<td>8</td>
<td>Response Time</td>
<td>&lt; 25 nano seconds</td>
</tr>
</tbody>
</table>

Visual Indication of the flag in the surge arrester (Line to Neutral)

Healthy condition : Green Colour
Faulty condition : Red Colour

### 5.6 SUB DISTRIBUTION BOARDS (UPS O/P PANELS, ESSENTIAL WALL DBS, SERVER ROOM DBS, UTILITY DBS, APFC PANELS)

Class C/Class II (according to IEC 61643)

3 numbers of pluggable type surge arrester with inbuilt thermal disconnector & provision for inbuilt indication for defective arresters to connect between Line and Neutral and one number arrester Spark Gap type to connect between Neutral and Earth of following ratings including base element & pluggable arresters.
5. Maximum Discharge Current \( I_{\text{max}} \)  
\begin{array}{|c|c|c|}
\hline
 & 40 \text{ KA} & 50 \text{ KA (8/20 \mu sec)} \\
\hline
6. Voltage Protection Level & < 1400 Volts & < 1200 Volts \\
\hline
7. Response Time & < 25 nano seconds & < 100 nano seconds \\
\hline
\end{array}

Visual Indication of the flag in the surge arrester (Line to Neutral)

Healthy condition : Green Colour

Faulty condition : Red Colour

**Connection diagram for SPD for 3 phase 4 wire network**

Note: In US, SPD is called as TVSS- Transient Voltage Surge Suppressor. BUT, IEEE also changed the name to SPD in 2009 April. Now, throughout the world, the common name is SPD.
List of Approved Makes/Brands

The contractor shall quote his rates on the basis of the price of best quality product of the brand/make. In case any particular brand of item is not acceptable to the client, the contractor shall supply items of other approved brands without extra cost.

C ELECTRICAL WORKS

<table>
<thead>
<tr>
<th>MATERIALS</th>
<th>MAKES/ BRANDS NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator</td>
<td>Stamford / Leroy Somer / KEC / BHEL / Crompton Greaves</td>
</tr>
<tr>
<td>APFC Panels</td>
<td>L&amp;T / Sprague / EPCOS / INEL</td>
</tr>
<tr>
<td>Battery Charger</td>
<td>Keltron / Automatic Electric / Sabnife / Waves Electronics</td>
</tr>
<tr>
<td>Bus Riser / Bus duct</td>
<td>Schneider / L&amp;T / Legrand / GE</td>
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<tr>
<td>Cable Gland</td>
<td>Dowells / Polycab / Jaison / Comet</td>
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<tr>
<td>Capacitors</td>
<td>Crompton Greaves / Schneider / Mehar / Shreem / Sprage / Epcos</td>
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<tr>
<td>Cable Management</td>
<td>OBO Betterman / Legrand / MK</td>
</tr>
<tr>
<td>Ceiling Roses/Batton Holder/Angle Batton</td>
<td>Precision / Anchor / legrand / MK / Schneider</td>
</tr>
<tr>
<td>Contactors</td>
<td>L&amp;T / ABB / GE / BCH / Schneider</td>
</tr>
<tr>
<td>Crimping Sockets</td>
<td>Dowells / Polycab / Jaison / Comet</td>
</tr>
<tr>
<td>Current transformer / PT</td>
<td>PGR Power / Intrans / Indus / Kappa / Kapco</td>
</tr>
<tr>
<td>Diesel Generator Engine</td>
<td>Caterpillar / Mitsubishi / Cummins / Volvo / Perkins / Ashok Lyland / Kirloskar</td>
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<tr>
<td>Distribution Boards</td>
<td>GE / Legrand / Siemens / Schneider / L&amp;T</td>
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<tr>
<td>Dry Type Transformers</td>
<td>ABB / Intrans / Schneider / BHEL</td>
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<tr>
<td>LT Panel Enclosure</td>
<td>Rittal / Hensel / Mehar / Megavin</td>
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<tr>
<td>Ceiling / Exhaust fan</td>
<td>Bajaj / Crompton Greaves / Havells / Khaitan / Usha / Almonard</td>
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<tr>
<td>HT / VCB Panel</td>
<td>Siemens / ABB / Schneider</td>
</tr>
<tr>
<td>HT &amp; LT Cables</td>
<td>Polycab / Gloster / Havells / Finolex / V-Guard</td>
</tr>
<tr>
<td>Item</td>
<td>Brands</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>HT Cable Termination Kit</td>
<td>Raychem/ M-Seal [Heat shrinkable type]</td>
</tr>
<tr>
<td>HT Panels</td>
<td>ABB / Siemens / Schneider</td>
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<tr>
<td>Indicating Meters</td>
<td>Socomec / L&amp;T / Elmeasure / Conzerv</td>
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<tr>
<td>Industrial Sockets &amp; Tops</td>
<td>Clipsal / Hensel / Legrand / Schneider / Anchor</td>
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<tr>
<td>Isolator / SFU</td>
<td>L&amp;T / ABB / Siemens / Schneider</td>
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<td>Light Fixtures</td>
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<td>LT ACBs</td>
<td>L &amp; T / ABB / Schneider / Siemens</td>
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<td>MCB, RCBO &amp; ELCB</td>
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<td>Balco / Finolex / Avon Plast / Supreme / Precision</td>
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<td>RMU</td>
<td>Siemens / ABB / Schneider / Crompton Greves</td>
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<td>Storage Battery</td>
<td>Exide / STANDARD / Amaron</td>
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<td>Switches/Sockets</td>
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<tr>
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<td>APC / Legrand / Emerson / TATA Liberty</td>
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<td>Cable Tray</td>
<td>OBO Bettermann / Copper B Line / Panduit</td>
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<tr>
<td>Telephone/Network cable</td>
<td>Havells / Finolex / RR cable / V-guard / Amber</td>
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<tr>
<td>MDF</td>
<td>Krone</td>
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<tr>
<td>Other Items</td>
<td>Approval from Client/ Consultant</td>
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</table>