

REQUEST FOR PROPOSAL

FOR

**PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND
PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2)
AT KHARADI SEZ**

Issued by

M/s KRC INFRASTRUCTURE & PROJECTS PRIVATE LIMITED



BID SPECIFICATION NO. Kharadi/Power/2018-19/K003 date: 27 April 2018

**Registered Address: Raheja Tower, Plot No: C-30, G Block, Next to Bank of Baroda,
Bandra Kurla Complex, Bandra (E) Mumbai-400051, Maharashtra, India**

REQUEST FOR PROPOSAL (hereinafter referred to as RFP) for PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ

BID SPECIFICATION NO. Kharadi/Power/2018-19/K003 date: 27 April 2018

The bid document is addressed to:

M/s.....
.....
.....

Notes:

1. The bid document is not transferable
2. Though enough care has been taken while issuing the bid documents, the bidder should satisfy himself that documents are complete in all respects. Intimation of any discrepancy shall be given to this office immediately. If no such intimation is received by this office from any bidder within 3 days from the date of issue of the bid documents to him, then this office shall consider that the bid documents complete in all respects have been received by the bidder.

Issued by:-

Name	:	Suhas Ambade
Designation	:	Associate Vice President
Address	:	Raheja Tower, Plot No: C-30, G Block, Next to Bank of Baroda, Bandra Kurla Complex, Bandra (E), Mumbai - 400051, Maharashtra, India
Contact Person for any queries	:	Vinayak Pawar/ Vikram Yermalkar
Phone	:	+91-22-26564659, +91 22-26564914
Fax	:	+91-22-26564604
Email	:	pawarv@kraheja.com / vyermalkar@kraheja.com
Date	:	27 th April 2018

VOLUME 1:

SECTION 1:

INVITATION FOR BIDS

SECTION 1: INVITATION FOR BIDS

Background: M/s KRC Infrastructure & Projects Private Limited and M/s. Gera Developments Pvt. Ltd. (jointly), under Section 3 of the Special Economic Zones (SEZ) Act, 2005 (28 of 2005), are setting up a sector specific Special Economic Zone (SEZ) for Information Technology and Information Technology Enabled Services (IT & ITeS SEZ) at Survey No. 65(p), Village Kharadi, Taluka Haveli, District Pune, Maharashtra, India. The Ministry of Commerce & Industry (Department of Commerce), Government of India, SEZ Section, on being satisfied that the requirements under sub-section (8) of Section 3 of the SEZ Act, 2005, and other related requirements have been fulfilled, granted the Letter of Approval (LoA) and notified an area of 4.03 hectares as SEZ area in the name of M/s. KRC Infrastructure and Projects Private Limited and M/s. Gera Developments Pvt. Ltd. (jointly) under sub-section (10) of Section 3 of the SEZ Act, 2005 for development, operation and maintenance of the sector Specific IT&ITeS SEZ at Kharadi, District Pune, in the State of Maharashtra . The proviso inserted in clause (b) of Section 14 of the EA2003 is as under:

“Provided that the Developer of a Special Economic Zone notified under Subsection (1) of section 4 of the Special Economic zones Act, 2005, shall be deemed to be a Licensee for the purpose of this cause, with effect from the date of notification of such Special Economic Zone”.

M/s. KRC Infrastructure and Projects Private Limited (Owner) and M/s. Gera Developments Pvt. Ltd. (Jointly) have been notified as the Developer of the SEZ by the Ministry of Commerce & Industry (Department of Commerce) vide Notification No. S.O. 2203 (E) dated June 19, 2017, and are developing the said IT & ITeS SEZ.

Thus, OWNER, being the developer of the IT & ITeS SEZ, is a deemed Power Distribution Licensee and has filed a petition to Maharashtra Electricity Regulatory Commission (MERC).

1. **Owner** hereby invites offers from interested companies who are capable of PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ. The Request for Proposal (**RFP**) is invitation to participate in the bidding process for the selection of Contractor for PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ. The responsibility of the Contractor shall be to provide, install, test and commission

Electrical Works for one no of buildings (G2) and handover to the Owner as per the terms and conditions of the RFP Document.

2. The salient details of RFP are furnished below:-

Table 1:

Sr. No.	Description	
1	Tender No.	BID SPECIFICATION NO. Kharadi/Power/2018-19/K003 date: 27 April 2018
2	Broad Scope of Work	PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ
3	Earnest Money Deposit amount	Rs 5, 00,000/- (Rupees Five Lakh only) in the form of DD / Banker's cheque / Pay Order along with the bank confirmation letter in favour of "KRC Infrastructure & Projects Private Limited" payable at Mumbai
4	Contract Performance Guarantee (CPG)	10% of Contract Price in the form of Bank Guarantee issued by any Nationalized/Private Bank
5	Bid Documents	To be downloaded by the Bidder from website www.krahejacorp.com
6	Prices	Firm
7	Validity of offer	The validity of Price Bid of bidder shall be Three Months from the Date of Opening of Price Bid.
8	Address	Suhas Ambade Associate Vice President Address: Raheja Tower, Plot No: C-30, G Block, Next to Bank of Baroda, Bandra Kurla Complex, Bandra (E), Mumbai – 400051, Maharashtra, India Email: sambade@kraheja.com
9	Contact Person & Email Address for RFP Queries	Mr. Vinayak Pawar / Mr. Vikram Yermalkar Email Address: pawarv@kraheja.com / vyermalkar@kraheja.com

3. The overall timelines for the bidding process are as follows:

Table 2:

Sr. No	Activity	Date
1	Commencement of sale of RFP	27 April 2018
2	Pre- Bid Queries from interested bidders	4 May 2018
3	Pre-Bid Meeting	11 May 2018
4	Response to the Bidder's queries	15 May 2018
5	Submission of Technical Bids	21 May 2018 by 14:00 hours
6	Opening of the Technical Bids	21 May 2018 by 14:30 hrs
7	Declaration of Technically qualified bidders	25 May 2018
8	Mandatory Training to Technically qualified bidders regarding "ARIBA" portal of KRC	28 May 2018
9	Training regarding E- Reverse Auction	29 May 2018
10	Submission of the Price bids online through "ARIBA" portal of KRC	30 May 2018 from 10:00 hrs to 16:00 hrs
11	E- Reverse Auction	30 May 2018 at 16:15 hrs to 17:00 hrs

4. The Bidder will have to download the RFP from the website of K Raheja Corp website www.krahejacorp.com . For any kind of queries you may contact the concerned officials mentioned above.
5. The Bidder will have to submit the EMD of Rs Rs 5, 00,000/- (Rupees Five Lakh only) in the form of DD / Banker's cheque / Pay Order along with the bank confirmation letter in favour of "KRC Infrastructure & Projects Private Limited" payable at Mumbai along with the submission of bid.
6. The bidder should meet the qualifying requirements stipulated in Section 3 of the Bid Document.
7. The Contractor shall be required to furnish Contract Performance Guarantee (CPG) in favour of M/s KRC INFRASTRUCTURE & PROJECTS PRIVATE LIMITED within 7 days from the date of selection of Contractor for an amount calculated at 10% of Contract Price.

8. The CPG shall be in the form of Bank Guarantee issued by any Nationalized/Private Bank.
9. The validity of Price Bid of bidder shall be three months from the Scheduled Date of opening of Price Bid. However, OWNER may ask the bidders to extend the validity period, if required.
10. OWNER in its own discretion has the right to reject all bids or part thereof without assigning any reason, including where the quoted prices are not aligned to the prevailing market prices. The decision of OWNER shall be final and binding on the bidders in this regard.
11. Interested eligible bidders may obtain further information in respect of bidding documents from the office of OWNER at the address mentioned above on all working days.
12. Address for communication: Suhas Ambade/ Vinayak Pawar/Vikram Yermalkar, Raheja Tower, Plot No: C-30, G Block, Next to Bank of Baroda, Bandra Kurla Complex, Bandra (E), Mumbai – 400051, Maharashtra, India

VOLUME 1: SECTION 2: INSTRUCTIONS TO BIDDERS

SECTION 2: INSTRUCTIONS TO BIDDERS

1.1 Scope of Work

The scope of work to be carried out under this Contract shall be PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ as per the “Bill of Quantities” and as per the “Terms and Conditions”. This shall also include the works of clearing of site to the entire satisfaction of the Owner, preparation of “As Installed/Built drawings”, all matters pertaining to this contract including certification of measurements, approval of materials and approval of all Design/ Drawing Documents from Statutory Authorities.

1.2 Eligible Bidders

- The invitation for bid is open to all the Competent and Capable Bidders.
- Bidder shall not be under a declaration of ineligibility for corrupt and fraudulent practices.
- The bidder should meet the Qualifying Requirements specified in Section 3 of this document.
- The Bidder should have the statutory licenses from the concerned authorities and should have requisite registrations with the concerned authorities including but not limited to the following:

- i. The Bidder should have a valid Electrical Contractor's License issued by the Govt. of Maharashtra (India)
- ii. The Bidder should be registered under GOODS & SERVICE TAX (GST) Act
- iii. The Bidder should be registered under Provident Fund Act (P.F. Act)

Copies of the certificates/documentary evidence for sub clause i to iii of above Clause shall be submitted along with the Bid in Envelope no.2. If the Bidder does not have the requisite licenses/ registrations at the time of submission of Bid, he has to process for them so that the same are made available before the time of Award of Contract, but in that case, he has to give undertaking on 100 Rs. Stamp paper that he is processing for obtaining the certificates/documentary evidence as stipulated and the same shall be made available by the time of Award of Contract. If the necessary certificates are not obtained by the bidder by the time of Award of Contract the EMD shall be forfeited.

1.3 Representation/ Authorization of Bidder

The Bidder shall name in the Format A its authorized representative / agent designation, contact numbers, email address and postal address. In case, the representative/agent is changed during the course of execution of the Contract, such changes shall be notified to the Owner by the Contractor, failing which, the Owner shall not accept any responsibility.

1.4 Local Representation

Foreign Bidders/ Foreign OEMs must have office in India and shall indicate in their Bid, the name of contact person and details of the office in India.

1.5 Cost of Bid

The bidder shall bear all costs associated with the preparation and submission of his bid and the Owner will in no case be responsible or liable for those costs.

1.6 Bidder to Inform Himself Fully

The bidder shall make independent enquiry and satisfy himself as to all the required information, inputs, conditions, circumstances and factors, which may have any affect on its bid price and also on the execution of work covered under these specifications and documents. In assessing the bid, it is deemed that the bidder has inspected and examined the site conditions and its surroundings, examined the laws and regulations in force in India, the transportation facilities available in India, the conditions of roads, bridges, ports, etc. for unloading and / or transporting heavy pieces of material and to have based its design, equipment size and fixed its price taking into account all such relevant conditions and also the risks, contingencies and other circumstances, which may influence or affect the execution of the works as specified in these bid specification.

The costs of visiting the site shall be at the bidder's own expense.

In their own interest, the bidders are requested to familiarize themselves with the Income Tax Act, the Companies Act, the Customs Act and all other related acts and laws prevalent in India. The Owner shall not entertain any request for clarifications from the bidders regarding such local laws and the conditions. However, the Owner shall direct the bidder from where to obtain such assistance, provided the request for such assistance is received well in advance. However, non-receipt of such information shall not be a reason for the bidder to request for extension to the date of submission of the bid.

The bidder shall understand and agree that before submission of its bid, all such factors, as generally brought out above, have been fully investigated and considered while submitting the bid. No claim for financial adjustment to the contract awarded under this specification and documents shall be entertained by the Owner. The Owner shall also not permit any change in time schedule or any financial adjustment arising thereof, which are based on lack of clear understanding of such site conditions, laws and regulations and other related information and / or its effect on the price quoted in the bid.

1.7 Bidding Documents

The bid documents comprise the following:

Volume -1: General information. Commercial conditions and Formats

- Section – 1 : Invitation for Bid.
- Section – 2 : Instructions to Bidders
- Section – 3 : Bid Qualification Requirements.

- Section – 4 : Special Conditions of Contract (SCC)
- Section – 5 : Formats & Schedules
- Section – 6 : General Conditions of Contract (GCC)

Volume-2: Technical Specification, Approved Make list & Single Line Diagram

- Section – 1 : Technical Specifications
- Section – 2 : Approved Make list
- Section – 3 : Single Line Diagram

This volume contains the site data, scope of works, system requirements, guarantee parameters, technical schedules, technical specification of the equipment, Single Line Diagram.

The bidder is expected to examine all forms, terms and conditions and specifications forming part of the bidding documents. Failure to furnish complete information required as per the bidding documents or submission of a bid not substantially responsive to the bidding documents in every respect will be at the bidder's risk and may result in the rejection of his bid.

The bidder shall bear all costs associated with the preparation and submission of the bid. The submission of any bid connected with these documents and specifications shall constitute an agreement that the bidder shall have no cause of action or claim against the Owner for rejection of its bid or if the Owner may elect to withdraw the invitation to bid. The Owner shall always be at liberty to reject or accept any bid or bids at its sole discretion and any such action shall not be called into question and the Bidder shall have no claim in that regard against the Owner. The Owner is not bound to give any reasons for the rejection of the bid.

The Bidder shall note the following:

- Bid Documents are not transferable.
- Not more than one bid for the work shall be submitted by one bidder.
- If the Bidder deliberately gives wrong information in its bid to create circumstances for the acceptance of its bid, the Owner reserves the right to reject such bid and / or cancel the order, if placed.
- Bid documents submitted by the bidder shall become the property of the Owner and the Owner shall have no obligation to return the same to the bidder.
- Bid must cover the entire scope of work as specified in Technical Specification.

- All the pages of the bid submitted shall be signed by authorized signatory.

Bids covering partial scope of work shall not be acceptable and shall not be considered for evaluation.

1.8 Clarification/Interpretation of Bidding Documents

If any bidder finds discrepancies or omissions in the Bid specification and documents or is in doubt as to the true meaning of any part of the bid documents or scope of work to be executed, it shall at once submit a written request in English Language for clarification or interpretation of the doubt in question. Such request should reach the Owner through Email and/ or courier by 4 May 2018 at the address/ contact details mentioned in Section 1.

Appropriate clarification / interpretation shall be given in the form of a supplementary notice, without identifying the source, to all the Bidders who have purchased the bid document. The Owner shall respond in writing to any request for clarification of the Bid Documents. However, no oral or other interpretation shall be considered as binding on Owner.

All the pre-bid queries shall be furnished in the following format through e-mail as a MS Word document along with a post confirmation copy thereof.

Sr. No	Volume / Section/Book	Page No	Clause No.	Bid Specification	Bidder's Query
1	2	3	4	5	6
A	Volume1				
	...				
				
B	Volume 2				
				

1.9 Amendment of Bidding Documents

At any time prior to the deadline for submission of bids, the Owner may, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, modify the bidding documents by amendment. The amendment shall be notified in writing through a letter, by fax or by e-mail to all prospective Bidders who have purchased the Bid Document, and shall become an integral part of the Bid Document.

1.10 Submission of Bid

The technical Bid shall be submitted in two Envelopes as specified below.

Envelope / Cover No.1(One) - EMD and Receipt of Tender Fee

This cover should contain the

1. Copy receipt of Tender Fee.
2. Earnest Money Deposit (EMD)
3. Duly Signed Check list

Envelope / Cover No.2 (Two) - Techno-Commercial Bid except price

This cover should contain following:

1. Bidder's Qualification Requirement as per Formats A, B, C, D, E.
2. Letter of Authorisation for signing the bid.
3. Signed copy of entire tender document.
4. Copy of Balance Sheets and Profit and Loss Accounts for past 3 years.
5. Self-Attested Copies of GST & PAN registration
6. Self-Attested copies of Valid Electrical Contractor's License issued by GoM
7. A Declaration that there are no legal pending legal cases or suits and liabilities. In case of such liabilities, details shall be furnished. Declaration shall be as per Format I

Every Envelope shall indicate clearly the name of the Bidder and his address & Envelope number and its details. In addition, the left-top corners of the envelope should indicate the Owner's Tender specification number. If any envelope is not sealed and marked as above, the Owner will assume no responsibility for the bid's misplacement or premature opening.

The bidder's address shall be stated in the format A of the bid at which notice may be served validly upon it. All such notices that are delivered to such address shall be deemed to have been served validly or if sent by post shall be deemed to have arrived in due course. Any change of address must be notified to the Owner in writing and until such notification is received, the Owner shall not be bound to take notice of any change of address and all correspondence sent to earlier address shall be deemed to be validly served on the bidder.

1.11 Modification and Withdrawal of Bids

The Bidder may modify or withdraw its bid after the bid submission, provided that written notice of the withdrawal or modification indicating the modification therein is received by the Owner prior to the deadline prescribed for submission of bids.

No bid can be withdrawn during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder in the timelines. Withdrawal of a bid during this interval shall result in the forfeiture of Bidders' EMD.

1.12 Bid Opening and Evaluation

1.12.1 Bid Opening

Owner shall open the bids at its office as indicated in Invitation for Bids. The date and time for the bid opening is indicated in "Invitation for bid". In case, the date of receiving / opening of the bids happens to be a holiday for the Owner, the bids shall be received / opened on the next working day at the same appointed time. The bids will be opened in presence of the representatives of the bidders who choose to attend. Maximum two (2) persons per bidder shall attend the opening of bids. Their signatures shall be obtained in a register evidencing their presence at the time of opening and certifying that their bids submitted were opened. The bidder's names, opening of the Techno-Commercial Bid and presence or absence of the requisite EMD will be informed in the bid opening. The Owner will prepare record notes for technical bid opening dates.

The price bids shall be submitted by the bidders online through "ARIBA" Portal before the mentioned date in Table 2. The owner shall give mandatory training to all the technically qualified bidders on the date mentioned in Table 2. The Owner shall give the training on dummy quotes so that the vendor gets acquainted with the ARIBA system. All the necessary training manuals/ files in soft copy shall be provided to all technically qualified bidders after training if needed.

1.12.2 Policy for Bids under consideration

After opening of the Technical Bid, the Owner shall make a study of individual bids submitted by various bidders, and clarifications / confirmation, if necessary; pertaining to each of the bid shall be called from the bidder or shall be discussed with the bidder separately during the validity period of their offer. By obtaining clarifications / confirmations in respect of each of the techno-commercial bid, all the bids will be brought at par as far as technical requirements and commercial terms and conditions are concerned.

Bids, which do not meet the stipulated qualifying criteria, will be rejected and such bidders shall be barred from submitting the price bids online.

Any effort by bidder to influence the Owner in the Owner's bid evaluation, bid comparison or contract award decision may result in the rejection of his bid.

1.12.3 Preliminary Examination

During bid evaluation, the Owner may, at its discretion, ask the bidder for a clarification of his bid. The request for clarification and the response shall be in writing and no change in substance of bid shall be sought, offered or permitted.

The Owner shall examine the bids to determine whether they are complete, whether any computational error has been made, whether required sureties have been furnished, whether documents have been properly signed, etc., and whether the bids are qualified, responsive and generally in order.

Prior to detailed evaluation, the Owner will determine whether each bid is of acceptable quality, generally complete and substantially responsive to the bidding documents. For the purpose of this determination, a substantially responsive bid is the one that conforms to all the terms, conditions and specifications of the bidding documents without material deviations, objections, conditionalities or reservations.

A material deviation, objection, conditionality or reservation is one

- a) that affects the scope, quality or performance of the contract;
- b) that limits in any substantial way, inconsistent with the bidding documents, the Owner's rights or the Contractor's obligations under the Contract, or
- c) Whose rectification would unfairly affect the competitive position of other Bidders who are presenting substantially responsive bids.

The Owner's determination of a bid's responsiveness is to be based on the contents of the bid itself without recourse to extrinsic evidence. If a bid is not substantially responsive, it will be rejected by the Owner, and may not subsequently be made responsive by the Bidder by correction of the non-conformity.

In particular, the bid will be treated as non-responsive under following circumstances.

- EMD not submitted;

A bid determined as substantially non-responsive shall be rejected by the Owner and Price Bid of such bidder will not be opened and the bid shall not be considered for further evaluation.

1.12.4 Evaluation of Bids

The Owner will carry out a detailed evaluation of the bids previously determined to be substantially responsive, in order to determine whether the technical aspects are in accordance with the requirements set forth in the bidding documents. In order to reach such a determination, the Owner will examine and compare the technical aspects of the bids on the basis of the information supplied by the Bidders, taking into account the following factors:

- a) Qualification Requirement;
- b) Overall completeness and compliance with the Technical Specifications, and deviations from the Technical Specifications to the bid, if any;
- c) Other relevant factors, if any, or other Sections of bid that the Owner deems necessary or prudent to take into consideration.

1.13 Currency for Bids

The bidders shall quote the prices in Indian Rupees only.

1.13.1 Prices- Definitions and Meanings

For the purpose of evaluation and comparison of bids, the following meanings and definitions shall apply.

“Bid Price” shall mean the Total Lump Sum Turn-key Price or Contract Price including Taxes and Duties', quoted by the bidder in its proposal for the complete scope of the works.

“Evaluated Bid Price” shall be the summation of Bid Price and Differential Price.

1.13.2 Change of Quantity before award of the Contract

The Owner reserves the right to vary the quantities of items to be ordered as per specifications, if found necessary before award of the contract as per unit prices. In case unit prices are not available, the prices for items added / deleted shall be mutually agreed.

1.14 Award of Contract

1.14.1 Award Criteria

The Owner will award the Contract to the Bidder whose Bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price.

1.14.2 Owner's right to accept any bid and to reject any or all bids

Notwithstanding anything contained in this document, the Owner reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids, at any time prior to award of contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder or Bidders the grounds for the Owner's action.

The Owner is not bound to accept the lowest or any bid, without assigning any reason for the rejection of any bid or part of the bid. It is also not binding on the Owner to disclose any analysis report on bids.

1.15 Notification of Award and signing of Contract Agreement

1.15.1.1 Letter of Award to the Contractor

The Bidder whose bid has been accepted will be notified of the award through 'Letter of Award' by the Owner by facsimile or email confirmed by letter sent by registered post, courier service or speed post - the mode accepted by the bidder - prior to expiration of the bid validity period.

The Contractor will acknowledge receipt of the Letter of Award and convey the acceptance to it to the Owner within three (3) days of receipt of the same.

Till such time the formal contract is signed, the Letter of Award issued by the Owner to the Contractor and its acceptance by the bidder shall be construed as a contract document and conditions of contract contained in these documents shall become applicable.

1.15.1.2 Acceptance of Work Order

The Owner shall issue signed Work Order after the acceptance of LOA from the contractor. The Contractor shall have to sign Work Order issued by the Owner within 7 (seven) calendar days from the date of issue of signed Work Order.

If the Contractor fails to sign the WO, the same shall constitute sufficient ground for the annulment of the award of work and also the forfeiture of EMD. In such event, the Owner may make the award to the next lowest evaluated responsive Bidder or call for new Bids.

1.16 Contract Performance Guarantee

The Contractor shall provide to the Owner the Contract Performance Guarantee within thirty (30) days of acceptance of WO,

The Contract Performance Guarantee to be provided in the form of a Bank Guarantee in the prescribed format by the Contractor of Nationalised/Private Bank in India.

The Bank Guarantee shall be denominated in the currency of the Contract and shall be in the form enclosed with this bidding document.

This Contract Performance Guarantee shall be valid up to 30 days beyond the Contract Period.

The Contractor failing to comply with the requirements of the above mentioned clause shall constitute sufficient grounds for cancellation of the award and forfeiture of the EMD. In such event, the Owner may make the award to the next lowest evaluated responsive Bidder or call for new Bids.

1.17 Check List

The Bidders are requested to carefully go through the instructions for preparation of their bids. The bid shall fully meet the technical requirement specified in Volume II of the Bid Document.

The Bidders may depute their representative to visit the site to get any additional information and to check the site conditions personally.

The Bidder may submit additional information, which in his opinion shall help the Owner to evaluate the bid. Bidder shall use continuation sheets wherever necessary.

The Bidders are requested to duly fill in the check list enclosed with Bid specifications. This check list gives only certain important items, to facilitate the Bidder to make sure that the necessary data / information is provided by the Bidder in its proposal. This, however, does not relieve the Bidder of his responsibility to make sure that his proposal is otherwise complete in all respects.

VOLUME 1:

SECTION 3: QUALIFICATION REQUIREMENT`

SECTION 3: QUALIFICATION REQUIREMENT

1 Technical Requirement

- 1.1 The Bidder shall be an EPC Contractor having Supplied, Erected, Tested & commissioned HT / LT network of 33/22 kV with a single order value of minimum Rs. 300 Lacs. The order of Rs. 300 Lacs should have been executed completely before the bid date. (Supporting documents/Completion Certificates of the customer to be submitted.)
- 1.2 The bidder shall have valid Electrical Contractor License for Maharashtra, registered under GST Act, ESIC Certificate & should have PF Registration Certificate. In case Electrical Contractor License for Maharashtra is not available, Bidder should at least possess Electrical License of any other State and furnish an undertaking to obtain the same for Maharashtra prior to award of Contract.

2 Financial Requirement:

The Average Minimum Annual Turnover (MAT) of the Bidder during last three financial years shall not be less than Rs 3 Crore.

The owner may assess the capacity & capability of the bidders, to successfully execute the scope of work covered under the work within stipulated completion period. This assessment shall inter-alia include.

- Document verification;
- Visit to the Bidder's works/manufacturing facilities;
- Verification of manufacturing capacity, details of works executed, works in hand, anticipated in future and the balance capacity available for the present scope of work;
- Verification of the details of plant and machinery, manufacturing and testing facilities, manpower and financial resources;
- Verification of details of quality systems in place;
- Past experience and performance;
- Customer feedback;
- Banker's feedback, etc.

Additional Documents:

Apart From various documents to be furnished along with the Bid, the following documents/details are to be furnished by the Bidder:

- Copy of Goods & Service Tax Registration Certificate
- Copy of Company PAN Card
- TAN Number of the Company
- Details of Partners/Directors of the Firm/Company.
- Last Three years audited accounts
- Solvency certificate from Bank (up to 20 % of Bid value).
- A declaration that there are no pending legal cases or suits and liabilities which will affect the performance of the Bidder while performing the works under this Bid. In case of any such liabilities, details shall be furnished by the Bidder as per Format I.

VOLUME 1:
SECTION 4:
SPECIAL CONDITIONS OF
CONTRACT

SECTION 4: SPECIAL CONDITIONS OF CONTRACT

1. Definitions

- **“Contractor”** means the Bidder whose bid has been accepted by the Owner for the award of Contract and shall include such Contractor’s legal representatives, successors and permitted assigns;
- **“Contract”** shall mean the Work Order issued by the Owner to the Contractor and shall include all the documents defined under contract documents clause of Special Conditions of Contract.
- **“Contract Price”** shall mean the firm price quoted by the Contractor in his Bid with additions and/ or deletions as may be agreed and incorporated in the Letter of Award and the contract agreement for the entire scope of works;
- **“Contract Period”** shall mean the period from the date of execution of the contract till the Taking Over Certificate is issued by the Owner
- **“Defect Liability Period”** shall mean the period during which the Contractor shall remain liable for repair or replacement of any defective part of the works performed under the Contract.
- **“Date of Contract Signing”** shall mean the date on which both the parties have signed the Contract document;
- **“Engineer”** shall mean the official of the Owner appointed in writing by the Owner to act as Project-In-Charge from time to time for the purpose of the Contract.
- **“Letter of Award”** shall mean the notification issued by the Owner to the Contractor about acceptance of his proposal;
- **“Latent Defects”** shall mean such defects caused by faulty designs, material or workman-ship which cannot be detected during inspection, testing etc., based on the technology available for carrying out such tests
- **“Owner”** means M/s KRC Infrastructure & Projects Private Limited (OWNER) and shall include the legal successors in title to the Owner, its legal representative and any permitted assigns of the Owner.
- **“Performance and Guarantee Tests”** shall mean all operational checks and tests to determine and demonstrate guaranteed parameters as specified in the Contract Documents
- **“Subcontractor”** means any firm or person (other than the Contractor named in the Contract) engaged for any part of the work or any person to whom any part of the Contract has been sublet by the Contractor with the consent in writing of the Owner/ Engineer and shall include the legal representatives, successors and assigns of such person;

- **“Specification”** shall mean the Specifications and Bidding Document forming a part of the Contract and such other schedules and drawings as may be mutually agreed upon;
- **“Taking Over”** shall mean the Owner’s written acceptance of the Works performed under the Contract, after successful commissioning/ completion of Performance and Guarantee Tests, as specified in the accompanying Technical Specifications or otherwise agreed in the Contract and receipt of charging permission upon Work Completion Report (WCR) accepted by the competent authority.
- **“Unit Price”** shall mean the firm price quoted by the Contractor in his Bid for each item of entire BOQ online;
- **“PMC”** shall mean the project management consultant appointed by the Owner.

2. Language and Measures

All documents pertaining to the Contract including specifications, schedules, notices, correspondences, operating and maintenance instructions, drawings or any other writing shall be written in English language. The Metric System of measurement shall be used exclusively in the Contract.

3. Unit Price

The Contract Price shall mean the firm price quoted by the Contractor in his Bid with additions and/ or deletions as may be agreed and incorporated in the Letter of Award and the contract agreement for the entire scope of works.

Detailed break up shall comprise all the price components of Unit Prices as submitted by the Contractor in the appropriate price schedules of bid proposal sheet.

The Unit Price shall remain firm during the Contract Period and shall not be subject to variation on any account or for change in quantity.

4. Scope of Work

The work to be carried out under this contract comprises of internal and external electrical installation of the project as called in the tender documents. The Electrical Contractor shall include for the supply of the whole of the materials in accordance with the Specifications and the whole of the work of fixing necessary for the complete installation as set out in these Specifications and with the accompanying schedule and drawings, commencing from the supply authority’s terminals. This also include any material, appliances, equipment not specifically mentioned herein or noted on the drawings as being furnished or installed but which are necessary and Customary to

make the installation complete in all respects. In general the work to be performed under this contract shall comprise supply, installation, testing & commissioning of the following:-

- a. All conduit work including junction boxes, outlet boxes, wiring & earthing for lighting & power.
- b. All conduit work including junction boxes, outlet boxes & wiring for LV systems such as voice, data, fire alarm, paging, CCTV, Access control & MATV etc.
- c. Switches, plug sockets, cover plates and wiring accessories.
- d. Emergency lighting, wiring, Inverter/UPS.
- e. Substation, HT Switchgear and HT Cabling.
- f. Mains and sub-mains between various distribution boards, cables, submain wiring, cable trays, Rising Mains & Bus Ducts.
- g. Distribution Boards, Panels, meter boards & final DB's.
- h. Earthing system.
- i. Lighting Fixtures and Fans.
- j. Lightning Arrestor System
- k. External lighting, cabling, lighting fixtures and poles.
- l. Installation of Bus Ducts.
- m. Training of owner's staff/representative.
- n. Preparation of "As Built Drawings & Documents".

Note:- Some items may be supplied free of cost by the owners for installation, testing & commissioning. The entire work is to be carried out with the direction of & to the satisfaction of the owner /Project Manager/ Architect.

The detailed BOQ in excel format is attached herewith for ready reference. This BOQ shall be available online during price bid submission through "ARIBA"portal.

5. Abbreviations

The following abbreviations have been used in the accompanying specifications, drawings and schedule of quantities:

RCCB stands for Residual Current Circuit Breaker
ELCB stands for Earth Leakage circuit Breaker
HRC stands for High Rupturing Capacity
G stands for gauge
GI stands for Galvanized Iron
MS stands for Mild Steel
AL stands for Aluminum

CU stands for Copper
CI stands for Cast Iron
PVC stands for Polyvinyl Chloride
A or Amp stands for Amperes.

V stands for Volts
KWH stands for Kilowatt hour
KV stands for Kilo Volts
LV stands for Low Voltage
LT stands for Low tension
HT stands for High tension
VCB stands for Vacuum Circuit Breaker
OCB stands for Oil Circuit Breaker
CSS stands for Compact Substation
VPI stands for Vacuum Pressure Impregnated
SLD stands for single line drawing/ diagram.
IEE stands for Institution of Electrical Engineers – London
IR stands for Insulation Resistance
IC stands for Iron Clad
IP stands for Ingress Protection
MCB stands for Miniature Circuit Breaker
MCCB stands for Moulded Case Circuit Breaker
MPCB stands for Motor Protection Circuit Breaker
ACB stands for Air circuit Breaker
CT stands for Current Transformer
PT stands for Potential Transformer
O/L stands for Over Load Relay
S/C stands for Short Circuit
SPP stands for Single Phasing Preventor
MV stands for Medium Voltage
SP stands for Single Pole
DP stands for Double Pole
TP stands for Triple Pole
TPN stands for Triple Pole and Neutral
FP stands for Four Pole
MDB stands for Main Distribution Board
DB stands for Distribution Board
SDB stands for Sub-Distribution Board
FDB stands for Final Distribution Board
MCC stands for Motor Control Centre
PCC stands for Power Control Centre
IS stands for Indian Standards
BIS stands for Bureau of Indian Standards
NEC stands for National Electrical Code
NBC stands for National Building Code of India
ECBC stands for Energy Conservation Building Code of India
BMS Building Management System
HVAC stands for Heating, Ventilation & Air Conditioning
NFPA stands for National Fire Protection Association of USA
PMC stands for Project Manager

SWG stands for Standard Wire Gauge
VFD stands for Variable Frequency Drive
PLC stands for Programmable Logic Controller
ATS stands for Automatic Transfer Switch

OLTC stands for On Load Tap Charger
EDO Electrically Operated Draw Out
MDO Manually Operated Draw Out
CPCB Stands for Central Pollution Control Board
BOQ Stands for Bill of Quantities (Schedule of Quantities)

6. TENDER DRAWINGS:

The tender drawings if enclosed with the tender documents are only for the purpose of guidance to the contractor. The exact level, location etc. is to be governed by the Architecture/ interior layouts. The data/ information provided in the tender drawings and documents are as exact as it could be secured, but its complete accuracy can not be guaranteed. The drawings indicate the general arrangement and broadly suggest the extent of work and route etc. Any change required to Co-ordinate this installation with other trades will have to be made without any extra cost to the owners. The contractor will have to assume and include everything from supply of material to its execution, testing & commissioning to make the job safe & complete in all respects as per rules & regulations, building codes & govt. approving agencies.

GOOD FOR CONSTRUCTION DRAWINGS (GFC's):

The details and data provided in "GFC" drawings is as exact and correct as it could be possible but its complete accuracy and correctness is not guaranteed. Every effort is made to make the drawings as per site conditions and the requirement of building codes but the electrical contractor has to check the accuracy and adequacy of "GFC" drawings before start of work. The contractor must study site conditions, understand Owner's requirement and also cross-check that the GFC drawings issued meet electrical codes, electrical safety and all govt. requirements or not. Contractor must also check the electrical earthing & lightning arrestor scheme for correctness and safety. Contractor must also check electrical SLD and calculate and cross-check load balancing on the Main LT Panel's different sections, switch gear rating and all the cable sizes. The electrical equipment layout plans must be checked for electrical safety and spacings as per electrical codes & requirement.

Any short coming noted in the design & GFC drawings and any variance from National Building codes, National Electrical code, Rules & Regulations of State Chief Electrical Inspectorate & Electrical supply company must be brought to the notice of the Architect/ Consultants/ Project Manager/ Owner in writing before the start of the work. The very purpose of preparation of shop drawings by contractor is to eliminate any error/ shortcoming in the design and the GFC's drawings prepared by the consultant.

SHOP DRAWINGS & FINAL WORKING DRAWINGS:

The Contractor after studying the Owner's requirement, site situation & constraints, specifications, schedule of quantities, tender drawings and good for construction drawings (if available or other wise) shall prepare and submit to Architects/ Project Manager/ Owner for comments/ approval on all the shop drawings & final working drawings required for completion of full job as per National Building Code, National Electrical Code, IEEE, requirement of Local Chief Electrical Inspectorate and the local electrical supply company including Owner's requirement. The contractor shall finally be responsible and accountable to Owner for correctness, accuracy, adequacy and safety of the complete electrical installation. The process of completing "The shop drawings & Final Drawings" shall be completed quickly with in the time frame of the project without causing any delay and before starting the actual execution work. No claims for extension of time shall be acceptable due to contractor's failure to produce right shop drawings at the right time in accordance with the approved programme of deliverables. All shop drawings to be prepared on the latest Architectural / Structural / Interior layouts, which are to be collected by the electrical contractor from the office of the Architect/Project Manager / Owner.

Following Shop Drawings & Final Working Drawings necessarily need to be prepared and submitted by the contractor:

a LIGHTING & POWER CONDUITING LAYOUTS & DB CHARTS:

Lighting & Power Conducting layout showing route with details on number, run & size of conduits, number of wires/ circuits to be carried thru conduits, location of junction boxes & pull boxes, circuit numbers, phase & load balancing of circuits, wire/ circuit/ point wire size sub main size. Complete DB Chart is to be submitted for each area/ Zone.

bLV CONDUITING LAYOUTS:

Conduiting layout of LV systems such as voice/ data/ intercom, MATV, CCTV Fire detection & alarm, Paging, public address, music and access control etc. showing route, layout, size of conduits, number of wires to be carried thru conduits, location of junction boxes & pull boxes etc. to be submitted.

c PANEL/ DISTRIBUTION BOARDS SHOP DRAWINGS:

Shop drawings/ GA drawings of all the panels/ distribution boards/ switch boards/ cabinets with SLD's and complete control wiring, power wiring and inter locking schemes and logics to be submitted.

d HT & LT EQUIPMENT LAYOUT:

Layout plans with dimensions, clearances for Panel rooms, Substation & DG set area, Electrical rooms and LT Panel room areas.

e BUS DUCTING LAYOUT:

Layouts of Bus ducting, its route with details of bends, fittings, supports and its co-ordination with other services.

f RISING MAINS LAYOUT:

Layouts of Rising Mains, route with details of bends, fittings, supports and its co-ordination with other services.

g CABLE TRAY/ TRENCH LAYOUT

Cable tray/ trench layouts with sizes of cable trays/ trenches, details on number/ run of various cables to be Laid on trays/ in trenches. Calculations showing cable tray sizing/ spacing need to be submitted with the cable tray/ trench layouts including cable tray supporting details. Complete cable schedule is also to be submitted.

h EARTHING LAYOUT

Earthing Layout of the complete installation showing all the earth details like size of earth tapes/ wires & materials for each equipment & routing of earth tapes/wires. Also layout of earth pits is to be submitted.

i LIGHTNING ARRESTOR LAYOUT

Lightning Arrestor Layout showing network of horizontal & vertical conductors, down takes, test boxes & earth pits location/ layout and sizing of earth tapes etc.

j.CONTROL SCHEMES AND INTER LOCKAING

Control Schemes and Inter Lockings for linkages with other systems such as BMS, HVAC & Fire Alarm / Paging Systems.

Drawings shall not be limited to the above only. All necessary drawings/ details required for satisfactorily execution of the job need to be included.

Electrical Contractor shall also to be Co-ordinating its drawings with other MEP Services & Site Plans before submitting to Owners/PMC.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

PRODUCT SAMPLES

Samples of the materials like conduits, accessories, switches, Sockets, wires & cables, light fixtures etc. shall be submitted to the Owners/ PMC prior to procurement. These will be submitted in two sets for approval and retention by Owners and shall be kept in their site office for reference and verification till the completion of the project.

MANUFACTURER'S CATALOGUES & DRAWINGS

Manufacturer's drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material to allow Architect/Consultant ample time for scrutiny.

TEST CERTIFICATES & TECHNICAL SUBMITTALS

Contractor shall submit to owners/Project manager, test certificates & technical data sheets of all the items covered in the scope of work before supply of the item.

MANUFACTURERS INSTRUCTIONS:

Where manufacturers have furnished specific instructions, relating to the materials used in this job and covering points not specifically mentioned in specifications & schedule of quantities, manufacturer's instructions shall be followed.

MATERIALS AND EQUIPMENT:

All materials and equipment shall be of the approved make and design. Unless otherwise called for only the best quality materials and equipment shall be used. The materials and equipment shall conform to relevant Indian standards. The contractor shall be responsible for the safe custody of all materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with a sample of each shall be submitted to the Architect / Consultant/ Project Manager / Owner's within 15 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical data giving sizes, particulars of materials and the manufacturer's name. At the time of the submission of proposed substitute the contractor shall state substitution be approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from the Architect/Consultants/ Project Manager / Owner's.

TOOLS AND TACKLES

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner/PMC.

CO-ORDINATION

Contractor shall fully Co-ordinate & render all necessary support and assistance to other contractors for completion of all MEP & Civil/Interior works to satisfaction & safety. This work will involve close Co-ordination with HVAC, BMS, Plumbing & Fire Fighting contractor including Civil contractor. Electrical contractor to ensure necessary safety linkages with AHU fire dampers & fire detection systems. Electrical contractor shall be fully responsible & accountable for these life safety linkages. Nothing extra can be claimed for this co-ordination support.

COMPLETION & AS BUILT DRAWINGS & DOCUMENTS:

On the completion of the work and before issuance of certificate of virtual completion, the contractor shall submit to the Architect/ Project Manager/ Owners/ Consultant five sets of “AS BUILT DRAWINGS & DOCUMENTS” drawn at approved scale.

- Contractor to submit a complete write-up of the electrical and LV system installed along with interlocking and safety schemes.
- All the shop drawings & final working drawings need to be converted into “AS BUILT” drawings based on actual executed conditions.
- Technical documents will also have the test certificates, test reports & IR results for all the electrical equipment/ material used in the installation, which will need to be submitted in proper folders. All the final DB charts shall also be included in the completion documents.
- Technical catalogues, operation & maintenance manuals of the all the products & equipment used in installation also to be submitted in proper folders. List of recommended spares is also to be furnished along with schedule of preventive maintenance is to be submitted as part of completion documents.
- All the “AS BUILT” drawings, test reports, test certificates & DB Charts must be signed and stamped by the contractors Engineer-in -Charge and the supervisor, who was responsible for the execution, testing & commissioning of the installation.
- Contractor shall be responsible for the correctness of the “AS BUILT DRAWINGS & DOCUMENTS” and shall sign & stamp them.

7. Taxes and Duties

In accordance with the provisions of The Central Goods and Services Tax Act, 2017, The Integrated Goods and Services Tax Act, 2017, The State Goods and Services Act, 2017 (respective State Act), The Union Territory Goods and Services Tax Act, 2017

and applicable Rules, Circulars, Notifications, Clarifications, etc. (as may be issued from time to time) ("GST"):

1)The Contractor hereby agrees and undertakes to pass on by way of commensurate reduction in Order Value due to (i) reduction in the rate of tax on any supply of goods and/or services and/or (ii) due to the benefit of Input Tax Credit under GST that may be available to the Contractor. In this regard, the Contractor agrees and undertakes to disclose all the requisite details of its Input Tax Credit to the Owner to enable to arrive at the said reduction in Order Value.

2)The Contractor agrees and undertakes to issue and furnish GST compliant Tax Invoice in a timely manner and also agrees and undertakes to upload on the GST website (GSTN) the requisite information as may be required in respect of the said Tax Invoice.

3)The parties hereby agree that the frequency of raising and furnishing Tax Invoice by the Contractor shall be every [mention here the frequency period, eg. monthly, fortnightly, every 15th of the month, etc. as the case may be].

4)The Contractor agrees and undertakes to make timely payment of tax under GST such that the Owner is able to claim Input Tax Credit in accordance with the provisions of GST in a timely manner. In this regard the Contractor agrees and undertakes to furnish copy of tax challan to the Owner as proof of payment of the said tax.

5)The Contractor agrees and undertakes that it shall take requisite steps such that there is no mismatch under GSTN in respect of the Tax Invoice raised and furnished by the Contractor to the Owner. Further, the Contractor agrees with the Owner that in case of any mismatch, the Contractor agrees and undertakes to rectify the mismatch and resubmit the revised / amended Tax Invoice / credit note to the Owner immediately prior to the next month's processing for GSTN uploading.

6)The Contractor agrees that the Owner would pay for the Tax Invoice after the confirmation of the entry without any mismatch on GSTN. Any queries in this regard should be settled between the parties before uploading the details in the GSTN.

7) IT-TDS & GST-TDS as applicable will be deducted from every Tax Invoice.

8. TESTS & TEST REPORTS

On completion of complete installation, contractor shall submit to PMC/ Owner a signed copy of test report of complete installation and assume full responsibility of its soundness and safety. All tests to be carried out in the factory before despatch of the material & all the expenses towards to and fro of the officials from Owner / PMC to the factory shall be borne by the Contractor. The site visits are not limited to the satisfactory performance of the Owner / PMC or as per IS mentioned in the tender. The no. of officials per visit shall be decided by the Owner and shall not exceed 5 no's for each visit.

Contractor shall physically inspect every material before installation and shall also carry out all necessary electrical tests such as:

- a. IR values of Panels, DB's, Boards, cabling, sub mains, circuit and point wiring.
- b. Checking and recording earth continuity, earth values of earthing pits and earthing conductor and entire earthing system and lightning arrestor system. Contractor shall be responsible for the adequacy of the earthing and lightning arrestor system and shall consider the changes in the BOQ as may be required but with the approval of the owners / PMC / site in-charge before execution.
- c. Testing of all the relays and testing of transformers, HT switchgear and DG set alternator.
- d. Checking all the terminations at panels, DB's and at lighting fixtures and socket outlets for tightness.
- e. It is to be ensured by the contractor and its staff that all wire connections / cable connections / lighting and socket connections are with proper sized lugs / thimbles.
- f. Contractor and its staff must follow good engineering practices.
- g. A complete log of all the tests shall be maintained for review of Project Manager / Owner / Consultant.
- h. Contractor shall assume full responsibility of correctness and validation of all the tests.

i. Any equipments / wire / cabling found faulty during testing carried out by contractor will be removed / replaced by healthy system / equipment by the contractor at its own cost.

o. Contractor shall assume full responsibility of safety of installation and shall be liable to owners for any loss / damage due to faulty equipment selection/ undersized equipment/ wrong design/ faulty installation / poor work-man-ship / poor quality.

k. It is contractor's responsibility to cross-check all the design and drawings before execution and assumes full responsibility for the correctness and adequacy of all the designs and drawings and shall be responsible and accountable to Owner for any deficiency and shortcomings in the system design/ product design.

9. List of Indian Standards (BIS)

The following list of the Indian Standards to be followed:

IS: 374 – 1979	Ceiling fans and regulators (3rd revision)
IS: 694 – 1990	PVC insulated Electric cable for working voltage upto and including 1100 volts.
IS: 732 – 1989	Code of practice for electrical wiring and installation
IS: 1255 – 1983	Code of Practice for installation and maintenance of Power Cables upto and including 33 KV rating (Second Revision)
IS: 1258 – 1987	Bayonet lamp holders (Third revision)
IS: 1293 – 1988	Three pin plugs and sockets outlets rated voltage upto and including 250 volts and rated current upto and including 160 amps.
IS: 1554 - 1988	PVC insulated (Heavy Duty) electric cables for working voltages upto and (Part - I) including 1100 volts.

IS: 1646 - 1982	Electrical installation fire safety of buildings (general) Code of practice.
IS: 1885 - 1971	Glossary of items for electrical cables and conductors.
IS: 1913 - 1978	General and safety requirements for fluorescent lamps luminaries Tubular.
IS: 2026 - 1977 to 81	Power Transformers (Part I to IV)
IS: 2071 - 1974 - 76	Methods of high voltage testing
IS: 2309 - 1989	Protection of building and allied structures against lightning
IS: 2551-1982	Danger notice plate.
IS: 3043 - 1987	Code of practice for earthing.
IS: 3480 - 1966	Flexible steel conduits for electrical wiring.
IS: 3837 - 1976	Accessories for rigid steel conduit for electrical wiring.
IS: 4146 - 1983	Application guide for voltage transformers
IS: 4615 - 1968	Switch socket outlets.
IS: 5133 - 1969	Boxes for the enclosure of electrical accessories.(Part -I)
IS: 5216 - 1982	Guide for safety procedures and practices in electrical work.(Part-I)
IS: 5424 - 1969	Rubber mats for electrical purposes.
IS: 5578 & 11353-1985	Marking and arrangement of bus bars
IS: 7098 - 1985	Cross linked polyethylene insulated PVC sheathed cables. For working (Part - II) voltages from 3.3 KV upto and including 33

KV

IS: 8130 - 1984	Conductors for insulated electric cables and flexible cords
IS: 8623 -1977	Factory built assemblies of switchgear and control gear for voltages upto (Part -I) and including 1000 V AC and 1200 V D C.
IS: 8623 - 1980	Bus Bar trunking system(Part -II)
IS: 8828 - 1996	Miniature Circuit Breakers
IS: 9537 - 1981	Rigid Steel Conduits for electrical wiring (Second Revisions)
IS: 10810 - 1988	Methods of test for cables.
IS: 12640 - 1988	Earth Leakage Circuit Breakers
IS: 13947-1993	Air Circuit Breakers(Part-II)
IS: 13947-1989	Moulded Case Circuit Breakers
IS: 13947 - 1993	Degree of protection provided by enclosures for LV switchgear and control gear.
IS: 13947 - 1993	General requirement for switchgear and control gear for voltage not exceeding 1000 Volts.
IS: 1651 & 1652 1991	Stationary cells and batteries lead acid type.
IS: 13779	Digital measuring instrument and testing accessories.
IS: 7098	XLPE Insulated HR PVC Sheathed Aluminum Conductor Armoured./ (Part 1) UnArmoured Cable.
IS: 3854 - 1997	Switch Modules
IS: 1293 - 1998	Socket Modules

Note:- 1. Follow relevant (amended upto date) Indian Standards in case the listed above are found not to be latest/upto date.

2. If codes of any/some of items are not written above, it is essential that relevant BIS Codes for these items are to be referred to.

10. Contract Performance Guarantee & Warranty Bond

The successful Contractor shall have to submit the contract Performance guarantee in the form of a Bank Guarantee for an amount of 10% of the total Contract Price to cover the entire Contract Period plus 1 (one) month. The Bank Guarantee to be issued by Scheduled Private Bank (covering the Contract Period) .

The above Bank Guarantee, to be submitted by Contractor for the above mentioned period, is for the faithful performance of the contract.

The Performance Guarantee shall cover additionally the following guarantees to the Owner:

- a) The successful Contractor guarantees the successful and satisfactory operation of the equipment furnished and erected under the Contract, as per the specifications and documents.
- b) The successful Contractor further guarantees that the equipment provided by him/his sub-vendors and installed by him shall be free from all defects in design, material and workmanship and shall upon written notice from the Owner fully remedy free of expenses to the Owner such defects as developed under the normal use of the said equipment within the period of guarantee.

In the event of non-compliance or breach by the Contractor of the above, the Owner, in addition to any other rights that it may have, shall be entitled to invoke the Bank Guarantee, as it may deem necessary.

The Contractor shall furnish within 7 (seven) days of Taking Over, the Warranty Bond, in the form of Bank Guarantee for an amount of 10% of the total Contract Price to cover the entire Defect Liability period plus 1 (one) month. The Bank Guarantee to be issued by Scheduled Private Bank (covering the Defect Liability Period). In case of non-submission of the Warranty Bond within 7 days of Taking over, the Owner shall encash the Contract Performance Guarantee. The Owner shall return the Contract

Performance Guarantee if the Contractor submits the Warranty Bond to the Owner within stipulated time period mentioned above.

Guarantee and Liabilities

11. Contractor's Warrantee

The Contractor shall assure, represent, warrant, guarantee and undertake that from the Taking Over by the Owner, till the expiry of the Defect Liability period, the whole project, in accordance with the Contract documents shall be free from defects in material/equipment and workmanship for a period of twelve (12) calendar months. In addition to the terms and conditions of the contract, the Contractor's liability shall be limited to the replacement of any defective parts in the equipment of his own manufacture or those of his Sub-Contractors under normal use and arising solely from faulty design, materials and/or workmanship provided always that such defective parts are repairable at the site and are not in meantime essential in the commercial use of the equipment. Such replaced/defective parts shall be returned to the Contractor unless otherwise agreed.

If it becomes necessary for the Contractor to replace or renew any defective portions of the works the provision of this clause shall apply to portion of the works so replaced or renewed until the expiry of twelve (12) months from the date of such replacement or renewal or the Defects Liability Period, whichever is longer. If any defects are not remedied within a reasonable time, the Owner may proceed to do the work at the Contractor's risk and cost but without prejudice to any other rights which the Owner may have against the Contractor in respect of such defects.

The repaired or new parts will be furnished and erected free of cost by the Contractor. If any repair is carried out on the Contractor's behalf at the site, the Contractor shall bear the cost of such repairs.

The cost of any special or general overhaul rendered necessary during the maintenance period due to defects in the equipment or defective work carried out by the Contractor, the same shall be borne by the Contractor.

The acceptance of the equipment by the Owner shall in no way relieve the Contractor of his obligations under the Work Order.

In the case of those defective parts, which are not repairable at site but are essential for the commercial operation of the equipment, the Contractor and the Owner shall mutually agree to a programme of replacement or renewal, which will minimize interruption to the maximum extent in the operation of the equipment.

At the end of the guarantee period, the Contractor's liability ceases except for latent defects. For latent defects, the Contractor's liability as mentioned above, shall remain till the end of 5 years from the date of completion of Defect Liability Period. In respect of goods supplied by Sub-Contractors to the Contractor where a longer defect liability period is provided by such Sub-Contractor, the Owner shall be entitled to the benefits of such longer defect liability period.

12. Statutory Approvals:

The Contractor shall take all necessary approvals required for completing the Scope of Work under the Contract which shall not be restricted to Clearance required to be obtained from Electrical Inspector.

13. Time Schedule

The basic consideration and the essence of the Contract shall be strict adherence to the time schedule for performing the specified works. The Owner's requirements of completion schedule for the Works are mentioned in the Schedule below.

Work Completion Schedule

Sr. No.	Description of Activity	Time Schedule from execution of the Work Order
1	Despatch of Equipment's	2 months from execution of the Work Order
2	Installation & Commissioning of the Equipment's	4 months from execution of the Work Order

The owner reserves the right to request for a change in the work schedule during pre-award discussions with Contractor. The Contractor will be required to prepare detailed PERT Network/ detailed M.S. Project Bar chart and finalise the same with the Owner as per the requirement mentioned in Clause "Time- The essence of Contract"

14. Time- The essence of Contract

The time and the date of completion of the Contract as stipulated in the Contract by the Owner without or with modifications, if any, and so incorporated in the Letter of Award, shall be deemed to be the essence of the Contract. The Contractor shall so

organize his resources and perform his work as to complete the same not later than the date agreed to.

The Contractor shall submit a detailed PERT network/bar chart consisting of adequate number of activities covering various key phases of the work such as design, procurement, manufacturing, shipment and field erection activities within fifteen (15) days of the execution of the Work Order. This network shall also indicate the interface facilities to be provided by the Owner and the dates by which such facilities are needed. The Contractor shall discuss the network so submitted with the Owner, and the mutually agreed network shall form part of the Contract. During the performance of the Contract, if in the opinion of the Engineer, proper progress is not maintained, suitable changes shall be made in the Contractor's operations to ensure proper progress without any cost implication to the Owner. The interface facilities to be provided by the Owner in accordance with the agreed network shall also be reviewed while reviewing the progress of the Contractor.

Based on the above agreed network/bar chart fortnightly reports shall be submitted by the Contractor as directed by the Engineer.

Subsequent to the finalization of the network, the Contractor shall make available to the Engineer a detailed manufacturing programme in line with the agreed Contract network.

Such manufacturing programme shall be reviewed, updated and submitted to the Engineer every month thereafter.

The above bar charts/manufacturing programme shall be compatible with the Owner's computer environment and furnished to the Owner on such media as may be desired by the Owner.

If the Owner deems that the Contractor is not progressing according to the mutually agreed PERT network, the Owner reserves the right to get the work executed through any other agency at the risk & cost of Contractor without assigning any reason(s) and/or notice.

15. Liquidated Damages for Delay

The Contractor should note that the completion time allowed for carrying out the work should be strictly observed. Any delay in completing the commissioning of the

Project shall be subject to the Liquidated Damages at the rate of 1% of the total Contract Price per week or part thereof, with a ceiling of 10 % of the total Contract Price.

The Owner reserves the right to recover the Liquidated Damages applicable against this contract from the bills payable or from the Bank Guarantee submitted with the Owner.

The Contractor shall have to supply all materials to match with the erection activities as per the PERT Network.

Equipment and materials will be deemed to have been delivered only when all its components, parts are also delivered. If certain components are not delivered in time the equipment and materials will be considered as delayed until such time the missing parts are also delivered.

For the purpose of Liquidated Damages, contractual obligation shall be completion of all supply and erection activities as per time schedule & value of these contracts shall be "Contract Value" for the working of Liquidated Damages.

16. Delays by Owner or his authorized agents

In case the Contractor's performance is delayed due to any act of omission on the part of the Owner or his authorized agents, then the Contractor shall be given due extension of time for the completion of the Works, to the extent such omission on the part of the Owner has caused delay in the Contractor's performance of the Contract. Regarding reasonableness or otherwise of the extension of time, the decision of the Owner shall be final.

In addition, the Contractor shall not be entitled to any claim whether demonstrable or reasonable compensation if such delays have resulted in any increase in cost.

17. Terms & Mode of Payment

- 60% of the Contract Price shall be paid on pro-rata basis against the receipt of materials at site against Invoice.
- 10% of the Contract Price shall be paid on the installation.

- 30% of the Contract Price shall be paid on the testing, commissioning & Taking Over of the entire Electrical works and acceptance of Electrical system by the Owner.

(A) Domestic Purchase

Bills will be paid within 45 days after submission of the invoice along with the other document as listed in the work order, through RTGS after deducting Tax Deducted at Source (TDS) as applicable.

Or

In case the Contractor opts for payment through Letter of Credit (L/C), the Owner shall open Irrevocable L/C for 100% of the Contract Price with interest free period of 90 days. The said L/C shall be established in favour of Contractor within 30 days after providing the approved drawings & designs to the Owner. The L/C shall be established in tranches depending upon the delivery schedule of various components as mutually agreed between the Owner and the Contractor.

(B) Import

In case of imports/overseas purchase, the Owner will open Irrevocable Letter of Credit with 45 days interest free credit period for the portion of the material which is to be imported.

18. Due dates for Payment

The owner shall make progressive payment as and when the payment is due as per the terms of payment set forth. Payment shall become due and payable by the Owner within forty five (45) days from the date of receipt of the Contractor's bill/ invoice/ debit note by the Owner provided the documents submitted are clear and complete in all respects.

19. Interest on delayed payments

If the owner has delayed payments beyond fifteen (15) days after the due date, interest shall be paid to the Contractor for each day of delay at the rate of 10% per annum from the date of expiry of 15 (fifteen) days till the date of payment by the Owner.

20. Demurrage/ Wharfage/ Warehouse charges, etc.

All demurrage, wharfage and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the Contractor.

It will be the responsibility of the Contractor to obtain clear Railway Receipt/ Lorry Receipt and allied documents in order to avoid any difficulty while clearing/ taking delivery of the materials.

21. Taking delivery and insurance

The Contractor has to keep materials in safe custody and transport to the Site and will be fully responsible for any damage to or loss of all materials at any stage during transportation or erection till Taking Over of the system by the Owner.

The Contractor has to open site store and ensure for safe custody of all the stored materials at his own cost.

The Contractor shall have total responsibility for the entire materials stored, loose, semi assembled and/or erected by it at site in its custody. The Contractor shall make suitable security arrangements at his own cost to ensure the protection of all materials, equipment and works from theft, fire pilferage and any other damages and loss. It shall be the responsibility of the Contractor to arrange for security till the works are finally taken over by the Owner.

22. Insurance

The Contractor at his cost shall arrange, secure and maintain all insurance as may be pertinent to the transit, storage, erection of the materials (cost to the extent of 110% cost of the system) and commissioning of the works up to the time of Taking Over of the system, which shall fully protect his interest and interests of the Owner against all perils detailed herein for the Contract Period. The form and the limit of such insurance as stated herein together with the under-writer in each case shall be as deemed necessary by the Owner. However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage at all time during the period of Contract shall be of Contractor alone. The proof of insurance policy taken by the Contractor shall be furnished to Engineer. In absence of the above insurance policy, payments to be made by the Owner will be withheld at its' sole discretion. The Contractor's failure in this regard shall not relieve him of any of his contractual responsibilities and obligations. The insurance covers to be taken by the Contractor shall be in the name of the Contractor. The Contractor shall deal directly with Insurance Company or Companies

and shall be responsible in regard to maintenance of all insurance covers. Further, the insurance should be in freely convertible currency.

Any loss or damage to the equipment during handling, transportation, storage, erection, putting into satisfactory operation and all activities to be performed till the successful completion of commissioning of the equipment shall be to the account of the Contractor. The Contractor shall be responsible for preference of all claims and make good the damages or loss by way of repairs and/or replacement of the equipment, damaged or lost. In the event of any damage, theft, loss, pilferage, fire etc., Contractor will be responsible to lodge, pursue and settle all the claims with the Insurance Company for all items, materials and the Owner shall be kept informed about it. The Contractor shall replace the lost / damaged materials / items promptly irrespective of the settlement of the claims by underwriter and ensure that the work progress is as per agreed schedule. The loss, if any, such replacement will have to be borne by the Contractor and Owner will not entertain any claim / representation in this regard. However it will be Contractor's responsibility to insure the entire project till the S/S is taken over by the Owner. The transfer of title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The Contractor shall provide the Owner with copy of all insurance policies and documents taken out by him in pursuance of the Contract. Such copies of documents shall be submitted to the Owner immediately after such insurance coverage. The Contractor shall also inform the Owner in writing at least sixty (60) days in advance regarding the expiry/cancellation and/or change in any of such documents and ensure revalidation, renewal, payment of premiums, etc., as may be necessary well in time.

The perils required to be covered under the insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (erection risks) workman compensation risks, loss or damage in transit, theft, pilferage, earth quake, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds, etc. The scope of such insurance shall be adequate to cover the replacement/reinstatement cost of the equipment for all risks up to and including delivery of goods and other costs till the equipment is delivered at Site. The insurance policies to be taken should be on replacement value basis and/or incorporating escalation clause. Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the Contractor shall be liable to make good the full replacement/rectification value of all equipment/materials and to ensure their availability as per project requirements.

All costs on account of insurance liabilities covered under the Contract will be on Contractor's account and will be included in Contract Price, However, the Owner may from time to time, during the pendency of the Contract, ask the Contractor in writing to limit the insurance coverage, risks and in such a case, the parties to the Contract will reduce the Contract price to the extent of premium reduced. The Contractor, while arranging the insurance shall ensure to obtain all discounts on premium which may be available for higher volume or for reason of financing arrangement of the project.

This clause covers the additional insurance requirements for the portion of the works to be performed at the Site.

23. Contract Quality assurance:

Within 10 days after Award of Contract, the detailed Quality Assurance Programme to be followed for the execution of the Contract will be mutually discussed and agreed and such agreed Programme shall form a part of the Contract.

The Contractor shall clearly specify the list of sub-vendors from whom the bought out items are being supplied. Such details shall be accompanied by their list of previous supplies made performance reports etc. However before placement of award in case of specific approval shall be obtained from the Owner for the Contractor supplied materials. The Quality Assurance Program (as per clause 1.13.5 of Section 2) shall be furnished for each material separately for approval.

24. Erection, Lifting & shifting, Tools And Tackles:

The Contractor under a separate schedule, in his proposal shall include a list of all-special equipment tools & tackles etc. which he proposes to bring to site for the purpose of erection, lifting & shifting, handling, testing and commissioning including performance and guarantee tests of the equipment. However such tools tackles brought to the site for purpose of erection, handling, testing & commissioning shall remain property of the Contractor and can be taken back after completion of the work.

25. Contract Documents

The term Contract Documents shall mean and include the following which shall be deemed to form an integral part of the Contract in the following Order of Priority:

- a) Work Order
- b) Technical Specifications & BOQ as per format J2

- c) Special Condition of Contract
- d) General Conditions of Contract

Some of the Conditions of Contract are included in Special Conditions of Contract as well as General Conditions of Contract. For the purpose of this Contract, such conditions as stipulated in Special Conditions of Contract will prevail upon the provisions in General Conditions of Contract.

Notwithstanding anything contained herein or elsewhere, in the event of any conflict between the above mentioned documents the matter shall be referred to the Engineer of the Owner whose decision shall be considered as final and binding upon the parties.

26. Use / Confidentiality of Contract documents and information

The Contractor shall not, without obtaining the Owner's prior written consent, disclose the terms of this Contract, or any provision thereof, or any past, present or future data or know-how or information or intellectual property, including but not limited to specification, plan, drawing, pattern, sample or information furnished by or on behalf of the Owner (whether tangible or intangible), or techniques, designs, engineering, prototyping, finances & financial data, and other materials whether created or produced by and/or on behalf of the Owner or is otherwise acquired in anticipation of, during, or as a result of, or in any way connected with this Contract as disclosed to the Contractor by the Owner ("**Confidential Information**"), to any person other than a person employed / hired / contracted, as the case maybe, by the Contractor in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for the purpose of such performance.

The Contractor shall not, without the Owner's prior written consent, make use of any document or information enumerated in various Contract documents except for the purpose of performing the Contract. The Contractor shall keep the Confidential Information confidential, to not disclose the same and to safeguard the Confidential Information in the same manner that the Contractor treats its' own confidential information of like kind, but not less than a reasonable degree of care.

The Contractor shall not communicate in advertising, publicity, sales releases or in any other medium, photographs or other reproduction of the Works under this Contract,

or descriptions of the site, dimensions, quantity, quality or other information, concerning the works unless prior written permission has been obtained from the Owner.

Any document, other than the Contract itself, enumerated in various Contract documents shall remain the property of the Owner and shall be returned (in all copies) to the Owner on completion of the Contractor's performance under the Contract if so required by the Owner.

27. Power to vary or omit work

No alterations, amendments, omissions, suspensions or variations of the works (hereinafter referred to as 'Variation') under this Contract as detailed in the Contract Documents. Such variations unless otherwise specified, shall not be subjected to any limitation for the individual items but the total variations in all such items under the Contract shall be limited to the extent of 20% (Twenty Percent) of the Contract Price by way of suitable amendment to the contract. The Variation shall be made by the Contractor as directed in writing by the Owner as follows:

- a. The Owner shall issue an addendum to the Work Order stating the estimated increase / decrease in the Contract Price / quantity / etc. as the case maybe;
- b. The Contractor shall revert with comments / revisions to the addendum within a period of 15 (fifteen days), failing which it shall be deemed to be accepted and the Contractor shall be bound by it;
- c. If the Contractor has reverted as stated in clause (b) above, then the parties shall mutually agree for the same based on estimates / inputs / discussions of the parties within a period of 15 days;
- d. Failure to carry out the work as per the addendum [as accepted or as deemed to be accepted as per clause (b)], shall result in a breach by the Contractor of the Section 27 below.

However, (a) the Unit Price quoted by the Contractor shall remain unchanged and (b) the work shall continue to be carried on irrespective of any deadlock / dispute between the parties.

The Contractor shall carry out such Variation and be bound by the same conditions as far as applicable as though the said variations occurred in the Contract Documents.

The Owner shall not become liable for payment of any charges in respect of any such variations, unless the instructions for the performance of the same shall be confirmed in writing or ratified at a later date by the Owner.

As this is an Engineering Procurement Construction (EPC) contract, design will be done by the Contractor. As also all responsibility relating to the material will be that of the Contractor.

28. Packing, Forwarding and Shipment

The Contractor, wherever applicable, shall after proper painting, pack and crate all equipment in such a manner as to protect them from deterioration and damage during rail and road transportation to the Site and storage at the Site till the time of erection. The Contractor shall be held responsible for all damages due to improper packing.

The Contractor shall notify the Owner of the date of each shipment from his works, and the expected date of arrival at the Site for the information of the Owner.

The Contractor shall also give all shipping information concerning the weight, size and content of each packing including any other information the Owner may require.

The following documents shall be sent by courier to the Owner within three days from the date of shipment:

- Packing list
- Pre-despatch clearance certificate, if any
- Test Certificate, wherever applicable
- Insurance Certificate

The Contractor shall prepare detailed packing list of all packages and containers, bundles and loose materials forming each and every consignment despatched to Site. The Contractor shall further be responsible for making all necessary arrangements for loading, unloading and other handling right from his works up to the Site and also till the equipment is erected, tested and commissioned. The Contractor shall be solely responsible for proper storage and safe custody of all equipment.

29. Taking Over

Upon (a) successful completion of all the tests and commissioning by the Contractor along with submission of the test reports; and (b) receipt of charging permission from Electrical Inspector, the Owner shall issue to the Contractor a Taking Over Certificate (TOC) as a proof of the acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Owner delay the issuance thereof on account of

minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issue of such certificate.

30. Liability for accidents and damages

Under the Contract, the Contractor shall be responsible for loss or damage to the plant until the issuance of Taking Over Certificate by the Owner.

31. Contractor's Default

If the Contractor shall neglect to execute the works with due diligence and reasonable level of care or shall refuse or neglect to comply with any instructions given to him, in writing by the Engineer in connection with the works or shall contravene the provisions of the Contract, the Owner may give notice in writing to the Contractor to make good the failure, neglect or contravention complained of. Should the Contractor fail to comply with the notice within thirty (30) days from the date of serving the notice, then and in such case the Owner shall be at liberty to employ other workmen and forthwith execute such part of the works as the Contractor may have neglected to do or if the Owner shall think fit, without prejudice to any other right he may have under the Contract to take the work wholly or in part out of the Contractor's hands and recontract with any other person or persons to complete the works or any part thereof and in that event the Owner shall have free use of all Contractor's equipment that may have been at the time on the Site in connection with the works without being responsible to the Contractor for fair wear and tear thereof and to the exclusion of any right of the Contractor over the same, and the Owner shall be entitled to retain and apply any balance which may otherwise be due on the Contract by him to the Contractor, or such part thereof as may be necessary, to the payment of the cost of executing the said part of the Works or of completing the Works as the case may be. If the cost of completing of works or executing part thereof as aforesaid shall exceed the balance due to the Contractor shall pay such excess amount. Such payment of excess amount shall be independent of the liquidated damages for delay which the Contractor shall have to pay if the completion of works is delayed.

In addition, such action by the Owner as aforesaid shall not relieve the Contractor of his liability to pay liquidated damages for delay in completion of works.

Such action by the Owner as aforesaid the termination of the Contract under this clause shall not entitle the Contractor to reduce the value of the Contract Performance

Guarantee nor the time thereof. The Contract Performance Guarantee shall be valid for the full value and for the full period of the Contract .

32. Termination of Contract on Owner's Initiative

The Owner reserves the right to terminate the Contract either in part or in full due to reasons other than those mentioned under clause entitled 'Contractor's Default'. The Owner shall in such an event give fifteen (15) days notice in writing to the Contractor of his decision to do so.

The Contractor upon receipt of such notice shall discontinue the work on the date and to the extent specified in the notice, make all reasonable efforts to obtain cancellation of all orders and Contracts to the extent they are related to the work terminated and terms satisfactory to the Owner, stop all further sub-contracting or purchasing activity related to the work terminated, and assist Owner in maintenance, protection, and disposition of the works acquired under the Contract by the Owner.

In the event of such a termination the Contractor shall be paid compensation, equitable and reasonable, dictated by the circumstances prevalent at the time of termination.

If the Contractor is an individual or a proprietary concern and the individual or the proprietor dies and if the Contractor is a partnership concern and one of the partners dies then unless the Owner is satisfied that the legal representatives of the individual Contractor or of the proprietor of the propriety concern and in the case of partnership, the surviving partners, are capable of carrying out and completing the Contract, the Owner shall be entitled to cancel the Contract as to its in completed part without being in any way liable to payment of any compensation to the estate of deceased Contractor and/or to the surviving partners of the Contractor's firm on account of the cancellation of the Contract. The decision of the Owner that the legal representatives of the deceased Contractor or surviving partners of the Contractor's firm cannot carry out and complete the Contract shall be final and binding on the parties. In the event of such cancellation the Owner shall not hold the estate of the deceased Contractor and/or the surviving partners of the estate of the deceased Contractor and/or the surviving partners of the Contractor's firm liable to damages for not completing the Contract.

33. Reconciliation of Accounts

The Contractor shall prepare and submit every two months, a statement covering payments claimed and the payments received vis-à-vis the works executed, for

reconciliation of accounts with the Owner. The Contractor shall also prepare and submit a detailed account of Owner Issue materials ,if applicable, received and utilized by him for reconciliation purpose in a format to be discussed & finalized with the Owner before the award of Contract.

34. Workman's Compensation Fund and Employer's Liability Insurance

The Contractor shall cover all his employees / sub-contractors / workers / sub-vendors under workmen's compensation and under the liability insurance as per applicable provisions. The Owner shall not be responsible for any payments of compensation or otherwise to the workers/supervisor / sub-contractors / employees / sub-vendors / personnel of the Contractor for fatal or non-fatal accidents during the pendency of the contract or arising due to the works carried out under the Contract.

The Contractor shall employ adequate number of experienced skilled at site for daily supervision and for maintenance of various registers and records required under the law and contract. No payment for supervision shall be admissible.

35. Contractor to indemnify the Owner

The Contractor shall Indemnify the Owner and every member, officer and employee of the Owner, Engineer and his staff against all acts, actions, proceedings, claims, demands, costs, litigations, losses and expenses whatsoever, arising due to any act of omission or commission by the Contractor & out of or in relation to the matters referred herein or elsewhere. The Owner shall not be liable for intervention of any authority for or in respect of performance of its' obligation under the Contract Documents. The Owner shall not be liable for or in respect of or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or his Sub-Contractor and the Contractor shall indemnify and keep indemnified the Owner against all claims, demands, proceedings, cost, charges and expenses whatsoever in respect thereof or in relation thereto. The aggregate liability for indemnifying the Contractor to the Owner under this Contract are limited up to the total Contract Price. The aforesaid claims shall be communicated by the Owner to the Contractor within a reasonable period from the receipt of the same by the Owner.

36. Import licence

The domestic Contractors should note that import licence for importing any components or assemblies or raw materials or finished products from any country or any foreign collaborator or associate or sub-vendor, etc. will have to be arranged by

the Contractor itself. The Owner will only issue a certificate, if required and if the Owner is empowered to issue such a certificate as per law, to obtain the import licence at the request of the Contractor. The Contractor shall give advance notice for issuing such certificate.

The foreign Contractor should note that he will complete the formalities to import the material on the Owner's behalf according to the laws prevalent at that time without any financial liabilities to the Owner.

In the event of any application of the Custom and Excise Duty due to change/abolition of the Deemed Export Benefits (DEB) within contractual delivery period, the Owner shall reimburse the same to the Contractor at actual on submission of documentary proof of such payments having been made. The Contractor must specify in their bid the import content (quantity and value wise) and the item number in the Customs Manual under which the raw material/ finished goods (directly dispatchable to site) are envisaged to be imported by him. However, in case Customs/Excise Duty, if any, is applicable due to change/abolition of DEB beyond the original contractual delivery/ project completion period, the same shall be borne by the Contractor and the Owner will not pay/ reimburse any such customs and Excise Duty.

The said works is to be carried out in notified SEZ Area hence the Owner is eligible for the benefits of getting exemption of Excise duty, Customs duty, CST and Service Tax. In the event, the Contractor choose to purchase any material from the overseas, necessary purchase orders to the manufacturers of overseas will be issued by the owner directly. However, all the exemptions has to be passed to the Owner. Hence Contractor will have to consider the costs implications of such benefits while submitting the price bid.

37. Access to Site and Works on Site

Suitable access to and possession of the Site shall be afforded to the Contractor by the Owner in reasonable time.

The works so far as it is carried out on the Owner's premises, shall be carried out at such time as the Owner may approve and the Owner shall give the Contractor reasonable facilities for carrying out the works.

In the execution of the works, no person other than the Contractor or his duly appointed representative, Sub- Contractor and workmen, shall be allowed to do work on the Site, except by the special permission, in writing of the Engineer or his representative.

38. Contractor's Site Establishment

The Contractor shall at all times keep posted an authorized representative for the purpose of the Contract. Any written order or instruction of the Engineer or his duly authorized representative shall be communicated to the said authorized resident representative of the Contractor and the representative shall be available at a stated address for this purpose.

39. Discipline of Workmen

The Contractor shall adhere to the disciplinary procedure set by the Engineer in respect of his employees and workmen at Site. The Engineer shall be at liberty to object to the presence of any representative or employee of the Contractor at the Site, if in the opinion of the Engineer such employee has misconducted himself or is incompetent or negligent or otherwise undesirable and then the Contractor shall remove such a person objected to and provide in his place a competent replacement.

40. Contractor's Field Operation

The Contractor shall keep the Owner informed in advance regarding his field activity plans and schedules for carrying-out each part of the works. Any review of such plan or schedule or method of work by the Engineer shall not relieve the Contractor of any of his responsibilities towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Owner or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.

The Contractor shall have the complete responsibility for the conditions of the Worksite including the safety of all persons employed by him or his Sub-Contractor and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of the Contract and shall not be limited to normal working hours.

41. Progress Report

The Contractor shall furnish three (3) copies of the Monthly Progress Report to the Owner by 5th of every month to report the progress made in previous month.

The monthly progress report detailing-out the progress achieved on all erection activities shall highlight comparison to the schedules. The report shall also indicate the reasons for the variance between the scheduled and actual progress and the action proposed for corrective measures, wherever necessary. The report should also include photographs of actual progress of works at site.

42. Facilities to be provided by the Owner

1. Space

Land for Contractor's Store, Workshop etc.

a) The Engineer shall at his discretion and for the duration of execution of the Contract make available at site, land for construction of Contractor's field office, workshop, stores, etc. required for execution of the Contract. Any such temporary construction shall be done by the Contractor at his cost.

b) On completion of work the Contractor shall hand over the land duly cleaned to the Engineer. Until and unless the Contractor has handed over the vacant possession of land allotted to him for the above purpose, the payment of his final bill shall not be made.

2. Electricity & Water

The Contractor shall arrange power supply at his own cost from the concerned distribution licensee at single point during the execution of the Contract. The owner shall provide required water at single point during the execution of the Contract.

43. Facilities to be provided by the Contractor

1. Tools, tackles and scaffoldings

The Contractor shall provide all the construction equipments; tools, tackles and scaffoldings required for pre-assembly, erection, testing and commissioning of the equipment covered under the Contract. He shall submit a list of all such materials to the Engineer before the commencement of work at Site. These tools and tackles shall not be removed from the Site without the written permission of the Engineer.

2. First-aid

The Contractor shall provide necessary first-aid facilities for all his employees, representatives and workmen working at the Site. Enough number of Contractor's personals shall be trained in administering first-aid.

44. Cleanliness

The Contractor shall be responsible for keeping the entire area allotted to him clean and free from rubbish, debris etc. during the period of Contract. The Contractor shall employ enough number of personnel to keep the work area clean. Materials and stores shall be so arranged to permit easy cleaning of the area. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil proof sheet shall be provided to protect the floor from such damage.

45. Security

The Contractor shall have total responsibility for all equipment and materials in his custody/stores, loose, semi-assembled and/or erected by him at Site. The Contractor shall make suitable security arrangements ensure the protection of all materials, equipment and works from theft, fire, pilferage and any other damages and loss.

46. Contractor's Representations and Warranties

The Contractor declares, assures, warrants and represents as follows:

- (a) The Contractor has full legal right, power and authority to enter into, execute and deliver this Contract and to perform the obligations, undertakings and transactions set forth herein, and this Contract has been duly and validly executed and delivered by the Contractor and constitutes a legal, valid and binding obligation, enforceable against it in accordance with the terms contained herein;
- (b) The Contractor undertakes that it shall not infringe any third party Intellectual Property Rights whilst carrying out the works;
- (c) The Contractor represents to Owner that it has requisite skills, knowledge and experience to provide the Services and the deliverables in accordance with the requirements stated in this Agreement;

- (d) The Contractor represents that the terms of this Contract do not constitute a breach of any obligation by which it is bound whether arising by contract or operation of law;
- (e) This Contractor constitutes a valid and binding obligation on the Contractor enforceable in accordance with its terms;
- (f) Each of the representations, warranties and undertaking shall be construed as a separate representation, warranty, covenant or undertaking, as the case may be, and shall not be limited by the terms of any other representation or warranty or by any other term of this Agreement;
- (g) The Contractor hereby acknowledges that time is the essence for the performance of the terms of this Agreement and that timely delivery of the works is imperative for the successful implementation of the Project;
- (h) The Contractor expressly agrees that the Representations, Warranties and Undertakings contained herein above shall survive the termination of this Agreement, and such representatives, warranties and undertakings, as may be required for the purpose shall be binding even after the completion of the term and or earlier determination of the Agreement;
- (i) The Contractor shall carry out the works a manner consistent with the professional skill and care ordinarily exercised by the contractors that work on projects internationally of a comparable nature to the works described herein.
- (j) The Contractor undertakes, warrants and guarantees that it has sufficient staff and knowledge to fulfil the its' obligations under this Agreement.

47. Anti Corruption Policy

- (a) The Contractor will abide by and comply with the conditions of the Anti-Corruption Policy (see website "<http://mindspaceindia.com/images/new-images/Policies/Anti-Corruption-Policy.pdf>" for the complete Anti-Corruption Policy), as a binding obligation under this Contract. For the purpose compliance with the Anti-Corruption Policy by the Contractor" and the Anti-Corruption Policy will be read accordingly.

- (b) All invoices of the Contractor must be accompanied with the following certification, duly signed by the authorized signatory of the Contractor :

"We _____, hereby confirm that as per the terms of the Agreement / PO / WO dated _____, we have completely implemented and adhered to the Anti-Corruption Policy (Annexure "___" thereto) in respect to our business and indemnify and agree to keep M/s KRC INFRASTRUCTURE & PROJECTS PRIVATE LIMITED indemnified for any damages to M/s KRC INFRASTRUCTURE & PROJECTS PRIVATE LIMITED for the violation of same."

- (c) The Contractor shall promptly notify the Owner of any violation or potential violation of the Anti-Corruption Policy, and shall be responsible for any damages to the Owner for the violation of same. Any violation of Anti-Corruption Policy may lead to termination of all business connections with the Contractor.

48. Relationship

- (a) None of the provisions of this Contract shall be deemed to constitute or create the relationship of employer and employee, principal and agent, partnership, joint venture, franchisee or franchisor, or any other fiduciary relationship/association between the Parties and/or any of hereto and neither Party shall have any authority to bind or shall be deemed to be the agent of the other in any way. The Parties intend, and the Contractor acknowledges, that the Contractor will remain throughout the term of this Contract, as an independent contractor. Accordingly, the Contractor agrees that the Contractor and/or its employees/personnel will not be qualified to participate in nor be entitled to worker's compensation, retirement, insurance, leave or other benefits afforded to employees of the Owner.
- (b) The relationship between the parties under this Contract is on a principal-to-principal basis and nothing contained herein shall be construed as constituting any relationship of agency, partnership, joint venture or sharing of profits.

49. Severability

Whenever possible, each provision of this Contract shall be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Contract should be prohibited or invalid under applicable law, such provision shall be ineffective to the extent of such prohibition or invalidity without invalidating the remainder of such provision or the remaining provisions of this Contract. In such event, the Parties shall negotiate, in good faith, a valid, legal and enforceable substitute provision, which most nearly affects the Parties' intent in entering into this Contract.

50. Survival

Where the purpose and the text of a provision in this Contract clearly indicate intent to survive termination of this Contract, such provisions shall survive the termination of this Contract.

51. Arbitration

If any dispute arising between the Parties is not settled within fifteen (15) days of commencement of amicable attempts to settle the same as provided above, the dispute shall be referred to, and be finally settled by arbitration. The Parties agree that the arbitration proceedings will be conducted at Mumbai and the proceedings shall be conducted in the English language and shall be governed by the provisions of the Arbitration and Conciliation Act, 1996, or any statutory modification or re-enactment thereof for the time being in force. The Parties agree that the Dispute shall be adjudicated by a single arbitrator mutually agreeable to, and appointed by, the Parties. In the event the Parties fail to appoint a single arbitrator the Owner and the Contractor shall appoint one (1) arbitrator each and the two (2) arbitrators so appointed shall nominate a third, presiding arbitrator. The decision of the arbitrator(s) shall be final and binding on the Parties. Each Party will be responsible for the costs of appointing their respective arbitrator as contemplated herein however where a joint appointment of an arbitrator occurs, the costs thereof will be shared equally by the Parties. Notwithstanding the pendency of any Award or difference between the Parties or any proceedings thereto, the Contractor shall be continue to provide the Services as stated herein.

52. Jurisdiction

This work order shall be construed under and governed by the laws of India and each party hereby expressly and irrevocably submits itself to the exclusive jurisdiction of Courts of competent jurisdiction at Mumbai, India.

53. Limitation of liability

The total liability of Contractor for all claims of any kind arising from or related to the formation, performance or breach of this Contract, or any products or services, shall not exceed the Contract Price. The Contractor shall not be liable for loss of profit or revenues, loss of use of equipment or systems, interruption of business, cost of replacement power, cost of capital, downtime costs, increased operating costs, any special, consequential, incidental, indirect, or punitive damages, or claims of Owner's customers for any of the foregoing types of damages.

54. Intellectual Property

Each party shall retain ownership of all intellectual property it had prior to the Contract. All rights in and to firmware and software not expressly granted to Owner are reserved by Contractor. All new intellectual property conceived or created by Contractor alone in the performance of this Contract shall be owned exclusively by Contractor. Prior to the execution of Work Order, the Contractor shall submit to the Owner the details of all the aforesaid intellectual property owned by the Contractor related to the performance of the Contract.

VOLUME 1:

SECTION 5:

FORMATS

CHECK LIST

We confirm that we have gone through the Bid Documents and as instructed in these documents we hereby submit the following documents to form the bid.

S. No.	Name of the Document	Whether Submitted Yes/No	Format Number	Envelope Number
1.	EMD in form of DD along with bank confirmation letter		-NA-	1
2.	Signed Check list		-NA-	1
3.	Structural & Organisational Details		A	2
4.	Financial Information		B	2
5.	Similar Works Completed by EPC		C	2
6.	Signed copy of entire tender document.		-NA-	2
7.	Letter of Authorisation for signing the bid		-NA-	2
8.	Copy of Balance Sheets and Profit and Loss Accounts for past 3 years		-NA-	2
9.	Income tax clearance certificate for past 3 years		-NA-	2
10.	Self-attested copy of PF Registration		-NA-	2
11.	Self-attested copy of GST Certificate		-NA-	2
12.	Self-attested copy of valid Electrical Contractor's License issued by the Govt. of Maharashtra (India) or Undertaking		-NA-	2
13.	A declaration that there are no pending legal cases or suits and liabilities. In case of such liabilities, details shall be furnished.		D	2

Signature of Authorized representative of Bidder

Name of Authorised

Signatory: _____

Name of BIDDER: _____

BIDDER QUALIFICATION REQUIREMENT FORMAT**Format A****STRUCTURE AND ORGANIZATIONAL DETAILS**

A	Name and address of Bidder	
B	Telephone No. / Fax No. / Telex No.	
C	Contact Person of the Authorized Signatory (Name, Address, Contact Number & Email id)	
D	The applicant is: (a) An individual (b) A Proprietary Firm (c) A firm in Partnership (d) A Limited Company (Private or Public) or Corporation	
E	Name of Directors/ Partners with their addresses, Telephone numbers, Fax, Email	
F	Was the applicant ever required to suspend any execution for a period of more than six months continuously after commencement of the works? If so, give the name of the project & reasons of suspension of work.	
G	Has the applicant or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.	
H	Has the applicant, or any constituent partner in case of partnership firm ever been debarred / black listed for tendering in any organization at any time? If so, give details Other details: (Self attested copies to be enclosed)	
I	EPF No. valid upto	
J	PAN No.	
K	GST Certificate no.	
L	Electrical Contract License No.	

Signature of Authorized representative of Bidder

Name of Authorised

Signatory:_____

Name of BIDDER: _____

BIDDER QUALIFICATION REQUIREMENT FORMAT

Format B

FINANCIAL INFORMATION

Financial Analysis	2014-15	2015-16	2016-17	Average annual turnover
	A	B	C	(A+B+C)/3
Gross Annual turnover				
Financial Analysis: Details to be furnished duly supported by figures in Balance Sheet / Profit & Loss Account for the last three years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (certified copies to be attached) Note- <u>All Amount in INR Crores</u>				

Signature of Authorized representative of Bidder

Name of Authorised

Signatory: _____

Name of BIDDER: _____

Format C

DETAILS OF SIMILAR WORKS COMPLETED BY EPC CONTRACTOR TO MEET QR SPECIFIED IN CLAUSE 1.2 OF QR (TO BE FILLED IN CASE BIDDER IS A EPC CONTRACTOR)

Sr . N o.	Name of Work / Project & Location along with Brief Description of Scope	Owner / Organization	Value of work in Rs lakh at completion	Date of commencement as per contract and Stipulated date of Completion	Actual date of completion	Reasons for Delay, if applicable	Name and contact details of person (Address, phone number and email id) to whom reference may be made

* The Bidder is required to submit the copy of supporting documents to substantiate the satisfactory performance

Signature of Authorized representative of Bidder

Name of Authorised

Signatory: _____

Name of BIDDER: _____

Format D

DECLARATION FOR LEGAL CASES

BID SPECIFICATION NO. Kharadi/Power/2018-19/____ date: 23rd April 2018

To,

The Associate Vice President,

M/s KRC INFRASTRUCTURE & PROJECTS PRIVATE LIMITED

Raheja Tower, Plot No: C-30, G Block, Next to Bank of Baroda,

Bandra Kurla Complex, Bandra (E),

Mumbai – 400051, Maharashtra, India

In reference to the Bid invitation for “RFP for PROVIDE, QUALITY ASSURANCE, ERECTION, TESTING, COMMISSIONING AND PERFORMANCE TESTING OF ELECTRICAL WORKS AT ONE NO OF BUILDING (G2) AT KHARADI SEZ”, We ---- (name)----- resident at ----(address)----- hereby declare that there are no pending legal cases or suits and liabilities against our Company which will affect our performance under this Contract except the following:

- 1.
- 2.
- 3.

Signature of Authorized representative of Bidder

Name of Authorised

Signatory:_____

Name of BIDDER: _____

Format K

CONTRACT PERFORMANCE BANK GUARANTEE FORMAT

FORM OF BOND / BANK GUARANTEE

BANK GUARANTEE ON STAMP PAPER

(VALUE TO BE CHECKED WITH THE BANK)

FOR LODGEMENT OF PERFORMANCE BOND

THIS DEED OF GUARANTEE made this _____ day of _____
having its office at _____ (hereinafter called the "Bank",
which expression shall unless repugnant to the context and meaning thereof include its
successors) favoring **M/s.** _____, a company incorporated under the
Companies Act, 1956, having its Registered Office at
_____ (hereinafter called the "Owner", which expression
shall unless repugnant to the context and meaning thereof include its successors and
assigns).

WHEREAS the Owner and M/s. _____
having their Registered Office at _____
(hereinafter called the "Contractor") have entered into a Agreement dated _____
(hereinafter called the "Agreement") whereby the Contractor has agreed to carry out the
_____ work at the **Owner's** _____
Project Site at _____ under the supervision of M/s. _____, the Owner's
Project Management Consultant upon and subject to the terms therein contained.

AND WHEREAS in accordance with the terms and conditions of the Agreement, the Contractor has agreed to furnish a Bank Guarantee to the Owner in the form acceptable to the Owner for a sum of Rs. _____ (Rupees _____ only) to ensure timely and satisfactory performance by the Contractor of its obligations under the Agreement.

AND WHEREAS the Bank has at the request of the Contractor agreed to furnish a irrevocable guarantee in favour of the Owner to secure performance by the Contractor of its obligations under the Agreement on the terms and conditions herein contained.

NOW THIS DEED WITNESSTH AS FOLLOWS:

1. The Bank hereby unconditionally and irrevocably guarantees the due and punctual performance and observance of and compliance by the Contractor of the covenants, agreements, conditions and provisions expressed or implied on the part of the Contractor to be performed, observed or complied with under the Agreement in accordance with the terms thereof and in the event of the Contractor's non-performance, non-observance and non-compliance of the same for any reason, the Bank shall absolutely irrevocably and unconditionally without any right of set off or counter claim, forthwith upon written demand by the Owner and without demur or protest and without reference to the Contractor pay to the Owner a sum not exceeding Rs. _____ (Rupees _____ only). A demand so made by the Owner shall be final and binding on the Bank.
2. The Bank also agree that withdrawal of the tender or part thereof by Contractor within its validity or Non submission of security Deposit by the Contractor within one month from the date tender or a part thereof has been accepted by the Owner would constitute a default on the part of the Contractor and that this Bank Guarantee is liable to be invoked and encashed within its validity by the Owner in case of any occurrence of a default on the part of the Contractor and that the encashed amount is liable to be forfeited by the Owner.

3. The Bank's liability under this Guarantee is restricted to Rs. _____ (Rupees _____ only).
4. The decision of the Owner, for the time being in force, or at any time thereafter as to the non-performance, non-observance and non-compliance by the Contractor of the covenants, agreements, conditions and provisions expressed or implied, on the part of the Contractor, to be observed, performed or complied with under the Agreement shall be final, conclusive and binding upon the Bank and shall not in any circumstances be questioned by the Bank.
5. Any demand for payment under this Guarantee shall be made on the Bank by the Owner in writing at _____ and shall be deemed to have been sufficiently made by the Owner if the writing containing the demand is sent to the Bank by registered post to the address as aforesaid or sent to the Bank by hand delivery at such address and written acknowledgement obtained to such delivery.
6. The guarantee obligations of the Bank hereunder shall continue in force and effect and be binding on the Bank in accordance with its terms **upto** _____ or until the performance, observance and compliance by the Contractor of all the covenants, agreements, conditions and provisions expressed or implied, on the part of the Contractor to be observed, performed or complied with under the Agreement, the completion of the **Defects Liability Period** and issue of the Certificate of Final Completion by the Owner in accordance with the Agreement whichever is later.
7. As between the Bank and the Owner (but without affecting the Contractor's obligations) the Bank shall be liable under this Guarantee as if it were the sole principal debtor. The Bank's liability hereunder shall not be discharged nor shall its liability be affected by:

- i. any time, indulgence, waiver or consent at any time given by the Owner to the Contractor;
 - ii. any amendment to the Agreement;
 - iii. the making or the absence of any demand by the Owner on the Contractor or any other person for payment;
 - iv. the enforcement or absence of enforcement of the Agreement or of any security or other guarantee or indemnity;
 - v. the illegality, invalidity or unenforceability of or any defect in any provision of the Agreement or of any of the Contractors obligations thereunder;
 - vi. the dissolution, amalgamation, reconstruction or reorganization or appointment of an Administrative Receiver of the Contractor.
8. The Guarantee herein contained shall not be determined or in any way prejudiced or affected by any change in the constitution of the Bank or by any merger, or amalgamation or reconstruction of the Bank but shall be enforceable against the merged, amalgamated or reconstructed body.
9. The Bank hereby expressly and irrevocably waives all claims of waiver, release, surrender or compromise and all defenses, setoffs, counter claims, recoupment's, reductions, limitations and impairments.
10. The Owner shall be at liberty to vary, and alter or modify any of the terms and conditions of the Agreement including without limitation to extend from time to time the time for the performance of the Agreement by the Contractor or to postpone from time to time any of the powers exercisable by the Owner against the Contractor,

to forbear or to enforce any of the terms and conditions of the Agreement, without in any manner affecting this Guarantee and without notice to or assent of the Bank.

11. The Bank waives any right to require / proceeding first against the Contractor or the realization first of any security or other guarantee, if any.
12. The Bank agrees and confirms that its obligation to make payment to the Owner on demand hereunder and discharge of such obligation shall not be delayed, exercised or avoided by reason of any act or omission on the part of the Owner the legal consequence of which may be the discharge of the bank as guarantor.
13. The Bank declares and confirms that the Bank has taken all necessary corporate action to authorize the execution delivery and performance of this Guarantee in accordance with the terms hereof and that the Bank has full power to enter into and perform and discharge its obligations undertaken hereunder and that this Guarantee constitutes legal, valid and binding obligation of the Bank, enforceable in accordance with its terms.
14. This guarantees shall be governed by and construed in all respects according to the laws of India and shall be subject to the jurisdiction of the courts in _____.
15. All notices, demands or communications required or permitted to be given hereunder shall be in writing and shall be valid and sufficient if dispatched by registered airmail, postage, prepaid, or by telex, cable or facsimile as follows:

If to the Bank:

If to the Owner:

Any party hereto may change its address by a notice given to the other party hereto in the manner set forth above. All notices, demands and other communications shall be deemed to have been duly given (i) on the expiry of seven days after posting, if transmitted by registered airmail or (ii) on the date immediately after the date of transmission with confirmed answer back if transmitted by telex, cable or facsimile, whichever shall first occur.

16. Any forbearance or indulgence on the part of the Owner in the enforcement of the Covenants, agreements, conditions and provisions express or implied on the part of the Contractor to be performed, observed or complied with by the Contractor under the Agreement shall in no way relieve the Bank of its liability under the Guarantee.
17. Terms and expression defined in the Agreement and used herein shall have the meanings assigned to them therein save and except where the context otherwise require.

Notwithstanding anything contained hereinabove,

- i. Our liability under this bank guarantee shall not exceed Rs. _____ (Rupees: _____ only).
- ii. This bank guarantee shall be **valid upto** _____ and;
- iii. It is a condition to our liability for payment of the guaranteed amount or part any thereof arising under this bank guarantee that we receive a valid written claim or demand for payment under this bank guarantee **on or before** _____, failing which, our liability under this bank guarantee will be automatically cease.

IN WITNESS WHEREOF THE BANK HAS SET ITS HAND AND SEAL THE DAY AND YEAR FIRST ABOVE WRITTEN.

SIGNED for and on
behalf of the Bank by
its duly authorized
Representative
Mr. _____
in the presence of

}

Format L

ADVANCE BANK GUARANTEE FORMAT

WHEREAS you, M/s. _____ (Name of Company) a company registered under the companies act 1956, and having registered office at _____ (Address) hereinafter referred to as Owner (which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors and assigners) having accepted the tender of _____ a company registered under the companies act, 1956 and having its registered office at _____ hereinafter referred to as Contractor (which expression shall unless repugnant to the context or meaning thereof be deemed to mean and include its successors and assigners), for the _____ (Nature of the works) have at the request of the contractor agreed to pay mobilisation advance of Rupees _____ (Rupees Only) to the said contractor as per clause no. _____ of the conditions of the contract dated _____ (hereinafter referred to as the said contract).

AND WHEREAS the Owner has, at the request of the Contractors agreed to pay to the contractor a mobilisation advance of Rs. _____/- (Rupees only) upon the condition that the Contractor shall procure in favour of the Owner an irrevocable and unconditional guarantee of a scheduled Bank for due payment to _____ the Owner of the said mobilisation advance of Rs. _____/- (Rupees only) as is herein contained.

AND Whereas the Contractor has requested the undersigned bank to give a guarantee as hereinafter contained to the Owner in respect of the said mobilisation advance of Rs. _____/- (Rupees Only).

NOW WE _____ BANK, _____, _____, having our Branch office at _____ and having our head office at _____, do at the request of the Contractor and in consideration of the premises, hereby, absolutely, irrevocably and unconditionally guarantee (as primary obligor and not merely as surety) so as to bind ourselves, our successors and assigns that in the event of default on the part of the contractor in making repayment to the Owner of the said mobilisation advance of Rs. _____/- (Rupees _____ only) or any part thereof or in the event of any loss or damage caused or suffered by the Owner by reason of any breach by the Contractor of any of the terms and conditions of the said contract, we shall forthwith within two days of the Owner notifying such default or breach to us (such notification to be conclusive as to default and breach), make payment to the Owner without any protest, objection or demur of the said sum of Rs. _____/- (Rupees _____ only) to the Owner as claimed in the notice by the Owner and we shall indemnify the Owner and keep the Owner indemnified against all costs charges and expenses whatsoever which the Owner may incur by reason of any such default/breach on the part of the Contractor. The decision of the Owner on all the matters concerning the terms and the requirements of the contract and the default /breach thereof by the contractor shall be final and binding on the Bank and the Bank shall not refer any such matter to the Contractor.

We, the Guarantors expressly agree that our liability and obligations under the Guarantee shall be continuing, absolute, unconditional and irrevocable irrespective of (i) any dispute/difference of whatsoever nature between the Owner and the Contractors or any claims of whatsoever nature of the Contractor against the Owner. (ii) the invalidity, illegality, irregularity or unenforceability for any reason of the obligations of the Contractors to the Owner or any other circumstances or considerations which might otherwise constitute a legal or equitable discharge or defence of surety or guarantor including, without limitation, any failure, omission or delay in the enforcement by the Owner of any of the obligations of the Contractor.

Our liability as Guarantors under this Guarantee shall not be altered or otherwise affected in any manner by reasons of any arrangement or compromise made between the Owner and the Contractor or by any time, forbearance or other indulgence where as

to payment, performance or otherwise given or agreed to be given by the Owner to the Contractor. AND WE (as primary obligor and not merely surety) expressly consent to any extension of time for recovery of the mobilisation advance from the Contractor by the Owner.

WE, the guarantors hereby expressly agree that our liability hereunder shall not be discharged or released or altered or impaired in any manner by any change in the constitution, structures or powers of the Contractor or amalgamations, mergers etc. or by reason of their winding up nor shall this Guarantee be determined or in any way prejudiced or affected by any absorption of or by the Guarantors or by any amalgamation thereof or therewith but shall ensure and be available for the absorbing or amalgamated Owner.

A demand for payment under this Guarantee shall be made on us by the Owner in writing at the following address:

Address: _____

And shall be deemed to have been sufficiently made after the writing containing the demand is deposited by the Owner by registered post prepaid in the post office box addressed as aforesaid and we shall pay the amount as claimed within 2 (two) days from the receipt of notice in writing from the Owner or on its behalf.

We the Guarantors absolutely, irrevocably and unconditionally agree that (a) the Owner shall be entitled to enforce this Guarantee without making any demand on or taking any

proceedings against the Contractor. (b) the Guarantee herein contained shall be a continuing guarantee and as such shall remain in full force and effect and shall be binding in accordance with the terms on us and enforceable against us.

Notwithstanding anything contained herein before our liability under this Guarantee is restricted to Rs. _____/- (Rupees only). This Guarantee shall remain in force upto_____ and unless a demand or claim under this Guarantee is made in writing within six months of the said dated viz._____ all the rights of the Owner under this Guarantee shall be forfeited and we shall be released and discharged from all liability hereunder.

Dated this _____ day of 2018

For Bank _____

Format M

WARRANTY BOND FORMAT

FORM OF WARRANTY BOND (BANK GUARANTEE)

BANK GUARANTEE ON STAMP PAPER

(VALUE TO BE CHECKED WITH THE BANK)

THIS DEED OF GUARANTEE made this _____ day of _____
having its office at _____ (hereinafter called the “Bank”,
which expression shall unless repugnant to the context and meaning thereof include its
successors) favoring **M/s.** _____, a company incorporated under the
Companies Act, 1956, having its Registered Office at
_____ (hereinafter called the “Owner”, which expression
shall unless repugnant to the context and meaning thereof include its successors and
assigns).

WHEREAS the Owner and M/s. _____
having their Registered Office at _____
(hereinafter called the “Contractor”) have entered into a Agreement dated _____
(hereinafter called the “Agreement”) whereby the Contractor has agreed to carry out the
_____ work at the **Owner’s** _____
Project Site at _____ under the supervision of M/s. _____, the Owner’s
Project Management Consultant upon and subject to the terms therein contained.

AND WHEREAS in accordance with the terms and conditions of the Agreement, the Contractor has agreed to furnish a Bank Guarantee to the Owner in the form acceptable to the Owner for a sum of Rs. _____ (Rupees _____ only) to ensure timely and satisfactory performance by the Contractor of its obligations under the Agreement.

AND WHEREAS the Bank has at the request of the Contractor agreed to furnish a irrevocable guarantee in favour of the Owner to secure performance by the Contractor of its obligations under the Agreement on the terms and conditions herein contained.

NOW THIS DEED WITNESSTH AS FOLLOWS:

1. The Bank hereby unconditionally and irrevocably guarantees the due and punctual performance and observance of and compliance by the Contractor of the covenants, agreements, conditions and provisions expressed or implied on the part of the Contractor to be performed, observed or complied with under the Agreement in accordance with the terms thereof and in the event of the Contractor's non-performance, non-observance and non-compliance of the same for any reason, the Bank shall absolutely irrevocably and unconditionally without any right of set off or counter claim, forthwith upon written demand by the Owner and without demur or protest and without reference to the Contractor pay to the Owner a sum not exceeding Rs. _____ (Rupees _____ only). A demand so made by the Owner shall be final and binding on the Bank.
2. The Bank also agree that withdrawal of the tender or part thereof by Contractor within its validity or Non submission of security Deposit by the Contractor within one month from the date tender or a part thereof has been accepted by the Owner would constitute a default on the part of the Contractor and that this Bank Guarantee is liable to be invoked and encashed within its validity by the Owner in case of any occurrence of a default on the part of the Contractor and that the encashed amount is liable to be forfeited by the Owner.

3. The Bank's liability under this Guarantee is restricted to Rs. _____ (Rupees _____ only).
4. The decision of the Owner, for the time being in force, or at any time thereafter as to the non-performance, non-observance and non-compliance by the Contractor of the covenants, agreements, conditions and provisions expressed or implied, on the part of the Contractor, to be observed, performed or complied with under the Agreement shall be final, conclusive and binding upon the Bank and shall not in any circumstances be questioned by the Bank.
5. Any demand for payment under this Guarantee shall be made on the Bank by the Owner in writing at _____ and shall be deemed to have been sufficiently made by the Owner if the writing containing the demand is sent to the Bank by registered post to the address as aforesaid or sent to the Bank by hand delivery at such address and written acknowledgement obtained to such delivery.
6. The guarantee obligations of the Bank hereunder shall continue in force and effect and be binding on the Bank in accordance with its terms **upto** _____ or until the performance, observance and compliance by the Contractor of all the covenants, agreements, conditions and provisions expressed or implied, on the part of the Contractor to be observed, performed or complied with under the Agreement, the completion of the **Defects Liability Period** and issue of the Certificate of Final Completion by the Owner in accordance with the Agreement whichever is later.
7. As between the Bank and the Owner (but without affecting the Contractor's obligations) the Bank shall be liable under this Guarantee as if it were the sole principal debtor. The Bank's liability hereunder shall not be discharged nor shall its liability be affected by:

- i. any time, indulgence, waiver or consent at any time given by the Owner to the Contractor;
 - ii. any amendment to the Agreement;
 - iii. the making or the absence of any demand by the Owner on the Contractor or any other person for payment;
 - iv. the enforcement or absence of enforcement of the Agreement or of any security or other guarantee or indemnity;
 - v. the illegality, invalidity or unenforceability of or any defect in any provision of the Agreement or of any of the Contractors obligations thereunder;
 - vi. the dissolution, amalgamation, reconstruction or reorganization or appointment of an Administrative Receiver of the Contractor.
8. The Guarantee herein contained shall not be determined or in any way prejudiced or affected by any change in the constitution of the Bank or by any merger, or amalgamation or reconstruction of the Bank but shall be enforceable against the merged, amalgamated or reconstructed body.
9. The Bank hereby expressly and irrevocably waives all claims of waiver, release, surrender or compromise and all defenses, setoffs, counter claims, recoupment's, reductions, limitations and impairments.
10. The Owner shall be at liberty to vary, and alter or modify any of the terms and conditions of the Agreement including without limitation to extend from time to time the time for the performance of the Agreement by the Contractor or to postpone from time to time any of the powers exercisable by the Owner against the Contractor,

to forbear or to enforce any of the terms and conditions of the Agreement, without in any manner affecting this Guarantee and without notice to or assent of the Bank.

11. The Bank waives any right to require / proceeding first against the Contractor or the realization first of any security or other guarantee, if any.
12. The Bank agrees and confirms that its obligation to make payment to the Owner on demand hereunder and discharge of such obligation shall not be delayed, exercised or avoided by reason of any act or omission on the part of the Owner the legal consequence of which may be the discharge of the bank as guarantor.
13. The Bank declares and confirms that the Bank has taken all necessary corporate action to authorize the execution delivery and performance of this Guarantee in accordance with the terms hereof and that the Bank has full power to enter into and perform and discharge its obligations undertaken hereunder and that this Guarantee constitutes legal, valid and binding obligation of the Bank, enforceable in accordance with its terms.
14. This guarantees shall be governed by and construed in all respects according to the laws of India and shall be subject to the jurisdiction of the courts in _____.
15. All notices, demands or communications required or permitted to be given hereunder shall be in writing and shall be valid and sufficient if dispatched by registered airmail, postage, prepaid, or by telex, cable or facsimile as follows:

If to the Bank:

If to the Owner:

Any party hereto may change its address by a notice given to the other party hereto in the manner set forth above. All notices, demands and other communications shall be deemed to have been duly given (i) on the expiry of seven days after posting, if transmitted by registered airmail or (ii) on the date immediately after the date of transmission with confirmed answer back if transmitted by telex, cable or facsimile, whichever shall first occur.

16. Any forbearance or indulgence on the part of the Owner in the enforcement of the Covenants, agreements, conditions and provisions express or implied on the part of the Contractor to be performed, observed or complied with by the Contractor under the Agreement shall in no way relieve the Bank of its liability under the Guarantee.
17. Terms and expression defined in the Agreement and used herein shall have the meanings assigned to them therein save and except where the context otherwise require.

Notwithstanding anything contained hereinabove,

- i. Our liability under this bank guarantee shall not exceed Rs. _____ (Rupees: _____ only).
- ii. This bank guarantee shall be **valid upto** _____ and;
- iii. It is a condition to our liability for payment of the guaranteed amount or part any thereof arising under this bank guarantee that we receive a valid written claim or demand for payment under this bank guarantee **on or before** _____, failing which, our liability under this bank guarantee will be automatically cease.

IN WITNESS WHEREOF THE BANK HAS SET ITS HAND AND SEAL THE DAY AND YEAR FIRST ABOVE WRITTEN.

SIGNED for and on
behalf of the Bank by
its duly authorized
Representative

Mr. _____
in the presence of

}

VOLUME 1:

SECTION 6:

**GENERAL CONDITIONS OF
CONTRACT**

SEZ Approval & Notification:

The setting up of SEZ (IT and ITES sector specific) has been published in the Gazette of India, {Extraordinary, Part II-Section 3 /Sub-section(ii), No. 1962} dated 12/07/2017, New Delhi, The SEZ has been Notified by the Jt. Sect, Ministry of Commerce and Industry (Department of Commerce)[F.NO. F.1/29/2016-SEZ], vide Gazette Notification No.S.O.2203(E). with effect from 19 th June, 2017.

The following exemptions are applicable :(1) GST,(2)Customs Duty.

Thus the vendor/works-contractor will not levy, GST, Customs Duty.

With reference to above and the subsequent discussions for carrying out above mentioned work, we are pleased to issue you the order on following terms and conditions and specifications for same.

- 1) The Supplier/Manufacturer agrees to file RFD 11 with Bond along with Bank Guarantee or Letter of Undertaking for supplies to be made for the SEZ project.
- 2) The Supplier/Manufacturer agrees to provide the acknowledged copy of RFD 11 with Bond along with Bank Guarantee or Letter of Undertaking.
- 3) The Supplier/Manufacturer agrees to indemnify and keep indemnified the SEZ Developer from all liabilities on account of any non-compliance of GST law by the Vendor / Contractor / Consultant.
- 4) The Supplier/Manufacturer agrees to provide the tax invoice with the Below given either of the below given endorsement:
 - a. Supply to SEZ Developer for authorized operations under bond or letter of Undertaking without payment of integrated tax.OR
 - b. Supply to SEZ Developer for authorized operations on payment of integrated tax.

With reference to above and the subsequent discussions, which we had with you, we are pleased to place this Work Order for carrying out Providing, Installing, Testing and Commissioning of Electrical works for Our Commercial Building G-2 at M/s. KRC INFRASTRUCTURE & PROJECTS PRIVATE LTD-SEZ, KIPL # BLDG-G2,KHARADI,S.No. 65/1, 65/2 and 65/3,Village Kharadi,Taluka Haveli,Pune-411014, Maharashtra with following terms and conditions.

The Work Order shall be subjected to the following terms and conditions. The Work Order shall be also subject to the provisions of,

- a)Preambles
- b)Section 1 : Scope of work
- c)Section 2 : General Conditions
- d)Technical specification as given in our tender
- e)Annexure A: Bill of Quantities and Rates

PREAMBLES

Owner/Employer means: M/s. KRC INFRASTRUCTURE & PROJECTS PRIVATE LTD-SEZ.

Consultant means : M/s. Sunil Nayyar Consultants Pvt. Ltd. (for Example)

contractor/Vendor means: M/s.ABC(India)Pvt.Ltd (for Example)

SECTION - 1 : SCOPE OF WORK

The scope of your work to be carried out under this Work Order shall be to carry out Providing, Installation, Testing & Commissioning of Electrical work for Our Commercial Building G-2 at M/s. KRC INFRASTRUCTURE & PROJECTS PRIVATE LTD-SEZ, KIPL # BLDG-G2,KHARADI,S.No. 65/1, 65/2 and 65/3,Village Kharadi,Taluka Haveli,Pune-411014, Maharashtra as per the Bill of Quantities enclosed as Annexure A and as per the terms & conditions. This is an item rate contract and rates payable for each item shall be as indicated in the said Bill of Quantities Annexure-A.

It is clearly understood and agreed that the quantities mentioned in the said bill of quantities are approximate estimated quantities and can therefore vary to any extent and that contractor shall not have any claim whatsoever for such variation. It shall however be incumbent on the contractor to bring out to the notice of the Consultants/Owner, any possibility of increase in the quantities of any item(s) of the Bill of Quantities. In the event of contractor's failure to bring out such information to the Owner's knowledge and the actual installed quantities exceed the estimated quantities; the Owner will have full right to,

-Ask the contractor to get such extra quantities of works removed from site at his own cost.

-Initiate such variations as changing the design or specification in consultation with his consultants and have such changes incorporated in the work at the risk and cost of contractor to mitigate the extra cost due to variation in quantities.

All item rates shall remain firm and valid regardless of any variations in quantities of any of the work items as aforesaid.

This building is developed as the green buildings with LEED (Leadership in Energy & Environment Design) India rating system of IGBC (Indian Green Building Council) aiming minimum GOLD rating, facilitation for this is provided by CII (Confederation of Indian Industries). Hence all the materials/equipment's to be used shall comply with the directions given in rating systems & certificates authenticating

these compliances shall be provided by the contractor in the formats, which shall be provided to them by the Owner. The contractor shall be responsible for the claims, which are made in the certification, provided by them & shall be able to defend their claims if asked by validators.

Rates for various items of work shall be as given in the Bill of Quantities enclosed with this Work Order as Annexure A and are 'all inclusive'. These are inclusive of all applicable taxes and duties, including, Transportation, Insurance and scaffolding, handling, testing and commissioning except IGST, which shall be exempted as this being a SEZ Project.

The item rates given in BOQ shall be deemed to be inclusive of,

a. Cost of transportation of all materials and equipment required to complete the work in all respects to the site, including their handling, loading and unloading etc. whenever required including cost of packing and transit insurance and temporary Godowns.

b. Cost of shifting and storing of materials as many number of times and in as many batches as may be required during the currency of the contract.

c. Cost of all the materials, labour, tools & tackles, plants & equipments, scaffolding, supporting and any other implements and equipments as may be required to complete the work in all respects. The contractor shall be allowed to remove such implements after satisfactory completion of work and after all the equipment's and materials are permanently installed in their final approved location.

d. Cost of supervisory staff including technical manpower required for testing, commissioning, load balancing of the system, design staff and all other manpower as are required to fulfil all obligations under this contract, including all direct, indirect, incidental cost of employing such manpower and cost of all the preparatory works required to complete the work successfully.

e. The work has to be completed strictly within time schedule required by the Owner and time shall be the essence of the contract. Cost of any overtime, extra incentives and night work is therefore deemed to be included in the said item rates.

f. Cost of wastage, breakages & cost of protecting works from any damage, pilferage or loss, etc. till the time works are handed over.

g. Cost of preparation of five sets of shop drawings, design calculations, installation of samples including modification thereto for the approval of Owner.

h. Cost of carrying out tests as are required to validate/verify design calculations and other performance parameters specified under this contract including cost of

carrying out various tests as may be required from time to time to ascertain that work is carried out as per specifications and that materials used are as per approved standards/quality.

i.All the workers employed by the contractor shall be insured by the contractor who shall indemnify and save harmless the Owner, from any damage or loss of property or any injury including loss of life of any person caused directly or indirectly due to work carried out by the contractor.

j.Cost of insurance for all the works to be carried out under this Work Order up to commissioning during which the contractor shall indemnify and save harmless the Owner, from all costs, charges, legal suits or any liabilities arising due to any damage or loss of property or any injury including loss of life of any person of the Owner or of any third party caused directly or indirectly due to work to be carried by the contractor.

k.Cost of compliances of all precautionary & safety rules and laws in force for carrying out the works and obtain all necessary permissions from local Government authorities in confirmation of having carried out the work in accordance with the condition of building permissions and fire safety codes and regulations.

l.Clearing the sites to the entire satisfaction of the Consultants/Owner as and when directed by Consultants/Owner and after completion of work. All the packing material and other waste resulting from this work including debris shall be removed by the contractor from site as and when required and site shall be kept clean during Construction/Installation.

m.Cost of all consumables required during installation, testing and commissioning including cost of such other parts which need to be replaced after the system is commissioned.

n.Cost of power required for the work, which will be on actual basis on site at One point. Necessary distribution shall be carried out by the contractor at his own cost including electrical connections of all equipment's to the electrical outlets or switches provided by the Owner.

o.Cost of preparation of 'As Installed/Built drawings' - 5 Sets each.

p.The contractor shall be paid only for the completed items.

q.For all matters pertaining to this work order including certification of measurements, approval of materials and approval of works and shop drawings, the Owner shall nominate his representative in writing to the contractor. In absence of such nomination by the Owner, the authority for certification / approval of all the matters pertaining to this work shall rest only with the Owner's Project in Charge.

Certification by any other entity should be deemed as invalid and will not be entitled for any payment against such work or material certified at site.

SECTION - 2 : GENERAL CONDITIONS

1.The Contractor shall cooperate and coordinate with Main Building Contractor and other agencies appointed by the Owner to the maximum possible extent in accordance with the advice of the Architect and Project Engineer.

2.The Owner reserves the right to add, to omit & to alter the work shown on the GFC drawings and described in the schedule of rates in Annexure A to this agreement and this shall not invalidate the Contract.

3.The Contractor shall be required to inspect and test the system minimum once in two month or whenever required by the Owner.

4.The item rates given in the Annexure A are applicable for the entire Electrical System works of the building mentioned above and no escalation on the same shall be given to the Contractor for any reason whatsoever. The rate for any item not specified in Annexure A but required to be carried out during the course of work shall be settled in accordance with the "Clause '46' (Extra Items)".

5.For the project execution and management, you will have to provide minimum staff as follows,

- One senior Site Engineer.
- One Senior Site Supervisors.

6. Chasing in wall/hole as well as making semi finish in Vendors scope

7. Supply of cement FOC with 2% wastage

8. Supply of Concrete FOC.

9. Scaffolding/passenger/materials lift/hoist, drinking water and sanitation are in vendor's scope.

All the above personnel shall be provided with mobile telephones facilities so that they can be easily reached. Senior Site Supervisor shall be available on Call basis at site after handing over. Owner of the contracting company shall visit the site at least twice in a week for the project execution.

6.CONSTRUCTION SCHEDULE

You shall submit a detailed construction schedule for completion of work within one week of LOI/Work order and give us requirements of GFC drawings well in Advance for work. You are requested to get in touch with our Project in Charge to obtain details of completion requirements, which shall have to be incorporated in the

schedule. You will also give us a fortnightly progress of work and submit updated schedules/status of work progress with submission of your interim bills giving details of remedial measures proposed by yourselves to make good delays if any.

7.WORK TO BE AS PER PROGRAMME

The contractor shall programme his work according to time schedule drawn up by the Consultant and the Owner's Project in Charge. The contractor shall provide full time qualified supervision for his work. The Contractor shall submit to the Consultants/Owner reports every month stating the progress of work.

Quantities and dimensions mentioned in the said bill of quantities are approximate and may vary to any extent. The contractor is required to verify and confirm the actual quantities and site dimensions from site measurements. The contractor shall have no claims whatsoever for rates revision on account of such variation.

8.ADEQUACY OF CONTRACTOR'S RESOURCES

The Contractor shall provide adequate resources to ensure timely completion of each milestone of the construction schedule approved by the Client.

9.SECURITY DEPOSIT

Within a week of award of this work order Contractor will submit a bank guarantee from nationalized bank for equivalent amount in approved format & valid from date of Work order till three months beyond completion period OR 5% of proportionate invoice value to be deducted in every invoice progressively as security deposit to be retained till three months beyond satisfactory completion period of the Contract. The failure to do so will automatically result in termination of the contract/order issued. In such an event the Owner shall have the right to award the work to any other agency at the risk and cost of the Contractor.

ii.Contractors shall be required to furnish the security bond/performance bond within seven days to receiving this work order. The failure to do so will automatically result in termination of the contract/ order issued. In such an event the Employer shall have the right to award the work to any other agency at the risk and cost of the Contractor.

10.DATE OF COMMENCEMENT

Date of commencement shall be date of LOI/ Draft work order or as confirmed by the Owner.

11.TIME OF COMPLETION

The entire work under this Work Order shall be completed within Seven Months from the date of acceptance of this work order or as directed by the Owner.

The contractor shall be deemed to have taken into consideration the statutory byelaws and requirements for the commencement of the work at each stage and shall be deemed to have considered fulfilment of such requirements in his completion schedule. The contractor is also required to account in his completion schedule, reasonable time for procurement of such permissions and shall have no claim for additional time for completion of the work.

After the completion of the work, the Contractor shall notify in writing to the consultants/Owner about completion of the work. Within 30 days from the date of notification, the consultant/Owner shall send his representative to remain present at the time of carrying out necessary tests by the Contractor.

12.DELAYS IN COMMENCEMENT

The contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work, whatever the cause for such delays may be, including delays in procuring government controlled or other materials.

13.STATUTORY APPROVALS

Contractor shall be responsible for obtaining all statutory approvals including No Objection Certificate from the Chief Electrical Inspector for the work completed by him. All costs for obtaining such approvals including cost of rectifications/modifications if required to be carried out for obtaining such approvals shall be deemed to be included in Contractor rates. Legal fees will be reimbursed against submission of Original receipt.

14). APPROVAL OF SHOP DRAWINGS

Within 7 days of the date of this Work Order M/s. ABC (India) Pvt.Ltd.shall furnish technical data sheet and full set of shop drawings for approval of Consultants. Upon approval of shop drawings the contractor shall rework the bill of quantities and submit to the Owner for approval. Before commencement of works and ordering of materials, contractor shall obtain express written approval of the Owner's chief engineer for Bill of Quantities of all items required to be executed as per approved shop drawings. The contractor needs to forward the approved revised Bill of Quantities based on approved shop drawings to the Owner's contract section. All works executed as per approved shop drawings and Bill of Quantities shall become fully payable as per terms of payment mentioned in this work order.

15.QA-QC/ SAFETY / METHOD STATEMENT / DAILY REPORTS / MEETINGS / PROGRAMME AS PER SITE INSTRUCTIONS FROM TIME TO TIME

The Contractor shall submit on request the following documents for approval/record of the Consultants/Project in Charge prior to commencement of the works and during the course of execution of work as applicable.

- a.Method statement for major items of work and as required by the Site Engineer
- b.Safety manual proposed for this project, which shall include safety precautions and safety measures etc.
- c.Quality Assurance and Quality Control manual as proposed for this project.
- d.Daily work/programme of next day/Plants status reports in a prescribed form.
- e.Weekly programme/progress reports in a prescribed form.

16.APPROVAL OF SAMPLES

Samples of all the materials shall be submitted to the Project in charge by the Contractor for approval before commencement of work. All the materials used shall be of approved make (described elsewhere in the specifications) unless specified otherwise.

17.CLARIFICATIONS OR AMBIGUITY

Any clarification required or ambiguity noticed by the Contractor as far as the GFC drawings are concerned, shall be brought to the notice of the Architect and the Project Engineer to get the matter resolved before commencement of work.

18.SAFE CUSTODY

Storing and safe custody of the materials required for work shall be your responsibility.

In event contractor is Providing any materials such as equipment's, machinery etc., he shall submit the packing list along with the delivery of materials. The receipt of materials shall be checked jointly by the representatives of the contractor and Owner. Thereafter the security of such and all other materials lies entirely on the contractor.

19.ASSIGNMENT AND SUB-LETTING

Assignment and subletting the work or any part of it to other Contractor(s) is strictly prohibited. The Contractor shall not sublet the work either in whole or in part without written consent of the Architect and the Owner.

20.MEASUREMENTS

The payment for any completed work shall be on the basis of the joint measurements as certified by the Owner's project in charge. Unless otherwise specified in this work order or BOQ Annexure A, all the measurements shall be taken in accordance with IS 1200.

The contractor shall submit measurements on every Monday to the project in charge for the work carried out in previous week for certification.

Points to be mentioned in Tax Invoices.

- a. Tax nos. like PAN, GSTIN, CIN No.
- b. Billing Company
- c. Billing Address of the Company
- d. Tax Invoice No.
- e. Bill of Supply
- f. Date of Tax Invoice/Date of Bill of Supply
- g. W O No. on Tax Invoice/Bill of Supply
- h. W O Date on Tax Invoice/Bill of Supply
- i. Building No./Wing No.
- j. Tax Invoice/Bill of Supply: Period: From##. To ###.
- k. Declaration of GST payable on reverse charge by the Company (Y/N)
- l. SAC code with description of Service in Tax invoice
- m. Place of Supply/Services in Tax Invoice
- n. Name of the State
- o. State Code
- p. Discounts in Contracts Document to be attached along with Tax Invoices.(Whichever is applicable)
 - a. Photocopy of Work Order
 - b. Photocopy of RC's of GSTIN, CIN etc.
 - c. Copy of drawing of completed works.
 - d. Copy of Debit Register (If Any)
 - e. Measurement sheet of Joint Records taken with Owner's Site Engineer/Project In charge.
 - f. GST Paid Challan (Relevant period or Previous period as the case may be)
 - g. Original + Duplicate + Triplicate for goods supply
 - h. Debit/Credit Note-Serial number of corresponding Tax Invoice as the case may be.
 - i. Declaration Certificate of the Contractor to be properly filled up by contractor on Letter head.
 - j. Declaration Certificate of the Sub-Contractor to be properly filled up by contractor on Letter head
 - k. P F Registration No.
 - l. P F paid challans.(Relevant period or Previous period as the case may be)

- m. ECR copies of relevant PF (Relevant period or Previous period as the case may be)
- n. ESIC Regn. No.
- o. ESIC paid challans. (Relevant period or Previous period as the case may be)
- p. ECR copies of relevant ESIC(Relevant period or Previous period as the case may be)
- q. Attendance Register/Muster Roll(Relevant period - marking the employees worked at our site)
- r. Wage Register (Relevant period - marking the employees worked at our site)
- s. Form-11 copies of the workers working on site.

ENDORSEMENT TO BE MENTIONED ON SEZ INVOICE
SUPPLY TO SEZ DEVELOPER FOR AUTHORISED OPERATIONS UNDER BOND
OR LETTER OF UNDERTAKING WITHOUT PAYMENT OF INTEGRATED TAX

OR
SUPPLY TO SEZ DEVELOPER FOR AUTHORISED OPERATIONS ON PAYMENT
OF INTEGRATED TAX

23.TAXES AND DUTIES

In accordance with the provisions of The Central Goods and Services Tax Act, 2017, The Integrated Goods and Services Tax Act, 2017, The State Goods and Services Act, 2017 (respective State Act), The Union Territory Goods and Services Tax Act, 2017 and applicable Rules, Circulars, Notifications, Clarifications, etc. (as may be issued from time to time) ("GST"):

1).The Contractor hereby agrees and undertakes to pass on by way of commensurate reduction in Order Value due to (i) reduction in the rate of tax on any supply of goods and/or services and/or (ii) due to the benefit of Input Tax Credit under GST that may be available to the Contractor. In this regard, the Contractor agrees and undertakes to disclose all the requisite details of its Input Tax Credit to the Owner to enable to arrive at the said reduction in Order Value.

2)The Contractor agrees and undertakes to issue and furnish GST compliant Tax Invoice in a timely manner and also agrees and undertakes to upload on the GST website (GSTN) the requisite information as may be required in respect of the said Tax Invoice.

3)The parties hereby agree that the frequency of raising and furnishing Tax Invoice by the Contractor shall be every [mention here the frequency period, eg. monthly, fortnightly, every 15th of the month, etc. as the case may be].

4)The Contractor agrees and undertakes to make timely payment of tax under GST such that the Owner is able to claim Input Tax Credit in accordance with the provisions of GST in a timely manner. In this regard the Contractor agrees and undertakes to furnish copy of tax challan to the Owner as proof of payment of the said tax.

5)The Contractor agrees and undertakes that it shall take requisite steps such that there is no mismatch under GSTN in respect of the Tax Invoice raised and furnished by the Contractor to the Owner. Further, the Contractor agrees with the Owner that in case of any mismatch, the Contractor agrees and undertakes to rectify the mismatch and resubmit the revised / amended Tax Invoice / credit note to the Owner immediately prior to the next month's processing for GSTN uploading.

6)The Contractor agrees that the Owner would pay for the Tax Invoice after the confirmation of the entry without any mismatch on GSTN. Any queries in this regard should be settled between the parties before uploading the details in the GSTN.

7) IT-TDS & GST-TDS as applicable will be deducted from every Tax Invoice.

24.ESCALATION

The prices shall remain firm till the completion of the Project and no escalation shall be applicable for any reasons whatsoever.

27.IDLING CHARGES

The contractor shall have no idling claims on any accounts for any reasons whatsoever.

28.GUARANTEE

Major equipment's to be installed under this contract shall have been manufactured for working life of not less than 5 year. Contractor shall get the makes of such equipment's approved from Owner prior to ordering. The Contractor shall provide free support for training of our personnel in the operation and maintenance of the Electrical Works if required for a period of one month after the completion of defect liability period of one year from the date of handing over. The support shall be limited to technical advice and troubleshooting.

29.PERFORMANCE GUARANTEE

The contractor shall furnish the Performance guarantee on stamp paper of minimum Rs.100/- for all Electrical Works against any defects & the due performance of the system for the intended minimum period of One year from the date of completion. In case if any defects noticed during this period shall be made good by the contractor by replacement of defective materials without any cost to Owner. This guarantee is to be submitted along with final bill after successful commissioning & handing over Electricals work to the Owner. The contractor is hereby intimated that in absence of this performance guarantee, final bill will be held back.

30.LABOUR LAWS

In the evaluation of Contractor's rates for the various items of work, Contractor have taken into account all the provisions of Labour Laws pertaining to (i) The Minimum Wages Act, 1948 (ii) The Industrial Disputes Act, 1947 (iii) The Employees' Provident Fund and Miscellaneous Provisions Act, 1952 (iv) The Child Labour (Prohibition & Regulation) Act, 1986 (v) ESIC Act-1948 applicable as on date to the construction labour and contractor personnel. The liability for compliance with all these laws rest entirely with Contractor and Contractor shall indemnify Owner completely on this account. Contractor will furnish us all necessary details about contractor labour and other personnel employed on the project as and when required by Owner in compliance with the above requirements. The contractor is required to submit the documentary evidences monthly and along with each invoice, for the compliance with respect to The Employees' Provident Fund and Miscellaneous Provisions Act 1952 & ESIC ACT 1948.

PF & ESIC registration will be mandatory for all contractors' executing works under this work order. RA Invoice will have to be produced supported with (i) declaration regarding compliance and (ii) copies of (a) salary/wage slips (b) attendance muster (c) PF & ESIC Challan for workers working at the site (d) ECR copies of PF & ESIC for the relevant period. (e) Copies of Form-11 for the workers working on site as per wage register.

As per Chapter VII of the Contract Labour (Regulation and Abolition) Central Rules, 1971, Every contractor shall in respect of each work on which he engages contract labour maintain following records and registers:

- o Muster Roll,
- o Wages Registers,
- o Deduction Register
- o Overtime Register,
- o Fine Register,
- o Advance Register,
- o Register of persons employed,
- o Employment Card,
- o Notice of commencement/completion of contract work,

- o Service Certificate
- o Returns

Muster Roll: The contractor shall maintain a muster-roll of the workers employed in various trades as required to execute the work at site, from the date of commencement to the to the completion of the project.

Wages Register: The contractor shall maintain a wage register of the workers employed in various trades, wherein the contractor shall obtain signature or thumb-impression of each such building worker against entries relating to him and such entries shall be authenticated by the contractor or his authorised representative.

Deduction Register: A register of deduction for damage or loss shall be maintained with all the relevant details of damage or loss and the amount recovered as deduction. In case, where during a wage period, no deduction has been made from the wages of a building worker a 'nil' shall be made against such wage period at the appropriate place.

Overtime Register: A register of overtime for recording therein the number of hours of, and the wages paid for, overtime work, if any.

Fine Register: A register of fines for violations/acts/omissions, by the workers, shall be maintained with all the relevant details and the amount recovered as fine. In case, where during a wage period, no fines are recovered from the wages of a building worker a 'nil' shall be made against such wage period at the appropriate place.

Advance Register: A register of advances shall be maintained for the advances given, if any, along with the purpose for which the advance was given and the number of instalments by which the recovery shall be made.

Register of persons employed: The contractor shall maintain, in respect of each establishment, where building workers are engaged, a register with all the relevant personal details of each worker, such as, permanent address, local contact details, age, Father's name, Designation etc.

Employment card: Each worker shall be issued an employment card with all relevant details and a photograph affixed, duly stamped, stating date of employment.

Notice of commencement/completion of contract work: The contractor, as per BOCW Act, Rule 239, shall send to the Inspector having jurisdiction, a written notice intimating the actual date of the commencement, the probable date of completion and other such particulars as referred to in sub-section (1) of section 46 of the Act relating to construction work on the site.

Service Certificate: The contractor shall issue a service certificate to each of such building worker in specified format, to such building workers on termination of his service on account of completion of such work or for any other reason.

Returns: The contractor shall send annually, return relating to such establishment in duplicate, in specified format, to the registering officer having jurisdiction so as to reach him not later than the fifteenth February following the end of each calendar year with a copy to the Inspector having jurisdiction.

The contractor shall ensure that the registers and other records required to be maintained under the BOCW Act (Regulation of Employment and Conditions of Service), Payment of Wages Act, 1936 (4 of 1936), or Minimum Wages Act, 1948 (11 of 1948) or the Contract Labour (Regulation and Abolition) Act, 1970 (37 of 1970), or these rules, are maintained complete and up-to-date, and made available for scrutiny by the Project Incharge and/or authorized representative of the Owner.

31.SAFETY PRECAUTIONS

You shall observe all necessary safety precautions to safeguard your personnel, plant, machinery, other personnel, equipment's and completed works at site. You shall remain solely liable for any claims or damages arising out of non-compliance of such safety precautions and would indemnify us from any such claims or damages.

32.SAFETY BREACH

The contractor shall organize his operations in a workman like manner and take all necessary precautions to provide safety and prevent accidents on the site to both, persons and property. The same is applicable to his sub-contractor/s, if any. Any accident taking place during the tenure of his contract, causing any injury to the life of any individual shall be treated as breach of provisions of the safety clause of the contract and the contractor will be liable for the recovery of damages by the Owner as given below.

- a. Owner shall impose a fine on the contractor of Rs.50/- (Rs. Fifty Only) per instant a worker is found not wearing a helmet at work site.
- b.Owner shall impose a fine on the contractor of Rs.500/- (Rs. Five Hundred Only) per instant a worker is found not wearing a safety belt at work site.
- c.Owner shall recover from the contractor, an amount of Rs.50,000/- (Rupees Fifty Thousand Only) per accident causing injury.
- d.Owner shall recover from the contractor, an amount of Rs.100,000/- (Rupees One Lac Only) per accident causing loss of life.

33.ENVIRONMENTAL PRECAUTIONS

You shall observe all necessary precautions and take all necessary measures to ensure that your personnel, workers, subcontractors or suppliers as well as equipments and vehicles the norms regarding emission levels and noise levels as laid down by the statutory authorities shall be strictly adhered to. All the vehicles coming into site on behalf of the contractor shall have valid registration & PUC Certificates. The drivers of vehicles shall have valid licenses. The contractor will

similarly observe all norms regarding disposal or treatment of all types of waste matter and shall be entirely responsible for any claims, damages or penalties in event of non-compliance. You shall indemnify us from any and all claims, damages or penalties and will remain liable for the losses caused to us as a result of your non-compliance of the said requirements.

34.INSURANCE

The contractor will be required to obtain Workmen's Compensation Policy jointly in the name of the Owner/Endorsement certificate from the Insurance company for coverage of workers to be deployed at Owner site (Company name, address & No of workers to be mentioned) and the Contractor covering the entire duration of the work within fifteen days from the date of this work order and furnish us the documents within seven days thereafter.

Owner will be taking CAR (Contractor All Risk) policy for entire project. In case of submission of claims if any by the contractors with regard to CAR Policy, the Company will provide the details to the Contractor about the same and Contractor will be responsible to prepare the necessary documents and to take up the matter of process of the claim with the Insurance Company

35.INDEMNITY

The contractor shall indemnify the Owner and shall keep them indemnified and save harmless from any losses, costs, suits, charges or legal actions brought against them due to any damage to the property or injury including loss of life of their employees/customers or any other individuals or animals visiting the premises caused due to construction activity carried out by yourself throughout the period of construction and till such time the site is completely cleared and handed over by you. Similarly you will also indemnify the Owner against all the risks, costs, law-suits or any other proceedings brought against them due to your non-compliance of rules and regulations laid down by Government, Statutory or Local bodies including ESIC, PF and Safety during the course of the contract

36. SAFETY PROVISIONS

Contractor shall provide necessary PPE required for their activity at site. Generally the following PPE has to be available at construction site for workers,

- a) Safety Helmet for all workers
- b) Safety Shoes for all workers
- c) Safety gloves for all workers
- d) Safety full body harness for workers working at heights.
- e) Safety goggles & welding shield for gas cutting & welding operations.
- f) Ear plugs for workers working at noisy area.
- g) Safety apron & face mask for workers working at chemical & dust polluted areas.

Contractor shall appoint safety supervisor if the value of work exceeds 50lac or if the workers strength is more than 250nos. Qualified safety officer shall be employed if the workers strength is more than 500nos as per the BOCW Act.

37.MOBILIZATION OF CONTRACTOR'S PLANT, EQUIPMENT, PERSONNEL ETC.

You shall be mobilizing to the site adequate plant and machinery and provide necessary supervision for fulfilment of the contract and timely completion of the job as per the requirement and construction schedule. You shall be permitted to plan your activities and for deployment of staff, labour, plant etc. as per the construction schedule, to ensure satisfactory execution of the work and also be permitted to remove extra materials / plants etc., from the site of works, if required due to tapering of work etc.

You shall co-operate with other contractors executing work at the site and permit them use of working space etc. in the building under construction so long as it does not hinder your progress.

38.FACILITIES TO CONTRACTOR

a.Drinking water for labour shall be provided free of cost at site at one point. However construction water shall be arranged by you at your cost including necessary distribution.

b.Free Electricity shall be provided at actual cost at site at one point.The distribution of electric supply as required for construction shall be done by you at your cost from a licensed electrician. The Owner shall not be responsible for continuity of electrical supply and in the event of its failure the contractor shall be required to make his own standby arrangements at his own cost. The contractor shall be responsible for safety of electrical installations and will get the same certified by electrical inspector as per the requirement of Indian Electricity Act.

c.Reasonable area of land if available, required for temporary construction of site office, stores, workshops shall be made available to you free of cost for the period of the contract. All temporary structures shall be removed immediately after completion of the works. You will construct, maintain and demolish these structures at your own cost and will remain liable for the same in respect of the statutory provision of the government and municipal authorities.

39.SUFFICIENCY OF OFFER

It is expressly understood that your representatives have visited the site(s) of work and have acquainted you to the conditions thereof. It is also expressly understood

that you have taken into account all factors for completing the works as per the schedule enclosed herewith, in all respects while fixing your rates for different items. If any work is required to be carried out to complete the works described in the schedule of works but not expressly mentioned therein you will be deemed to have taken cost of such works into account in your pricing and nothing extra would become payable to you.

40.INSPECTION AND TESTING

The Owner or his authorized representative shall have full power to inspect the drawings of any portion of the work or examine the materials and workmanship of Electrical work at the contractor's works or at any place from which the materials or equipments are obtained. Acceptance of any materials or equipments shall in no way relieve the contractor of his responsibility for meeting the requirements of the specifications. Routine type tests for the various items of the Electrical System shall be performed at the contractor's works and test certificate furnished. If required by the Engineer, the contractor shall permit the Owners authorized representative to present during any of the tests.

The Contractor shall carry out the work to the satisfaction of the Architect and Project Engineer and shall be responsible for any breakage, wastage of material etc. The Contractor shall rectify at his own cost any defects arising out of bad workmanship or use of substandard/faulty materials or due to any other reasons as has been pointed out by the Architect and his representative.

In matters such as workmanship, quality of materials used on work, extra items, rates of extra work done and all such matters with respect to the Contract and execution of the work, the Architect / Consultant shall be the final Authority and his decision will be final and binding on the Contractor without any further legal reference.

41.ACCEPTANCE CRITERIA

The final acceptance of the work by the Owner shall be on the basis of,

- a.Certification by Owner's Consultants that work is carried out as per contract specifications and highest engineering practice.
- b.All tests are carried out and the results equal or exceed the specified design parameters certified by Consultants.
- c.Final approvals of statutory authorities are obtained.
- d.Final approval by architect, consultant and Owner.
- e.System functions without any fault for a period of one month after commissioning.
- h.Submission of the performance guarantee as per Clause No.- 28.
- i.Submission of 'As Built Drawings'.

The installation will be taken over by the client after the approval and the successful testing, checking and commissioning of the entire Electrical System by the client's Engineer, Architects and Consultants.

42.DOCUMENTATION

Contractor shall furnish to Owner following information within Seven days of the LOI / Work Order,

- a.Detail construction schedule showing the completion of works as per completion date including testing and commissioning.
- b.Site Organization Chart showing the names of the Project Manager and Engineers.
- c.Material order report showing detail programming for ordering of all materials and equipment and names of manufacturer showing delivery dates.
- d.List of equipments proposed to be used in works for Owner's approval.
- e.5 Sets of shop drawings.
- f.Upon completion of work 5 sets of as built drawings shall be submitted along with operation and maintenance manuals for all equipment.
- g.Test reports of the material / equipment as and when required by the Owner or his Consultants.
- h.Commissioning report and Consultants Certificate.
- i.Original guarantees of all equipment.

43.WORKS TO BE AS PER PROGRAMME AND SPECIFICATIONS

Contractor shall be responsible to carry out the works strictly in accordance with specifications given by Consultants and in accordance with the approved construction programme. In the event of the Contractor's failing to do so the Owner shall give 24 hours written notice to the Contractor to rectify the defects and/or take necessary measures to improve the progress of work. The Contractor's failure to do so shall result in automatic cancellation of contract and the Owner shall have the right to complete the work by appointing another agency at the entire risk and cost of Contractor.

44.WORKS TO BE PROTECTED

The work in every respect during its progress and till the final acceptance by the Owner, including the raw materials delivered to the site to be incorporated or used in construction of the work by the Contractor shall be under the charge and in the care of and under the responsibility of the Contractor and at his own risk. Any loss or damage to such materials or work prior to final acceptance of the work by the Owner shall immediately be replaced by the Contractor at his own expenses.

All the materials and finished or unfinished work shall be protected by the Contractor at his cost till the work is taken over by the Owner. Receiving part of full

payment for material or any part of incomplete/completed work shall not absolve the Contractor from his responsibility to safeguard such works from possible damage due to site conditions.

45.WORKS TO BE OPENED FOR INSPECTION

a.The Contractor shall provide all facilities to the Owner's representatives for inspection of the work or any part thereof.

b.The Contractor shall give all information and access to Owner's representatives.

c.In the event of Owner requiring any documents to verify specifications or other details pertaining to any work or part(s) thereof then the Contractor shall promptly provide such documents.

46.EVALUATION OF EXTRA WORKS

Rates for extras items/work as may be ordered shall be determined by the Consultant/Owner as follows,

a.The rate of extra item shall be submitted by Contractor for the approval of consultants/Owner before execution of work. The same shall be confirmed by Consultants/Owner. However the contractor shall not hold or delay execution of such works pending finalization of rates.

b.If not specified, the rates for that item shall be derived from the nearest similar item in the bill of quantities.

c.As per the actual expenditure incurred in execution of the item inclusive of all taxes plus 15% for contractor's profit, plant, machinery, tools etc. supervision and overheads. Contractor shall furnish all necessary documents/invoices if required by the consultants/Owner, for verification.

d.For extra items contractors shall get the instructions confirmed in writing from Project in Charge before executing the work and keep proper record of same.

e.The contractor shall get confirmed in writing, any verbal instruction by Engineer-in-charge for executing the work or any extra items before execution.

The decision of Owner regarding rate of extra items shall be final and binding on contractor.

47.SUSPENSION OF WORK

The contractor shall, on the written order by the Employer suspend the progress of the works or any part thereof for such time or times and in such manner as the Owner/Consultant may consider necessary and shall during such suspension, properly protect and secure the work, so far as is necessary in the opinion of the Consultant.

48.ISO 14001 : 2004 & ISO 18001 : 2007

The Owner has committed for Environmental, Occupational Health & Safety aspects in design & construction of all his activities, products & services. The Owner is registered under ISO 14001 : 2004 for Environmental Management System & under ISO 18001 : 2007 for Occupational Health & Safety Management System. Hence the contractor has to follow provisions of ISO 14001 : 2004 & ISO 18001 : 2007 along with the Owner's manual which is kept at site, the cost of which is deemed to be included in the agreed price.

49.TERMINATION OF CONTRACT

We will have the right to terminate the contract after giving one week notice, in the event of your failure to carry out the work as per the schedule or to maintain the acceptable quality of the workmanship or to observe the safety precautions at site or non-compliance of rules and regulations of local and government bodies or non-compliance of any other conditions required under the agreement.

50.MISDEMEANOUR ON PART OF THE CONTRACTOR

In the event of any misdemeanour on part of the contractor or his involvement in unethical/corrupt practices or his attempt to unduly influence the Owner's/consultant's personnel for any reasons whatsoever, the Owner shall have full right to terminate the contract without any notice to the contractor and forfeit all the money payable to the contractor without prejudice to any other remedy available under the terms of contract, to complete the balance work at the risks and costs of the contractor.

51.FORCE MAJEURE

Notwithstanding anything contained hereinabove, neither party to this contract shall be liable to other for discharging of its obligations under the terms and conditions of the agreement where,

a)From the date of issue of the LOI/Work order till the completion of work, if there occurs an event of Force Majeure which includes, but not limited to, earthquake, floods, famine or terrorist attacks, war (If declared or not), hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection, military or usurped power, strike, civil war, riot, commotion or disorder or any other irresistible force, adverse

market conditions or any other reasons beyond control of the Owner, which may affect his business directly or indirectly, the Owner shall have option to terminate the contract, if such Force Majeure continues for a period of 30 days or beyond.

b) In case of delay or default by a government agency, local authority or statutory undertaker in carrying out work or granting the consents and approvals in pursuance of its statutory obligations in relation to the Initial Works or exercise after issue of this LOI/Work order any statutory power which restricts the availability or use of labour or prevents delays the prospective contractor in obtaining goods, materials, fuel or energy for 30 days or beyond, adverse market conditions or any other reasons beyond the control of the Owner, which may affect the business directly or indirectly, the Owner shall have the right to terminate the contract with immediate effect.

c) If during tenure of the contract, any completed portion of the work is destroyed or damaged by fire (not caused by any wilful act of the contractor), earthquake, tempest, flood, lightning, violence of any army or mob or enemies of the country or by irresistible force of the orders of any statutory authorities or any other natural calamity so as to render the portion of work completed unfit for the purpose for which it was constructed for 30 days or beyond, the Owner shall have the right to terminate the contract with immediate effect.

d) If during the term of the contract, the complex, the building or any part thereof is acquired or requisitioned by the government or any local authority or authority under any act or rules made thereunder, the Owner has right to terminate the contract with immediate effect.

In cases of termination of the contract agreement as mentioned hereinabove, the prospective contractor shall return advances paid to him by the Owner along with handing over of site.

52. ARBITRATION CLAUSE

In the case of disputes, if any, between the parties hereto arising out of the Agreement herein including the determination of the quantum of the amount payable to the Contractor by the Employer for the work done by them and/or the quantum of amount as damages payable by the Contractor to the Employer, shall be settled as per the provisions on Indian Arbitration and Conciliation Act 1996. The courts of jurisdiction will be at Mumbai.

53. Governing Law : This order shall be governed by Indian law and the legal jurisdictions of this order shall be at Mumbai.

54. CLAUSE FOR STATUTORY COMPLIANCE

Contractor / Service Provider shall comply with all the provisions of statutory legislations applicable to their establishment / company which are in force from time to time including but not restricted to :

- 1) Minimum Wages Act, 1948
- 2) Maharashtra Workmen's Minimum HRA Act, 1983
- 3) The Contract Labour (R&A) Act, 1970
- 4) Employees Provident Fund & Misc. Provisions Act, 1952
- 5) Employees State Insurance Act, 1948
- 6) Maharashtra Labour Welfare Fund Act, 1953
- 7) The Profession Tax Act, 1975
- 8) Employees' Compensation Act, 1923
- 9) Payment of Bonus Act, 1965
- 10) Payment of Gratuity Act, 1972
- 11) Maternity Benefits Act, 1961
- 12) Sexual Harassment of Women at Work Place (Prevention, Prohibition & Redressal) Act, 2013
- 13) Maharashtra Shops & Estb. Act, 1948
- 14) Inter State Migrant Workman Act, 1979
- 15) The Building & Other Construction Workers (RE & CS) Act, 1996 Actwise list of records / registers needs to be maintained, which is an integral part of this Service Contract / Agreement. Contractor / Service provider shall timely maintain all original records at site and timely submit all returns (monthly/quarterly/half yearly/annually) as required under the provisions of different acts applicable to them. The records should be readily available for inspection /Verification as and when demanded by the Owner or any other authority.

CLAUSE FOR COMPLIANCE

As per Chapter VII of the Contract Labour (Regulation and Abolition) Central Rules, 1971, Every contractor shall in respect of each work on which he engages contract labour maintain following records and registers.

- a) Muster Roll: The contractor shall maintain a muster-roll of the workers employed in various trades as required to execute the work at site, from the date of commencement to the to the completion of the project.
- b) Wages Register: The contractor shall maintain a wage register of the workers employed in various trades, wherein the contractor shall obtain signature or thumb-impression of each such building worker against entries relating to him and such entries shall be authenticated by the contractor or his authorised representative.
- c) Deduction Register: A register of deduction for damage or loss shall be maintained with all the relevant details of damage or loss and the amount recovered as deduction. In case, where during a wage period, no deduction has been made from the wages of a building worker a 'nil' shall be made against such wage period at the appropriate place.
- d) Overtime Register: A register of overtime for recording therein the number of hours of, and the wages paid for, overtime work, if any.

e) Fine Register: A register of fines for violations/acts/ omissions, by the workers, shall be maintained with all the relevant details and the amount recovered as fine. In case, where during a wage period, no fines are recovered from the wages of a building worker a 'nil' shall be made against such wage period at the appropriate place.

f) Advance Register: A register of advances shall be maintained for the advances given, if any, along with the purpose for which the advance was given and the number of instalments by which the recovery shall be made.

g) Register of persons employed: The contractor shall maintain, in respect of each establishment, where building workers are engaged, a register with all the relevant personal details of each worker, such as, permanent address, local contact details, age, Father's name, Designation etc.

h) Employment card: Each worker shall be issued an employment card with all relevant details and a photograph affixed, duly stamped, stating date of employment.

i) Notice of commencement/completion of contract work: The contractor, as per BOCW Act, Rule 239, shall send to the Inspector having jurisdiction, a written notice intimating

the actual date of the commencement, the probable date of completion and other such particulars as referred to in sub-section (1) of section 46 of the Act relating to construction work on the site.

j) Service Certificate: The contractor shall issue a service certificate to each of such building worker in specified format, to such building workers on termination of his service on account of completion of such work or for any other reason.

k) Returns: The contractor shall send annually, return relating to such establishment in duplicate, in specified format, to the registering officer having jurisdiction so as to reach him not later than the fifteenth February following the end of each calendar year with a copy to the Inspector having jurisdiction.

The contractor shall ensure that the registers and other records required to be maintained under the BOCW Act (Regulation of Employment and Conditions of Service), Payment of Wages Act, 1936 (4 of 1936), or Minimum Wages Act, 1948 (11 of 1948) or the

Contract Labour (Regulation and Abolition) Act, 1970 (37 of 1970), or these rules, are maintained complete and up-to-date, and made available for scrutiny by the Project Incharge and/or authorized representative of the Owner.

55.ORDER CONFIRMATION

The confirmation of this Order shall be in writing which includes email and which shall constitute a contract. The confirmation shall be communicated within 3 days of receipt of this order. If the Supplier/Contractor does not accept the Purchase order / Work Order within 3 days from the date of receipt, the company shall be at liberty to consider it deemed accepted or cancel the same without incurring any liability whatsoever.

56.OTHER CONDITIONS

a.All appliances & works shall confirm to the relevant IS standards unless particularly specified in the list of approved makes.

b.Contractor has visited the site and has confirmed the rates after acquainting himself with the conditions at site, clearances available and dimensions provided in civil works.

c.Contractor shall remain responsible for testing, commissioning of the entire system and shall remain liable for defects liability period for one year for functioning of the entire system, during which any repair/rectifications or replacement as may be required shall be carried by the Contractor without any cost to the Owner.

d.Contractor shall prepare the shop drawings showing detail arrangements of piping, fittings, panels and cabling etc. in relation to the Architectural and Structural details. Owner shall not be liable to make payment for any material brought by the Contractor or any work carried out by him, which is not in accordance with the approved shop drawings.

Annexure A enclosed with this Work Order shall, be deemed to be part of this Work Order along with original tender of Consultants/Owner. Any correspondence prior to this work order shall be superseded by the terms and conditions of this work order. In case of discrepancies noticed in specifications at different places in documents attached with this work order or original tender, the most stringent shall apply.

The terms and conditions stipulated above have been mutually agreed upon. This Work Order is being issued in duplicate. Please sign and return one copy of this Work Order as token of your acceptance.

57 Anti-Corruption Policy

(i) The Vendor will abide by and comply with the conditions of the Anti-Corruption Policy (see website <http://mindspaceindia.com/images/new-images/Policies/Anti-Corruption-Policy.pdf> for the complete Anti-Corruption Policy), as a binding obligation under this contract. For the purpose compliance with the Anti-Corruption Policy by the Vendor in its business, all references to the "KRC Group" and "Company" in the Anti-Corruption Policy shall be deemed to be references to the "Vendor" and the Anti-Corruption Policy will be read accordingly.

(ii) The final invoice of the Vendor must be accompanied with the following certification, duly signed by the authorized signatory of the Vendor :

"We M/s. ABC(India)Pvt.Ltd, hereby confirm that as per the terms of the PO No. 4800000000 dated 18/05/2018 , we have completely implemented and adhered to the

Anti-Corruption Policy (Annexure "A" thereto) in respect to our business and indemnify and agree to keep the Company indemnified for any damages to the Company for the violation of same."

(iii) The Vendor shall promptly notify M/s. KRC INFRASTRUCTURE & PROJECTS PRIVATE LTD-SEZ. of any violation or potential violation of the Anti-Corruption Policy, and shall be responsible for any damages to the M/s. KRC INFRASTRUCTURE & PROJECTS PRIVATE LTD-SEZ. for the violation of same. Any violation of Anti-Corruption Policy may lead to termination of all business connections with the M/s. ABC(India)Pvt.Ltd "

ANNEXURE A - BILL OF QUANTITIES
ANNEXURE B -MAKE LIST

PREAMBLES OF BOQ

a.Detailed description of items please refer Bill of Quantities of Original Tender Documents.

b.Contractor has confirmed the rates for finished items after visting the site.

c.The rates are all inclusive and include all taxes and duties including freight, loading, unloading, insurance, scaffolding, testing etc. except IGST, which shall be exempted as this being a SEZ Project.

d.Rates are inclusive of Carting away debris, Cleaning & Security.

e.Rates confirmed in this building shall be applicable to any height and any location except wherever mentioned otherwise in this BOQ.

f.The bill of quantities is to be read in conjunction with the drawings, specifications, terms and conditions of tender documents and work order.

g.All electrical works on terrace/exposed to weather shall have IP 55 Protection and cables to be laid on Ladder Type G.I. Trays.

h.The quanties given are approximate and can vary to any extent. The contractor will not be entitled to claim any extra on account of this quantity variation.

i.The contractor needs to get shop drawings approved from the consultants and thereafter work out BOQ, which are to be whetted by the consultants/Owner before procurement of materials.

j.The rates shall remain firm till the completion of the work and the contractor shall not be entitled to claim any escalation on any account till the completion of the project.

k.The Material shall be supplied as per the approved make list ANNEXURE attached with this work order

m.Testing equipments require at factory as well as at site necessary testing has to be arrange is in vendors scope.

PACKAGE: ELECTRICAL PANELS - LT / MAIN PANELS			
×	(T&C) -Not Required		
□	(T&C) -Required		
		Testing Requirements	
Code	Description	Factory acceptance test	Site acceptance test
E001	Pre-functional / Installation verification as per approved drawing	□	□
E002	Torque test	×	□
E003	Millivolt drop test	×	□
E004	Megger test	□	□
E005	Hi-pot test	□	×
E006	Interlock Logic verification of panels	□	□
E007	ATS logic verification	×	□
E008	ON / OFF operation of breakers	□	□
E009	Voltage measurement	□	□
E010	I/C and O/G continuity test	×	□
E011	Phase sequence verification	×	□
E012	Metering arrangement verification	□	□
E013	Energy meter parameters verification	□	□
E014	Energy meter calibration verification	×	□
E015	Energy meter BMS data verification	□	□
E016	BMS interface verification - High and Low levels	□	□
E017	EOP switch operation (if any)	×	□
E018	Thermography check of panels of load	×	□

PACKAGE: ELECTRICAL SYSTEMS			
✖	(T&C) -Not Required		
☐	(T&C) -Required		
Code	Testing & Commissioning Description	Site acceptance test	Remarks
Electrical DBs			
E001	Prefunctional / Installation verification	☐	
E002	Circuit verificaiton and socket testing	☐	
E003	Cable meggering	☐	
E004	DB meggering	☐	
E005	ON / OFF operation of breakers	☐	
E006	I/C and O/G contunity test	☐	
E007	Phase sequence verification	☐	
E008	Metering arrangement verification	☐	
E009	Energy meter parameters verification	☐	
E010	Energy meter calibration verification	☐	
Earthing			
E011	Earthpit test	☐	
E012	Earth loop verification	☐	
Bus-duct & Bus Way Systems			
E013	Meggering	☐	
E014	Torque test	☐	
E015	Millivolt drop test	☐	
E016	Thermography check of bus ways	☐	

PACKAGE: ELECTRICAL PANELS - HT / MAIN PANELS			
✖	(T&C) -Not Required		
☐	(T&C) -Required		
		Testing Requirements	
Code	Testing & Commissioning Description	Factory acceptance test	Site acceptance test
Electrical Panels - LT PANELS/MAIN PANELS			
HT001	Pre-functional / Installation verification as per approved drawing	☐	☐
HT002	Torque test	☐	☐
HT003	Primary /Secondary Injection for HT Relays	☐	☐
HT004	Megger test (25kV)	☐	☐
HT005	HT metering verification	☐	☐
HT006	Pressure check of HT Breaker (SF6 or Vaccum)	☐	☐
HT007	Operation check of HT Panel	☐	☐
HT008	Control Logic Verification of HT Panel	☐	☐

ANNEXURE B -MAKE LIST

22 kV SF6 Panels =ABB/ Siemens/ Schneider/ CG

22 kV Grade XLPE HT Cables= Polycab/ Havells/ Apar/ KEI

VOLUME 2: SECTION 1: TECHNICAL SPECIFICATIONS

SUB-HEAD: A. CONDUIT, ACCESSORIES & FIXING ARRANGEMENT

a. 1. RIGID PVC CONDUIT & ACCESSORIES

PVC conduits shall be high impact, rigid, FRLS PVC, heavy-duty type and shall comply with relevant Indian Standards.

Plain conduits shall be jointed by slip type of couplers with approved sealing cement. All conduit entries to outlet boxes are to be made with adaptors female thread and screwed male bushes. Conduit fittings and accessories such as inspection boxes, draw boxes and junction boxes shall be of heavy duty rigid PVC installed in such a manner that they can remain accessible for existing wires or for the installation of the additional wires. Fan hook box shall be of M.S. Inspection boxes shall be covered with suitable covers.

Conduit runs shall be so arranged that the cables connected to separate main circuits shall be enclosed in separate conduits and that all lead and return wires of each circuit shall be run with the same circuit.

PVC conduits shall be smooth in bore, true in size and all ends where conduits are cut shall be made carefully smooth. Sharp edges shall be trimmed. All joints between lengths of conduits or between conduits and fittings and boxes shall be held firmly together and glued properly. All joints shall be fully water tight. All jointing of PVC conduits shall be by means of adhesive jointing.

2. RIGID MS CONDUIT/GI CONDUIT & ACCESSORIES

Rigid MS conduits shall conform to relevant Indian Standards. MS ERW conduits protected inside & outside by black stove enamel shall be used as called for in the schedule of quantities.

Conduit upto 32mm dia shall be of 16 G and above that shall be of 14 G.

Joints between conduits and accessories shall be securely made, to ensure earth continuity (screwed joints). All joints shall be fully watertight. Threads and Sockets shall be free from grease and oil.

Conduit fittings and accessories such as inspection boxes, draw boxes and junction boxes shall be of C.I. for concealed conduiting and shall be of M.S. for surface conduiting. Fan hook box shall be of M.S. Inspection boxes shall be covered with 16 G GI covers. All conduit accessories shall be threaded type only.

Conduit runs shall be so arranged that the cables connected to separate main circuits shall be enclosed in separate conduits and that all lead and return wires of each circuit shall be run with the same circuit.

MS conduits shall be smooth in bore, true in size and all ends where conduits are cut shall be made carefully smooth. Sharp edges shall be trimmed. All joints between lengths of conduits or between conduits and fittings and boxes shall be held firmly together and screwed properly. Connection between screwed conduit and sheet metal boxes shall be by means a brass / GI hexagonal check nut fixed from inside the box and another check nut from outside the box. Smooth PVC bushes from inside the box to be used to avoid damage to wires.

GI conduits if called for in the schedule of quantities shall conform to relevant Indian Standards. These conduits shall be protected by hot dip galvanized coating both inside and outside.

3. FLEXIBLE CONDUITS

Flexible conduits shall be made of heavy gauge MS strip galvanized after making the spiral. Both edges of the strip to have interlocking to avoid opening up.

4. LAYING / FIXING OF CONDUITS.

Conduits shall be installed so as to avoid steam and hot water pipes. Conduits for LV systems shall be at least 150mm away from the electrical conduits.

Wires shall not be drawn into conduits until the conduits are erected, firmly fixed and cleaned out. Not more than two right angle bends or the equivalent shall be permitted between draw or junction boxes. Bending radius shall not be less than 2.5 times the outer diameter of the conduit.

Conduits concealed in the ceiling slab shall run parallel to walls and beams and conduit concealed in the walls shall be vertical or horizontal.

The chase in the walls required for the recessed conduit system shall be neatly made and shall be of ample dimensions to permit the conduits to be fixed in the manner desired. Conduits in chase shall be held by steel clamps of approved design. The chase shall be filled up neatly after erection of conduits and brought to the original finish of the wall with cement plaster/cement concrete. The spacing between each clamp shall be 60 cm center to center.

Surface conduits shall be fixed by means of spacer bar saddles at intervals of not more than 500 mm from both sides of fittings/accessories. The saddles shall be of 3mm x 19mm galvanized M.S. flat properly treated, primed and painted securely fixed to support by means of nuts & bolts / raw plugs and brass machine screws.

Where conduits cross expansion joints in the buildings, adequate expansion fittings shall be used to take care of any relative movement.

Separate conduits shall be laid for the following systems:

- a) Normal light, Fan and 6 A socket outlets.
- b) Power points.

- c) TV outlets.
- d) PA/ Paging system.
- e) Telephone points and Data Points
- f) Fire alarm system.
- g) UPS points.
- h) CCTV System
- i) Access Control System
- j) Emergency Lighting

Contractor shall submit the conduiting layout to PMC / Owners for approval before start of work. While laying conduiting, care should be taken that water, mortar and dirt etc. do not enter the conduits and boxes.

Conduiting system should be such that it shall facilitate easy drawing of new wires/additional wires at any stage. All junction boxes/pull boxes/ draw boxes shall be completely accessible for inspection, maintenance or for future expansion. While drawing of wires, care shall be taken to avoid damage to the wire insulation.

All joints in the wiring shall be made only at switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joint shall be made in conduits and junction boxes.

5. FAN HOOK BOX:

- Recessed Fan hook box shall be fabricated from 16G 'MS' sheet Anodized.
- Fan hook box shall be Hexagonal in shape with 75mm depth & 150mm diameter.

The fan fixing rod shall be 'U' shaped, 12mm dia 'MS' Anodised, welded to the box with minimum 150mm projection on either side.

SUB-HEAD: B.

WIRING AND WIRING ACCESSORIES

1. GENERAL

- All the internal wiring shall be with 450 / 750 V grade, single core FR-LSH, PVC insulated, unsheathed multi-stranded electrolytic grade annealed bare copper conductor wires confirming to IS: 694/2010 amended & revised to date and wiring installation should conform to IS: 732.
- Multicore flexible cables shall be 450/750V, multicore, PVC insulated, FR-LSH PVC Sheathed, multi-stranded, electrolytic grade annealed bare copper conductor flexible cables conforming to IS:694/2010.

2. COLOUR CODING

Colour coding of wiring shall be done as per IS specifications, for identification of different circuits and phases. All wiring shall be in concealed or surface conduits as called for.

In three phase feeder circuit, three phase wire, with or without neutral wire, shall be taken through any single conduit. In lighting and power socket outlets wiring, in no case two lives wires of different phases shall be drawn through the same conduit.

3. SWITCH

All switches shall be connected to live wire and neutral of each circuit shall be continuous everywhere having no fuse or switch installed in the line except at the main switch board.

4. INSTALLATION

The conduits and wiring installation are to be installed such that modifications or repairs can be carried out in future without disturbing the building fabric in any way.

For wiring accessories partly recessed in wall, special care must be taken to ensure that the final position of all switch\ socket plates are set symmetrical with the pattern of the wall finish as required by the architect. All switch socket-mounting plates shall be set square to the vertical and horizontal axis.

5. FISH WIRE

GI Fish wire / Pull wire of 14G shall be provided in the recessed conduiting to facilitate pulling of wires through conduits.

6. INSPECTION BOXES

Inspection boxes / Pull boxes shall be provided as required and approved by the Architect / Consultant for pulling of wires through conduiting network. Rigid PVC boxes shall be used for the PVC conduiting and G.I. boxes of suitable size and depth shall be used for MS / GI conduiting.

7. JOINTS

Only looping system of wiring shall be used. Wires shall not be jointed/ taped. All joints shall be made at switches, sockets outlets, distribution boards and lighting points. No joints shall be made inside conduits and in junction boxes. Suitable sizes

connectors to be used at light fixtures. No reduction of strands is permitted at terminations. Before connections, copper conductor wire ends shall be properly soldered (at least 20-mm length). Terminals shall have adequate cross-sectional area to take all strands. No wire smaller than 1.5 sq.mm shall be used.

8. IDENTIFICATION

Identification ferrules indicating the circuit and D.B. number shall be used for sub mains and sub-circuit wiring. The Ferrules shall be provided at both ends of each sub-main and sub-circuit.

9. CIRCUITS OF DIFFERENT PHASES & DIFFERENT DB's

Where single-phase circuits are supplied from a three phase and neutral distribution board, no conduit shall contain the wiring of different phases. Circuits fed from distinct sources of supply \ from different distribution boards or MCB's shall not be bunched in one conduit.

10. LOAD BALANCING, CONTROL & EARTH WIRE

Load Balancing of circuits in three-phase installation shall be arranged before installation is taken up.. The earth continuity green FRLS PVC insulated copper wire for individual circuits of light / power / UPS should be laid. From D.B. each circuit will have separate earth wire. Earth wire shall be run inside the conduit to earth the third pin of socket outlets, earth terminal of light fixtures & fans etc. & earth terminals of outlet box as required. Light points shall be either of single control, twin control & multiple points controlled by a single switch / MCB as per schedule of works. Insulated copper wire for earthing as specified in the item of work shall be provided with each circuit and terminated in the earth bar of DB's / Switch boxes with proper lugs, as required.

11. CONDUIT FILL

Number of wires in each conduit shall be drawn as per chart given below:

MAXIMUM PERMISSIBLE NUMBER OF 1100 V GRADE FRLS PVC INSULATED COPPER CONDUCTOR WIRES THAT CAN BE DRAWN INTO METALLIC AND NON METALLIC CONDUITS:

Maximum permissible number of Single-core cables upto and including 1100V that can be drawn into Rigid steel and Rigid Non-metallic conduits

Nominal cross sectional area in sq.mm	20mm		25mm		32mm		40mm		50mm		60mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1.0	-	-	-	-	-	-	-	-	-	-	-	-
1.5	5	4	10	8	18	12	-	-	-	-	-	-
2.5	5	3	8	6	12	10	-	-	-	-	-	-
4.0	3	2	6	5	10	8	-	-	-	-	-	-
6.0	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-

16	-	-	2	2	3	3	6	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6

Notes:

1. The above table shows the maximum capacity of conduits for a simultaneously drawing of cables. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from the straight by an angle of more than 15°. The columns headed 'B' apply to runs of conduit, which deflect from the straight by an angle of more than 15°.
2. In case an inspection type draw in box has been provided and if the cable is first drawn through one straight conduit, then through the drawn in box and then through the second straight conduit, such systems may be considered as that of a straight conduit even if the conduit deflects through the straight by more than 15°.

12. WIRING AND EARTHING NORMS

Light Points, 6 A sockets and fans points may be wired on a common circuit. Not more than 10 light points, 6 A sockets and fan points and a load not exceeding 800 W be connected on a lighting circuit unless it is specified otherwise on the drawings/ in the schedule of quantities. It will however, be preferred to have separate circuits of 6A sockets as may be required by the consultant. Size of the earth wire shall be of the same size as that of the live / phase conductor unless specified otherwise. It shall however, be ensured that in one switchboard, only one circuit is terminated. For different circuits, separate switch boards shall be used. Each power circuit shall be wired as specified in drawings/schedule of quantities. Not more than two power points 6A/16A sockets shall be connected on one power circuits unless specified differently in the drawings/schedule of quantities.

UPS circuits shall start from the UPS DB's. UPS points will have two insulated green earth wires, one for the earthing of the 3rd pin of the socket and other for the earthing of the outlet box/furniture.

The smallest copper conductor to be used for lighting circuits shall be of 1.5/2.5 sq. mm (as specified in the schedule of quantities) and for power circuit 4 sq. mm respectively. Wiring shall be done in the looping system. Phase or live conductor shall be looped at the switch box and neutral conductor can be looped from the light, fan or socket outlet. Neutral conductor and earth continuity wire shall be brought to each switchboard situated in rooms/ halls. These shall be terminated inside the switchboards with suitable connectors.

SUB-HEAD: C.

SWITCHES, SOCKETS & ACCESSORIES

1. MODULAR SWITCHES

All 6 and 16 amps switches shall be clip in switch modules. Switches shall be with positive action rockers clipped on to modular front plates and shall be suitable for 230 volts AC. Switches & plates shall be made out of Fire retardant UV stabilized Engineering thermo plastic (grade poly carbonate). All modular plates shall be fixed to the switch boxes with brass screws, leaving ample space at the back and sides for accommodating wires. All switches shall conform to IS: 3854 amended and revised to date. Switches controlling the lights shall be connected to the phase wire of the circuit.

2. MODULAR SOCKET OUTLET

Socket outlets shall be clip in modules, clipped on to modular front plates and shall be 3/5/6 pin round or flat pin or universal or international type as called for in the Schedule of Quantities. Socket outlets and plates shall be made out of Fire retardant UV stabilized Engineering thermo plastic (grade poly carbonate). GI outlet box shall have an earth terminal. The earth terminal of the socket shall be connected to the earth terminal provided inside the box.

Each socket outlet shall be controlled by a switch. The switch controlling socket outlet shall be on live side/phase wire of the circuit. All switches shall confirm to IS: 3854 and socket outlets to IS: 1293 amended and revised to date.

3. POWER OUT-LETS

Each socket outlet shall be controlled by a switch. The switch controlling socket outlet shall be on live side of the circuit. All sockets shall conform to IS: 1293 amended and revised to date.

Switches and Sockets shall have Silver Cadmium contacts for long life. Live terminals should be shrouded for finger protection.

All 3 pin / 6 pin socket outlets shall be child resistant shuttered system.

4. MODULAR FAN REGULATORS & DIMMERS

Fan regulator shall be clip in modular type suitable for 230V AC. The minimum rated power shall be 120W. The regulator shall be totally hum free. The fan regulator shall have "Off" position. The fan regulator shall be clipped on to modular front face plate.

The dimmer shall be clip in modular type suitable for 230V AC. The minimum rated power shall be 400W. The dimmer shall have "Off" position. The dimmer shall be clipped on to modular front face plates.

These shall be made of Fire retardant, UV Stabilized, and engineering thermo plastic. Dimmers and fan regulators operation should not interfere with radio & TV signal.

5. METAL OUTLET BOXES

16 G GI outlet boxes of suitable size as per the requirement of modular front plate shall be used. The outlet box shall be of minimum depth of 50mm unless otherwise specified differently. GI outlet box shall have a brass earth terminal.

6. PLASTIC OUTLET BOXES

Plastic enclosures / outlet boxes where ever required shall be of suitable size as required for the switch / socket front face plates and shall be made of UV stabilized engineering plastics.

7. PLATE SWITCHES AND SOCKETS

Plate switches and sockets shall be suitable for 230V AC supply and made out of Urea formaldehyde thermo setting resin. Switches shall be rocker operated. Socket shall be shuttered. All current supply contacts shall be with Silver Cadmium Oxide contact tips. All sockets shall in corporate phosphorus bronze contacts. Suitable sized 16G GI outlet boxes with earth studs to be used.

8. TYPE OF SOCKET OUTLETS (to be used as specified in the B.O.Q.)

- a. 6 Amps. 3 Pin Round
- b. 6 Amps. 5 Pin Round
- c. 16 Amps. 3 Pin Round
- d. 6A/16 Amp. 6 Pin Round
- e. 6 Amps. 3 Pin Universal
- f. 13 Amps. 3 Pin Flat
- g. 6 Amps. 3 Pin International (Intel Socket)

SUB-HEAD: D. CABLES

MEDIUM VOLTAGE 1.1 KV GRADE XLPE INSULATED PVC SHEATHED CABLES

1. GENERAL

The MV cables shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, Specifications, relevant Indian Standard and cable manufacturer's instruction.

2. MATERIAL

i. Specifications of PVC insulated, sheathed aluminum / copper conductor cable shall be as follows:

b. Conductor

Stranded compacted circular conductor shall be of electrical grade high conductivity aluminum/ copper conductor as per IS: 8130 / 84.

b. Insulation

The insulation shall be compounded PVC, application shall be by extrusion process insulation type C (85deg.C) conforming to IS: 5831-1984. The thickness of insulation will be as per the relevant Indian codes.

c. Laying-up

Insulated conductors of multi core cables shall be with thermoplastic fillers in the interstices. The phase identification of cores shall be by colored strips.

d. Inner Sheath

Cores shall be surrounded either by a wrapped or an extruded PVC sheath. The thickness of the inner sheath shall be as per relevant Indian codes.

e. Armouring

The armouring shall be provided over the inner sheath. Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip armouring. Steel wires and strips for armouring confirm to IS: 3975. The direction of lay of armouring shall be opposite to that of cores.

f. Outer Sheath

Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS: 1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST1 of IS 5831. The colour of the outer sheath shall be black.

ii. Specifications for XLPE insulated HR PVC sheathed aluminum/ copper conductor cable shall be as follows:

a Conductor

Stranded compacted circular conductor shall be of electrical grade high conductivity aluminum / copper conductor per IS: 8130/84.

b. Insulation

The insulation shall be of natural unfilled chemically cross linked polyethylene conforming to IS: 7098. The thickness of insulation shall be as per the relevant Indian codes.

c. Laying-up

Insulated conductors of multi core cables shall be with plastic fiber in the interstices. The phase identification of cores shall be by colored strips.

d. Inner Sheath

The cores shall be surrounded by either a wrapped or by an extruded PVC sheath. The thickness of the inner sheath shall be as indicated in the relevant codes.

e. Armouring

The armouring shall be provided over the inner sheath. Single core cable shall have non-magnetic armouring. Multi core cables shall have either galvanized round steel wires or flat steel strip. Steel wires and strips for armouring confirm to IS: 3975. The direction of lay of armouring shall be opposite to that of cores.

f. Outer Sheath

Single and multi core cables are provided with an extruded PVC outer-sheath. The thickness of the sheath shall be as per IS: 1554-1988. The PVC compound for the outer-sheath shall confirm to Type ST2 of IS: 5831. The colour of the outer sheath shall be black.

iii. Specifications for Fire Resistant Power Cables

Cable shall be Aluminum / Copper conductor, mica taped, XLPE Insulated, Halogen free sheathed, Armoured, HFLS Jacket. The cables shall be rated for 900°C temperature withstand for 3 hrs.

The cables shall be as per BS6387CWZ.

3. CABLE LAYING AND HANDLING

It should be ensured that both ends of the cable are properly sealed to prevent ingress / absorption of moisture.

4. CABLE HANDLING

When cable drums have to be moved over short distance, they should be rolled in the direction of the arrow marked on the drum.

While removing cables, the drums shall be properly mounted on jacks or on a cable wheels or any other suitable means, making sure the spindle, jack etc. are strong enough to take the weight of the drum.

The cables shall not be given a sharp bend to a small radius. The minimum safe bending radius for all types of PVC/XLPE cables shall be taken as 12 times the overall diameter of the cable. Wherever practicable, larger radius should be adopted. At joints and terminations, the bending radius of individual cores of a multicore cable shall not be less than 15 times its overall diameter.

Cable with kinks and straightened kinks, or with similar apparent defects like defective armoring etc. shall not be installed / laid.

Cables of different voltages as well as power and control cables should be kept in different trenches/racks with adequate separation. Where available space is restricted, LV/MV cable shall be laid above HV cables.

Where cables cross over cannot be avoided, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.

Installation of cables including jointing shall be carried out as per IS: 1255 amended and revised to date.

Power and communication cables shall, as far as possible cross at right angles. Where power cables are laid in proximity to communication cables, the horizontal and vertical clearances shall not normally be less than 60 cm.

Cables shall be laid direct in ground, in pipes / closed ducts, in open ducts or on surface depending on environmental conditions, and as required in schedule of quantities.

During the preliminary stages of laying the cable, consideration should be given to proper location of the joint position so that when the cable is actually laid, the joints are made in the most suitable places and as approved by Consultant. 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.

The cable shall not in any circumstances be bent so as to form an abrupt right angle but must be rounded off at the corners to a radius not less than 12 times the overall diameter of the cable.

In case, where there are chances of any damage to the wiring/cables, such wiring/cables shall be covered with a sheet metal protective covering (not less than 16 SWG), the base of the covering being flush with the plaster or brickwork as the case may be, or the wiring /cables shall be drawn through a heavy gauge metal conduit pipe by complying with all the requirements of conduit wiring system.

Such protective covering shall, in all cases, be fitted on all down drops within 1.5 m from the floor or from floor level upto the switch board, whichever is less.

While cutting and stripping of the outer sheathing of the cable, care shall be taken that the sharp edge of the cutting instrument does not touch the inner insulation of the conductors. The protective outer covering of the cable shall be stripped off near connecting terminal and this protective covering shall be maintained upto close proximity of connecting terminals. The cables laid near junction boxes shall be made moisture proof with a plastic compound.

5. CABLE JOINTING & TERMINATION

Jointing shall be as per the manufacturer's recommendations using standard kits. Cable joints shall be made in suitable, approved cable joint boxes, jointing of cables in the joint boxes and filling of compound shall be done as per manufacturer's recommendations. Heat shrinkable joints shall be made.

Cables shall be terminated onto the terminals of switchgear through crimping lugs of proper size and of heavy duty. Cable lugs shall be fitted onto the cable by crimping or compression jointing.

Continuity of cable armouring is to be maintained. Double compression glands to be used. Proper crimping tools to be used.

6. TRENCHING & CABLE LAYING

The minimum width of trench shall be 45 cm and depth shall be 75cm for laying of cable. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the minimum gap between the cables is one diameter of the cable unless specified otherwise.

The clearance between axis of the end cables and the sides of the trench shall be minimum 1.5 D (diameter) of the end cable.

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature shall be provided.

Where gradients and changes in depth are unavoidable, these shall be gradual.

The bottom of the trenches shall be level and free from stone, brick bats etc. The trench shall then be provided with a layer of clean, dry sand cushion of not less than 9 cm in depth.

Cable laid in trenches in a single tier formation shall have a covering of clean, dry sand of not less than 20 cms. 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 30 cms shall be provided over the initial bed before second tier is laid. If additional tiers are formed, each of the subsequent tiers shall have a sand cushion of 30 cms as stated above. The top-most cable shall have final sand covering not less than 17 cms before the protective cover is laid.

Unless otherwise specified, the cables shall be protected by second class bricks of not less than 20 cm x 10 cm x 10 cm (nominal size) as per CPWD building specification, or protection covers placed on top of the sand, (brick to be laid breadth wise) for the full length of the cable to satisfaction of the owner. 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 5 cm over the sides of and cables.

The trenches shall be then back filled with excavated earth free from stone or other sharp-edged debris and shall be rammed and watered, if necessary, in successive layers not exceeding 30 cm. Unless otherwise specified, a crown of earth not less than 50 mm in the center and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of earth, however, should not exceed 10 cms.

Where road bends or lawns have been cut or kerb stones displaced, the same shall be repaired to the satisfaction of the architect and all surplus earth or rock removed to places as specified.

In locations such as road crossing, entry to building in paved areas etc. cables shall be laid in pipes or closed ducts.

All cable entry/exit points into the building through pipe sleeves shall be properly sealed with water and fire safe sealants in an approved manner to avoid any seepage of water into the building.

Manholes of adequate size, as decided by the Architect, shall be provided to facilitate of adequate strength feeding/drawing in of cables and to provide working space for persons. Suitable manhole covers with frame of proper design shall cover Manholes.

CABLE LOOPS: Sufficient cable loop length shall be left at both ends.

7. CABLES ON HANGERS OR RACKS / TRAYS

The contractor shall provide and install all iron hangers racks, or racks with die-cast cleat, with fixing rag bolts or girder clamps or other specialist fixing as required.

Where hangers or racks are to be fixed to wall sides ceiling and other concrete structures, the contractor shall be responsible for cutting away, fixing and grouting in rag bolts and making good the damages as required.

The hangers or racks shall be designed to leave at least 25 mm clearance between the cables and the face to which it fixed. Multiple hangers shall have two or more fixing holes. All cables shall be saddled at not more than 500 mm intervals. These shall be designed to keep provision of some spare capacity for future development. Minimum spacing between the cables shall be one diameter of the cable or as specified.

8. CABLE TRAY

- a) The MS cable trays should have undergone rigorous rust proofing process, which should comprise of alkaline, degreasing, descaling in diluted sulphuric acid and a recognized phosphating process. The sheet work shall then be given two coats of oxide primer before two coats of final painting. Cable trays shall be either painted (Stove enameled) or hot dip galvanized as called for in the schedule of quantities.
- b) Cable trays shall be complete with bends, joints, coupler plates and accessories as may be required for joining the cable trays.
- c) Cable trays shall be either perforated or ladder type as called for in the schedule of quantities.

9. PERFORATED CABLE TRAYS

Standard Technical details of perforated cable tray shall be as follows:

S. No.	SIZE OF TRAY (Width)	THICKNESS & COLLAR HEIGHT
1.	150mm to 450mm width	2mm thick & 40mm collar
2.	600mm to 750mm width	2mm thick & 50mm collar
3.	900mm to 1200mm width	3mm thick & 50mm collar

Note: Supports shall not be charged extra. It shall be considered to be included in the rate of the tray.

10. LADDER TYPE CABLE TRAYS

Standard technical details of ladder type cable trays shall be as follows:

S. No.	SIZE OF TRAY	SIZE OF MAIN CHANNEL	SIZE OF RUNG & SPACING	CABLE TRAY SUPPORT
1.	900mm to 1500mm	25 x 100 x 25 x 2.5mm	20 x 50 x 20 x 2mm @ 250 C/C	50 x 50x 5mm angle @ 1000mm spacing.
2.	450mm to 750mm	25 x 75 x 25 x 2.0mm	20 x 50 x 20 x 2mm @ 250 C/C	40 x 40 x 5mm angle @ 1250mm spacing.
3.	150mm to 300mm	25 x 75 x 25 x 2.0mm	15 x 30 x 15 x 2mm @ 250 C/C	40 x 40 x 3mm angle @ 1500mm spacing.

Hangers shall be minimum 10mm dia GI Round bar.

Fixing /supporting arrangement shall be as approved by the Consultant / Owner / PMC

Hardware to be used in cable tray system shall be galvanized or zinc passivated.

Note: Supports shall not be charged extra. It shall be considered to be included in the rate of the tray. All structural steel shall be according to the latest revision of IS: 226 & 808.

a. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

b. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs; rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing, pickling in acid, cold rinsing and then galvanizing.

11. TESTING OF CABLES

The Megger value in normal dry weather shall be 50 mega ohm for 1.1 KV grade cable. Cables shall be tested at works for the following tests before being dispatched to site by the project team:

- a. Insulation Resistance Test.
- b. Continuity resistance test.
- c. Sheathing continuity test.
- d. Earth test.(in armoured cables)
- e. Hi Pot Test.

Test shall also be conducted at site for insulation between phases and between phase and earth for each length of cable, before and after jointing. On completion of cable laying work, the following tests shall be conducted in the presence of the Owner's site representative:

- a. Insulation Resistance Test(Sectional and overall)
- b. Continuity resistance test.
- c. Sheathing continuity test.
- d. Earth test.

All tests shall be carried out in accordance with relevant Standard Code of Practice and Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the PMC / Owner representative.

12. CABLE TAGS

Cable tags shall be made out of 2mm thick aluminum sheets. Each tag shall be 2" in dia or 3" x 3" square with one hole of 2.5mm dia, 6 mm below the periphery, or as approved by Consultant. Cable designations are to be punched with letters / number punches and the tags are to be tied to cables with piano wires of approve quality & size. Tags shall be tied inside the panels beyond the glanding as well as above the glands at cable entries. Along trays tags are to be tied at all bends. On straight lengths, tags shall be provided at every 5 meters.

Cables shall be secured to cable trays with 3mm thick x 25mm wide aluminum strips/suitable GI clamp, or as approved by Consultant, at 1000 mm intervals and screwed by means of rust proof screws, washers and bolts, of adequate but not excessive lengths. Cable trays for horizontal runs suspended from the ceiling will be supported with mild steel straps or brackets, at 1000 mm intervals and the overall tray arrangement shall be of a rigid construction. External cabling route marker with GI plate marked with "DANGER 1.1 kV CABLE" with 1 meter long GI angle iron grouting bracket including 1:3:6 ratio cement concrete base block of minimum size 200 x 200 x 350 mm to be provided or as approved by Elect. Supply Company.

SUB-HEAD: E. EARTHING

1. SYSTEM OF EARTHING

The system shall be TNS with 4 wires supply system (R, Y, B, N and 2 Nos. E) brought from the Main LT Panel.

All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043 – 1987 with latest amendment. All metal conduits, cable sheath, switchgear, DB's, light fixture, equipment and all other parts made of metal shall be bonded together and connected to earth electrodes. Earthing shall be in conformity with provisions of rules 32, 61, 62, 67 and 68 of Indian Electricity Rules, 1956.

All earthing conductors shall be of high conductivity copper or GI, as specified in the schedule of quantities & shall have protection against mechanical damage. The cross-sectional area of earth conductors shall not be smaller than half that of the largest current carrying conductor.

Main earthing conductors shall be taken from the earth connections at the main L T panel to an earth electrode with which the connection is to be made. All joints in tapes shall be with four rivets and shall be brazed in case of copper and by welding bolting in case of GI. Wires shall be connected with crimping lugs, all bolts shall have spring washers. Sub- mains earthing conductors shall run from the main distribution panel to the sub distribution panel. Final distribution panel earthing conductors shall run from sub-distribution panel.

Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor, or its distribution panel. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to distribution panel at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of the earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

- a. All Lighting fixtures, sockets outlets, fans, switch boxes and junction boxes etc. shall be earthed with copper wire as specified in schedule of quantities. The earth wire ends shall be connected with solderless/bottle type copper lugs.
- b. All the earth wires in switch boxes, sockets outlets, DB's and light fixtures shall be of green Colour (PVC insulated).
- c. Main earth bus shall be taken from the L.T. switch board to earth electrodes. The electrical resistance of earthing conductors shall be low enough to permit passage of fault current necessary to operate fuse or circuit breaker, and it shall not exceed 1 ohm.

2. SIZING OF EARTHING CONDUCTORS

The cross sectional area of earthing conductor shall not be smaller than half of the largest current carrying conductor subject to an upper limit of 80 Sq.mm. If the area of the largest current carrying conductor or bus bar exceeds 160 sq.mm then two or more earthing conductors shall be used in parallel, to provide at least half the cross sectional area of the current carrying conductor or bus bars. All fixtures, outlet boxes, junction boxes and power circuits upto 15 amps shall be earthed with PVC insulated copper wire.

All 3 phase switches and distribution panels upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper / GI wires. All 3 phase switches and distribution panels upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper / GI wires. All switches, bus bar, ducts and distribution panels of rating 200 amps and above shall be earthed with minimum of 2 nos separate and independent 25 mm x 3 mm copper / GI tape.

Earthing details given in Table - A & B shall be referred to as a general guidance. Exact sizes to be worked out by the contractor as per relevant IS Codes.

TABLE - A

Size of earth leads

(a) For Transformer/Generator Neutral Point Earthing:

Transformer/ DG Set Rating	Electrolytic Bare copper Conductor Wire or strip	Galvanized Iron Conductor wire or strip
50KVA & below/4mm dia	4mm dia	25mm x 6.0mm
75 KVA	25mm x 3.0mm	25mm x 6.0mm
100 KVA	25mm x 6.0mm	32mm x 6.0mm
150 KVA	25mm x 6.0mm	40mm x 6.0mm
200 KVA	25mm x 6.0mm	40mm x 6.0mm
250 KVA	25mm x 6.0mm	40mm x 6.0mm
300 KVA	25mm x 6.0mm	40mm x 6.0mm
500 KVA	40mm x 6.0mm	40mm x 6.0mm
750 KVA	40mm x 6.0mm	50mm x 6.0mm
1000 KVA	40mm x 6.0mm	50mm x 6.0mm
1250 KVA	50mm x 6.0mm	50mm x 6.0mm
1500 KVA	50mm x 6.0mm	75mm x 6.0mm
2000 KVA	50mm x 6.0mm	75mm x 6.0mm

NOTE: - EXACT SIZE OF EARTH LEAD TO BE DETERMINED AS PER LATEST IS CODES.

TABLE - B

- (b) For Equipment Earthing (Applicable to Transformer, Generators, Switchgears, Panels, DB's, Motors etc.)

Rating of 400-V, 3ph 50 cy. Equipment In KVA	Bare Electrolytic Copper conductor Wire / Strip	Galvanised Iron Wire / Strip
upto 5	2mm dia	2mm dia
6 to 15	3mm dia	3mm dia
16 to 30	4mm dia	4mm dia
31 to 50	6mm dia	6mm dia
51 to 100	25mm x 3.0mm	25mm x 6.0mm
101 to 125	25mm x 3.0mm	32mm x 6.0mm
126 to 150	25mm x 3.0mm	32mm x 6.0mm
151 to 200	25mm x 6.0mm	40mm x 6.0mm
201 to 300	25mm x 6.0mm	50mm x 6.0mm
301 to 500	32mm x 6.0mm	50mm x 6.0mm
501 to 800	40mm x 6.0mm	50mm x 6.0mm
Above 800	50mm x 6.0mm	50mm x 6.0mm

NOTE: EXACT SIZE OF EARTH LEAD TO BE DETERMINED AS PER LATEST IS CODES.

NOTE: ALL THREE PHASE EQUIPMENT SHALL BE DOUBLE EARTHED

3. PROHIBITED CONNECTIONS

Neutral conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a earthing conductor.

4. CONNECTION/JOINTS

The earthing connections/joints should be bolted, riveted, welded, brazed type. In case of bolted joints, GI/Passivated hardware's of adequate size/nos. should be used for firm connections. The minimum contact area should be equal to the width of the strip or cross-sectional area of earthing lead. Welded/brazed joints should be smooth and continues. All welded/brazed joints should be treated with anti-corrosive paints to protect it from corrosion/rusting.

All bolted connections/joints of Cu strip should be tinned.

Wherever, flexible earthing connection is must, it should be hydraulically crimped lugs of Copper/Aluminum.

The effective earthing connection surface should be smooth & free from paints and oxide coatings.

5. EARTHING

The following must always be ensured in earthing system:

- All earth pits should be at equi - potential. Main equipotential bonding conductors shall be provided.
- Extraneous conductive parts such as gas pipes, other service pipes and ducting risers and pipes of fire protection equipment and exposed metallic parts of the building structure shall be bonded to earth.
- The Contractor shall get the soil resistivity test done at his own cost of the area where earthing pits are to be located before starting the installation.

6. RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1 ohm.

SPECIFICATION FOR HOT DIP GALVANIZING PROCESS FOR MILD STEEL USED FOR EARTHING FOR ELECTRICAL INSTALLATION

7. GENERAL REQUIREMENTS

a. Quality of Zinc

Zinc to be used shall conform to minimum Zn 98 grade as per requirement of IS: 209-1992.

b. Coating Requirement

Minimum weight of zinc coating for mild steel flats with thickness upto 6 mm in accordance with IS:6745-1972 shall be 400 g/sqm.

The weight of coating expressed in grams per square meter shall be calculated by dividing the total weight of Zinc by total area (both sides) of the coated surface.

The Zinc coating shall be uniform, smooth and free from imperfections as flux, ash and dross inclusions, bare patches black spots, pimples, lumpiness, runs; rust stains bulky white deposits, blisters.

Mild steel flats / wires shall undergo a process of degreasing pickling in acid, cold rinsing and then galvanizing. Jointing of earthing tape shall be by welding. All joints and cut ends shall be properly painted with aluminum paint.

8. MAINTENANCE FREE CHEMICAL EARTHING:

Maintenance Free Chemical Earthing shall be done strictly as per manufacturer's recommendations. It shall be completely maintenance free, long life close to 25 years, environmentally safe, non corrosive & electrically conductive. The earth resistance results shall be less than one ohm.

SUB-HEAD: F.

FINAL DISTRIBUTION BOARDS (FDB's)

Final Distribution Boards (FDBs) shall be suitable for operation on 3 Phase/single phase, 415/240 volts, 50 cycles, neutral grounded at transformer. The DB shall be minimum di-electric strength of 2.5 KV for 1 Sec. All Distribution Boards shall manufactured by a manufacturer listed in approved makes of material.

FDB's shall comply with the latest Relevant Indian Standards and Electricity Rules and Regulations and shall be as per IS: 13947-1993.

1. CONSTRUCTIONAL FEATURES

FDB's shall be made out of 1.6 mm thick high quality CRCA sheet steel and shall be pre-treated and powder coated sheet steel used in the construction of FDB shall be folded and braced as necessary to provide a rigid support for all component. FDB shall be suitable for indoor / outdoor installation as the case may be, wall mounting or free standing type as per requirement, in double door construction. The Final Distribution Boards shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket, padlocking arrangement. All removable/ hinged doors and covers shall be grounded by 4.0 sqm tinned stranded copper connectors. Final Distribution Boards shall be suitable for the climatic conditions / site conditions. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS: 8623-1977 (Part-1) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of FDBs.

Knockout holes of appropriate size and number shall be provided in the FDB's in conformity with the location of cable/conduit connections. Detachable sheet steel gland plates shall be provided at the top / bottom to make holes for additional cable entry at site if required.

2. Final Distribution Boards shall comprise of the following:

- 2.1 A Din Channel for mounting, where appropriate incoming supply circuit breaker & other auxiliaries for Control & distribution as required.
- 2.2 Installation accessories shall be part of the DB for fixing conductor and rails/ Din Channels for mounting MCB's and RCCB's etc. phase bus bars, neutral bus bars & earthing bus bars as required. All bus bars shall be of tinned copper. MCB's / ELCB's shall be simply snapped fitted on to a Din Channel and screwed to the bus bar. The arrangement should be such that any MCB can be taken out of without disturbing the other MCB's.
- 2.3 Service cable /entry connection shall be part of the Distribution Boards.

- 2.4 The board shall be installed at a height such that the operating is within reach of the normal human height i.e. 1.2 to 1.8 meters from finish floor level.
- 2.5 Degree of protection shall be **IP-52 for indoor application, IP-54 for kitchen, laundry, basements/garages and IP-55 for outdoor application.**
- 2.6 All three phase distribution boards shall have 4 rows and single phase distribution boards shall have single rows for housing of MCB's and RCCB's unless noted otherwise.
- 2.7 Phase segregation to be maintained in all three phase distribution boards.
- 2.8 Earthing shall be provided in each FDB's.
- 2.9 Where in 3 Phase FDB's, if each phase is controlled by a DP ELCB/ DP RCCB, then a separate neutral link / bar is to be provided per phase. These will be in addition to the main neutral link / bar.
- 2.10 All internal wiring within the FDB shall be with flexible PVC insulated copper conductor wires of adequate size.
- 2.11 All bus bars including neutral bar / link shall not be less than 100 Amp, 415 V.
- 2.12 Main neutral bar / link and separate neutral link / bar per phase shall also be of 100 Amp.
- 2.13 All connections with wires shall be with adequately sized thimbles.
- 2.14 UPS DB's will have two earth buses i.e. one for body earthing and another for third pin earthing of UPS socket. Dedicated earth bus shall be fixed on the insulated supports.

3 EARTHING

Earthing shall be provided as per IS: 3043-1987.

4 PAINTING

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of FDB inside/outside shall be of Siemens gray paint shade no. RAL-7032 of IS Code No.5 or as per Owner / Architect / PMC's requirement.

5 LABELS

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the distribution panels shall be pasted on inside of the panel door and covered with transparent plastic sheet.

6 TESTING

Testing of FDB's shall be as per following codes:

- a. IS: 8623 (Part -I) 1977 for factory built assemblies of switch gear for voltages upto and including 1000 VAC.

b. IS: 13947: 1993 for Degree of protection

7 WIRING

In wiring a FDB, it shall be ensured that total load of various circuits is divided evenly between the phases and number of ways as per Consultants approval.

8.0 Pre-commissioning Test for Final Distribution Boards

PROJECT :
 LOCATION :
 ARCHITECTS :
 PROJECT MANAGERS :
 ELECTRICAL CONSULTANTS :
 ELECTRICAL CONTRACTORS :

D.B. No..Name : Location :
 D.B. Size :
 Incomer Cable Size :
 3 Phase Incomer MCB/MCCB :
 Phase Incomer DP ELCB :

S.No.	Ckt.No.	Wire Size	MCB Rating	I.R. Value (M.Ohm)			Polarity Test	Visual Check	Remarks
				P-N	P-E	N-E			

Particular of Meggar : Meger Sl.No.
 Range
 Make
 Voltage

Name & Designation of _____
 Testing Engineer _____

Signature of Testing Engineer _____

Date _____

Note:- Each Final DB to be tested and a Pre-commissioning report to be generated in the format given above.

SUB-HEAD: G. LT SWITCH GEAR

1. AIR CIRCUIT BREAKERS (ACB)

- 1.1 The ACB shall confirm to the requirements of IEC 60947-2 / IS 13947-2 and shall be type tested & certified for compliance to standards from-CPRI, ERDA/ any accredited international lab. The circuit breaker shall be suitable for 415 V + 10%, 50 Hz supply system. Air Circuit Breakers shall be with moulded housing flush front, draw out type and shall be provided with a trip free manual operating mechanism or as indicated in drawings and bill of quantities with mechanical "ON" "OFF" "TRIP" indications.

The ACB shall be 3/ 4 pole with modular construction, draw out, manually or electrically operated version as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram / in the B.O.Q/ as required for the application and should be equal to the Ultimate breaking capacity(Icu) and short circuit withstand values(Icw) for 1 sec.

Circuit breakers shall be designed to 'close' and 'trip' without opening the circuit breaker compartment door. The operating handle and the mechanical trip push button shall be at the front of the breakers panel. Inspection of main contacts should be possible without using any tools. The ACB shall be provided with a door interlock. i.e. door should not be open when circuit breaker is closed and breaker should not be closed when door is open.

All current carrying parts shall be silver plated and suitable arcing contacts with proper arc chutes shall be provided to protect the main contacts. The ACB shall have double insulation (Class-II) with moving and fixed contacts totally enclosed for enhanced safety and in accessibility to live parts. All electrical closing breakers shall be with electrical motor wound stored energy spring closing mechanism with mechanical indicator to provide ON/OFF status of the ACB.

The auxiliary contacts blocks shall be so located as to be accessible from the front. The auxiliary contacts in the trip circuits shall close before the main contacts have closed. All other contacts shall close simultaneously with the main contacts. The auxiliary contacts in the trip circuits shall open after the main contacts open.

Minimum 4 NO and 4 NC auxiliary contacts shall be provided on each breaker.

Rated insulation voltage shall be 1000 volts AC.

1.2 CRADLE

The cradle shall be so designed and constructed as to permit smooth withdrawal and insertion of the breaker into it. The movements shall be free from jerks, easy to operate and shall be on steel balls/rollers and not on flat surfaces.

There shall be 4 distinct and separate position of the circuit breaker on the cradle.

Racking Interlock in Connected/Test/Disconnected Position.

Service Position: Main Isolating contacts and control contacts of the breaker are engaged.
Test Position: Main Isolating contacts are isolated but control contacts are still engaged.
Isolated Position: Both main isolating and control contacts are isolated.

There shall be provision for locking the breaker in any or all of the first three positions.

The following safety features shall be incorporated:

- a. Withdrawal or engagement of Circuit breaker shall not be possible unless it is in open condition.
- b. Operation of Circuit breaker shall not be possible unless it is fully in service, test or drawn out position.
- c. All modules shall be provided with safety shutters operated automatically by movement of the carriage to cover exposed live parts when the module is withdrawn.
- d. All Switchgear module front covers shall have provision for locking.
- e. Switchgear operating handles shall be provided with arrangement for locking in 'OFF' position.

1.3 PROTECTIONS

The breaker should be equipped with micro-controller based release to offer accurate and versatile protection with complete flexibility and shall offer complete over current protection to the electrical system in the following four zones:

- Long time protection.
- Short time protection with intentional delay.
- Instantaneous protection.
- Ground fault protection.

The protection release shall have following features and settings:

a. **True RMS Sensing**

The release shall sample the current at the rate of 16 times per cycle to monitor the actual load current waveform flowing in the system and shall monitor the true RMS value of the load current. It shall take into account the effect of harmonics also.

b. **Thermal Memory**

When the breaker shall reclose after tripping on overload, then the thermal stresses caused by the overload if not dissipated completely, shall get stored in the memory of the release and this thermal memory shall ensure reduced tripping time in case of subsequent overloads. Realistic Hot/Cold curves shall take into account the integrated heating effects to offer closer protection to the system.

c. **Defined time-current characteristics :**

A variety of pick-up and time delay settings shall be available to define the current thresholds and the delays to be set independently for different protection zones thereby achieving a close-to-ideal protection curve.

d. **Trip Indication**

Individual fault indication for each type of fault should be provided by LED's for faster fault diagnosis.

e. **Self powered**

The release shall draw its power from the main breaker CT's and shall require no external power supply for its operation.

f. **Zone Selective Interlocking**

The release shall be suitable for communication between breakers to enable zone selective interlocking. This feature shall be provided for both short circuit and ground fault protection zones to offer intelligent discrimination between breakers. This feature enables faster clearance of fault conditions, thereby reducing the thermal and dynamic stresses produced during fault conditions and thus minimizes the damage to the system. To implement ZSI manufacturer should supply all related equipment like power supply, wiring etc.

On-Line change of settings should be possible. It should be possible to carry out testing of release without tripping the breaker.

g. The release shall meet the EMI / EMC requirements.

h. The setting range of release shall be as follows:

TYPE OF PROTECTION	SETTING RANGE OF RELEASE	
	PICK-UP CURRENT	TIME DELAY
Long Time	0.4 to 1.0 times I_n (I_r) Steps : 0.04, 0.05, 0.55, 0.60, 0.65, 0.70, 0.75, 0.80, 0.85, 0.90, 0.95, 1.00. Operating Limit : 1.05 to 1.2 times I_r	0.5 to 30 sec at 6 I_r Steps 0.5, 1, 2, 4, 6, 8, 12, 18, 24 and 30 secs Tolerance : Corresponding to $\pm 10\%$ of current.
Short Time	2 to 10 times I_r Steps : 2, 3, 4, 5, 6, 7, 8, 9 & 10	20 ms to 600 ms Steps 20, 60, 100, 160, 200, 260, 300

	Tolerance : $\pm 10\%$	400,500 and 600 ms Tolerance : $\pm 10\%$ or 20ms whichever is higher
Instantaneous	2 to 12 times In Steps : 2,3,4,6,8,10,12 Tolerance : $\pm 10\%$	
Ground Fault	0.2 to 0.6 time In Steps : 0.2,0.3,0.4,0.5,0.6 Tolerance : $\pm 10\%$	100 ms to 400 ms Steps : 100,200,300,400ms Tolerance : $\pm 10\%$ or 20 ms Whichever is higher.

All **incomer** ACB's shall have following additional protections other than mentioned above:

- Under and over voltage
- Under and over frequency
- Restricted Earth Fault protection
- Trip Circuit supervision with PS class CT's.
- Undercurrent
- Reverse power
- Phase sequence reversal (for DG set only)
- Load shedding and reconnection thru programmable contacts.
- Release should display the Contact wear indication.

The release should provide local indication of actual %age loading at any instant. The release should be able to communicate on MODBUS RTU protocol using inbuilt RS485 port and shall be integral part of supply with trip unit. Parameters of the Protection Release should be changeable from Release as well as thru communication network. Release should have graphical LCD for display of power parameters. The release should provide comprehensive metering with the following parameters.

- Phase currents (running, avg & max) – All parameters in single window.
- Release should be able to capture short circuit current on which ACB has tripped. The last ten trips and alarms shall be stored in memory with the date & time stamping along with type of fault and alarm. The sensing CT should be Rogowsky type with measurement precision of 1%.
- Release should be self powered.

- Release should have facility to select different type of IDMTL protection (DT, SIT, VIT, EIT, HVF) for better co-ordination with HT Breaker/Fuse.
- Phase voltages (running, avg & max)
- Energy & power parameters (active, reactive and apparent)
- PF
- Frequency
- Maximum Demand (KVA & KW)
- Total Harmonics distortion

All O/G ACBs shall have following functions:

Protection

■ The ACB control unit shall offer the following protection functions as standard:

- Long-time (LT) protection with an adjustable current setting and time delay;
- Short-time (ST) protection with an adjustable pick-up and time delay;
- Instantaneous (INST) protection with an adjustable pick-up and an OFF Position.
- Current and time delay setting shall be indicated in amperes and seconds respectively on a digital display.
- Earth-fault protection with an adjustable pick-up and time delay shall be provided if indicated on the appended single-line diagram.

Measurements

- An ammeter with a digital display shall indicate the true rms values of the currents for each phase. Release shall acknowledge the current & time delay settings done by user on the LCD display.
- A LED bargraph shall simultaneously display the load level on the three phases.
- A maximeter shall store in memory and display the maximum current value observed since the last reset. The data shall continue to be stored and displayed even after opening of the circuit breaker.

1.4 SAFETY FEATURES

- a. The safety shutter shall prevent inadvertent contact with isolating contacts when breaker is withdrawn from the Cradle.
- b. It shall not be possible to interchange two circuit breakers of two different thermal ratings. For Draw-out breakers, an arrangement shall be provided to prevent rating mismatch between breaker and cradle.
- c. There shall be provision of positive earth connection between fixed and moving portion of the ACB either thru connector plug or sliding solid earth mechanism. Earthing bolts shall be provided on the cradle or body of fixed ACB.
- d. The incoming panel accommodating ACB shall be provided with indicating lamps for ON-OFF positions, digital voltmeter and ammeter of size not less than 96 mm x 96 mm, selector switches, MCB for protection circuit and measuring instrument circuits.
- e. It shall be possible to bolt the draw out frame not only in connected position but also in TEST and DISCONNECTED position to prevent dislocation due to vibration and shocks.

- f. Draw out breakers should not close unless in distinct Service/Test/Isolated positions.
- g. The insulation material used shall conform to Glow wire test as per IEC60695.
- h. The ACB shall provide in built electrical and mechanical anti-pumping.
- j. All EDO ACB's Shall have Ready to Close Contact to ensure that the ACB gets a command only when it is ready to close for applications of Remote Control, AMF, Synchronization and Auto Source Change Over Systems.

2. MOULDED CASE CIRCUIT BREAKER (MCCB)

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified. The circuit breakers shall be for continuous rating and service short Circuit Breaking capacity (Ics) shall be as specified on the single line diagram and should be equal to the Ultimate breaking capacity (Icu) and short circuit withstand values (Icw) for 1 sec. MCCB shall comply with the requirements of the relevant standards IS1 3947 - Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.

The breaking capacity of MCCB shall be as specified in the single line diagram / in the schedule of quantities/ as required for the application. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (Icu). MCCB's for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2.

The breaker as supplied with ROM should meet IP54 degree of protection.

a. Current Limiting & Coordination

The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB.

The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

Protection Functions

- MCCB's with ratings up to 250 A shall be equipped with Thermal-magnetic (thermal for overload and magnetic for short-circuit protection) trip units.
- Microprocessor MCCB's with ratings above 250A and above shall be equipped with microprocessor based trip units.
- Microprocessor and thermal-magnetic trip units shall be adjustable and it shall be possible to fit

lead seals to prevent unauthorized access to the settings.

- Microprocessor trip units shall comply with appendix F of IEC 60947-2 standard (measurement of rms current values, electromagnetic compatibility, etc.).
- Protection settings shall apply to all poles of circuit breaker.
- All Microprocessor components shall withstand temperatures up to 125 °C.

b. Testing

- Original test certificate of the MCCB as per IEC 60947-1 & 2 or IS13947 shall be furnished.
- Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

c. Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

- i. Handle interlock to prevent unnecessary manipulations of the breaker.
 - ii. Door interlock to prevent the door being opened when the breaker is in ON position.
 - iii. Defeat-interlocking device to open the door even if the breaker is in ON position.
- The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCB's shall be capable of defined variable overload adjustment.
 - All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
 - The trip command shall override all other commands.

3. MOTOR PROTECTION CIRCUIT BREAKER (MPCB)

Motor circuit breakers shall conform to the general recommendations of standard IEC 947 -1,2 and 4 (VDE 660, 0113 NF EN 60 947-1-2-4, BS 4752) and to standards UL 508 and CSA C22-2 N°14. The devices shall be in utilization category A, conforming to IEC 947-2 and AC3 conforming to IEC 947- 4. MPCB shall have a rated operational and insulation voltage of 690V AC (50 Hz) and MPCB shall be suitable for isolation conforming to standard IEC 60947-2 and shall have a rated impulse withstand voltage (Uimp) of 6 kV. The motor circuit breakers shall be designed to be mounted vertically or horizontally without derating. Power supply shall be from the top or from the bottom. In order to ensure maximum safety, the contacts shall be isolated

from other functions such as the operating mechanism, casing, releases, auxiliaries, etc, by high performance thermoplastic chambers. The operating mechanism of the motor circuit breakers must have snap action opening and closing with free tripping of the control devices. All the poles shall close, open, and trip simultaneously. The motor circuit breakers shall accept a padlocking device in the “isolated” position.

The motor circuit breakers shall be equipped with a “PUSH TO TRIP” device on the front enabling the correct operation of the mechanism and poles opening to be checked. The auxiliary contacts shall be front or side mounting, and both arrangements shall be possible. The front-mounting attachments shall not change the breaker surface area. Depending on its mounting direction the single pole contact block could be NO or NC. All the electrical auxiliaries and accessories shall be equipped with terminal blocks and shall be plug-in type. The motor circuit breakers shall have a combination with the downstream contactor enabling the provision of a perfectly co-ordinated motor-starter. This combination shall enable type 1 or type 2 co-ordination of the protective devices conforming to IEC 60947-4-1. Type 2 co-ordination shall be guaranteed by tables tested and certified by an official laboratory: LOVAG (or other official laboratory). The motor circuit breakers, depending on the type, could be equipped with a door-mounted operator which shall allow the device setting. The motor circuit breakers shall be equipped with releases comprising a thermal element assuring overload protection and a magnetic element for short-circuit protection. In order to ensure safety and avoid unwanted tripping, the magnetic trip threshold (fixed) shall be factory set to an average value of 12 Ir.

All the elements of the motor circuit breakers shall be designated to enable operation at an ambient temperature of 60°C without derating. The thermal trips shall be adjustable on the front by a rotary selector. The adjustment of the protection shall be simultaneous for all poles. Phase unbalance and phase loss detection shall be available. Temperature compensation (-20°C to +60°C).

4. MINIATURE CIRCUIT BREAKER (MCB)

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCB's shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCB's shall be classified (B, C, D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values. MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

Use of MCB's shall be application based i.e.:

For computers / UPS circuits	:	Type 'D' characteristics
For motors, inductive loads and Discharge Lamps	:	Type 'C' characteristics
For lighting & small power	:	Type 'B' characteristics

5. RESIDUAL CURRENT CIRCUIT BREAKER CURRENT OPERATED TYPE (RCCB)

a. System of Operation

Residual Current Circuit Breaker shall conform to IEC 61008. RCCB shall work on the principle of core balance transformer. The incoming shall pass through the toroidal core transformer. As long as the currents in the phase and neutral shall be the same, no electro motive force shall be generated in the secondary winding of the transformer. In the event of a leakage to earth, an unbalance shall be created which shall cause a current to be generated in the secondary winding, this current shall be fed to a highly sensitive miniature relay, which shall trip the circuit if the earth leakage current exceeds a predetermined critical value. RCCB shall be current operated independent of the line voltage, current sensitivity shall be of 30 mA at 240/415 volts AC and shall have a minimum of 20,000 electrical operations.

b. Mechanical Operation

The moving contacts of the phases shall be mounted on a common bridge, actuated by a rugged toggle mechanism. Hence, the closing /opening of all the three phases shall occur simultaneously. This also shall ensure simultaneous opening of all the contacts under tripping conditions.

c. Neutral Advance Feature

The neutral moving contact shall be so mounted on the common bridge that, at the time of closing, the neutral shall make contact first before the phases; and at the time of opening, the neutral shall break last after allowing the phases to open first. This is an important safety feature which is also required by regulations.

d. Testing Provision

A test device shall be incorporated to check the integrity of the earth leakage detection system and the tripping mechanism. When the unit is connected to service, pressing the test knob shall trip the ELCB / RCCB and the operating handle shall move to the "OFF" position.

6. METERS

- a. All voltmeters and indicating lamps shall be protected through MCB's.
- b. Meters and indicating instruments shall be flush type.
- c. All CT's connection for meters shall be through Test Terminal Block (TTB).
- d. CT ratio and burdens shall be as specified on the Single line diagram/ in the BOQ/ as required for the application.

7. CURRENT TRANSFORMERS

Current transformers shall be provided for Distribution panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary's for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

Accuracy class and VA burden shall be as per the application as required as per metering / protection needs.

8. INDICATING PANEL

All meters and indicating instruments shall be in accordance with relevant Indian Standards. Meters shall be flush mounted digital type. Indicating lamps shall be of low burden, and shall be backed up with 2 amps MCB/MPCB as per required fault level. Indicating Lamps shall be of LED type. All digital instruments shall have shrouded terminals and suitable for 0°C to 50°C temperature range and shall withstand 1.2 time over loading. Accuracy class and VA burdens shall be as per the requirement.

9. SELECTOR SWITCH

Where called for selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

10. CONTACTOR

Contactor shall be built into a high strength thermoplastic body and shall be provided with a shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starter's contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta Starters. The insulation for contactor coils shall be of Class "E".

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 240 / 415 + 10% volts, 50 cycles AC supply. Contactors shall be of 3P / 4P design as required.

11. THERMAL OVERLOAD RELAY

Thermal overload relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing. The relay shall operate on the

differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5deg C + 55 deg C.

All overload relays shall be of three element, positive acting ambient temperature compensated time logged thermal over load relays with adjustable setting. Relays shall be directly connected for motors upto 35 HP capacity. C.T. operated relays shall be provided for motors above 35 HP capacities.

12. TIME DELAY RELAYS

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

13. TOGGLE SWITCH

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS codes and shall be of 5 amps rating.

14. PUSH BUTTON STATIONS

Push button shall be provided for manual starting and stopping of motors / equipment "Green" and "Red" colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

15. Coordination Study In LV Network

LV Switchgear Manufacturer shall submit coordinated & Discriminated solution for LV Network protection devices i.e. **ACB, MCCB, MPCB & MCB** for all Incoming and outgoing devices for all Panels/ DB's as per BOQ with the help of published discrimination tables. Total discrimination shall be provided up to the short circuit breaking capacity of downstream circuit Breakers.

SUB-HEAD: H. CONSTRUCTION FEATURES OF LOW VOLTAGE MAIN AND SUB DISTRIBUTION BOARDS / PANELS/SWITCH BOARDS/ METER BOARDS/ACB ISOLATOR PANELS & GENERAL NOTES FOR PANELS & SWITCH BOARDS

GENERAL SPECIFICATIONS

Main & Sub Distribution Boards shall be classified as FBA (Factory Built Assemblies) as per IS: 8623:1998/ IEC: 60439 Part-I of Cubicle type, Sheet steel clad, Totally enclosed, Dust & Vermin proof, Indoor type, Rigid, Free standing, Floor mounted compartmentalized, Single front for use on 415 volts, 3 phase, 50 cycles, AC system with a fault level withstand capacity as per B.O.Q. /as required, RMS Symmetrical. Complete with busbars interconnections, power, control/auxiliary circuits/ wiring & earthing. With powder coated paint finish, switchgear as per B.O.Q of approved makes specified.

BASE FRAME: 3MM

Normal Indoor Application: CRCA

Outdoor Application: GI

Sheet Type: PN02/ Equivalent as approved

Sheet Make: TISCO/ Equivalent as approved

STRUCTURE, COVER BACK & FRONT DOOR: 2MM

Normal Indoor Application: CRCA

Outdoor Application: GI

Sheet Type: PN02/ Equivalent as approved

Sheet Make: TISCO/ Equivalent as approved

PARTITIONS: 1.6MM

Normal Indoor Application: CRCA

Outdoor Application: GI

Sheet Type: PN02/ Equivalent as approved

Sheet Make: TISCO/ Equivalent as approved

GLAND PLATES: 3MM

Multi Core Cables: CRCA

Single Core Cables: Aluminum

MOUNTING PLATES: 2MM

Normal Indoor Application: CRCA

Outdoor Application: GI

Sheet Type: PN02/ Equivalent as approved

Sheet Make: TISCO/ Equivalent as approved

CONSTRUCTION

Completely modular & compartmentalized, form 3B separation. Separate adequately spaced Unit Chamber, Bus bar & cable compartments.

EXTENSIBILITY

Readily extensible on both ends.

Panels should be made in easily transportable sections.

DIMENSIONS

Operating height	1800mm max. 300mm min.
Overall height	2400mm max.
Compartment size HXW	225mm x 500mm min
Cable chamber	300mm min.

DEGREE OF PROTECTION

IP: 52 for totally Indoor application.

Example: Panels in Substation area, Electrical Rooms, LT Panel Rooms

IP: 54 for Semi Indoor Application

Example: Panels in AC plant room, AHU Room, Panels in Basements Car Parking Areas/ in garages, in pump room, Laundry, Kitchen and Similar areas

IP: 55 for Outdoor Application.

Example: Feeder Pillar, outdoor Junction boxes, outdoor boards / panels, ACB Isolators (outdoors)

Note: - These IP ratings have to be adhered to strictly whether schedule of quantities indicate it or not or indicate otherwise.

DOOR HINGES

Concealed, Powder Painted

DOOR LOCKS

Zinc alloy powder painted with provision for pad locking..

GASKET

Neoprene / PE foam of suitable profile to provide desired degree of protection.

LIFTING ARRANGEMENT

Eye bolt of removable design, when removed these shall not leave any opening in the boards.

PAINTING

Pre-treatment eight tank process or on line automatic spray system with oven for drying after Pre-treatment as per IS: 101-1988 effective temperature and concentration control. Powder coating of desired shade as per requirement. Paint thickness min. 60 micron

CORROSION RESISTANCE

Withstand 500 hrs of Salt Spray as per IS: 101-1988

BUS BARS MAIN

Aluminum E-91E grade, min. 53% IACS

Copper min 99% IACS (Tinned copper)

Configuration: Interleaved 2000A & above

Minimum clearances shall be:

Phase to Phase	32mm
Phase to Neutral	25mm
Phase to earth	25mm
Neutral to earth	25mm

BUS BARS EARTH

As per material of main busbar of size suitable to withstand fault level specified / as required. Continuous length of earth bus to be provided.

UPS Output Panels shall have two earth bars of tinned copper of suitable rating. One of the earth buses shall be dedicated i.e. mounted on insulated supports.

BUS BAR TEMP. RISE

Ambient 45°C

Maximum bus bar temperature rise 40° C over ambient

No deration of Switchgear & Panels upto 45°C

BUS BAR SIZING / CROSS-SECTION

Bus bars to be sized to carry the full rated load current without exceeding maximum temperature rise as limited above. Bus bar size calculations to be submitted with shop drawings. Busbars to withstand the maximum short circuit current as specified / as per requirement.

BUS BAR SUPPORTS

Non Hygroscopic Epoxy/SMC at suitable distance to withstand forces of short circuit as per requirement.

BUS BAR INSULATION

Black heat shrinkable, fire retardant, self extinguishing type sleeves suitable to withstand 110°C

Colour coding to be followed as per IS codes. Phase sequences and polarity to be followed as per IS codes.

SHROUDING

All live parts should be shrouded with IP2 protection Fire Retardant, Non Inflammable, Non Hygroscopic e.g. Polycarbonate, FRP.

HARDWARE

High tensile for ACB & ACB Bus termination Joints

Corrosion resistance, Cadmium plated for other joints

All bolts with spring/ star washer

WIRING

1100V Fire retardant, virgin PVC color coded flexible wire

Voltage circuit	1.5 sq mm
Current circuit	2.5 sq mm

Earth circuit 2.5 sq mm
As per IS: 694

WIRING IDENTIFICATION

Computerized ferrule on both ends as per IS: 375

TERMINAL BLOCK

Power - Melamine stud type.

Control - Polyimide color coded screw less clamp fit type.

Not more than one wire connected to one terminal block.

Plug in type terminal block at each transport section.

COMPONENT LEGEND

Computerized labels for all control component & terminal block

FEEDER DESCRIPTION PLATES

Powder coated Al. Plate with computerized printing, size:

MDB = 150 x 50 mm

S/DB = 100 x 40 mm

SPARE FEEDERS

It shall be as per B.O.Q. / SLD. If B.O.Q / SLD does not specify anything, than an average of 20% of a mix of various ratings / feeders to be provided as spare feeders in each board / panel. Spare feeders must include a minimum one biggest and a minimum of one smallest rated feeders as spares along with other spares.

CABLING

Provision for top/ bottom/ top & bottom entry of cables, as per requirement / as per site. Adequately sized cable chambers. Easy and safe termination & maintenance facility.

BUS TRUNKING TERMINATION

Wherever specified in B.O.Q power connection arrangement at top suitable for bus trunking.

SWITCHGEAR

As per specification & Makes specified. IS: 13947 I- IV, 1993

Only one make of switchgear to be used in a board/panel. The switchgear selection shall be as per manufacturer's co-ordination tables.

CONTROL COMPONENTS

As per specification & Makes specified. IS: 13947 I - IV, 1993

INDICATING INSTRUMENTS

Analog/Digital as per specifications, notes, B.O.Q. & Makes specified. IS: 13779

BMS compatible multifunction meters shall be complete with communication card, shall be net-workable and shall be wired on to common RS 485 Bus and information from these meters to BMS to be released at one point.

INDICATING INSTRUMENTS ACCESSORIES

CT/PT-Cast resin as per specifications & make specified. IS: 2705, 1992

CONTROL MCB'S / MPCB'S

For control and metering circuit/wiring, these shall be of fault level as required.

SPACE HEATER

All ACB Incomer & bus couplers shall be provided with Space Heater & Thermostat & 11 watt panel illumination. Heaters shall be controlled by a 6A MCB / MPCB as per the required fault level.

SHOP DRAWINGS

Notes, General arrangement, Elevations, Single line diagram, Bill of material, Control and inter locking scheme to be submitted for approval prior to manufacturing and approval taken from PMC / Consultant / Owner.

TESTING & PRE-DISPATCH QUALITY CONTROL

A. Fabrication, Pre-treatment, painting, assembly and wiring.

B. Tests:

- Physical, Electrical, and Operational tests of all Breakers / Switches.
- Operational check of all meters and relays.
- Dielectric strength test for insulation at 2.5kV for 1 sec.
- Insulation resistance test at 1000V megger,
- Protective measures and continuity of circuits, as per IS: 8623-I, 1993.
- Testing of protection relays by secondary injection kit before commissioning.
- Interlocking Function Test.
- Earth continuity test between various Non-current carryings parts of equipment steel work etc. & the earth bus provided in the panel.

INSPECTION

To be offered at works to PMC / Owner.

TEST CERTIFICATE TYPE AND ROUTINE

Test results for routine tests conducted at works should be submitted. Type tests as per IS: 8623 - Part I for Short circuit, Temperature rise, Degree of protection to meet the specifications and B.O.Q must be furnished.

PACKING

Wooden Crates/ Wooden Cases/ Polythene & Water proof paper to be used.

AS MANUFACTURED DRAWINGS

To be submitted in CD format with catalogues and test certificates of switchgear, controlgear and other components used within MDB & PDB.

AFTER SALES SERVICE

Manufacturer to have an Independent department to render after sales support for Installation, commissioning & trouble shooting during and after warranty period.

OPERATING CONDITIONS:

- No De-ration of panels, Switchgear/Equipment & Busbars upto 45 Deg. C & Altitude of 1000M above MSL for indoor panels.
- No De-ration of panels, Switchgear/Equipment & Busbars upto 50 Deg. C & Altitude of 1000M above MSL for outdoor panels / feeder pillars.

CONNECTION BETWEEN BUSBARS & SWITCHGEAR

- Upto 63Amp Switch rating with 1.1 KV grade FRLS PVC insulated flexible single core copper cables. Tinned copper or silver plated copper lugs shall be used on copper wires.
- Above 63Amp Switch rating, with solid aluminium / copper busbar links, to be used.
- Neutral Bus bars for four pole feeders shall be of the same size as phase.
Neutral Bus bars for triple pole feeders shall be of 50% size of phase.
Neutral Bus bars for UPS panels shall be of 200% size of phase.

IMPORTANT NOTE: - VENDORS TO SUBMIT SWITCHGEAR SELECTION/ RATINGS FOR ALL THE PANELS ALONG WITH THE BID.

SUB-HEAD: I. BUS DUCTS – COMPACT SANDWITCH TYPE

c.

1. Scope

This specification covers sandwich type busbar trunking for use as feeder busbars for interconnection between separate electrical equipment / load centers, and for use as plug in busbar risers.

2. System details

The busbar shall be suitable for maximum rated voltage of 1000V.
Insulation voltage shall be 1000V.

3. Standards

The busbar shall be designed and manufactured in accordance with the following international standards for busbar trunking:

- BS 5486 Part 2: Particular requirements of busbar trunking systems
- EC 60439 -2: Particular requirements of busbar trunking systems
- IEC 60529: Degree of protection
- IEC 60331: applicable for the cast resin busbar – fire rating

The busduct shall conform to IEE, NEMA BU1, and JIS for Seismic protection certification.

4. Testing

The busbars shall be type tested at a reputable international test laboratory (ASTA or CPRI) for short circuit withstand. The test shall be for a minimum duration of 1 second. Tests shall be performed over a range of current ratings, covering the different frame sizes of the manufacturer. The minimum short circuit rating of the sandwich bus duct / rising main shall be as specified in the BOQ. In case it is not specified in the BOQ, then it shall be minimum 50kA for 1 Sec.

Degree of ingress protection (IP rating) shall also be tested at any reputed independent laboratory. This test shall be for IP68 in the case of cast resin busbars, and IP54 for indoor application and IP65 for outdoor application sandwich busbars

Bus bars system shall be type tested to IEC/EN-60439-1 and 2 & IS-8623 part-1 & part 2.

5. Manufacturer

The manufacturer must have an established track record in design and manufacture of sandwich and cast resin busbar trunking, and must have supplied busbar systems for at least 10 years.

The manufacturer must have ISO 9001 certification for design, manufacture and testing of busbar systems.

6. Design & Construction requirements – Sandwich busbars

6.1 General

The busbars shall be of sandwich construction, non-ventilated design. It shall be possible to mount the busbar system in any orientation, without affecting the current rating. The sandwich busbar configuration must be compatible with the cast resin busbar, and must allow for interconnection of the two types, wherever required.

6.2 Busbars

6.2.1 The busbars shall be of high conductivity Copper, or Aluminum, as specified in the Schedule of quantities. Bus bars where ever specified of copper, shall be made of electrolytic 99.97% pure copper (ETP grade) duly silver plated and are with full round edges for easy insertion and removal of plug-in boxes. Aluminium conductors shall be of EC grade aluminium.

6.2.2 Where an earth conductor is required, it shall be a separate, internal earth conductor, of the same high conductivity material as the phase conductors, and at least 50% cross section of the phase conductor / as specified in the BOQ.

6.2.3 It should be possible to provide a 200% Neutral where specified, otherwise 100% neutral is to be provided.

6.3 Insulation

6.3.1 The busbars shall be insulated throughout their length by one of the following methods:

- a. Thermoset Epoxy coating
- b. Extruded Epoxy coating
- c. Mylar
- d. Epoxy coating plus mylar

6.3.2 The class of insulation shall be one of the followings:

- a. Class 'B' (130°C as max. temp withstand)
- b. Class 'F' (155°C as max. temp withstand)

6.3.3 The insulation should be 100% water resistant.

6.3.4 The insulation must comply to UL 94 V-O..It shall be Halogen Free.

6.4 Housing

The housing shall be made of 1.6mm thick extruded Aluminum case / electro galvanized sheet steel with an epoxy powder coated paint finish. The housing shall be profiled, to provide higher strength and efficient heat dissipation. The width of the housing shall preferably be the same for all ratings of busbars, in order to provide

interchangeability of tap off boxes. **Where ever, there is no internal earth bus along with the phase & neutral bus bars, then the earthing bus shall be the bus housing/ enclosure itself in case of extruded aluminium housing or separate earth bus along the enclosure if enclosure is not of aluminium construction.**

6.5 Joints

The joints between sections shall be made so as to provide flexibility during installation and expansion / contraction of busbar during operation. The joint shall be of the single bolt type. The joints shall be of the double head bolt type for proper tightening. All joints shall be at operational height in each floor level.

The joint construction must have the following features.

- 6.5.1 Heat expansion of at least 3mm per joint.
- 6.5.2 The joint insulation must be of one piece molded design and not have any cut edges which can absorb moisture.
- 6.5.3 The joint construction must allow a +/- 14mm adjustment at the time of installation, for ease of adjusting to site measurement variations.
- 6.5.4 The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of moulded one piece.
- 6.5.5 The joint system must be designed in a way that the installer cannot insert the busduct length too far and damage the bolt insulator.
- 6.5.6 The busbar ends shall not have holes or slots at the joints – the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.
- 6.5.7 It shall be possible to install and remove the joints without disturbing the busbar run.

6.6 Temperature Rise & Temperature Deration:

- a. The bus duct & rising main shall be designed to keep the temperature rise to a minimum. The temperature rise shall not exceed 55°C above an ambient of 40°C.
- b. There shall be no capacity deration of bus bars upto 45°C of ambient temperature i.e. No current derating upto 45°C of ambient temperature.

6.7 Tap off units

Where specified, tap off locations shall be provided for insertion of plug in tap off units. Hinged plates shall cover the tap off locations. All tap-offs shall be at operational height. Tap-off boxes shall be fabricated out of 14 SWG sheet steel with lockable door and duly powder coated.

Tap off units safety features:

- 6.7.1 When the door cover is open, it should not be possible to turn the MCCB on. This should be by means of mechanical safety locking system and not by the rotary handle of the MCCB.
- 6.7.2 The door shall be provided with a lock and keys.
- 6.7.3 When the lever is in 'on' position, even with the key unlocked, the operator should not be able to remove the box or open the tap off location cover.
- 6.7.4 During insertion, the earth conductor shall make contact first before the phase conductors. This should follow the sequence of first in last out concept.
- 6.7.5 The tap off unit handle shall be flexible in the sense that the 'on/off' handle can be attached to the left or right side of the box, depending on the site situation.
- 6.7.6 When the box is open the live conductors shall be safe guarded by a transparent insulator plate which allows for visible inspection but does not allow touching of the live conductors.
- 6.7.7 In the event of a MCCB requiring maintenance or changing, the mechanical interlocking must allow easy access by removing only the front plate and not interrupting the adjacent linkages.
- 6.7.8 For IP65 bus trunking, the tap off unit arrangement also must achieve IP65 without requiring any additional sealing at site. The complete arrangement with the tap off unit shall be tested for IP rating by an independent test authority. The same holds good for IP54 & IP 55 bus trunking.
- 6.7.9 The tap off boxes will be suitable for accommodating MCCBs or other accessories, as required. The tap off units should allow the flexibility of accommodating different, reputed MCCB makes, to be mutually agreed depending on the tender requirements.
- 6.7.10 Plug-in boxes to have integral earth clip which makes automatic contact while plugging the box on to the trunking.

7. Accessories

- a. A full range of accessories like elbows, offsets, end flanges, end feed units and support brackets etc. shall be made available, as required as per site conditions.
- b. For horizontal runs, a horizontal expansion joint unit shall be used at every 40 meters and at each expansion joint of the building.
For vertical applications, a vertical expansion unit shall be used at every floor.

8. Fire Rating

Bus bar shall have capability to operate (without short circuit) minimum 5 hours in 750 deg C or 2 hours in 1000 deg C fire conditions without derating.

9. Installation

Bus ducts running along the wall shall be supported at intervals not exceeding 1.5 m. In case of branching, there shall be support on all branches at a distance of 300 mm

from the point of branching, Support shall not be less than 40 x 40 x 6 mm GI angle secured in an approved manner. Supports may also be provided in the form of brackets fixed to walls where the duct runs along the wall. In case of ceiling suspended bus ducts, supports made out of 40x40x6 mm GI angle iron shall be provided. The horizontal distance between two such supports shall not be more than 1200 mm. The ducts supports shall be suspended from suitable approved suspension devices provided in the ceiling. Fire barrier shall be provided at each floor/wall crossing as per relevant IS code.

10. Test at Works

The following factory tests shall be carried out and test results to be recorded:

- a. Temperature rise (Type test with no extra cost).
- b. Insulation resistance shall be tested with 1000 V megger and shall be not less than 100 mega ohms. The testing shall be done as per IS: 8084-1976.
- c. Earth continuity test.

11. Test at Site

The following tests shall be carried out at site and test results to be recorded:

- a. Insulation resistance shall be tested with 1000 V megger and shall be not less than 100 mega ohms. The testing shall be done as per IS: 8084-1976.
- b. Earth continuity test.

12. Design & Construction requirements – Cast Resin busbars / busducts**12.1 General**

The busbars shall be of cast construction, non-ventilated design. It shall be possible to mount the busbar system in any orientation, without affecting the current rating. The cast resin busbar configuration must be compatible with the sandwich busbar, and must allow for interconnection of the two types, wherever required.

12.2 Busbars

The busbars shall be of high conductivity Copper, or Aluminum, as specified in the tender. Where an earth conductor is required, it shall be a separate, integral earth conductor, of the same high conductivity material as the phase conductors, and at least 50% cross section of the phase conductor. No capacity deration of bus bars upto 45 deg C of ambient temperature.

12.3 Insulation

12.3.1 The busbars shall be insulated throughout their length by one of the following methods:

- a. Thermoset Epoxy coating
- b. Extruded Epoxy coating
- c. Mylar
- d. Epoxy coating plus mylar

12.3.2 The class of insulation shall be one of the followings:

- a. Class 'B' (130°C as max. temp withstand)
- b. Class 'F' (155°C as max. temp withstand)

12.3.3 The insulation must comply to UL 94 V-O. It shall be Halogen Free.

12.3.4 It must also be 100% waterproof tested and comply to IP 68. Both requirements must be tested by independent testing authorities.

12.4 Joints

The joints between sections shall be made so as to provide flexibility during installation and expansion / contraction of busbar during operation.

The joint construction must have the following features.

12.4.1 Heat expansion of at least 3mm per joint.

12.4.2 The joint insulation must be of one piece molded design and not have any cut edges which can absorb moisture.

12.4.3 The joint construction must allowed a +/- 14mm adjustment at the time of installation, for ease of adjusting to site measurement variations.

12.4.4 The joint bolt must be insulated with a bolt insulator. The bolt insulator must be of molded one piece.

12.4.5 The joint system must be designed in a way that the installer cannot insert the busduct length too far and damage the bolt insulator.

12.4.6 The busbar ends shall not have holes or slots at the joints – the electrical continuity shall be through pressure plates, achieving a high area of joint cross section and expansion capability.

12.4.7 The joint system shall have a main single bolt joint in the center and another 4 bolts on the external edges to ensure maintenance free operation.

12.4.8 The joint shall be torqued as recommended by the manufacturer.

12.4.9 The joint housing will be cast at site strictly as per the manufacturers

13. Fire Rating

Bus bar shall have capability to operate (without short circuit) minimum 5 hours in 750 deg C or 2 hours in 1000 deg C fire conditions without derating.

14. IP Ratings

The IP ratings of bus duct and rising mains for different application shall be as follows:

Application	IP Rating
a) Indoor application for areas like:	IP 54
Inside Sub-Station area	
Inside LT Panel Rooms	

Inside DG Set Room	
Inside Shafts / Risers / Electrical Rooms / Electrical Shafts.	
b) Indoor application for areas like:	IP 55
In Basement Parkings / Garages	
c) Outdoor application (over ground)	IP 65 and in addition a canopy need to be provided or IP 66.
d) Outdoor application (in ground / earth / water)	IP 67 or IP 68 as called for in the BOQ.

Note: The protections listed above have to be adhered to even if not mentioned or mentioned differently in the Schedule of Quantities.

15. Configuration of Bus Ducts

3P+1N	3 Phase, 1 Neutral 100%, Enclosure as earth
3P+1N+1/2 E	3 Phase, 1 Neutral 100%, 50% Internal Earth bus, Enclosure as earth
3P+2N	3 Phase, 200% Neutral, Enclosure as earth
3P+2N+1E	3 Phase, 200% Neutral, 100% Internal Earth bus, Enclosure as earth

NOTE:- Where ever, there is no internal earth bus along with the phase and neutral bus bars, then the earthing bus shall be the bus housing / enclosure itself i.e. Bus enclosure earthing itself. It should be rated for minimum 50% capacity. In case of aluminium housing, the housing itself acts as earth bus. In case of housing other than aluminium, separate earth bus need to be run alongwith the body of the rising main / bus duct. (Two runs of earth bus shall be needed).

d. SUB-HEAD: J. HT CABLE - 22KV GRADE XLPE INSULATED CABLES

1. GENERAL

Cables shall be aluminum conductor, XLPE insulated, HR PVC sheathed, armoured and shall be supplied, inspected, laid, tested and commissioned in accordance with drawings, specifications, relevant Indian Standard Specifications and cable manufacturers instructions.

2. MATERIAL

a. Conductor

The Conductor shall be made from electrical purity aluminum stranded wires compacted together.

b. Insulation

High quality TROPOTHEN - X (XLPE) unfilled insulating compound of natural colour shall be used for insulation. Insulation shall be applied by extrusion process and shall be chemically cross linked in continuous vulcanization process.

c. Shielding

Cables shall be provided with conductor shielding as well as insulation shielding and shall consist of extruded semi-conducting compound, additionally insulation shield shall be provided with semi-conducting and metallic tape shield over the extruded insulation shield. XLPE insulation and outer core shielding shall be extruded in one operation.

d. Armouring

Armouring shall be applied over the inner sheath and shall comprise of flat steel wires (strips).

e. Outer Sheath

Tough outer sheath of heat resisting PVC compound shall be extruded over the armouring in case of armoured cables or over inner sheath in the case of unarmoured cables.

3. TESTS

Cables shall be type tested and routine tested in accordance with IS: 7098 (Part II):

- a. Conductor resistance test.
- b. Partial discharge test.
- c. High Voltage test.

The following tests shall be carried out at site for insulation between phases and between phase and earth before and after cable laying:

- a. Insulation Resistance Test.
- b. Continuity resistance test.
- c. Sheathing continuity test.
- d. Earth test.
- e. High Voltage test.

4. LAYING OF CABLES

Minimum depth of the cable in the ground shall be 90cm. Laying & Protection of cable shall be as per relevant IS Standards & Codes.
Sufficient cable loops to be left at both the cable ends.

SUB-HEAD: K.**HT SF-6(CB) SWITCH BOARD - 22 KV SF-6****1. GENERAL**

Manufacturing, testing, supplying and commissioning of integrated cubicle type, floor mounted, free standing extensible sheet steel enclosed, front operated indoor type 33 kV or 22 KV switch board as per specifications given below:

System: The switch board shall be suitable for the following system.

- | | | | |
|----|-----------------------|---|---|
| a. | Rated voltage | - | 22 kV, 3phase (earthed system) |
| b. | Rated frequency | - | 50 cycles |
| c. | Fault level withstand | - | 750 MVA at 22 KV for 3 sec or as specified in the schedule of quantities. |

2. Site conditions climatic conditions

Ambient temperature	-	45° C maximum
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0°
C
minimum

Altitude	-	1000M above MSL
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The switchgear should be suitable to operate without any capacity deration at the climatic condition listed above.

3. Standard

Unless otherwise stated below HT switchboard shall conform to relevant Indian standards.

4. Construction features

The switchboard shall be made from CRCA sheet steel 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal. Panels shall be totally enclosed design, completely dust tight and vermin proof **with IP-4X for totally indoor application** protection grade. Gaskets between all adjacent units and beneath all cover shall be used to render the joints effectively dust tight. Panel shall be draw out type. Panel shall be provided with filter fans and exhaust filters as required for ventilation purpose. The unit shall be equipped with heater and thermostat.

5. Instrument accommodations

Separate and adequate compartment shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, bus-bar and connections.

6. Circuit breaker

The panel shall be provided with TP 22 kV indoor type vacuum breaker as specified in the schedule of quantities with symmetrical breaking capacity of 750 MVA at 22 kV as specified in the schedule of quantities,

The breaker shall be flush front, metal clad, draw out type and shall be provided with trip free, manual/spring charged/motorized closing mechanism (as called for in the schedule of quantities) with mechanical ON / OFF indication. The operating handle and the mechanical trip push button shall be at the front of the breaker and integral with the breaker and provision shall be made for remote operation of breakers.

7. Circuit

Each circuit breaker shall be housed in separate compartment and shall be enclosed on all sides. The following safety interlocks shall be provided.

- 7.1 The breaker can't be plugged in unless it is off.
- 7.2 The breaker can't be drawn out when it is on.
- 7.3 Tank can be removed when the breaker is on.
- 7.4 The breaker can't be plugged in with the tank off.
- 7.5 Automatic shutters prevent the access to bus bar when breaker is removed.

8. Cradle

The cradle shall be so designed and constructed as to permit smooth withdrawal and intersection of the breaker. The movement shall be free of jerks, easy to operate and shall preferably be on steel balls/rollers and not on flat surfaces.

9. Service

Both mains and secondary isolating contacts in service.

9.1 Test

Main isolating contacts separated and secondary contacts in service.

9.2 Isolated

Both main and secondary isolating contacts isolated.

9.3 Maintenance

Circuit breaker fully outside the cubical

10. Barriers

Steel sheet barrier shall be provided between:-

- 10.1 Instrument panel and potential transformer.
- 10.2 Instrument panel and current transformer.
- 10.3 Bus-bar chamber and circuit breaker compartment

11 Bus bars and connections

11.1 The bus bar shall be of electrolytic tinned copper and rectangular cross section suitable for rated capacity with heat shrinkable colour coded sleeves.

11.2 The bus bar shall be rigidly fixed on insulated supports to withstand short circuit and mechanical stresses. All bus bar connection shall be fully enclosed so as to leave no exposed live parts and shall present a neat appearance. An earth bar of 50mm x 6mm copper size shall be provided with the switchboard.

12. Terminals
All the cable terminations shall be at the rear side of the panel in adequate length for connecting the cable.
13. Protective devices
 - 13.1 Circuit breaker shall be provided with the triple pole IDMT relay for combined over current and earth fault protection, suitable for 24-volt operative power along with batteries and charger.
 - 13.2 Auxiliary trip relays for winding temperature trip of transformers to be provided.
 - 13.3 Master trip relay to be provided.
14. Instrument transformer
 - 14.1 The panel shall be provided with suitable but not less than 50 VA burden, accuracy class 1 potential transformers of ratio 22000/110 volts (for 22kV respectively) with HV and MV fuses. Potential transformer shall be draw out type.
 - 14.2 Panel shall be provided with accuracy class 1.0 current transformer of required VA burden for metering and protection.
 - 14.3 All control circuits shall be provided with proper and adequate protective fuse. All fuses shall be easily accessible from front only.
 - 14.4 Instrument testing plug shall be provided for testing the meters.
15. Metering
Panel shall be provided with BMS / Non BMS Compatible multifunction meter in the incomer as called for in the BOQ:
 - 15.1 Digital Ammeter within built for selector switch as called for in the outgoings.
 - 15.2 Digital Trivector meter with MDI as called for in the B.O.Q.

NOTE: For exact requirement of metering per breaker module, refer Schedule of Quantities.
16. Wiring
All wiring for meters and relays shall be copper conductor wires and shall be colour coded and labeled with approved plastic beads for identification. The size of the conductor should not be less than 2.5 sqmm. Copper wire.
17. Indicating lamps
LED type indicating lamps shall be provided for:-
 - 17.1 Phase indication (R, Y, B)
 - 17.2 Indication shall be provided for Breaker "OFF" (Green), breaker "ON" (Red) and breaker "TRIP" (Amber).
 - 17.3 Indication shall be provided for trip circuit healthy (Green) & Spring charged (Blue)
18. Earthing

Main copper earth bar of 25 mm x 6 mm shall be provided and connected to the framework of the switchboard. Provision shall be made for connections from the earth bar to the substation earth on both sides of the switchboard.

19. Painting

All sheet steel work shall be undergo a process of degreasing, pickling in acid, cold rinsing and then sprayed with a high corrosion resistant primer. The primer shall be baked in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade and stored.

20. Mechanical operation counter to be provided.

21. Breaker operated auxiliary switches – 6 NO. & 6 NC to be provided.

22. 6 window annunciation panel to be provided.

23. Labels

The breaker shall have Formica circuit labels in black and white indicating where they serve.

24. Drawings

Two sets of detailed technical literature and dimensional drawings shall be submitted with the tender and 3 copies of the manual of complete instruction for the installation, operation, maintenance and repairs, circuit diagrams, foundation and trenching details shall be provided with the switch board.

25. Testing & Commissioning:

HV switch shall be subject to tests specified in relevant Indian standards before dispatching and tests certificates shall be furnished.

Prior to commissioning of HV switchboard following tests shall be carried out at site:

Mechanical endurance test shall be carried out by closing and opening of the circuit breaker. Insulation resistance test shall be carried out between phase and phase to earth with 5kV megger.

All control relays and tripping mechanism shall be checked for proper operation.

Secondary current injection of all protection relays.

26. DC Power Pack:

One Power pack shall be suitable for 2 panels.

It shall be "SMPS based DC Power pack, constant voltage, constant current type, self powered power pack protected from overcharging, short circuit & fuse at Input, input voltage 230V / 110V AC \pm 20% and output voltage 24V DC with 7AH Sealed maintenance free (SMF) Battery.

e.

Type	:	CVCC (constant voltage constant current)
Rated Input Voltage	:	230 VAC
Input Voltage Tolerance	:	170v to 270 V
Rated Input Frequency	:	50 Hz.
Input Frequency Tolerance	:	± 5%
Output Voltage(AC mode)	:	26.0 Volts
Output Voltage(DC mode)	:	24.0 Volts
Battery	:	12V7AH X2
Output Current	:	0-10Amps.(for Tripping).
Tripping	:	8-10(Depending on Batt.Condition)
Ripple filtration	:	4,700mfd. /50V
Surge Suppression time	:	< 5pico seconds
Spike suppression energy	:	20 Joule
Short Circuit protection	:	Fuse
Recharge time	:	8-10hrs. /Condition
Protections	:	Over Charge and low battery Electronically controlled.
Indications	:	AC-ON,DC-ON,Ch.Fail
Ventilation	:	Air cooled
Mounting	:	Surface/Wall
f. Dimensions	:	

TECHNICAL DATA SHEET TO BE FILLED BY VENDOR

S. No	Description	To be Filled by Vendor
1	IP Rating	
2	Indoor/ Outdoor Type	
3	Operating Voltage	
4	No. of Panels	
5	Breaker - Type/ Operation	
6	Fault Withstand Rating	
7	Type of Busbars - Aluminium/ Copper.	
8	Type of CT's for Metering & Protection & CT Ratio & VA burden & Accuracy Class	
9	Type of PT's & Voltage Ratio	
10	Metering & Indications Details	
11	Details of Auxiliary Contacts & Annunciator Panel	
12	Type & Details of Relays	

Note: Provide Data Sheet for each panel i.e. Incoming & Outgoing.

SUB-HEAD: L. TRANSFORMERS 22 kV / 433V ONAN (OIL COOLED) WITH ON LOAD TAP CHANGER

1. SCOPE

This section covers the detailed requirements regarding supply and installation of transformer as per specifications.

2. GENERAL CONSTRUCTION

a. The transformer shall comply with the following Indian Standards as amended upto date:

1. IS 2026 - Part I to V power Transformers.
2. IS 1886 - Installation and Maintenance of Transformers.
3. IS 2099 - Bushings.
4. IS 2705 - Current Transformers.
5. IS 6600 - Guide for loading of oil immersed Transformers.
6. IS 335 - Transformer Oil.

b. Tanks and Radiators

Tanks shall be of MS plates and structural, electrically welded. The construction shall be robust and substantial, suitable for road/rail transport and to withstand vibration. Radiator tubes shall be electrical resistance welded type, round or elliptical or rectangular. They may be welded to the transformer tank or in case of very large sizes to separate detachable radiator banks connected through intermediate leak proof valves. Detachable radiator banks shall have top and bottom headers with flanged connections, with drain and vent fittings. Tanks shall be provided with lifting lugs and jacking lugs. Inspection hole with cover should also be provided for large transformers. Oil conservators shall be mounted on brackets attached to the top cover on tank. Dimensions of the conservator shall be such as to allow change in volume of oil due to change in temperature from 10°C to 95°C.

Tanks shall be thoroughly cleaned, degreased and sand blasted inside and outside. A coat of rust resistance primer shall immediately be given on outside surface. Inside surface shall be painted with oil resistance enamel paint. Tank and radiators shall be hydraulically pressure tested. Tanks shall also be tested for full vacuum. The procedure for testing shall be as follows:

i. Vacuum Test

The tanks designed for all vacuum shall be tested at an internal pressure of 3.33kN/m² (25mm of Hg) for one hour. The permanent deflection of flat plates after the vacuum has been released shall not exceed the value specified in Table 'A' without affecting the performance of the transformer.

ii. Pressure Test

One transformer tank of each size together with its radiators, conservator vessel and other fitting shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35kN/m² (0.35kg/sq.cm) whichever is lower measured at the base of the tank and will be maintained for one hour. The permanent

deflection of flat plates after the excess pressure has been released shall not exceed the figure specified in Table' A.

g. TABLE 'A'

<i>h. Horizontal length of Flat plate (in mm)</i>	<i>Permanent deflection (in mm)</i>
Upto and including 750	5.0
750 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.5
2001 to 2250	11.0
2251 to 2500	12.5
2501 to 3000	16.0
Above 3000	19.0

c. Cores

Cores shall be built from cold rolled grain oriented silicone steel laminations. Suitable high temperature resistance, oil proof, and adherent coating materials shall insulate the core laminations from each other. Core clamps and clamping bolts shall be heavily insulated from the core laminations.

The insulations of core bolt shall be minimum of class 'A'. The bottom and top frames shall be connected with the tie rods to make a complete structure rigid for carrying the weight of core-oil assembly without unduly stressing the laminations or windings. Lifting eyes shall be provided on the frame for removal of core assembly from the tank. Completed core shall be flash tested for insulation with 2500 Volts between the core and each of the clamps or core bolts (core being connected to earth).

All the core frames shall be bonded together with two metallic strips and connected to the tank for earthing to ensure earth return and operation of protective gear in the event of a fault. Lifting eyes (or any other provision) for lifting the core from the tank shall be provided.

d. Winding and Insulation

Winding shall be three phase with minimum class 'A' insulation. High conductivity electrolytic quality copper shall be used for winding. Windings shall be suitably braced to withstand the dynamic forces due to short circuit. Winding insulation shall be uniform and windings shall have full insulation.

Winding shall be individually vacuum dried before assembly as well as after assembly.

f. Insulation Oil

Insulation oil shall conform to IS: 335. Transformers shall be supplied with initial fill of filtered oil.

g. Impedance

The transformer impedance shall be as per IS Codes.

3. MAXIMUM ALLOWABLE POWER TRANSFORMER LOSSES

Maximum allowable No load and Load losses for ONAN type distribution transformers with highest voltage for equipment shall be as per ECBC of Indian or less.

4. GENERAL REQUIREMENTS

The transformer shall be outdoor type as specified. Unless otherwise specified the transformer in addition shall have thermal and dynamic ability to withstand external short circuit as per clause 9 of IS: 2026 (Part I) 1977.

5. TEMPERATURE RISE

The reference ambient temperatures assumed for the purpose of this specification are as follows: -

- a. Maximum ambient air temperature 50°C
- b. Maximum daily average ambient air temperature 40°C
- c. Maximum yearly weighted average ambient temperature 32°C
- d. Minimum ambient air temperature + 3°C

The temperature rise at the above conditions and at an altitude of 1000 meters above MSL shall not be exceeding as follows:

By resistance method 55°C

By thermometer 50°C.

6. RATING AND CAPACITY

Transformer shall be suitable for continuous operation and maximum capacity as given in the schedule of quantities. It shall be suitable to deliver full capacity continuously without any deration upto an ambient temperature of 50° C for outdoor application.

7. ON LOAD TAP CHANGING DEVICE (For Transformer with OLTC)

The tap changing device shall be provided on H.V. side, on circuit type, for tap position and locking arrangement at any of the tapping positions. It shall be designed for bi-directional operation and shall be of self positioning type and shall have the following steps:

- ± 2.5%
- ± 5%
- ± 7.5%
- ± 10.0%
- 12.5%
- 15.0%

9. VOLTAGE RATIO

The transformer shall be suitable for a voltage ratio of 11kV / 433 Volts or 22kV / 433V or 33 kV/433 Volts as specified in Schedule of Quantities.

10. VECTOR GROUP

The winding connection shall conform to vector group Dyn 11 unless otherwise specified.

11. COOLING

The transformer shall be oil immersed natural air-cooled type (ONAN). Transformer shall be suitable for completely outdoor duty / application.

12. ACCESSORIES

The transformer shall be single tank type with termination on bushings for outdoor installation or cable end box for indoor installation as specified on HV side. The MV side shall be suitable to receive cable suitable for full load current of the transformer.

13. FITTINGS

The transformer shall be complete with the following fittings:

- a. Oil conservator with oil level indicator, minimum level marking and drain plug for all transformers.
- b. Off circuit type tap change arrangement with position indicator and locking arrangement for all transformers.
- c. Thermometer pocket with plug for all transformers.
- d. 3 nos. 150mm dial type/stem type thermometer with metal guard dial type calibrated thermometer may have max. Temperature indicator and resetting device for all thermometers winding temperature alarm/trip and fitted in a marshaling box.
- e. Lifting lugs for all transformers.
- f. Bi-directional rollers.
- g. Rating diagram and terminal marking plate for all transformers.
- h. Explosion vent for transformers.
- i. Additional Neutral separately brought out on a bushing for earthing for all transformers.
- j. Earth terminals (2Nos) for body earthing for all transformers.
- k. Valves for filtration, drainage and filling etc. with necessary plugs for all transformers.
- l. Radiator assembly for all transformers.
- m. Silica gel breather for all transformers.
- n. Air release plug for all transformers.
- o. First filling of oil as per IS 335/72 including make up fill during installation for all transformers.
- p. Facility to connect up Buchholtz relay for all transformers.
- q. Inspection cover on tank cover for access to terminal connections for all transformers.
- r. Bushing terminations or cable box terminations as specified.
- s. Necessary hardware clamps, lugs etc. for terminations on HV/MV etc. for all transformers.
- t. Disconnecting chamber for H.T. and L.T.cable.
- u. **OLTC with RTCC Panel and necessary control cable (length 30M approx.) for transformer with OLTC provision**

14. EXPLOSION VENT

Explosion vent or pressure relief device shall be provided of sufficient size for rapid release of any pressure that may be generated within the tank and which might result in damage to the equipment. The device shall operate at a static pressure less than the hydraulic test pressure for transformer tank. Means shall be provided to prevent the ingress of moisture and of such a design to prevent gas accumulation.

15. ACCOMMODATION FOR AUXILIARY APPARATUS

Restricted earth fault protection facilities shall be provided for the mounting of a neutral current transformer which shall be integral to Transformer. CT shall be 2000/5A, 15VA, class-PS with knee voltage 15V approx.

16. RATING AND DIAGRAM PLATES

The following plates shall be fixed to transformer tank in a visible position.

1. A rating plate of weatherproof material bearing the data specified in the appropriate clauses IS: 2026-1977.
2. A diagram plate showing the internal connections and also the voltage vector relationship of the several windings in accordance with IS: 2026 - 1977 and a plan view of the transformer giving the correct physical relationship of the terminals

17. JOINTS AND GASKETS

All gaskets used for making oil tight joints shall be of proven material such as granulated cork bounded with synthetic rubber gaskets of synthetic rubber.

18. GAS AND OIL ACTUATED (BUCHHOLTZ) RELAYS

Buchholtz relay shall be provided for the transformers.

Oil actuated relay equipment shall conform to IS: 3637-1966 and shall be double float type having contacts which close following oil surge or under incipient fault conditions.

Each gas and oil actuated relay shall be provided with a test cock to take a flexible pipe connection for checking the operation of the relay.

Where specified to allow gas to be collected at ground level, a pipe approximately 5mm inside diameter shall be connected to the release cock of the gas and oil actuated relay and brought down to a point approximately 1.25m above ground level, where it shall be terminated by a cock. A machined surface shall be provided on the top of each relay to facilitate the setting of the relays and to check the mounting angle in the pipe and the cross level of the relay.

The design of the relay mounting arrangements, the associated pipe work shall be such that mal-operation of the relays shall not take place under normal service. The pipe work shall be so arranged that all gas arising from the transformer shall pass through the gas and oil-actuated relay. The oil circuit through the relay shall not

form a delivery path in parallel with any circulating oil pipe, nor shall it be tied into, or connected through, the pressure relief vent. Sharp bends in the pipe work shall be avoided.

All wiring connections, terminal boards, fuse and links etc. connected with gas-actuated relays shall be suitable for tropical atmosphere. Any wiring liable to be in contact with shall have oil resisting insulation and the bared ends of stranded wire shall be sealed together to prevent creep age of oil along the wire. There shall be no possibility of oil entering connection boxes used for cables or wiring.

19. BUSDUCT / CABLE BOX

Cable box shall not be mounted on the tank covers. It shall be feasible to remove the tank covers for inspection during maintenance etc. without recourse to breaking the joints or disturbing the cables already terminated. Necessary removable links in oil approachable through inspection cover in tank etc. after lowering coil shall be provided for test purpose.

20. TESTS

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

- a. Measurement of winding resistance.
- b. Voltage ratio, polarity and phase relationship.
- c. Measurement of impedance voltage.
- d. Load losses.
- e. No load losses and no load current.
- f. Induced over voltage withstand.
- g. Separate source voltage withstands.
- h. Partial discharge 25PC upto 1.2 times the rated voltage.
- i. Heat run test of one transformer, the quoted rate for the transformer shall include all routine tests to be carried out at the manufacturer's works and all routine tests to be carried out at site as per specifications.

21. Pre-commissioning Tests.

- 1) General inspection
 - a) Control and relay panels, etc.
 - b) Junction boxes and marshalling kiosks.
- 2) Secondary injection on all transformer protection relays.
- 3) Primary injection
 - a) Tests on operation and stability of earth fault relays on high voltage side. (Also to be repeated at the end of all other Commissioning tests)
 - b) Tests on over current relays on low voltage side.
 - c) Tests on operation and stability of earth fault relays on low voltage side.

- d) Tests on operation of standby earth fault relays on low voltage side.
 - e) Tests on overcurrent relay on high voltage Side (when current transformers are not in transformer bushings).
 - f) Voltage compensation.
- 4) Ratio tests
 - a) With 415V applied on high-voltage side, Measure the voltage between all phases on the low-voltage side for every tap position.
 - b) To check phasing, measure volts:
A to a,b and c
B to a,b and c
C to a,b and c

Where A, B and C (or R, Y, B) are the terminals of three phases on high voltage side and a, b and c are the corresponding terminals on low voltage side.

 - c) Magnetic balance test.
- 5) Tripping tests
 - a) High voltage.
 - b) Low voltage.
 - c) Intertripping tests.
 - d) Winding temperature trips.
- 6) Calibrate earthing resistance
- 7) Tap changing tests to check mechanism, Indication, buzzer, lamp,etc.
- 6) Insulation tests
 - a) On high and low voltage windings.
 - a. On current and voltage transformers, circuits, etc.
- 9) See that neutral earthing switches are closed before making alive.
- 10) Check Transformers
 - a) For Transformer in a bank on equal taps before Switching in
 - b) For Transformers in a parallel
- 9) Set down relays before closing in advise control
- 12) Load tests
 - a) Voltmeter, ammeters, etc., on both high and low voltage sides.
 - b) Over current.

- b) No spill in high voltage star point.
 - c) No creeping of contacts on both high and low voltage earth fault relays.
 - d) Voltage on relays.
- 13) Advice control of any new Equipment commissioned.
- 14) Low voltage excitation current.
- 15) Single phase, magnetic balance test.
 - d. The power frequency test voltage for the secondary winding shall be 2.5kV R.M.S. The transformer shall be charged only after the tests are conducted and approval of local authorities is obtained.

TECHNICAL DATA SHEETS

Data sheet for Transformers

i. S.NO. SHORT DESCRIPTION AS PER TENDER QUOTED DATA

1.0	Make	-
2.0	Service/ Duty	-
3.0	Type	
	a. Dry Type	
	b. Oil Type	
4.0	Installation	
	a. Indoor	
	b. Outdoor	
5.0	Protection class of enclosure (IP Rating)	
6.0	kVA rating	-
	a. @45°C Ambient for Indoor Type	
	b. @50°C Ambient for Outdoor Type	
7.0	Rated voltage	
	a. HV	-
	b. LV	-
8.0	Rated frequency (Hz)	-
9.0	Max. Temperature Rise	-
10.0	Connections	
	a. HV	-
	b. LV	-
11.0	Tapping	
	a. Range	-
	b. Tap Steps	-
12.0	Tap Changing Mechanism	
	a. Without OLTC (off circuit)	
	b. With OLTC	
13.0	No load loss on rated voltage - & frequency (Watt)	
14.0	Load loss at rated voltage	-
15.0	Type of cooling	-

16.0	Insulation class	-
17.0	Terminal arrangement (Cable box/ Bus ducts)	
a.	HV	-
b.	LV	-
18.0	Impedance	-
19.0	Total weight of transformer	-
a.	Wt. of copper Winding	-
b.	Wt. of Tank & fittings	-
c.	Total Weight.	-
20.0	Overall dimensions of the transformers	
a.	Length (mm)	-
b.	Width (mm)	-
c.	Height (mm)	-
21.0	Applicable standard	-
22.0	Regulation of Transformer	
a.	At 0.8 power factor	-
b.	At unit power factor	-
23.0	Foundation Detail	-
24.0	Efficiencies at unit power factor and 0.8 power factor at 100%, 75%, 60% and 50% load.	
a.	At Unit Power Factor	
(i)	At 100% load	-
(ii)	At 75% load	-
(iii)	At 60% load	-
(iv)	At 50% load	-
b.	At 0.8 Power Factor	
(i)	At 100% load	-
(ii)	At 75% load	-
(iii)	At 60% load	-
(iv)	At 50% load	-
25.0	Load at which maximum efficiency occurs	-
26.0	Maximum efficiency at above load.	-
27.0	Neutral current of transformer for restricted earth fault protection.	-
28.0	Fitting and accessories (Furnish a Complete list)	-

SUB-HEAD: M. 24 VOLTS DC BATTERY CHARGER:

a. Scope:

This section covers supply, installation, testing and commissioning of Battery and Battery charger.

b. 24 volts DC battery:

12 volts each 180AH, (25 plates battery each) batteries comprising of 2 Nos. standard lead acid stationary tubular type batteries.

- i. MS painted / powder coated battery enclosure with rubber pads or spill proof plastic trays.
- ii. Set of connectors with ends take-off suitable for connections.
- iii. Spring type hydrometer.

c. Battery charger:

Battery float cum boost charger of continuous load current plus boost charge current & capable of achieving required specific gravity & suitable for charging batteries. The charger shall have following accessories:

- i. 1 No. rotary switch to select auto float / manual float / manual boost. During auto float mode automatic changeover shall take place from float mode to boost mode and vice versa.
- ii. Single phase double copper wound impregnated naturally air cooled mains transformer.
- iii. 1 Set solid state constant potential controller to stabilize the DC output voltage of the float cum boost charger at + 2% of time set value of AC input voltage variation of 230V \pm 10%, frequency variation of \pm 5% from 50Hz and simultaneous load variation of 0-100% and also complete with Current Limiting Circuit to drop the Float Charger output voltage upon overloads to enable the battery to take over.
- iv. 1 No. electronic controller to automatically changeover battery charging from boost to float and vice versa.
- v. 1 No. DC ammeter and toggle switch to read charger output current and battery charge / discharge current.
- vi. 1 No. moving coil DC voltmeter to read the DC output voltage.
- vii. 2 Sets potentiometer to adjust the output voltage during manual / auto float and boost modes.
- viii. 1 No. double pole ON / OFF MCB for Charger Output (24V DC rating)
- ix. 2 Sets DC output terminals. 1 set for the load and the other set for the battery.

Alarm annunciation: Visual and audible alarm with manual accept reset facility shall be provided for the following:

- a. AC mains failure
- b. Charger Failure
- c. Load / Output over voltage

Rating:

AC Input	230 \pm 10% AC 50Hz single phase.
DC output	To float / boost charge 24V suitable rating batteries and also supply a continuous load.
Current Rating	As battery rating
Float Mode	27.0V nominal (adjustable) between 24-28.0V
Boost Mode	28.2V nominal (adjustable) between 24-29.0V
Voltage regulation	\pm 2% for AC input variation of 230V \pm 10%. Frequency variation of 50Hz \pm 5% and DC load variation 0-100%
Ripple	Less than 5%

SUB-HEAD: N. LIGHTNING PROTECTION SYSTEM ESE (Advanced Lightning Protection System) (Based on French Standards)

1. SYSTEM

The design of the components / system shall be traceable to field research, laboratory testing, fundamental analysis, and statistical levels of the lightning event.

The design of the components shall be traceable to long term practical field studies, laboratory testing, fundamental scientific principles and statistical levels of the lightning event as documented in international standard.

The lightning protection system should complies in accordance with NFC 17-102 standard and shall be installed strictly to the manufacturer's instructions.

The advanced lightning protection system shall include components as follows:

ESE Air terminal
Mechanical supports
Down-conductors
Performance Recording Equipment
A low impedance Grounding system.

2. STANDARDS

Complete installation shall be engineered and constructed in accordance with the latest revision of the following:

- NFC-17-102
- IEC 61204

The details of the lightning protection system shall also confirm to the requirements of all relevant local codes, as applicable, together with the additional requirements referred to in this specification and drawings, whichever is more stringent and acceptable to the Owner / PMC.

3. AIR TERMINAL

The air termination shall be of the type that responds dynamically to the appearance of a lightning down leader by creating free electrons between outer surfaces and an earthed central finial rod.

The Air terminal should work under **Early Streamer Emission (ESE) Technology** and the attractive radius of the air termination shall be traceable to known and acceptable lightning research and statistics.

The Lightning conductor should deliver a unique gain time in efficiency, anticipating the natural formation of an upward leader. The Air terminal generates a leader that propagates rapidly to capture the Lighting stroke and conduct it towards the ground.

Arcing is not to be continuous and shall only occur during the progress of the lightning leader.

The air termination shall not cause high frequency radio interference except during the millisecond intervals associated with the progress of the lightning leader and during the main return strike of lightning events in the region.

The materials of the air termination shall be non-corroding in normal atmosphere.

The air termination shall not be dependent upon batteries or external power supplies for any part of its operation.

The Height of the air terminal support mast should be minimum 2mts and the height will be increased as per the coverage design.

The support shall be securely installed and guy wires shall be used where necessary to enable the air termination and mast system to withstand maximum locally recorded wind velocities.

4. DOWNCONDUCTOR

The down conductor should be used 25 x 3 mm copper strip. Two down conductors shall be used in case of the structure height is above 28mts and both should be connected with maintenance-free Grounding system.

The main copper conductor shall be connected directly to the air termination.

The down conductor shall be installed in accordance with the manufacturer's instructions and should not be subject to sharper bends.

The down conductor must be kept in constant physical contact with the structure via conductive mounting clamps.

5. LIGHTNING FLASH COUNTER

Each protection system shall be supplied with Lightning strike counter. The counter shall have a register that activates one count for every discharge where the peak current exceeds 400A at the 8/20us standard.

The lightning flash counter shall be robust and easy to install. The counter shall operate from the energy of the lightning discharge and should not work on external or battery power to operate.

The lightning flash counter shall be installed to the manufacturer's instructions in a readily accessible manner (always 2mts above the Ground) so that reading can be taken at regular intervals. It shall be positioned such that its operating temperature is within the range -20°C to + 60°C.

6. GROUNDING SYSTEM - CHEMICAL EARTHING

The Lightning arrestor grounding system reading shall not exceed 10 ohms static impedance except with prior approval by the specifying engineer or manufacturer of the lightning protection system.

Grounding will be done by copper bonded steel core ground rods especially designed for electrical grounding.

Bonding of the grounding system to metallic parts of the building, the structural reinforcing steel of the building to arriving services is recommended.

Electrically conductive, non soluble TEREC Powder should be used to achieve low ground resistance.

The materials are mixed and installed strictly in accordance with the manufacturer's instructions for chemical earthing.

SUB-HEAD: O.

TESTING & COMMISSIONING

After completion of erection works before equipment is charged, the following minimum test shall be carried out. All tests shall be recorded in the format as approved by Architect/Consultant /PMC / Owner besides the test mentioned below any other tests specified by the local authority shall also be carried out. All tools and calibrated instruments for testing, labour, materials and incidentals necessary, to conduct the tests mentioned below shall be provided by the contractor at his own cost.

L.T. Switchgear & Distribution Boards.

Insulation resistance test of all the feeders by 500 V megger.

1. Test to Earth

This is made with all fuse links in place, all switches on and all lamps in position. The result must be not less than 50 megohms divided by number of outlets i.e., points and switch positions except that it need not exceed 1 megohm for the whole installations.

Control rheostats, heating and power appliances and electric signs may, if desired be disconnected for this test but if their insulation resistance must, in each case be not less than that given in the appropriate British Standard Specifications, or where there is no such specifications, be not less than half a megohm.

2. Test between Conductors

Where practicable, a test should be made between all conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply.

For this test, all lamps should be removed and all switches on. The result again must be 50 megohms divided by the number of outlets i.e., points and switch positions but need not exceed 1 megohm for the whole installation.

Continuity test of all breakers, MCCB and fuse switch units.

Earth continuity test between various non current carrying parts of equipment steel work et., and the earth bus provided in panels.

Operation of all meters and relays by secondary injection.

High voltage test 3 KV for 1 minute.

3. Cables

Insulation resistance test of all LT cables with 500 V megger.

Continuity test of all the cores and the armour.

Sheathing continuity test.

Earth test.

4. WIRING

4.1 Testing of Wiring

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

Testing of Earth Continuity Path

The earth continuity conductor, metallic envelopes of cables shall be tested for electric continuity and the electrical resistance of the same, along with 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.

4.2 Insulation resistance Test

The insulation resistance shall be measured by applying between earth and the whole system to conductors or any sections thereof with all fuses in place and all switches closed, and except in earthed concentric wiring all lamps in position or both poles or the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it need not exceed 500 V for medium voltage circuits. Where the supply is derived from the three wire DC or poly phase AC system, the neutral pole of which is connected to earth direct or through added resistance, the working pressure shall be deemed to be that which is maintained between the phase conductor and the neutral.

The insulation resistance shall be measured between all conductors connected to one pole or phase conductor of all supply and all the conductors connected to the neutral or to the other pole or phase conductors of the supply with all lamps in position and switches in OFF position. The insulation resistance in mega ohm measured as above shall not be less than 50 mega ohm divided by the number of outlets or when PVC insulated cables are used for wiring 12.5 mega ohm divided by number of outlets.

4.3 Polarity test of switches

In two-wire installation, a test shall be made to verify that all switches in every circuit have been fitted in the same conductor throughout and such conductor shall be labelled or marked for connection to the phase conductor or to the non-earthed conductor.

In a three wire or a four-wire installation, test shall be made to verify that every non-linked single pole switch is fitted in a conductor, which is labelled or marked for connection to one of the phase conductor of the supply.