



ई-निविदा क्रमांक – भुसावल-एल-डब्लू-टी-51-2026

कार्य का नाम

**Name of work – Electrification work in connection with following,  
Sch. A :- Development of Infrastructure and other needs of Railway School at  
Bhusawal. ; Sch. B :- Construction of Integrated Crew Lobby with provision of basic  
amenities at Bhusawal.**

**टेण्डर जारी किया :**

**टेण्डर दिया गया :**

वरिष्ठ मंडल विद्युत अभियंता (सामान्य), मध्य रेल, भुसावल	मेसर्स _____ _____ _____
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**E-Tender No:-BSL-L-W-T-51-2026**

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## CENTRAL RAILWAY

### E-TENDER NOTICE NO BSL-L-W-T-51-2026 (ELECT. GEN) OPEN TENDER

**Senior Divisional Electrical Engineer (General Services) Central Railway, Bhusawal** for & on behalf of President of India invites **E-TENDER** from reputed & experienced contractors on website [www.ireps.gov.in](http://www.ireps.gov.in) for the following work –

SN	Tender No.	Description of work	Approx. Cost Rs.	Bid Security	Validity of offer	Completion period
1	BSL-L-W-T-51-2026	Electrification work in connection with following, Sch. A :- Development of Infrastructure and other needs of Railway School at Bhusawal. ; Sch. B :- Construction of Integrated Crew Lobby with provision of basic amenities at Bhusawal.	2,48,31,306	4,96,600	60 days	9 Months

**Notes-(I)** Tender Closing Date Time of aforesaid tender up to 15.00 Hrs. of **06/07/2026**.

(II)The prospective tenderers are requested to visit the website – [www.ireps.gov.in](http://www.ireps.gov.in) for details of tenders & Corrigendum, if any.

(III)The tender notice is also displayed on **Notice Board** of Sr.DEE(G) Office, Bhusawal.

(IV)Tenderer may participate in above E- tender electronically through website [www.ireps.gov.in](http://www.ireps.gov.in) only & submission of manual offers against e-tender are not allowed & if any manual offers submitted shall neither be opened nor considered.

(V) **Bid Security** :- The Bid Security shall be deposited either in cash through e-payment gateway or submitted as Bank Guarantee bond from a scheduled commercial bank of India or as mentioned in tender documents. The Bank Guarantee bond shall be as per **Annexure-VIA** and shall be valid for a period of 90 days beyond the bid validity period.

**Exemptions:**

- (i) Any firm recognized by Department of Industrial Policy and Promotion (DIPP) as ‘Startups’ shall be exempted from payment of Bid Security detailed above.
- (ii) Labour Cooperative Societies shall submit only 50% of above Bid Security detailed above.

**Note:-** Subject to exemptions provided above, the tender must be accompanied by a Bid Security as mentioned in tender document, failing which the tender shall be summarily rejected.

(VI) The contractor shall submit self-attested/digitally signed copy of valid Electrical Contractor License as per Clause No. 45 IE Rule 1956 along with the offer. The offer will be summarily rejected in absence of valid Electrical Contractor License.

(VII) Tenderer should submit their credential of work done along with the offer as per 'Eligibility Criteria', Definition of "similar nature of work" and Para 7.0 given in tender booklet. (for details please see tender booklet Page. No. 5 to 9)

(VIII) **Special Condition** - Tenderer, in case of other than Company / Proprietary Firm, Annexure-V(A) shall be submitted by the each member of a Partnership Firm / Joint Venture (JV) / Hindu Undivided Family (HUF) / Limited Liability Partnership (LLP) etc. as the case may be. **Non submission of Annexure-V(A) by the bidder shall result in summarily rejection of his/their bid.** It shall be mandatorily incumbent upon the tenderer to identify state and submit the supporting documents duly self-attested/digitally signed by which they/he is qualifying the Qualifying Criteria mentioned in the Tender Document.

SENIOR DIVISIONAL ELECTRICAL ENGINEER.  
(GENERAL SERVICES)  
CENTRAL RAILWAY, BHUSAWAL  
On behalf of President of India

## PREAMBLE AND SCOPE OF WORK

**E-Tender No:- BSL-L-W-T-51-2026**

**NAME OF WORK :-** Electrification work in connection with following, Sch. A :- Development of Infrastructure and other needs of Railway School at Bhusawal. ; Sch. B :- Construction of Integrated Crew Lobby with provision of basic amenities at Bhusawal.

### **SCOPE OF WORK :-**

The scope of work involves supply, erection, testing and commissioning of concealed wiring with various switches, sockets, fans, switchgears, LED lights/ fittings, earthing, lighting circuit board, octagonal pole, Air conditioning with accessories, transformer, online UPS, ON GRID and OFF GRID Solar photovoltaic power plants / power pack, stadium mast, water cooler, LT panel, LT XLPE cables along with their transportation, laying and other necessary accessories, pump sets along with accessories, etc in Bhusawal Divn:

1.0 APPROXIMATE COST OF THE WORK	:-Rs. 2,48,31,306
TIME AND DATE OF CLOSING	:-15.00 Hrs on 06/07/2026
COMPLETION PERIOD	:- 9 Months
VALIDITY OF OFFER	:-60 days.

**2.0 FOREIGN EXCHANGE:** No foreign exchange and/or import license shall be released/provided to the Contractor in connection with this contract.

**3.0 “Tenderer should participate electronically in E- tender through website www.ireps.gov.in & submission of manual offers against e-tender are not allowed & if any manual offers submitted shall neither be opened nor considered.”**

### **4.0 GENERAL**

- i) Water / electricity / transport shall be arranged by the Contractor at his own cost. The Purchaser shall not provide the same under any circumstances. The site for depot / workshop can be provided to the Contractor on his request.
- ii) The Contractor shall arrange at his own cost, all tools & plants, facilities required for erection, testing and commissioning of all the equipment in compliance with the respective specifications.
- iii) The schedule of rates and quantities enclosed should be read in conjunction with the explanatory notes given in the tender papers.
- iv) **Tenderer should submit their credential of work done as per Eligibility criteria of Tender and Similar Nature of Work**

**5.0 Bid Security:** The Bid Security shall be deposited either in cash through e-payment gateway or submitted as Bank Guarantee bond from a scheduled commercial bank of India or as mentioned in tender documents. The Bank Guarantee bond shall be as per **Annexure-VIA** and shall be valid for a period of 90 days beyond the bid validity period.

### **Exemptions :-**

- (i) Any firm recognized by Department of Industrial Policy and Promotion (DIPP) as ‘Startups’ shall be exempted from payment of Bid Security detailed above.
- (ii) Labour Cooperative Societies shall submit only 50% of above Bid Security detailed above.

**5.1 In case, submission of Bid Security in the form of Bank Guarantee, following shall be ensured:**

- i. A scanned copy of the Bank Guarantee shall be uploaded on e-Procurement Portal (IREPS) while applying to the tender.
- ii. The original Bank Guarantee should be delivered in person to the official nominated as indicated in the tender document before closing date for submission of bids (i.e. excluding the last date of submission of bids)
- iii. Non submission of scanned copy of Bank Guarantee with the bid on e-tendering portal (IREPS) and/or non-submission of original Bank Guarantee within the specified period shall lead to summary rejection of bid.
- iv. The Tender Security shall remain valid for a period of 90 days beyond the validity period for the Tender.
- v. The details of the BG, physically submitted should match with the details available in the scanned copy and the data entered during bid submission time, failing which the bid will be rejected
- vi. The Bank Guarantee shall be placed in an envelope, which shall be sealed. The envelope shall clearly bear the identification “**Bid for the \*\*\*\*\* Project**” and shall clearly indicate the name and address of the Bidder. In addition, the Bid Due Date should be indicated on the right hand top corner of the envelope.
- vii. The envelope shall be addressed to the officer and address as mentioned in the tender document.
- viii. If the envelope is not sealed and marked as instructed above, the Authority assumes no responsibility for the misplacement or premature opening of the contents of the Bid submitted and consequent losses, if any, suffered by the Bidder.
- ix. Bank guarantee shall be in the name of “Senior Divisional Finance Manager, Central Railway Bhusawal” on minimum Rs. 500 stamp only.
- x. Successful tenderer will deposit Rs. 200 legal vetting charges before execution of work.

**Note :- (a)** Subject to exemptions provided under para 5.0 above, the tender must be accompanied by a Bid Security as mentioned in tender document, failing which the tender shall be summarily rejected.

**(b)** The Tenderer(s) shall keep the offer open for a minimum period of 60 days (in case of two packet system of tendering 90days) from the date of closing of the Tender. It is understood that the tender documents have been issued to the Tenderer(s) and the Tenderer(s), is / are permitted to tender in consideration of the stipulation on his / their part that after submitting his / their tender subject to the period being extended further, if required by mutual agreement from time to time, he will not resile from his offer or modify the terms and conditions thereof in a manner not acceptable to \_\_\_\_\_ Railway. Should the tenderer fail to observe or comply with the foregoing stipulation, the amount deposited or Bank guarantee bond submitted as Bid Security for the due performance of the above stipulation, shall be forfeited to the Railway.

**6.0 Eligibility Criteria (Refer clause 10 of Part-I of GCC April-2022):**

**6.1 Technical Eligibility Criteria:**

The tenderer must have successfully completed or substantially completed any one of the following categories of work(s) during last 07 (seven) years, ending last day of month previous to the one in which tender is invited:

- (i) Three similar works each costing not less than the amount equal to 30% of advertised value of the tender, or

- (ii) Two similar works each costing not less than the amount equal to 40% of advertised value of the tender, or
- (iii) One similar work costing not less than the amount equal to 60% of advertised value of the tender.

## 6.2 DEFINITION OF SIMILAR NATURE OF WORK: -

Definition of Similar Nature of Works
Electrification / Rewiring of Service or Residential building / Yard / HT / LT substation work / HT / LT cable work / street lighting / platform or building lighting management / circulating area Lighting / Electrical overhead power supply work / Electrical pump work etc.

**Note:** (1) Work experience certificate from private individual shall not be considered. However, in addition to work experience certificates issued by any Govt. Organization, work experience certificate issued by Public listed company having average annual turnover of Rs 500 crore and above in last 3 financial years excluding the current financial year, listed on National Stock Exchange or Bombay Stock Exchange, incorporated/registered at least 5 years prior to the date of closing of tender, shall also be considered provided the work experience certificate has been issued by a person authorized by the Public listed company to issue such certificates.

In case tenderer submits work experience certificate issued by public listed company, the tenderer shall also submit along with work experience certificate, the relevant copy of work order, bill of quantities, bill wise details of payment received duly certified by Chartered Accountant, TDS certificates for all payments received and copy of final/last bill paid by company in support of above work experience certificate.

**Note:** (2) If a bidder has successfully completed a work as subcontractor and the work experience certificate has been issued for such work to subcontractor by a Govt. Organization or public listed company as defined in Note 1 above, the same shall be considered for the purpose of fulfillment of credentials.

**6.3 Financial Eligibility Criteria:** The tenderer must have minimum average annual contractual turnover of V/N or 'V' whichever is less; where

V= Advertised value of the tender in crores of Rupees

N= Number of years prescribed for completion of work for which bids have been invited.

The average annual contractual turnover shall be calculated as an average of "total contractual payments" in the previous three financial years, as per the audited balance sheet. However, in case balance sheet of the previous year is yet to be prepared/ audited, the audited balance sheet of the fourth previous year shall be considered for calculating average annual contractual turnover.

The tenderers shall submit requisite information as per **Annexure-VIB**, along with copies of Audited Balance Sheets duly certified by the Chartered Accountant/ Certificate from Chartered Accountant duly supported by Audited Balance Sheet.

**6.4** No Technical and Financial credentials are required for tenders having advertised value up to Rs. 50 lakh.

**6.5** Credentials if submitted in foreign currency shall be converted into Indian currency i.e., Indian Rupee as under:

The conversion rate of US Dollars into Rupees shall be the daily representative exchange rates published by the Reserve Bank of India or entity authorized by RBI to do so for the relevant date or immediately previous date for which rates have been published. Where, relevant date shall be as on

the last day of month previous to the one in which tender is invited. In case of any other currency, the same shall first be converted to US Dollars as on the last day of month previous to the one in which tender is invited, and the amount so derived in US Dollars shall be converted into Rupees at the aforesaid rate. The conversion rate of such currencies shall be the daily representative exchange rates published by the International Monetary Fund for the relevant date or immediately previous date for which rates have been published.

#### **7.0 Tenderer Credentials:**

Documents testifying tenderer previous experience and financial status should be produced along with the tender.

Tenderer(s) shall submit along with his / their tender:

- (i) Certificates and testimonials regarding contracting experience for the type of job for which tender is invited with list of works carried out in the past.
- (ii) Audited Balance Sheet duly certified by the Chartered Accountant regarding contractual payments received in the past.
- (iii) The list of personnel / organization on hand and proposed to be engaged for the tendered work. Similarly list of Plant & Machinery available on hand and proposed to be inducted and hired for the tendered work.
- (iv) Tenderer, in case of other than Company / Proprietary Firm, Annexure-V(A) shall be submitted by the each member of a Partnership Firm / Joint Venture (JV) / Hindu Undivided Family (HUF) / Limited Liability Partnership (LLP) etc. as the case may be. **Non submission of Annexure-V(A) by the bidder shall result in summarily rejection of his/their bid.** It shall be mandatorily incumbent upon the tenderer to identify state and submit the supporting documents duly self-attested/digitally signed by which they/he is qualifying the Qualifying Criteria mentioned in the Tender Document.
- (v) The Railway reserves the right to verify all statements, information and documents submitted by the bidder in his tender offer, and the bidder shall, when so required by the Railway, make available all such information, evidence and documents as may be necessary for such verification. Any such verification or lack of such verification, by the Railway shall not relieve the bidder of its obligations or liabilities hereunder nor will it affect any rights of the Railway there under.
- (vi) (a) **In case of any information submitted by tenderer is found to be false, forged or incorrect at any time during process for evaluation of tenders, it shall lead to forfeiture of the Bid Security and may also lead to any other action provided in the contract including banning of business for a period of upto two year.**  
  
(b) **In case of any information submitted by tenderer is found to be false, forged or incorrect after the award of contract, it will lead to termination of the contract, along with forfeiture of Bid Security/Security Deposit and Performance guarantee and may also lead to any other action provided in the contract including banning of business for a period of upto two year.**

**Note :-Non-compliance with any of the conditions set forth therein above is liable to result in the tender being rejected.**



**8.0** - Contractor shall ensure all precautions during digging work close to Rly signaling, telecom electrical cables etc. Penalties to be imposed for damages to any cable as per Railway board letter no. 2021/Tele/5(2)/3-Part(1)/(3425647) dtd 12.06.2023

**9.0 GENERAL CONDITION OF CONTRACT:**

Unless otherwise stated in the tender papers, contract shall be governed by “**Indian Railways Standard General Conditions of Contract, April 2022**”, along with the amendments, if any, issued by the Government of India, Ministry of Railways (Railway Board) from time to time. In case of any contradiction with the regulations laid down here under, GCC April 2022 with latest orders, modification and amendments will prevail, copy of which may be downloaded from the website:

[https://indianrailways.gov.in/railwayboard/uploads/directorate/civil\\_engg/pdf/2022/GCC\\_April-2022\\_2022\\_CE-I\\_CT\\_GCC-2022\\_POLICY\\_27\\_04\\_22.pdf](https://indianrailways.gov.in/railwayboard/uploads/directorate/civil_engg/pdf/2022/GCC_April-2022_2022_CE-I_CT_GCC-2022_POLICY_27_04_22.pdf)  
and [https://indianrailways.gov.in/railwayboard/view\\_section.jsp?id=0,1,304,366,526](https://indianrailways.gov.in/railwayboard/view_section.jsp?id=0,1,304,366,526)

For block working in Bhusawal Division, rules/procedure stipulated in PDSR (Power Distribution & Subsidiary Rules) and G&SR (General & Subsidiary Rules) as applicable for Bhusawal Division shall be followed. Successful tenderer shall ensure himself & his staff for getting acquaintance of these rules. The complete tender document should be read in conjunction with GCC April 2022 and all forthcoming amendments.

**10.0 ADDRESSES:**

Relevant addresses for specified purposes in connection with the tender are given below:

**10.1 For Contract execution –**

**Senior Divisional Electrical Engineer,  
(General Service) Bhusawal,  
DRM office Bldg., 1<sup>st</sup> floor,  
Central Railway, Bhusawal-425201.**

**CHAPTER-I**

**INSTRUCTIONS TO TENDERERS**

**&**

**SPECIAL CONDITIONS OF CONTRACT**

## CHAPTER-I

### INSTRUCTIONS TO TENDERERS & SPECIAL CONDITIONS OF CONTRACT

The special conditions of contract shall supplement and to be read together with the General Conditions of Contract, April 2022 of the Indian Railway and the extant orders along with the amendments, if any, issued by the Government of India, Ministry of Railways (Railway Board) from time to time.

#### **1.0 Care in submission of Tenders: -**

Before submitting a tender, the tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the works, that all conditions liable to be encountered during the execution of the works are taken into account and that the rates he enters in the tender forms are adequate and all-inclusive to accord with the provisions in Clause-37 of the Standard General Conditions of Contract for the completion of works to the entire satisfaction of the Engineer.

#### **2.0. Documents to be Submitted Along with Tender**

(i) The tenderer shall clearly specify whether the tender is submitted on his own (Proprietary Firm) or on behalf of a Partnership Firm / Company / Joint Venture (JV) / Registered Society / Registered Trust / Hindu Undivided Family (HUF) / Limited Liability Partnership (LLP) etc. The tenderer(s) shall enclose the attested copies of the constitution of their concern, and copy of PAN Card along with their tender. Tender Documents in such cases are to be signed by such persons as may be legally competent to sign them on behalf of the firm, company, association, trust or society, as the case may be. **In case a tenderer is participating as Sole Proprietor in a tender, it is mandatory for him to submit an undertaking on suitable stamp paper to this effect clearly mentioning PAN number also along with tender document at the time of submission of tender.**

(ii) Following documents shall be submitted by the tenderer:

##### **(a) Sole Proprietorship Firm:**

(i) All documents in terms of Para 10 of the Tender Form (Second Sheet) of GCC April 2022

##### **(b) HUF:**

(i) A copy of notarized affidavit on Stamp Paper declaring that he who is submitting the tender on behalf of HUF is in the position of 'Karta' of Hindu Undivided Family (HUF) and he has the authority, power and consent given by other members to act on behalf of HUF.

(ii) All other documents in terms of Para 10 of the Tender Form (Second Sheet) of GCC April 2021

##### **(c) Partnership Firm:**

(i) All documents as mentioned in para 18 of the Tender Form (Second Sheet) of GCC April 2022

(d) **Joint Venture (JV):** All documents as mentioned in para 17 of the Tender Form (Second Sheet) of GCC April 2022

##### **(e) Company registered under Companies Act 2013:**

(i) The copies of **MOA (Memorandum of Association) / AOA (Articles of Association)** of the company

(ii) A copy of Certificate of Incorporation

- (iii) A copy of Authorization/Power of Attorney issued by the Company (backed by the resolution of Board of Directors) in favour of the individual to sign the tender on behalf of the company and create liability against the company.
  - (iv) All other documents in terms Para 10 of the Tender Form (Second Sheet) of GCC April 2022
- (f) **LLP (Limited Liability Partnership):**
- (i) A copy of LLP Agreement
  - (ii) A copy of Certificate of Incorporation
  - (iii) A copy of Power of Attorney/Authorization issued by the LLP in favour of the individual to sign the tender on behalf of the LLP and create liability against the LLP.
  - (iv) An undertaking by all partners of the LLP that they are not blacklisted or debarred by Railways or any other Ministry / Department of the Govt. of India from participation in tenders / contracts as on the date of submission of bids, either in their individual capacity or in any firm/LLP or JV in which they were / are partners/members. Concealment / wrong information in regard to above shall make the contract liable for determination under Clause 62 of the Standard General Conditions of Contract.
  - (v) All other documents in terms of Para 10 of the Tender Form (Second Sheet) of GCC April 2022
- (g) **Registered Society & Registered Trust:**
- (i) A copy of Certificate of Registration
  - (ii) A copy of Memorandum of Association of Society/Trust Deed
  - (iii) A copy of Power of Attorney in favour of the individual to sign the tender documents and create liability against the Society/Trust.
  - (iv) A copy of Rules & Regulations of the Society
  - (v) All other documents in terms of Para 10 of the Tender Form (Second Sheet) of GCC April 2022
- (iii) If it is NOT mentioned in the submitted tender that tender is being submitted on behalf of a Sole Proprietorship firm / Partnership firm / Joint Venture / Registered Company etc., then the tender shall be treated as having been submitted by the individual who has signed the tender.
- (iv) After opening of the tender, any document pertaining to the constitution of Sole Proprietorship Firm / Partnership Firm / Registered Company/ Registered Trust / Registered Society / HUF/LLP etc. shall be neither asked nor considered, if submitted. Further, no suo moto cognizance of any document available in public domain (i.e., on internet etc.) or in Railway's record/office files etc. will be taken for consideration of the tender, if no such mention is available in tender offer submitted.
- (v) A tender from JV shall be considered only where permissible as per the tender conditions.
- (vi) The Railway will not be bound by any change of power of attorney or in the composition of the firm made subsequent to the submission of tender. Railway may, however, recognize such power of attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the Contractor.

**2.1 Note :-** The tenderer whether sole proprietor / a company or a partnership firm / joint venture (JV) / registered society / registered trust / HUF / LLP etc if they want to act through agent or individual partner(s), should submit along with the tender, a copy of power of attorney duly stamped and authenticated by a Notary Public or by Magistrate in favour of the specific person whether he/they be partner(s) of the firm or any other person, specifically authorizing him/them to sign the

tender, submit the tender and further to deal with the Tender/ Contract up to the stage of signing the agreement except in case where such specific person is authorized for above purposes through a provision made in the partnership deed / Memorandum of Understanding / Article of Association /Board resolution, failing which tender shall be summarily rejected.

A separate power of attorney duly stamped and authenticated by a Notary Public or by Magistrate in favour of the specific person whether he/they be partner(s) of the firm or any other person, shall be submitted after award of work, specifically authorizing him/them to deal with all other contractual activities subsequent to signing of agreement, if required.

Note: A Power of Attorney executed and issued overseas, the document will also have to be legalized by the Indian Embassy and notarized in the jurisdiction where the Power of Attorney is being issued. However, the Power of Attorney provided by Bidders from countries that have signed the Hague Legislation Convention 1961 are not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.

### **3.0. Employment/Partnership etc. of Retired Railway Employees:**

- (a) Should a tenderer
- i) be a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement, whether in the executive or administrative capacity or whether holding a pensionable post or not, in the Engineering or any other department of any of the railways owned and administered by the President of India for the time being, OR
  - ii) being partnership firm / joint venture (JV) / registered society / registered trust etc have as one of its partners / members a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement, OR
  - iii) being an incorporated company have any such retired Engineer of the gazetted rank or any other gazetted officer working before his retirement as one of its directors

AND

in case where such Engineer or officer had not retired from government service at least 1 year prior to the date of submission of the tender

THEN

the tenderer will give full information as to the date of retirement of such Engineer or gazetted officer from the said service and as to whether permission for taking such contract, or if the Contractor be a partnership firm or an incorporated company, to become a partner or director as the case may be, has been obtained by the tenderer or the Engineer or officer, as the case may be from the President of India or any officer, duly authorized by him in this behalf, shall be clearly stated in writing at the time of submitting the tender.

- b) In case, upon successful award of contract, should a tenderer depute for execution of the works under or to deal matters related with this contract, any retired Engineer of gazette rank or retired gazetted officer working before his retirement in the Engineering or any other department of any of the railways owned and administered by the President of India for the time being, and now in his employment, then the tenderer will ensure that retired Engineer or retired gazetted officer had retired from government service at least 1 year prior to the date of his employment with tenderer and in case he had retired from service within a year then he possesses the requisite permission from the President of India or any officer, duly authorized by him in this behalf, to get associated with the tenderer.

- c) Should a tenderer or Contractor being an individual, have member(s) of his family or in the case of partnership firm/ company / joint venture (JV) / registered society / registered trust etc. one or more of his partner(s)/shareholder(s) or member(s) of the family of partner(s)/shareholder(s) having share of more than 1% in the tendering entity employed in gazetted capacity in the Engineering or any other department of the railway, then the tenderer at the time of submission of tender, will inform the authority inviting tenders the details of such persons.

**Note:** - If information as required as per 3.0. a), b), c) above has not been furnished, contract is liable to be dealt in accordance with provision of clause 62 of Standard General Condition of contract.

#### **4.0. Participation of Partnership Firms in works tenders:**

4.1 The Partnership Firms participating in the tender should be legally valid under the provisions of the Indian Partnership Act.

4.2 The partnership firm should have been in existence or should have been formed prior to submission of tender. Partnership firm should have either been registered with the Registrar or the partnership deed should have been notarized as per the Indian Partnership Act, prior to submission of tender.

4.3 Separate identity / name should be given to the partnership firm. The partnership firm should have PAN / TAN number in its own name and PAN / TAN number in the name of any of the constituent partners shall not be considered. The valid constituents of the firm shall be called partners.

4.4 Once the tender has been submitted, the constitution of the firm shall not normally be allowed to be modified / altered / terminated during the validity of the tender as well as the currency of the contract except when modification becomes inevitable due to succession laws etc., in which case prior permission should be taken from Railway and in any case the minimum eligibility criteria should not get vitiated. The re-constitution of firm in such cases should be followed by a notary certified Supplementary Deed. The approval for change of constitution of the firm, in any case, shall be at the sole discretion of the Railways and the tenderer shall have no claims what-so-ever. Any change in the constitution of Partnership firm after submission of tender shall be with the consent of all partners and with the signatures of all partners as that in the Partnership Deed. Failure to observe this requirement shall render the offer invalid and full Bid Security shall be forfeited.

If any Partner/s withdraws from the firm after submission of the tender and before the award of the contract, the offer shall be rejected and Bid Security of the tenderer will be forfeited. If any new partner joins the firm after submission of tender but prior to award of contract, his / her credentials shall not qualify for consideration towards eligibility criteria either individually or in proportion to his share in the previous firm. In case the tenderer fails to inform Railway beforehand about any such changes / modification in the constitution which is inevitable due to succession laws etc. and the contract is awarded to such firm, then it will be considered a breach of the contract conditions liable for determination of the contract under Clause 62 of the Standard General Conditions of Contract.

4.5 A partner of the firm shall not be permitted to participate either in his individual capacity or as a partner of any other firm in the same tender.

4.6 The tender form shall be submitted only in the name of partnership firm. The Bid Security shall be submitted by partnership firm. The Bid Security submitted in the name of any individual partner or in the name of authorized partner (s) shall not be considered.

4.7 On issue of Letter of Acceptance (LOA) to the partnership firm, all the guarantees like Performance Guarantee, Guarantee for various Advances to the Contractor shall be submitted only in the name of the partnership firm and no splitting of guarantees among the partners shall be acceptable.

4.8 On issue of Letter of Acceptance (LOA), contract agreement with partnership firm shall be executed in the name of the firm only and not in the name of any individual partner.

4.9 In case the Letter of Acceptance (LOA) is issued to a partnership firm, the following undertakings shall be furnished by all the partners through a notarized affidavit, before signing of contract agreement.

(a) Joint and several liabilities:

The partners of the firm to which the Letter of Acceptance (LOA) is issued, shall be jointly and severally liable to the Railway for execution of the contract in accordance with General and Special Conditions of the Contract. The partners shall also be liable jointly and severally for the loss, damages caused to the Railway during the course of execution of the contract or due to non-execution of the contract or part thereof.

(b) Duration of the partnership deed and partnership firm agreement:

The partnership deed/partnership firm agreement shall normally not be modified/altered/terminated during the currency of contract and the maintenance period after the work is completed as contemplated in the conditions of the contract. Any change carried out by partners in the constitution of the firm without permission of Railway, shall constitute a breach of the contract, liable for determination of the contract under Clause 62 of the Standard General Conditions of Contract.

(c) Governing laws: The partnership firm agreement shall in all respect be governed by and interpreted in accordance with the Indian laws.

(d) No partner of the firm shall have the right to assign or transfer the interest right or liability in the contract without the written consent of the other partner/s and that of the Railway.

4.10 The tenderer shall clearly specify that the tender is submitted on behalf of a partnership firm. The following documents shall be submitted by the partnership firm, with the tender:

- (i) A notarized copy of the Partnership Deed or a copy of the Partnership deed registered with the Registrar.
- (ii) A notarized or registered copy of Power of Attorney in favour of the individual to tender for the work, sign the agreement etc. and create liability against the firm.
- (iii) An undertaking by all partners of the partnership firm that they are not blacklisted or debarred by Railways or any other Ministry / Department of the Govt. of India from participation in tenders / contracts as on the date of submission of bids, either in their individual capacity or in any firm/LLP in which they were / are partners/members. Any Concealment / wrong information in regard to above shall make the bid ineligible or the contract shall be determined under Clause 62 of the Standard General Conditions of Contract.
- (iv) All other documents in terms of explanatory notes in clause 10 (i.e. Eligibility Criteria) of GCC, April-2022.

**4.11 Evaluation of eligibility of a partnership firm:**

- (i) Technical and financial eligibility of the firm shall be adjudged based on satisfactory fulfillment of the eligibility criteria laid down in Clause 10 (i.e. Eligibility Criteria) of GCC, April-2022.

**5.0 TENDERER SPECIAL CONDITIONS:**

The tenderer should normally not stipulate any special conditions while submitting his tender. In such an eventuality, Central Railway reserves the right to summarily reject such tenders without assigning any reasons whatsoever. The tenderer should normally submit his tender in full conformity with the tender conditions of Central Railway, Bhusawal. If any particulars are furnished by the tenderer in response to specific tender conditions, by which such particulars are required to be furnished at the tender stage, this shall not be treated as special conditions for the purpose of this para.

**6.0 PRICE VARIATION CLAUSE (PVC) :** As per GCC along with latest amendments.

**7.0 DEFECTIVE EQUIPMENTS TO BE CHANGED :**

Not with standing completion of work in partial or full use of any equipment, if the completed equipment or any portion thereof before it finally taken over at the end of the guarantee period be found to be or to have become defective in course of usage by the Railway due to faulty material, design or workmanship, or otherwise fails to fulfill the requirement of the contract and/or its purpose, the purchaser shall normally give the contractor prompt notice setting forth the particulars of each defects or failure and the contractor shall forthwith make the defects good or modify or replace the equipment, as may be directed by the purchaser's Engineer, at his own cost in all respects to make comply satisfactorily with the said requirements. Should the contractor fail to do within a reasonable time the service of the said notice upon him or should time not permit of service of such notice, the purchaser may repair or reject and replace the whole or part of such defective equipment as the case may be, at the cost of the contractor. The contractor's full liability under this clause shall be satisfied by the payment to the purchaser of the extra total cost, if any, of such replacement delivered and erected as provided for in the original contract, such extra cost being the ascertained difference between the price paid by the purchaser under the provisions above mentioned for such replacement and the contractor's price for the plant so replaced, plus the sum, if any, paid by the purchaser to the contractor in respect of such defective equipment. Should the purchaser not so replace the rejected equipment within a reasonable time, the contractor's liability under this clause shall be satisfied by the repayment by the contractor of all money paid by the purchaser to him in respect of such rejected equipment. Rejected/defective materials shall be returned to the contractor to the extent possible.

**8.0 FINAL ACCEPTANCE:**

The final acceptance of the entire equipment installed on the site shall take effect from the date of expiry of the period of guarantee. After expiry of the period of guarantee for each section, a certificate of final acceptance shall be issued by the Purchaser and the last of such certificate will be called the last and final acceptance certificate. The contract shall not be considered as completed until the issue of final acceptance certificate by the Purchaser. The Purchaser shall not be liable to the Contractor for any matter arising out of or in connection with the contract or execution of the work unless the Contractor shall have made a claim in writing in respect thereof before the issue of final acceptance certificate under this clause. Notwithstanding the issue of final acceptance certificate, the Contractor and the Purchaser (subject to sub-clause as above) shall remain liable for fulfillment of any obligation incurred under the provision of the contract prior to the issue of final acceptance certificate which



remains unperformed at the time such certificate is issued and for determining the nature and extent of such obligation the contract shall be deemed to remain in force between the parties hereto.

#### **9.0 ISSUE OF IDENTITY CARDS TO CONTRACTOR'S LABOURS:**

Following certificates/documents should be issued to each contract labourers nominated to work in the railway premises by the contractor, indicating Contract No, Name of the person, place of work etc.

1. Identity Card,
2. Character certificate issued by Police Department,
3. Certificate for technical competency.

If these are not issued to contract Labour, he / they will not be permitted to work in the Railway premises. The list of the labour should be submitted to this office for records.

#### **10.0 ISSUE OF MATERIALS TO THE CONTRACTOR:**

Contractors have to submit a Bank Guarantee for an amount equal to the cost of material paid to them and to be handed over to them for erection. The cost of material paid to them and handed over to them and under their possession at any time shall not exceed the value of the B.G. already submitted.

#### **11.0 STANDING INDEMNITY BOND:**

Cost of all the materials for which 'On Account' payments have been made to the contractor against the Contract and materials handed over to the contractor by the purchaser for the purpose of execution of the said Contract, until such time the materials are duly erected or otherwise handed over to the purchaser shall be covered by the standing indemnity bond(see FormNo.16).

#### **12.0 INSPECTION :**

All the material, required for this work shall be subject to inspection to ensure that the work is done in accordance with specification, drawings and is of the best quality suitable for the purpose. Following inspection schedule shall be followed.

- a) **Inspection of material :-**
- i) **At Firm's premises:-** Material having value above Rs.5 lakhs shall be inspected by RITES. Inspection of other materials shall be done by Railway's representative. Firm will submit manufactures original test certificate.
- ii) **After Receipt of material:-** Inspection of other item shall be done at depot / site by Railway Engineer's representative. Contractor shall produce all the test reports, material documents, etc. during inspection.
- iii) All the defects / discrepancies, if any, pointed out during inspection should be attended by the contractor immediately.
- b) **Stage Inspections:-** Stage inspections shall be carried out by Railway Engineer's representative from time to time during execution of the work at site. All the shortcomings noticed during stage inspection shall be attended by the contractor.
- c) **Final Inspections:-** After completion of work, contractor shall offer it for final inspection and testing. All the shortcomings noticed during final inspection shall be attended by the contractor, immediately and a joint inspection shall be carried out by Railway Engineer's Representative and by Contractor Representative after completion of the entire work and a joint inspection report shall be made. The joint inspection report shall be signed by the contractors representative, Railway's authorized Engineer for that work and shall be enclosed

along with the final bill with details of works carried out in individual location. Any defect / shortcomings noticed shall be attended by the contractor immediately.

### **13.0 MATERIALS/EQUIPMENTS:**

All materials used in the work shall be of the best quality and of the class most suited for the purpose specified. All the standard fittings, equipments, motor, gear box, breaks, governors, control panel, cables and other accessories required for this work shall be as per RDSO / RCF / ICF approved make conforming to relevant IS specifications against each schedule item. If any material does not appear in the RDSO / RCF / ICF approved list then make of material should approved by Sr.DEE(G) Bhusawal /Railway representative before supply.

All the equipments, materials, fittings and components will be subject to quality control program of being part of the quality assurance program of the contractor. All the major equipments / material shall be inspected as per inspection clause para 12.0.

### **14.0 WARRANTY/GUARANTEE :-**

After successful completion of entire work and the same has been taken over by Railway, it shall be guaranteed for 12 months. During this period if any defects arise the same shall be made good by the contractor free of cost. LED fittings shall be guaranteed for 5 years.

### **15.0 RELEASED MATERIAL: -**

The released materials should be returned by the contractor to Railways and acknowledged. The released materials should be transported to respective depot with the tenderers men and vehicle as per instruction of Railway's Engineer.

### **16.0 ELECTRICAL CONTRACTORS LICENSE:**

**The contractor shall submit self-attested copy of valid Electrical Contractor License as per Clause No. 45 IE Rule 1956 along with the offer. The offer will be summarily rejected in absence of valid Electrical Contractor License.**

### **17.0 OTHER SPECIAL CONDITIONS: -**

- 17.1 Tenderers should submit their offer with credentials regarding working capacity and financial capabilities.
- 17.2 Tenderers should submit the list of personnel / organization on hand and proposed to be engaged for the tendered work. Similarly list of Plant & Machinery available on hand and proposed to be inducted and hired for the tendered work.
- 17.3 Contractors found using un-approved materials shall be, on the spot, stopped from executing further work and suitable action taken to terminate the contract. Particular note of this should be taken and it shall be strictly ensured that only quality work is done.
- 17.4 All completed work shall be jointly recorded by contractors with Railways in 'Measurement Books' which will be available with Rly's engineer No work, other than those recorded in M.B, will be recognized.
- 17.5 Bills shall be submitted in Rly's bill form only. All released materials shall be handed over to Railways at the depot of Senior Section Engineer (EM)'s. Contractors should keep a proper account of the released materials handed over, with proper acknowledgement from Railway's engineer and submit the same along with the bills.(NA)
- 17.6 During the process of work the contractor shall arrange to keep electric supply available to avoid any inconvenience to the occupant and the temporary wiring shall be safe and shall not pose any hazard to any points. It shall be contractor's responsibility to ensure the safety of his man and also materials and occupants from any hazard of electricity during the process of wiring. (NA)
- 17.7 During the process of work the contractors shall arrange to keep the material away from the LC gate to avoid any inconvenience of the traffic on gate.

- 17.8 The switchboard shall be of seasoned teak wood/ PVC confirming IS.
- 17.9 Code of practice for electrical wiring installation shall be followed as per IS-732 – 1989 with latest amendment.
- 17.10 PVC insulated wires for working voltages up to and including 1100 Volt shall be as per IS-694 – 1990 with latest amendment.
- 17.11 PVC insulated (heavy duty)/XLPE electric cables for working voltages up to and including 1100 Volt shall be as per IS-1554 – (Part – I) – 1988 with latest amendment.

**18.0 OTHER SPECIAL CONDITION OF THE WORK**

The Contractor shall maintain a register showing names and addresses of the person so engaged along with photographs of each person and shall produce the same for inspection on demand by Welfare Officer or such other person so authorized by the owner. The Contractor shall not use or allow to be authorized to be used train or any part thereof for dwelling purpose and shall not allow any outsiders to loiter in or around the train without valid authority.

- 18.1 The contractor shall be required to employ/engage only that number of employees/workers as may be specifically authorized by Railway Administration from time to time and shall maintain complete records of such employees/workers with regard to their names, address qualifications, experience and other required details. The Railway shall have absolute right to test, interview or otherwise assess or determine skills, knowledge, proficiency, capability, etc. so as to ensure that such employees/workers are competent, qualified or otherwise suitable for efficient working. Workers rejected on this account by the Railways shall not be employed/ engaged by the contractor on the work covered by this contract.
- 18.2 The contractor is liable to pay provident fund contribution. Leave salary, medical benefits to his employees and to observe statutory working hours. The contractor is responsible for the proper maintenance of registers, records and accounts so far as compliance with any statutory provisions/obligations is concerned. The contractor to keep proper records pertaining to payment of wages, etc. and also for depositing the provident fund contributions with the authorities concerned. The contractor is liable to defend, indemnify and hold harmless to the Railway from any liability or penalty which may be imposed by the Central, State or local authorities by reason of any violation by the contractor or such laws regulations and also from all claims, suits or proceedings that may be brought against the management arising under or incidental to or by reason of the work provided/assigned under the contract brought by the employees of the contractor, third party or by the Central or State Government authorities.
- 18.3 The contractor will make aware his employees that the contract employee are employee of contractor and the employee are not entitled for any regularization in Railway Service. If such situation arises in future contractor is liable to defend indemnify & hold harmless to the Railway Administration from any such liability.
- 18.4 The contractor shall follow all labour Law, rules, regulation pertaining to labour, whether mentioned or not.
- 18.5 (i)** Contractor is to abide by the provisions of Payment of Wages act & Minimum Wages act in terms of clause 54 and 55 of Indian Railways General Condition of Contract. In order to ensure the same, an application has been developed and hosted on website ‘[www.shramikkalyan.indianrailways.gov.in](http://www.shramikkalyan.indianrailways.gov.in)’. Contractor shall register his firm/company etc. and upload requisite details of labour and their payment in this portal. These details shall be available in public domain. The Registration/ updation of Portal shall be done as under:

- (a) Contractor shall apply for onetime registration of his company/firm etc. in the **Shramikkalyan portal** with requisite details subsequent to issue of Letter of Acceptance. Engineer shall approve the contractor's registration in the portal within 7 days of receipt of such request.
- (b) Contractor once approved by any Engineer, can create password with login ID (PAN No.) for subsequent use of portal for all LOAs issued in his favour.
- (c) The contractor once registered on the portal, shall provide details of his Letter of Acceptances (LOA) / Contract Agreements on **shramikkalyan portal** within 15 days of issue of any LoA for approval of concerned engineer. Engineer shall update (if required) and approve the details of LOA filled by contractor within 7 days of receipt of such request.
- (d) After approval of LOA by Engineer, contractor shall fill the salient details of contract labours engaged in the contract and ensure updating of each wage payment to them on **shramikkalyan portal** on monthly basis.
- (e) It shall be mandatory upon the contractor to ensure correct and prompt uploading of all salient details of engaged contractual labour & payments made thereof after each wage period.
- (ii) While processing payment of any 'On Account bill' or 'Final bill' or release of 'Advances' or 'Performance Guarantee / Security deposit', contractor shall submit a certificate to the Engineer or Engineer's representatives that "I have uploaded the correct details of contract labours engaged in connection with this contract and payments made to them during the wage period in Railway's Shramikkalyan portal at '[www.shramikkalyan.indianrailways.gov.in](http://www.shramikkalyan.indianrailways.gov.in)' till \_\_\_\_Month, \_\_\_\_Year."

**18.6** The payment to the contract labours should be made through Bank / EFT only.

**19.0** The registration of contractors working under Railway departments with ESIC is mandatory.

**20.0** Special Condition for employment of staff by the contractor for works contract as per HQ's Policy L.no. L.253.AC.AMC/Policy Dated-15.01.2010

#### **Employment of staff-**

- (a) The contract is liable for cancellation if either the contractor himself or any of his employee is found to be a person of Gazetted rank of Engineering Department which includes Civil, Mechanical, Signal & Telecommunication Department of Railways whether pensionable or non-pensionable who after retirement has sought engagement as contractor for or in connection with the execution of public works whether on Railway, P.W.D. or Defence Forces or as an employee of such contractor within 2 years of his retirement without obtaining the permission of the President of India before taking up such engagement or employment.
- (b) The contractor shall employ the following technical staff during the execution of the work.
  - i) At least one Graduate Electrical/ Electronics Engineer when the cost of the work to be executed is Rs. 50 lakhs and above.
  - ii) At least one qualified Electrical /Electronics diploma holder when the cost of the work to be executed is more than Rs. 10 lakhs, but less than Rs. 50 Lakhs.
- (c) Technical staff should be available at site whenever required by the Engineer –in-charge to take instructions. In case the desired level of technical staff fails to take instructions of the Engineer –in-charge, contractor shall liable to pay a reasonable amount to the Railways not exceeding a sum of Rs. 5000/- (Rupees five thousand only) for each calendar month or part

thereof for default in case of Graduate Engineer and Rs. 2500/- (Rupees two thousand five hundred only) for each calendar month or part thereof for default in case of Diploma holder.

- (d) The decision of the Engineer-in-charge as to the period for which required technical staff was not employed by the contractor and as to the reasonableness of the amount to be deducted from the contractor, shall be final & binding on the contractor.
- (e) The contract is liable to be terminated in case of persistent failure to engage suitable technical staff by the contractor.

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## **CHAPTER – II**

### **PRICES AND PAYMENT**

## CHAPTER – II

### PRICES AND PAYMENT

#### 1. SCOPE :-

This chapter deals with prices to be paid for the various items of work and other amount payable in accordance with accepted schedule of prices and conditions of payment herein mentioned.

#### 2. SCHEDULE OF PRICES :-

The unit rates given against various items of work in tender papers are the schedule of rates. The tenderers are required to quote **rates above /at par/ below as specified** against schedule of rates while quoting the summary of prices. The actual payment to be made against any item of Schedule of rates shall be derived after loading the Schedule of rates prices with the tenderer's quoted percentage. The prices so obtained shall be the unit prices for the various items of work given in Schedule of rates.

#### 3. INCIDENTAL CHARGES :-

The unit prices are including of loss, wastage, incidental charges for transportation, loading, unloading and handling of materials. It also include commissioning for arranging dispatch by rail, completing all necessary formalities in this respect, arranging payment of wages collection of railway receipt all insurance premier banker's charges etc.

#### 4. OTHER PRICE PAYMENT :-

No adjustment in unit price on account of price fluctuation will be permitted on any account.

#### 5. PAYMENT TERMS :-

##### (i) On A/c. payment for supply

(a) Payment to the extent of **70 %** towards cost of supply of materials will be made on receipt of the materials only either at site or at purchasers depot of the following tender schedule items as tabulated below :

<b>Sch. A(I)</b>	<b>12 to 28, 30 to 32, 39, 46 to 52, 55</b>
<b>Sch. A(II)</b>	<b>7, 8, 10, 11</b>
<b>Sch. A(III)</b>	<b>10 to 19, 23, 25, 27</b>
<b>Sch. B</b>	<b>4 to 9, 13, 14, 17 to 19, 26, 29, 30, 34, 36, 37, 39</b>

Received material shall be duly supported by Suppliers delivery challan and inspection certificates of Engineers representagtive. Engineers representative shall make proper accountal of material received.

(b) The following schedule items whose supply & erection rates are combined, payment to the extent of **60%** towards cost of supply of material shall be made subject to conditions as mentioned above:

<b>Sch. A(I)</b>	<b>54</b>
<b>Sch. A(II)</b>	<b>Nil</b>
<b>Sch. A(III)</b>	<b>24, 26, 29, 30</b>
<b>Sch. B</b>	<b>35, 41</b>

Further balance payment will be released after erection & satisfactory completion of each item and quantity as certified and measurements recorded in measurement book by engineer's representative.

(c) Firm will submit manufacturers original test certificate and material purchase proof from OEM or his authorized agents.

**(ii) Issue of materials to the contractor for erection.**

The material for which payment has been released will be issued by Railway to the contractor for execution of work as per site requirement and as per the discretion of 'Engineer'

**(iii) Progress on account payment for Supply & erection**

The contractor shall be paid payment to the extent of **30%** of supply & 100% of erection for such item as given above in **i)(a)** on satisfactory completion of each item and quantity as certified and measurements recorded in measurement book by engineer's representative.

**(iv)** 100% progressive payment for following schedule items of tender schedule shall be made after successful completion of same :

<b>Sch. A(I)</b>	<b>1 to 11, 29, 33 to 38, 40 to 45, 53</b>
<b>Sch. A(II)</b>	<b>1 to 6, 9, 12 to 25</b>
<b>Sch. A(III)</b>	<b>1 to 9, 20 to 22, 28</b>
<b>Sch. B</b>	<b>1 to 3, 10 to 12, 15, 16, 20 to 25, 27, 28, 31 to 33, 38, 40, 42 to 49</b>

**(v) Final payment:** - Final Bill of supply & erection shall be paid after successful completion of entire work as per terms, condition and scope of work of contract and provisional acceptance of the work.

**(vi)** Joint inspection report with engineer's representative and provisional acceptance certificate by engineer shall be submitted by contractor.

**The payment shall be made against**

i) Certificate by the Railway representative that the work has been done in accordance with the provision of the contract agreement and all the material replaced by the contractor during the maintenance period has been of good quality and as per specification.

ii) All the schedule as mentioned in the tender has been successfully carried out.

iii) The statement of recovery if any.

iv) Valid security deposit furnished in advance at the time of signing of agreement. All the above payments shall be subject to observance of all formalities viz. Signing of agreement, furnishing S.D., verification of power of attorney, MB formalities, bill in Railways standard form etc.

***Note: Following particulars to be furnished by firm***

**i) PAN NO. ii) FULL ADDRESS iii) GST REGISTRATION**

**6. FINAL PAYMENT :-**

On completion of entire work in all respect and on submission of joint inspection report and PROVISIONAL ACCEPTANCE CERTIFICATE, the contractor shall receive the final payment for remaining works.



## **7. REFUND OF SECURITY DEPOSIT:-**

The security deposit will be refunded on submission of Final Completion Certificate after successful completion of the contract and after expiry of the guarantee obligation.

## **8. TAXES :-**

**The contractor should have GST registration number.**

(i) Tenderers will examine the various provisions of The Central Goods and Services Tax Act, 2017(CGST)/ Integrated Goods and Services Tax Act, 2017(IGST)/ Union Territory Goods and Services Tax Act, 2017(UTGST)/ respective state's State Goods and Services Tax Act (SGST) also, as notified by Central/ State Govt. & as amended from time to time and applicable taxes before bidding. Tenderers will ensure that full benefit of Input Tax Credit (ITC) likely to be availed by them is duly considered while quoting rates.

(ii) The successful Tenderer who is liable to be registered under CGST/IGST/UTGST/SGST Act shall submit GSTIN along with other details required under CGST/IGST/UTGST/SGST Act to Railway immediately after the award of contract, without which no payment shall be released to the contractor. The contractor shall be responsible for deposition of applicable GST to the concerned authority.

(iii) In case the successful tenderer is not liable to be registered under CGST/IGST/UTGST/SGST Act, the Railway shall deduct the applicable GST from his/their bills under reverse charge mechanism (RCM) and deposit the same to the concerned authority. **(Authority –Railway Board's Letter No.2017/CE-I/CT/4/GST Dated 23/06/2017.)**

## **9. PENALTY :-**

- 1) As per relevant clause of GCC April 2022.
- 2) A suitable token penalty shall be imposed if any deficiency in workmanship or quality of work is noticed during inspection by competent authority.

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## **CHAPTER-III**

### **TECHNICAL SPECIFICATION**

Central Railway

Electrical (G) Branch

Bhusawal Division

**E-Tender no.BSL-L-W-T-51-2026**

This tender calls for the work of Electrification work in connection with following,  
**Sch. A :- Development of Infrastructure and other needs of Railway School at Bhusawal. ; Sch. B :- Construction of Integrated Crew Lobby with provision of basic amenities at Bhusawal.**

**1.Schedule item no. A(I)-1, A(II)-1, A(III)-1, B-1**

**Wiring of the concealed Light / fan Point with all accessories and running earthing copper conductor as per standard practise. The switches shall be of modular type.(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.)**

**Special requirements for Concealed wiring**

- I) For concealed wiring rigid plain conduits of insulating materials confirming to IS:9537 (Part-III), flexible conduit as per IS:6946 and fittings as IS:3419 shall be used.
- II) Conduit shall be circular in cross section and not less than 25 mm diameter.
- III) Hot dipped GI box, concealed GI boxes (for switch / socket / regulator and accessories etc) fabricated out of 14 gauge CRCA sheet, shall be provided with brass earthing stud and cover of 3 mm thick fire retardant Formica make Bakelite sheet of required sizes.
- IV) Other technical requirements shall be as described above.
- V) No on Account payments will be made for supply of wiring materials.
- VI) **Contractor should submit the detail drawing with single line diagram for location of all the points for approval before commencement of work.**

The wiring for essential load and non-essential load should be done in separately so that complete electrical isolation is achieved. The Contractor should submit the as erected drawings in triplicate with original in reproducible form. The concealed wiring will be completed as per site condition with necessary sub-main wiring, plug point wiring, power plug wiring and associated accessories, SDB, switch board etc. as per instruction of field Engineer. **The payment of concealed point wiring will be done as per actual quantity executed at site.**

**1.System of Interior wiring.**

The wiring (unless otherwise specified) shall be carried out in single core, multi-stranded PVC insulated copper wire conforming to IS-694/1990 with latest amendments and of the 1100 volts grade in rigid heavy-duty non-metallic flame retarding PVC conduit of Heavy duty.

The PVC insulated wire shall be FRLS (Fire Retardant Low Smoke) with latest amendment. The wiring shall be done on the distribution system with main and branch distribution boards at convenient centers and without isolated fuses. All conductors shall be run, as far as possible along the walls and ceiling, so as to be easily accessible to and capable of being thoroughly inspected. Runs as marked out will be inspected and cables shall not be fixed until the lay-out is approved by Sr.DEE(G)BSL or his authorized representative whose decision is final and binding on the contractor. The internal wiring shall be conforming to code of practice for electrical wiring as per IS-732 – 1989 with latest amendment.

The cables shall be run on rigid heavy duty non-metallic fire retarding PVC conduit Heavy duty. with corresponding accessories. The conduit shall conform to IS-2509 and accessories to IS-3419 with latest amendments. The PVC conduit of Heavy duty and accessories shall be ivory white with fire retardant type.

Bends or diversions shall be done by employing normal bends, inspection bends, inspection boxes, elbows or similar fittings if required at site. Conduit joints shall be by means of plain or

screwed couplers. For long run of straight conduit inspection type coupler shall be provided at intervals if required at site.

## 2.PVC Junction box.

All ceiling roses, lamp holder etc. shall be fixed on rigid PVC square junction box conforming to relevant IS and of stardust colour.

Switch board –Electrical switchboard shall be of PVC fire retardant board of standard type as per IS. Electrical switchboard of seasoned teak will be used if required as per site condition.

## 3.Plugging walls or ceilings.

Plugs for ordinary walls or ceiling shall be of PVC of appropriate size. They shall be cemented into the walls or ceilings to within line of the surface and remainder being finished according to the nature of surface used with plaster or lime putty. Where owing to irregular coursings or other reasons, the plugging of the wall or ceiling present difficulties, the casing shall be attached to the walls or ceiling in a manner approved by the Sr.DEE(G)BSL

Plugs for fixing square box for ceiling rose or single switch shall be sufficiently large to take two screws so as to prevent box from turning while in use.

## 4.Passing through floors and walls.

This shall be done strictly in accordance with code of practice for wiring installation as per IS-732 / 1989 with latest amends.

## 5.White washing.

Walls cut or defaced during wiring will have to be made good and adequately white washed, distempered/painted as the case may be.

## 6.Wires and cables.

All conductors shall be standard copper and in accordance relevant IS specifications. The wiring shall conform to the IEE, wiring rules (Latest) and no conductors shall have a cross section of less than 2.5 sq.mm. Unless otherwise specified.

Each coil of wire and cables proposed to be used must be accompanied by the makers test certificates stating that the 'Class' and giving the results of insulation tests.

## 7.Main and sub-distribution boards.

The fuses/switch board/ meter board must be the swing back type provided with suitable hinged unglazed cover permitting of inspection at back and having ample room behind the boards for the convenience and neat arrangement of the conductors and to take a small amount of slack necessary to enable cut out to be readily connected up. The board must be made of seasoned teak wood, impregnated with varnish and with a good finish and constructed with all joints dove tailed and provided with a back of the same materials or PVC Board. Meter should be provided on teakwood board of appropriate size.

Placement of fuses – Fuses shall not be placed in ceiling roses or in any position other than the distribution boards or the sub-distribution boards which shall be located as approved by the Sr.DEE(G)BSL. No fuses shall be placed in the neutral conductor of a main, sub-main or sub-circuits.

Adequate space, clear of other fittings and to the satisfaction of the Sr.DEE(G)BSL or his representative shall be provided on each main distribution board for the installation of KWH Meters.

Adequate size of PVC heavy duty conduit leading to the main board will be provided for the incoming mains.

Similarly adequate space shall be provided on the switchboards controlling fan light, plug for the installation of fan regulators.

Bus bar contacts and other live metal parts shall be suitably protected as to render it impossible for anyone to make accidental contact with them while replacing fuses. A strip of teak wood easily removable shall be provided in front of the neutral bus bar so as to avoid contact with it while fuses are being attended to.

#### 8. Main and sub-distribution boards – Earthing.

Continuous running earth shall be provided by the contractor as given below:-

The continuity of earth wire shall be maintained throughout without any joints. This shall be in conformity with IEE Rules No. 32 & IS-3064 (latest) section 2 clauses 12 to 13.7.

1.	Main earth pit/pole to main meter board or distribution board	25mm x 3mm GI Strip
2	Meter board/distribution board to main switch inside quarters.	2.5 sq.mm. PVC copper stranded Green colour wire.
3	Main switch inside quarters to wall plug fan, fan regulators & any other metallic/ accessories.	2.5 sq.mm. PVC copper stranded Green colour wire.

The fuses shall be mounted as follows.

The distribution boards shall be fixed at such a height as to be within easy reach of a person standing on the floor. The installation of main and distribution boards shall be as per IS-732 Clause 4.3.

The cost of point wiring includes the cost of sub-main circuits unless otherwise specified, which shall not be less than 4 sq. mm. and No sub-main circuit shall contain more than 10 (Ten) light/fan/5A, plug points. Wherever No. of points exceeds more than 10. The contractor shall draw separate sub-main circuit for each 10 points or part thereof.

The contractor shall observe all colour code in wiring viz. Red, Yellow, Blue for phases, Black for neutral and Green for earthing.

On completion of wiring of each quarters, contractor shall do routine tests as per IS. Free of cost and result of same shall be submitted along with bill duly certified by Railway's representative.

#### 9. Joints.

All joints in conductors shall be made by mechanical connections in suitable joint boxes, jointing of aluminum conductors shall be in accordance with IS-732 appended 'C' Clause C-6. Joint boxes shall be as per approved make by Sr.DEE (G) or his representative at site.

#### 10. Switches.

All switches, controlling points must be placed on 'Phase' wires. All switches shall be of Modular type (as per site requirement) 5/10/15 Amps capacity unless otherwise specified and conforming to relevant IS specifications of approved make and shall be provided with quick make and break movement and shall have substantial plain bakelite cover. The switches shall be mounted at height of 4'-6" from ground level unless otherwise approved. The switches shall generally comply with the relevant IS specification. The switches shall be of Original Approved make only.

The modular switch shall be having following features as mentioned below:-

S.No.	Descriptions	Dept.'s requirement
1	Standard	IS 3854
2	Voltage	240V AC
3	Construction	Modular
4	Installation	Snap fit with Modular Plates
5	Terminals	Brass (Screw Type)
6	Screws	Steel with zinc plating
7	Rocker spring	Stainless steel

8	Shall be	Flame Retardant
9	IP degree of protection	IP20
10	Tests	Marking, Mechanical Strength, Making & Breaking Capacity, Temperature rise, Insulation resistance, Electric Strength Test

#### 11.Plugs and sockets.

Plugs shall be of a front entry pattern with hand shield. The shrouds of sockets and the grips of plugs shall be moulded bakelite and the bases of sockets shall be of vitreous porcelain or bakelite. All sockets shall be complete with plugs of standard dimensions and shall be interchangeable. Each plug point shall be controlled by a switch on the supply side. The socket shall be 5-Pin Universal design 5/15 Amp unless otherwise specified with separate controlling switch and original approved make.

The modular Sockets shall be having following features as mentioned below:-

S.No.	Descriptions	Dept.'s requirement
1	Standard	IS 1293 / IEC 60950
2	Voltage	240V AC
3	Construction	Modular with Shutters
4	Installation	Snap fit with Modular Plates
5	Terminals	Brass (Screw Type)
6	Screws	Steel with zinc plating
7	P-N-E Contact	Brass
8	Shall be	Flame Retardant
9	IP degree of protection	IP20
10	Tests	Marking , Resistance to ageing, Insulation resistance, electric strength, Temperature-rise , Making and breaking capacity , Mechanical strength

#### 12.Lamp holders, shades etc.

PVC casing/capping/heavy guage conduit, pendants in open verandahs, and bakelite lamp holders with necessary accessories shall be robust and of approved make. Lamp holders for use of brackets and the like shall be in accordance with IS-1258 (latest) and as per Clause 5.5 of IS-732 / 1989 (latest).

#### 13.Mountings.

All fittings such as switches, plugs etc mounted on board shall be adequate spaced with a uniform margin to the satisfaction of the Sr.DEE(G)BSL and only brass fixing screws/Nut bolts of approved sizes shall be used. The mounting heights from the floor shall be a generally as follows:- Switches, distribution boards etc. 1.5 mtrs., Lights –2.5 Mtrs.

#### 14.Flexible wires and pendants.

Unless otherwise specified and except in PVC pipe pendants, flexible wire with PVC insulated and PVC sheathed copper conductors bearing ISI mark with a minimum of size of 24/0.2 mm or the nearest equivalent shall be used. This will be subject to approval by the Sr.DEE(G)BSL.

Suitable service connections by cable etc. at positions decided by the Sr.DEE(G)BSL or his authorized representative will be provided.

#### 15.Special clauses for the internal wiring.

The work shall comprise supply of all necessary materials, installations, testing and putting into operational lights, plugs etc. as per schedule, which is subject to slight variations at the time of execution of the work.

The system of wiring for lighting and fan point shall be PVC insulated cable on rigid PVC heavy duty conduit.

The contractor shall on completion of the work but before the installation is taken over by the Railway, supply drawings as under :

- a) Wiring – diagram sub-mains mains with particulars of size of cables and wires used.
- b) Main and branch distribution boards.

#### 16.Special Clauses for the internal wiring.

Conformity with Indian Electricity Act, 2003. The installation shall be in conformity with the requirements of the Indian Electricity Act, 2003 as amended up to the date and Indian Electricity Rules, framed, there under and also the relevant regulations of the electric supply authority concerned, and IS-732 of 1989 with latest amends.

#### 17.Materials.

All materials fittings, appliances, used in electrical installations shall conform to Indian Standard Specification and of approved make.

#### 18.Workmanship.

Good workmanship is an essential requirement for compliance with the Rules in the code. The work shall be carried out under the direct supervision of a person holding a certificate of competency issued by the State Government for the type of work involved.

- a) Position of lamp, fans and fittings, branch wires and not be shown, but the fittings etc. connected to each circuit must be clearly indicated by numbers on the fuse carrier of distribution board.
- b) Any alternations in the position of fittings or modifications of the existing lay out of the schedule of suit local conditions as indicated by the representative of the Sr.DEE(G)BSL shall also be carried out while the work is in progress.

Before taking the work in hand a specimen of each of the materials and fittings proposed to be used as per schedule shall be submitted to the Sr.DEE(G)BSL for his approval. The letter of approval of materials by Sr. DEE (G) BSL shall be submitted along with final bill.

#### 19.Metal casings.

All metal casings of metallic coverings containing or protecting any electric supply line or apparatus shall be connected with earth by the contractor shall be jointed and connected across all junction boxes and other openings as to make a good mechanical and electrical connection throughout the whole length.

#### **NOTE:**

- i. All wall plugs mentioned under clause page 6 shall be of Universal pin type, the earth pin being connected to the continuous running earth.
- ii. All fan even if supplied by the Railways shall be connected to the continuous running earth conductor.
- iii. Continuous running earth through 2.5 sq. mm. copper PVC conductor PVC wire green colour from the main board to the various wall plugs, fan points, regulator etc.
- iv. All existing indoor FT/LED fittings, fans, incandescent light fittings and other equipment shall be connected to ceiling rose/power point with 2 core twisted PVC insulated copper conductor of size not less than 1.0 sq.mm.

- v. Concealed wiring shall be carried out with 2x2.5 sqmm FRLS Copper conductor along with running earth conductor of 2.5 sq.mm. FRLS Copper wire.

**2.Schedule item no. A(I)-3, A(II)-3**

**Supply, erection, testing & commissioning of 6A & 3 Pin Universal Modular Type Plug Socket with switch & concealed type point wiring with 2x2.5 sq mm FRLS Multistranded PVC Copper wire with all accessories and running earth on seprate board..(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of concealed wiring 6A & 3 Pin plug point and switch on separate PVC control board and in connection with 2.5 sq.mm PVC insulated 1.1 KV grade multistranded copper conductor along with 2.5 sq. mm green colour copper earth wire including sub-mains of 4 sq. mm PVC insulated copper wire as per standard practice. The switches, plugs, sockets shall be of modular type.

The wire shall also confirm FRLS (Flame retardant Low Smoke) properties as per ASTM-D 2863 and IEC 60754-1 and of 1100 volts grade.

**Note : along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.**

**3.Schedule item no. A(I)-4, A(II)-4, A(III)-6**

**SETC of Wiring of the concealed 6 A / 3 Pin Universal plug point as per latest IS on switch board with all accessories and running earthing copper conductor as per standard practise. The Switches shall be of Modular Type.**

The price shall cover the cost of supply, loading, transportation and erection of 5A /5 Pin or 6A / 3 Pin Universal Plug Point on switch board with all accessories and running Earthing copper conductor to site as per standard practice. The switches, plugs, sockets shall be of modular type and to be provided on board.

The wire shall also confirm FRLS (Flame retardant Low Smoke) properties as per ASTM-D 2863 and IEC 60754-1 and of 1100 volts grade.

**Note : along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.**

**4.Schedule item no. A(I)-2, A(II)-2, A(III)-2, B-3**

**Supply of material and fixing and concealed wiring for (3 Plug & 3 switch on separate board) 6 A 3 pin universal socket outlet complete with 6 Sqmm PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25mm / 32mm dia PVC conduit pipe flush type 5A socket outlet and 5A piano type switch in GI box with PVC topsheet 5mm thick..(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing and concealed wiring for (3 plug & 3 switch on separate board) 5/6 amps universal socket outlet as per specification complete with sub-mains of 6 sq.mm, PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25



/ 32 mm dia PVC conduit pipes, flush type 6 amps socket outlet 6 amps in PVC box with PVC top sheet 5 mm thick and wiring as per standard practice. The switches, plugs, sockets shall be of modular type.

The wire shall also confirm FRLS (Flame retardant Low Smoke) properties as per ASTM-D 2863 and IEC 60754-1 and of 1100 volts grade.

**Note : along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.**

**5.Schedule item no. A(I)-5, A(II)-5, A(III)-5**

**Wiring of Concealed 15 A 6 Pin Wall Socket Point complete with 4 Sqmm Wiring all accessories and running earthing copper conductor as per standard practice. The switches shall be of modular type for Gyser, Kettle & Fridge.(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of concealed wiring for 15 amps universal socket outlet as per specification complete with 4 sq.mm, PVC insulated 1.1 KV grade multistranded copper conductor wires along with 2.5 sq. mm green colour copper earth wire in 25 / 32 mm dia heavy duty PVC conduit pipes, flush type 15 amps socket outlet 15 amps switch in PVC box with PVC top sheet 5 mm thick including sub-mains of 4 sq.mm. PVC insulated copper wire as per standard practice. The switches, plugs, sockets, board shall be of 20A DP modular type MCB. Wiring includes all accessories and including cutting the wall / ceiling / chipping and re plastering the same as good condition as directed by Engineer in charge at site.

The wire shall also confirm FRLS (Flame retardant Low Smoke) properties as per ASTM-D 2863 and IEC 60754-1 and of 1100 volts grade.

**Note : along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.**

**6.Schedule item no. A(III)-3**

**Supply, erection, testing and commissioning of 5A & Pin Universal Modular Type Plug Socket with switch & concealed type point wiring with 2x2.5 sq mm FRLS Multistranded PVC Copper wire with all accessories and running earth on separate board in each Bathrooms & for Wifi Modem in each rooms.**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of concealed wiring 5A/5-pin plug point and switch on separate PVC control board and in connection with 2.5 sq.mm PVC insulated 1.1 KV grade multistranded copper conductor along with 2.5 sq. mm green colour copper earth wire including sub-mains of 4 sq. mm PVC insulated copper wire as per standard practice. The switches, plugs, sockets shall be of modular type.

**7.Schedule item no. A(I)-9, A(II)-6, A(III)-8, B-15**

**Supply, erection, testing & commissioning of submain from switch board to single phase DP switch / DP one circuit meter comprising of submain with 2x4 sq.mm. PVC insulated FRLS 1.1KV multistranded wire & one running earth of 2.5 sq.mm. copper conducting PVC insulation green colour of 1.1 KV grade on rigid PVC casing capping with all accessories.**

Supply, erection, testing and commissioning of Submain with 2x4 sq mm 1100V grade PVC FRLS copper wire. The wiring for submains shall consist of two wires of single core 4 sq.mm. PVC insulated multi-stranded FRLS copper wire of 1.1 KV grade on rigid PVC casing capping/ PVC Conduit pipe ( If required as per site condition) along with running earthing with one wire of 2.5 sq.mm. wire insulated with green colour PVC. For measurement purpose each meter of submain shall comprise of 2 wires of 4 sq.mm. of 1 mtr. length each and one earthing wire of 2.5 sq.mm of 1 mtr. length along with associated accessories like PVC casing –capping/ PVC conduit etc. The sub-mains shall be run inside the PVC casing capping /PVC conduit of suitable size as per site condition as per standard practice specified above as per the instructions of field Engineer. The item sub main shall be measured only for length upto switch board in room If more than one switch board is provided in a room or adjacent room and total no. of points is upto 10, then interconnection between switch boards as per schedule item of point wiring shall be done as stated in specification for point wiring.

**8.Schedule item no. A(I)-10, A(III)-7, B-16**

**Supply, erection, testing & commissioning of Submain with 2x6 sqmm FRLS copper wire inside PVC Casing capping with running earth etc complete. (1 m length of submain consists one cktmtr including all accessories & 2 wire of 6 sqmm with one wire of 2.5 sqmm for earth conn).**

The wiring for sub-mains shall consist of two wires of single core 6 sq.mm. PVC insulated multistranded FRLS copper wire of 1.1 KV ISI mark and confirming to IS-694/1990 or latest grade on rigid PVC casing capping/ PVC conduit along with running earthing with one wire of 2.5 sq.mm. wire insulated with green colour PVC. For measurement purpose each meter of submain shall comprise of 2 wires of 6 sq.mm. of 1 mtr. length each and one earthing wire of 2.5 sq.mm of 1 mtr. Length along with associated accessories like PVC casing–capping/ PVC conduit etc. The sub-mains shall be run inside the PVC casing capping /PVC conduit of suitable size as per site condition as per standard practice specified above as per the instructions of field Engineer. The item submain shall be measured only for length upto switch board in room. If more than one switch board is provided in a room or adjacent room and total no. of points is upto 10, then interconnection between switch boards as per schedule item of point wiring shall be as stated in specification for point wiring.

**9.Schedule item no. B-11**

**Supply, erection, testing & commissioning of Wiring of 15 A power point on separate switch board with wiring 2x4 sqmm FRLS copper wire for earthing with all accessories running earth and finishing of the surface after rewiring etc.**

The socket outlet shall be 6-pin universal design 15 amp capacity with piano type switch, fuse, indicator. The socket outlet shall confirm to IS 1293 of 1988 with latest amends & ISI mark. Each socket outlets shall be controlled by a separate Point Wiring With 2x4 sqmm FRLS PVC Copper wire from nearest Sub distribution board. Piano type Switch controlling the socket outlet shall be on phase side of the line. Each 15 Amp. 6 pin socket and switch will be fixed on separate switch board and running earthing of 2.5 sq.mm. copper conductor with green colour PVC insulated to metallic part.

**10.Schedule item no. B-2**

**Supplying and fixing following modular switch /socket on the existing modular plate & switch box including connections but excluding modular plate etc. as required. 3 pin 5/6 A socket outlet.**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of concealed wiring 5/6 A 3 Pin plug point and switch on separate PVC control board and in connection with 2.5 sq.mm PVC insulated 1.1 KV grade multistranded copper conductor along with 2.5 sq. mm green colour copper earth wire including sub-mains of 4 sq. mm PVC insulated copper wire as per standard practice. The switches, plugs, sockets shall be of modular type.

**11.Schedule item no. B-12**

**SETC of Industrial type metallic plug sockets 30A with 30 A MCB DP with 2x4 sqmm PVC insulated and sheathed copper conductor complete.**

Supply, erection, testing and commissioning of Industrial type plug socket metallic 30 amp with DP MCB of rated current 30 Amp., 10 kA breaking capacity, 'C' series shall be provided inside the suitable size of MS sheet enclosure along with plug socket. Iron clad Plug socket with 3 pin top shall be mounted on teak wood board. The wiring for the industrial plug socket shall be done with PVC insulated 2 x 4 sq. mm. FRLS copper wire as per IS 694/1990 or latest from nearest sub distribution board. The work shall be carried out under the supervision of field engineer.

**12.Schedule item no. A(I)-6, B-10**

**Supply, erection, testing & commissioning of Concealed wiring for call bell with copper PVC insulated FRLS 1.1 KV point wiring of 2 x1.5 sq.mm. wire on PVC conduit of suitable size with all accessories and running earthing. The plug point to be provided on separate switch board and switch with supply and fixing of bell and switch. The switch should be bell push type 5 A capacity. (along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of concealed wiring for 15 amps universal socket outlet as per specification complete with 4 sq.mm, PVC insulated 1.1 KV grade multistranded copper conductor wires along with 2.5 sq. mm green colour copper earth wire in 25 / 32 mm dia heavy duty PVC conduit pipes, flush type 15 amps socket outlet 15 amps switch in PVC box with PVC top sheet 5 mm thick including sub-mains of 4 sq.mm. PVC insulated copper wire as per standard practice. The switches, plugs, sockets, board shall be of 20A DP modular type MCB. Wiring includes all accessories and including cutting the wall / ceiling / chipping and re plastering the same as good condition as directed by Engineer in charge at site.

**13.Schedule item no. A(I)-7, A(III)-4**

**Supply of material and fixing and concealed power point wiring 20A DP MCB complete with 4 Sqmm PVC insulated copper conductor wires along with 14SWG tinned copper earth wire in 25/32mm dia PVC conduit pipe flush type 5/15A socket outlet and 15A piano type switch in GI box with PVC topsheet 5 mm thick for AC..(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material and fixing and concealed power point wiring 20A DP MCB complete with 4 Sqmm PVC insulated copper conductor wires along with 14SWG tinned copper earth wire in 25/32mm dia PVC conduit pipe flush type 5/15A socket outlet and 15A piano type

switch in GI box with PVC top sheet 5mm thick for AC. Wiring includes all accessories and including cutting the wall / ceiling / chipping and re plastering the same as good condition as directed by Engineer in charge at site.

**14.Schedule item no. A(I)-44, A(I)-45, A(III)-21, A(III)-22**

**Supply, erection, testing and commissioning of PVC Flexible pipe 16 mm**

**Supply, erection, testing and commissioning of PVC flexible pipe 25 mm**

The cost includes supply, erection testing and commissioning of PVC Flexible pipe 16 mm and 25 mm as per Standard practice specified & as per the instructions of field Engineer.

**15.Schedule item no. A(I)-23, A(III)-17**

**Supply, erection, testing & commissioning of single phase Domestic Exhaust Fan of 250 mm size sweep, 1200 RPM with self closing Louvers, full plastic body, colour white complete.**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of Plastic body single phase Exhaust Fan 250 mm, 36W 800Cum/hr with automatic shutter suitable to work at 230 Volts 50 Hz AC supply complete with motor guard, cover etc. The exhaust fan shall be procured from reputed make.

**16.Schedule item no. A(I)-22, A(II)-10, A(III)-16, B-7**

**Supply, erection, testing and commissioning of BLDC Super efficient electrical Ceiling Fan 1400 mm sweep (56') 260-280 RPM, Services value 7.7 input voltage 140-285 V. Power consumption 26 W to 30 W. Air delivery 270 CMM or more, 3 blades with double ball bearing with regulator of electronic step type and down rod 300-600 mm as per requirement, canopies, shackle.**

Supply, erection, testing and commissioning of Ceiling fan 1400 mm sweep BLDC with Down rod and other accessories with regulator of electronic step type.

**TECHNICAL SPECIFICATION FOR BLDC CEILING FAN, INPUT VOLTAGE SINGLE PHASE 230 VOLT AC 50 HZ FOR GENERAL SERVICES APPLICATIONS.**

**1.0 SCOPE:**

This specification defines the requirement of Design, Manufacture, Supply, Testing & inspection of Ceiling Fan & Electronic fan Regulator for various applications at Platforms, services buildings & Railway Quarters for General services over Central Railway. This specification supersedes earlier CR specification no PCEE / CR / 2019 / 1400 MM BLDC FAN dtd 10.01.2019 & Rev 1 dtd 05.02.19.

**2.0 Reference Standards:**

The following documents given below are for reference to the manufacturer for design, manufacture, performance, safety, environmental & other type test requirements. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall prevail.

**IS/IEC:**

SN	Specification no.	Description
1	IS:374- 2019 Fourth revision with latest amendment	Electric Ceiling Fan
2	IS: 302.2.80-2017	Safety Requirements

3	IS: 12360-1988, Reaffirmed 2020	Rated Voltage
4	IS: 648-2006 IS: 649-1997 IS: 3024-2006	Stampings
5	IS: 1271- 1985	Insulating Materials
6	IS: 1248- 2003	Routine & Acceptance Tests
7	IS: 4905-1968	Scale of Sampling
8	IS: 11037-2019	Electronic Fan Regulator
9	IS:737 - 2008	Fan Blade
10	IS: 13730 -1993	Copper winding wire
11	IS:13778 - 2011	Test Method of Copper winding wire

### 3.0 SCOPE FOR SUPPLY OF ITEMS:

- Supply of 1400/1200 mm Sweep Ceiling Fan BEE 05 star with ISI Marked confirming to IS 374/2019 Fourth revision with latest amendment.
- Fan regulator: ISI marked electronic fan regulator in four/five steps or stepless upto 100 watt.

### 4.0 GENERAL TECHNICAL REQUIREMENTS:-

4.1 The fan regulator shall be electronic type and should be able to with stand long periods of overload without getting damaged.

4.2 The ceiling fans 1200mm & 1400mm sweep shall be BEE 05 star with ISI Marked.

4.3 The tolerance limit in technical parameters if not given shall be as per reference of Indian Standard.

4.4 The Public Procurement (Preference to make in India), 'Order-2017' shall be applicable for procurement.

5.0 Supply ceiling Fan 'ISI' marked and latest highest BEE star ratings confirming to IS: 374/2019 Fourth revision with latest amendment.

### 5.1 1400 mm Sweep ceiling fan:

SN	Item	Description
1	Type of motor	Brushless DC
2	Sweep size in mm	1400 mm
3	BEE star rating	5 star
4	Minimum air delivery (Cubic m/min)	250
5	Service value (air delivery cu. Meter/min/watt)	Not less than 7.5
6	Power factor	Not less than 0.90
7	Power consumption	26 W to 30 W
8	Safety wire set	1.6 mm strand wire, 2 U clamp, 1 L clamp.
9	Rated voltage & frequency	230 V Single phase AC , 50 Hz
7	Working Voltage	140-285 V
8	Standard color	Ivory/ white or based on site requirement
9	Regulator	Fixed speed.
10	No. of blades	03

11	Blade thickness	Minimum 1.1 mm
12	Blade material	Aluminum
13	Winding material	Enameled copper
14	Bearing	Double ball bearing
15	Length of down rod without shackle	300 mm or greater
16	Shank	Thickness : 1.6 mm (Minimum) Material: CRC (cold Rolled Coiled) sheet
17	Shackle	Thickness : 2.0 mm (Minimum) Material: CRC (cold Rolled Coiled) sheet
18	Total Harmonic distortion (THD)	Less than 15%
19	Canopy	02 Nos
20	ISI mark	IS:374 :2019 Fourth revision with latest amendment
21	Noise level	Less than or equal 55 dB at 1 meter below fan
22	Surge protection capacity	2 KV
23	Warranty	The fan shall be with warranty of 05 years

## 5.2 'ISI' marked Electronic Fan Regulator in Four/Five steps or stepless upto 100 watt.

SN	Item	Description
5.3.1	Fan regulator upto 100 watt	ISI marked Electronic Fan Regulator as per IS: 11037-2019.
5.3.2	Types of Fan Regulator	The Fan Regulator shall be Switch/Socket Type low inductive cell of metalized polyester film coated with flame retardant grade epoxy powder.  The regulator shall be suitable for surface/concealed mounting complete with Knob & screws.
5.3.3	Input Voltage	Single Phase 230 volt AC, 50Hz
5.3.4	Material Grade	Poly Carbonate
5.3.5	Life Test Conditions	a) a) Endurance Test: Loaded at 1.1 times of rated voltage at 70 deg. C for 500 hours b) Switching Test; >20,000 cycles of 4 step/5step switch type fan regulator c) Lot to Lot testing: loaded at 450 volt AC at ambient temperature for 2 hours
5.3.6	Noise level	No appreciable noise/ disturbance on radio/television when operated outside a radius of 2 mtr. From the regulator

6.0 **Warranty:** The fan shall be with warranty of 05 years.

7.0 **Identification:** Each fan shall be indelibly marked firm name, month & year of manufacture, warranty period, serial number, rated voltage, wattage, size of fan & type of fan on ceiling fan.

## 8.0 Inspection:

The Inspection facility for carrying out acceptance tests as per IS/IEC specification shall be made available by the manufacturer to inspecting authority at manufactures cost.

## 9.0 TESTS:

The ceiling fan shall be tested with the applicable IS/IEC reference standards given In Para 2.0 of this specification.

### TYPES OF TESTS:

#### 9.1.1 Types Tests:

Inspecting authority will verify the documents available with the firm for type tests mentioned in Para 9.1.4 carried out from Govt. Laboratory/National/International Accredited Laboratory to ensure the confirmation with the requirement of specification. However, only BIS-approved laboratories are permitted.

#### 9.1.2 Acceptance tests:

These tests shall be carried out by an Inspecting Agency at the manufacturer works on sample taken from a lot for the purpose of acceptance of material.

#### 9.1.3 Routine Tests:

These tests shall be performed by the manufacturer on each item and the records shall be shown to the Inspecting Agency during the inspection of lot offered for acceptance tests.

#### 9.1.4 TESTS SCHEME

<b>9.1.4 (a) For Fan</b>					
<b>SN</b>	<b>Description of test</b>	<b>Reference Para of the IS specification</b>	<b>Type test</b>	<b>Acceptance test</b>	<b>Routine test</b>
1	Safety requirements	Clause 9 (IS: 374:2019)	Y	-	-
2	Performance requirements	Clause 15 (IS: 374:2019)	Y	-	-
3	Speed and power factor	Clause 14.4 & 14.5 (IS: 374:2019)	Y	Y	-
4	Speed regulators	Clause 10 (IS: 374:2019)	Y	Y	-
5	Starting	Clause 11 (IS: 374:2019)	Y	Y	-
6	Interchangeability	Clause 12 (IS: 374:2019)	Y	-	-
7	Silent operation	Clause 13 (IS: 374:2019)	Y	-	-
8	Power input	10 of IS: 302 (part 2/sec 80) (IS: 374:2019)	Y	Y	-
9	Test for harmonic	Clause 17	Y	-	-

	distortion	(IS: 374:2019)			
10	Endurance test	Clause 16 (IS: 374:2019)	Y	-	-
11	Leakage current at operating temperature	13 of IS 302 (part 2/sec 80)	-	Y	-
12	Earthing connection	27 of IS 302 (part 2/sec 80)	-	Y	-
13	Earth continuity test	A-1 of IS 302-1	-	-	Y
14	Electric strength test	A-2 of IS 302-1	-	-	Y
15	Functional test	A-3 of IS 302-1	-	-	Y
16	Simple running test (checking fan is operating or not)	-	-	-	Y
9.1 4 (b) . For Regulator					
SN	Description of test	Reference Para of the IS specification	Type test	Acceptance test	Routine test
1	Temperature-rise	Clause 9.5.1 (IS: 11037-2019)	Y	-	-
2	Leakage current	Clause 9.5.2 (IS: 11037-2019)	Y	Y	-
3	High voltage	Clause 9.5.3 (IS: 11037-2019)	Y	Y	-
4	Insulation resistance	Clause 9.5.4 (IS: 11037-2019)	Y	Y	-
5	Earthing connection	Clause 9.5.5 (IS: 11037-2019)	Y	Y	Y
6	Protection against electric shock	Clause 9.5.6 (IS: 11037-2019)	Y	Y	-
7	Voltage drop Performance	Clause 7.7 (IS: 11037-2019)	Y	-	-
8	Performance	Clause 8 (IS: 11037-2019)	Y	Y	-
9	Moisture resistance	Clause 9.5.7 (IS: 11037-2019)	Y	Y	-
10	Mechanical strength	Clause 9.5.8 (IS: 11037-2019)	Y	-	-
11	Creepage distances and clearances	Clause 9.5.9 (IS: 11037-2019)	Y	-	-
12	Electrical endurance test	Clause 9.5.10 (IS: 11037-2019)	Y	Y	-
13	Environmental tests	Clause 9.5.11 (IS: 11037-2019)	Y	-	-
14	Resistance to abnormal heat and to fire	Clause 9.5.12 (IS: 11037-2019)	Y	-	-
15	Resistance to rusting	Clause 9.5.13 (IS: 11037-2019)	Y	-	-
16	Checking of dimensions	Clause 9.5.14 (IS: 11037-2019)	Y	-	-



17	Flash rate	Clause 9.5.3.4 (IS: 11037-2019)	-	-	Y
18	Insulation resistance	Clause 9.5.4.2 (IS: 11037-2019)	-	-	Y

**Note :** Safety Wire Set 1.6 mm Strand Wire, 2 U Clamp, 1 L Clamp required to be provided with fan.

**17.Schedule item no. A(I)-49, A(I)-50, A(III)-26, A(III)-27, B-13, B-14**

**Supply, erection, testing & commissioning of Three phase Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 63 A 4P MCB as I/C and 6 Nosx10 A SPN MCB and 4 Nosx 20A SPN MCB for O/G.**

**Supply, erection, testing & commissioning of Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 32 A DP RCBO as I/C and 6 Nos x 6 A SPMCB and 2 Nos x 20A O/G SPMCB Complete.**

**SETC of Lighting Circuit board, double door powder coated with locking arrangement consisting 40 A 2P RCBO for I/C 6 Nos x 32 A SPMCB and 2 nos x 16 A SPMCB O/G complete.**

**SETC of Lighting Circuit board, double door powder coated with locking arrangement consisting 63 A 4P RCBO for I/C 18 Nos x 32 A SPMCB and 4 nos x 16 A SPMCB O/G complete.**

The price shall cover cost of supply, loading, transportation and unloading of material at site, erection testing and commissioning of single phase/ 3 phase distribution board as above. The DB shall be double metallic door type with earthing terminal, bus bars, neutral link, etc. housed in 16 SWG CRCA sheet enclosure powder coated type with all accessories with IP 65 **protection**. The minimum breaking capacity of MCB shall be 10 KA.

**MCB DB-** MCB Distribution board consisting with various capacity of MCB's as in schedule. MCB shall be 'C' Class, of 10 kA breaking capacity and conforming to IS 8828 –78 with latest amendments. MCB shall be with ON/OFF indication, IP 65-degree protection, showing mid trip position in case of overload or short circuit conditions. MCB shall be having bi-connect terminals, load-line reversibility and with energy limitation class –III features.

Distribution board shall be made of high quality CRCA steel sheet with surface finish powder coated mat finish broken white distribution board double door & neutral link with box type terminal tin plated Electrolyte grade copper bus bar & phase link tin plated brass earthing link and wire set for internal wiring. DB shall be with IP 65 protection. It shall be provided with cements skill protection and side locking DIN bar interchangeable door.

**RCBO –**

RCBO shall have conformance to IS 12640-2 / IEC 61009-1.

RCBO shall be of breaking capacity of 10kA.

RCBO shall not be line load biased.

RCBO shall have minimum electric life of 10,000 electric operations.

Single Phase RCBO of 6A-40A to be in 2 Modules size with a breaking capacity of 10kA.

The RCBO shall have separate indications for short circuit fault and earth leakage fault.

The RCBO shall trip on leakage fault of AC waveform consisting of pulsating DC along with transients and harmonics.

The RCBO shall have pollution degree 3.

The RCBO shall have rated impulse withstand of 6 kV.

The RCBO shall have IP20.

The RCBO shall have a test button to check health of RCBO by creating artificial fault.

The RCBO shall be suitable for isolation.

The RCBO shall have bi-connect terminals for both bus bar and cable termination.

The RCBO, up to 63A, shall have cable termination capacity of 35 sq mm for rigid cable & 25 sq mm for flexible.

The RCBO shall have safety shutter to avoid any wrong insertion of cable.

The RCBO shall have operating temperature -5 °C to +60 °C.

The RCBO shall have a provision for padlock to prevent unauthorized access.

The RCBO shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release.

The RCBO shall have DIN clip on both the sides for easy removal of an RCBO from the DIN rail.

#### **18.Schedule item no. A(I)-24, A(III)-18, B-9**

**Supply, erection, testing & commissioning of Heavy Duty single phase Exhaust Fan of 380 mm size sweep, 1440 RPM duly wired with 3 core flexible copper wire and fixing arrangement, hardware etc. complete.**

Supply erection, testing and commission of single phase Exhaust fan of 380 mm sweep heavy duty ISI mark and fixing arrangement, Hardware etc 1440 RPM duly wired with 3 core flexible copper wire with flexible pipe shall be erected on position with necessary material and fixing arrangements. The mounting frame shall be passed with steel bracket which will connect the frame and fan motor assembly. Rubber mountings shall be provided between mounting fan and mounting brackets.

The work shall be done in approved manner as per the instructions of field Engineer.

#### **19.Schedule item no. B-5**

**Supply, erection, testing & commissioning of energy efficient 1x18 W indoor fitting LED batten with extruded aluminium housing with integrated LED Driver/Tube complete and associated accessories complete.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of energy efficient 1x18W LED batton, Extruded aluminium housing fitted with engg. Plastic end caps. Opal diffuser provides smooth light distribution. LED populated on PCB comprising of LED's connected in series parallel. Luminaire color temperature: White (WH) : 6500K. Driver: Constant current output driver, operating range 150–275V AC supply voltages. Ingress protection: IP20, Luminaire efficacy required minimum guaranteed **120 Lumen/watt**, PF >= 0.95, THD <10%, CCT 6500, CRI ≥ 70. LED fittings shall be guaranteed for 5 years.

#### **20.Schedule item no. A(I)-17, A(II)-7, A(III)-14, B-6**

**Supply, erection, testing & commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts with CRCA sheet housing comprising connected in series parallel. Opal diffuser fixed in separate CRCA sheet frame. Opal diffuser frame is held in with housing by screws for easy maintenance. Driver: Constant current LED driver. Finish : Housing white powder coated. (RAL9016 Luminaire efficacy required minimum guaranteed **125 lumen/watt**, beam angle 100 degree, PF >= 0.95, Built in surge protection of 3 KV, THD<10%, CCT 5700, CRI = 80, Operating Temperature range -10°C to 45°C. LED fittings shall be guaranteed for 5 years.

**21.Schedule item no. A(I)-18, A(II)-8, A(III)-15, B-4**

**Supply, erection, testing & commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts LED fitting complete with connections as per site requirements with CRCA sheet housing comprising connected in series parallel. Opal diffuser fixed in separate CRCA sheet frame. Opal diffuser frame is held in with housing by screws for easy maintenance. Driver : Constant current LED driver. Finish: Housing white powder coated. (RAL9016) Luminaire efficacy required minimum guaranteed **125 lumen/watt**, beam angle 100 degree, PF  $\geq 0.95$ , Built in surge protection of 3 KV, THD<10%, CCT 5700, CRI = 80, Operating Temperature range -10°C to 45°C. LED fittings shall be guaranteed for 5 years.

**22.Schedule item no. A(I)-13, A(III)-10, B-37**

**Supplying LED concealed type foot / step light with aluminium body for indoor application suitable for upto 5 W LED including driver and erecting by making necessary arrangement/ recess in wall to make it flush with surface.**

**Supply, erection, testing & commissioning of LED concealed type foot/step light suitable upto 2W LED including driver having fibre reinforced plastic housing as per specification.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of LED concealed type foot / step light with aluminium body for indoor application suitable for LED including driver and erecting by making necessary arrangement/ recess in wall to make it flush with surface.

- It is a sleek and durable step light designed for stairs and garden pathways.
- It features a white powder-coated cast aluminum body. Powered by a constant current driver, it ensures efficient and long-lasting illumination for outdoor spaces.
- The luminaire comprises of a white powder coated cast aluminium body. Warm white well-lit with no glare provided by opal PC diffuser.
- Electrical Class I & Constant current electronic driver provided with high voltage, open & short circuit protection.
- Asymmetrical diffuse light distribution. Luminaire is wired with in-built driver.
- Easy to install and maintain.

**Specifications**

- Wattage: 5W /9W
- Efficacy: 80 lm/W
- IP: 66
- IK: 06
- CCT:3000 k
- THD: <10%

**23.Schedule item no. A(I)-12, B-36**

**Supply, erection, testing & commissioning of LED Reading Lamp of 01-02 W Along with all accessories with 1.5 Sq mm 2 Core Copper Wire for connections.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of indoor Luminaire with energy efficient **LED Reading Lamp of 01-02 W**, Square/ Round Shape Recessed Mounted. Luminaire color temperature: White (WH) : 3000-6000K . IP20, Luminaire efficacy required minimum guaranteed **100 Lumen/watt** PF $\geq$  0.95, THD <15%, CCT 5700, CRI < 70, Life Expectancy > 50,000 Hrs. Nominal Voltage – 230 V, Input line voltage 100-265 V AC Driver type constant current Driver with short circuit protection. Sample shall be got approved before supply.

**24.Schedule item no. A(I)-20**

**SETC of LED Post top 65 Watt with spun aluminium housing for lamp and reflector assembly with clear polycarbonate cover and IP 65 protection.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of LED Post top 65 Watt with spun aluminium housing for lamp and reflector assembly with clear polycarbonate cover and IP 65 protection. The fitting shall be exactly similar to **Bajaj model No. Flounce/Auracrest/Archner/Antiqua/Borage/BNRRL** Post Top 65 W LED from any approved make. Luminaire efficacy required minimum guaranteed  $\geq 110$  **Lumen /watt** at luminaries level. LED fittings shall be guaranteed for 5 years.

**Specifications**

- Powder coated spun aluminium housing for lamp & reflector assembly
- Powder coated spun aluminium reflector with UV stabilized clear polycarbonate cover is
- fixed to the housing from top with mounting arrangement for incoming pole of 40 to 50 mm
- O/D pipe
- Colour temp. – 5700°K  $\pm$  300°K / 3000°K
- Driver has protection against over voltage & short circuit.
- Input voltage range: 140–310V AC.
- Ingress protection : IP66
- IK- 09
- Input Voltage(V) AC - 240V AC
- System Current - 0.270 (Amp.)
- System Wattage – 65 (W)
- Power Factor - 0.95
- IS 10322 (PART 5/SEC 3) : 2012
- IS 15885 (Part 2/Sec 13): 2012
- LED module with SMD LED package mounted on MCPCB.

**Features** – 1) No harmful UV & IR radiations.

2) Spun aluminium powder coated housing with casted aluminum heat sink.

3) Graphite Grey powder coated-RAL 7024

4) Optical grade injection moulded polycarbonate diffuser.

5) Constant current electronic driver provided with high voltage open and short circuit protection.

**Electronic driver** - Built-in potted electronic LED driver with APFC, (SMPS based constant current supply), lower THD, Open Circuit Protection, over Voltage protection, Surge Voltage Protection upto 10kV With Built In SPD & other safety test as per IS 15885 Part-2/Sec 13.

**25.Schedule item no. A(I)-14, A(III)-11**

**Supply, erection, testing & commissioning of Indoor type Energy Efficient. The fitting shall be complete with 2x18 W LED luminaire with ballast (driver)etc. and connection to over head mains/junction box.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of surface / suspended mounted IP66/IP65 protected water proof fitting complete with 2 no. 18-20 Watt LED tube light complete with all accessories and fixing arrangement with clamps, brackets, nut-bolts etc.s as per site condition. The fittings shall be as per list of acceptable make enclosed. The cost shall also cover the wiring from ceiling rose / junction box / overhead wire to luminaries by 0.75 sq. mm cable of 3 core PVC insulated multistrands copper conductor with suitable size of flexible PVC conduit and fixing arrangement with clamps, brackets, nut-bolts etc. The technical parameter will be generally conforming to specification enclosed. The tenderer shall mandatorily submit following test certificates/reports of offered Luminaire and Luminaire to be got approved by Sr. DEE (G) CSMT before supply. LED fittings shall be guaranteed for 5 years.

1. LM 80 from LED Manufacturer with TM 21 extrapolation (IS: 16105 or latest).
2. LM 79 from NABL Accredited LAB (IS: 16106 or latest).
3. Photobiological safety Report from LED Manufacturer. (IEC 62471/ EN 62471/ IS: 16108 or latest).

Test certificate of accredited international / national laboratory shall be submitted.

4. Drivers Test certificates
5. BIS Certificates for Luminaires and Drivers separately.
6. Polar Diagram, Cone Diagram
7. Test certificate from NABL accredited laboratory in support of IP protection and Impact Resistance.

**26.Schedule item no. A(I)-15, A(III)-12**

**SETC of 15/18 Watt Warm White SLD Square / Round LED downlight fitting of size 6"x6" complete with all accessories.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of energy efficient 15/18 Watt Warm White SLD Square / Round LED downlight fitting of size 6"x6" complete with all accessories. The fitting shall be 6\*6 by supply installation and commissioning of maximum 15/18W with CRCA sheet housing comprising connected in series parallel. Opal diffuser fixed in separate CRCA sheet frame. Opal diffuser frame is held in with housing by screws for easy maintenance. Driver: Constant current LED driver. Finish: Housing white powder coated. (RAL9016) Luminaire efficacy required minimum guaranteed **125 lumen/watt**, beam angle 100 degree, PF >= 0.95, Built in surge protection of 3 KV, THD<10%, CCT (3500-4100)K, CRI = 80, Operating Temperature range -10°C to 45 °C. LED fittings shall be guaranteed for 5 years.

**27.Schedule item no. A(I)-16, A(III)-13**

**SETC of 2Ft 10 watt LED tube 4000 k all in one fixtures for Dressing, mirror and kitchen.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of 2 FT 1x10 watt LED tube fitting with accessories complete, Polycarbonate co-extrusion tube for LED light housing with engg-plastic end caps. Opal diffuser provides smooth light distribution. LED populated on PCB comprising of LED's connected in series parallel. LED fittings shall be guaranteed for 5 years.

Wattage	<b>10 W</b>
Ingress Protection	IP 20
Luminaire efficacy	100 lm/ W
PF	$\geq 0.90$
THD	$<15\%$ ,
CCT	4000 K
CRI	$\geq 70$

### **28.Schedule item no. B-8**

#### **Supply, erection, testing & commissioning of 45W Multi LED Fittings for Outdoor Purpose.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of LED street light Road way fittings in Alluminium PDC housing and toughened glass cover with IP66 Protection, wattage- 45 W, input voltage-240 volts AC, 501 Hz complete with Pressure die cast aluminium housing graphite powder coated finish with mid power LEDs and opal polycarbonate diffuser, LED make Cree , Osram, Luminaire efficacy required minimum guaranteed **110 Lumen/watt**, CCT $\geq 5700$ , CRI  $>80$ , Driver efficiency  $> 85\%$  ,Beam Angle 120 degree, P.F  $\geq 0.95$ , THD  $< 10\%$ , Manufacturer Logo Embossed on Luminaire, Short Circuit /open load/reverse polarity protection should be available. LED fittings shall be guaranteed for 5 years.

### **29.Schedule item no. A(I)-52**

#### **Supply, erection, testing & commissioning of LED street Light Roadway fittings in aluminium PDC housing, toughened glass cover with IP66 protection, Wattage 45 watts, input voltage-240 volts ac, 50Hz. Complete.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of energy efficient LED street light luminaries 45 W in Epoxy powder coated pressure die-cast aluminum housing with weatherproof gasket for lamp and control gear accessories. Toughen Glass front cover fixed with SS screws. LED specification – High power LED chip with secondary lenses for proper light distribution with color temperature 5700K  $\pm 300$ K LED. Luminaries is wired with inbuilt driver with open/short circuit and surge protection inbuilt 5kV and external 10 kV Input voltage range: 100–300 V AC. Side entry mounting for 25-33 mm OD pipe bracket. Degree of protection: IP66, CRI  $\geq 70$ , Driver efficiency $>85\%$  P.F.  $\geq 0.95$ , THD $< 15\%$ , Luminaries efficacy required minimum guaranteed **110 Lumen/watt**. LED and driver compartment should be separated. LED fittings shall be guaranteed for 5 years.

### **30.Schedule item no. A(I)-55**

#### **SETC of 160 Watts LED Flood light fittings with high luminous efficiency, protected to IP65.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of 160/150W industrial LED Flood light fitting, Powder coated die-cast aluminum housing & driver compartment. LEDs are fixed in above aluminum PDC housing for proper thermal management. Isolated (Potted) driver with constant voltage & constant current type. With high voltage, short circuit, open load & short circuit, High efficiency, Optimized uniformity, Lens without holder provided. Also provision for bracket mounting for aiming purpose. Completely pre-wired with accessories up to terminal block. Luminaire efficacy required minimum guaranteed **110 Lumen /watt** at luminaries level; LM 79 and 80 to be provided along with tender. CCT 6500, CRI $\geq 70$ , Beam Angle 60 degree, Operating Temperature range -10°C to 50 °C, PF  $> 0.95$ , THD  $< 15\%$ , Built in Surge protection of 5 KV internal & 10 KV external. IP: 66 LED fittings shall be guaranteed for 5 years.

**31.Schedule item no. B-39**

**Supply, erection, testing & commissioning of Bulkhead fitting with 10 W LED light with heat resistant glass cover and MS galvanised wire guard complete in toilet/bath.**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of indoor Luminaire Bulk head fitting with 10 watt LED Light with heat resistant glass cover and MS Galvanised wire guard complete with energy efficient 1x10 W LED, multipurpose application made from extruded aluminum housing and polycarbonate diffuser. Luminaire color temperature: White (WH) : 5700K. IP20, Luminaire efficacy required minimum guaranteed **100 Lumen/watt** PF $\geq$  0.95, THD <15%, CCT 5700, CRI  $\geq$  70. LED fittings shall be guaranteed for 5 years.

**32.Schedule item no. A(I)-19**

**Supply, erection, testing & commissioning of LED Bollard 8W**

The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of **LED Bollard 8W** Light with heat resistant, Gasket – silicon rubber optical cover, Translucent diffuse tube with energy efficient 8W LED, multipurpose application made from aluminum housing and polycarbonate diffuser. Luminaire color temperature: Warm White (WH) : 3000 K. protection class IP65, RAL color -Traffic grey, mounting device – Baseplate, mech. Impact protection IK 10, IEC- safety class I. Driver Current-20 mA, Inrush Current – 0.087A, Power supply : 220 -240V/ 50-60 Hz integrated.

**33.Schedule item no. B-38**

**Supply of 0.5 W LED Bulb Night lamp complete with associated accessories etc.**

The cost includes supply of 0.5 W LED Night lamp and 3 W LED Bulb complete with associated accessories.

**SPECIFICATION OF LED LUMINAIRES**

**Ref: RDSO Doc. No. RDSO/EM/ LED Norm/ 01, Ver: 1.0 Date: 18.09.2014**

**Technical requirements of LED**

S.No.	Description	Specification
1	LED Make	Nichia, Osram, Seoul, Philips, Lumileds, Cree and Lednium
2	LED Type	High Power, SMD (Surface Mounting Device) LED
3	Lumen Out Put / Efficacy at luminaries Level	I. >125 lumen/Watt for Indoor Light fittings. II.>100 Lumen/Watt for Street Light up to 45 watt &>110 lumen/Watt above 45 Watt. III. >110 Lumen/Watt for Flood Light up to 100 Watt & >120 lumen/Watt above 100 Watt. IV. >120 lumen/Watt for Highbay Fittings up to 100 Watt &> 140 Lumen/Watt above 100 Watt.
4	LED Life	> 50,000 Burning Hours.
5	Depreciation	30% max. after 50,000 Burning Hours.
6	Nominal Voltage	220 V, 50 Hz AC
7	Input Operation Voltage	90-300 Volts AC
8	Control of Distribution	Fully cut Off
9	Driver Type	Constant Current Driver with short circuit Protection.
10	Driver Component	Industrial Grade only
11	THD	< 10 %

12	Efficiency of Driver	> 90 %
13	Driver Surge Protection	10 KV
14	Color Temperature	5665 $\pm$ 355 K
15	Color Rendering Index	$\geq$ 65
16	Power Factor	> 0.95
17	Construction of Housing	Extruded Aluminum /CRCA/ Die Cast Aluminum
18	Finishing	Powder coated / anodized
19	Lamp cover	Poly Carbonate / Toughened glass
20	Secondary Optics	Poly carbonate reflector / Poly carbonate lens
21	Mounting	Suitable for surface /recessed /Pole (as per requirement)
22	Ingress Protection	For Indoor :- IP20 & for Out Door :- IP 65
23	Temperature Rise	Soldering point temperature of the LEDs must be equal to or less than 85 <sup>0</sup> C. Temperature rise (above ambient) of heat sink should generally remain within 20 <sup>0</sup> C.
24	Report to be submitted	LM 79, duly certified by NABL accredited Lab- for LED Luminaire Performance. LM 80, duly certified by accredited Lab of the host country for LED Chip Performance.

#### **34.Schedule item no. A(I)-26**

**Supply, erection, testing & commissioning of Astronomical Timer 3Ph with multitime setting including suitable contactor of 100 Amp.**

Supply, erection, testing and commissioning of Astronomical Street Light timers for automatic controlling of street lighting with 100Amp contactor power, AC-1 rating 440V, 50Hz confirming to IS 60947-4-1.

**GENERIC** ATSC is an intelligent Street light control timer that can be used to control several existing street light

#### **Technical specification for Street Light Timer**

1	Operating Voltage	240VAC
2	Rated Frequency	50 Hz
3	Installation Type	DIN Rail
4	Type of Contact	Changeover Contact
5	Program Functions	ON/OFF
6	Number of Programming	8 ON/8 OFF (or) better
7	Power Reserve	48 Hrs (or) better
8	Switching Capacity at 250 VAC, cos =1	43A
9	Switching Capacity at 250 VAC, cos=0.6	24A
10	Shortest Switching Time	< 1 Min
11	Mechanical Life	10 <sup>7</sup> or more
12	Electrical Life	10 <sup>5</sup> or more
13	Time Accuracy	< 2 s/day
14	Power Consumption	< 4 VA
15	Degree of Protection	IP 65
16	Ambient Temperature	10°C to + 40° C
17	Over voltage protection	260 V $\pm$ 5V
18	Under voltage protection per phase	160 V $\pm$ 5V
19	Over load minimum 10% of rated load	protection per phase
20	Programmable time switch	Programmable time switch shall automatically adjust the ON/OFF set



		time along with seasonal variations like sun rise and sun set as per the geographical area
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### **35.Schedule item no. A(I)-11, A(III)-9**

**Provision for supply & laying of 10 Sq. mm copper unarmoured, multistrand, PVC insulated PVC sheathed wire, alongwith earth wire of 1.5 Sq. mm. copper PVC insulated/heathed wire in separate PVC casing-capping with all accessories. (Sub Main - 32 Amp MCCB to DB).**

The wiring for sub-mains shall consist of two wires of single core 10 sq.mm. PVC insulated multistranded FRLS copper wire of 1.1 KV ISI mark and confirming to IS-694/1990 or latest grade on rigid PVC casing capping/ PVC conduit along with running earthing with one wire of 2.5 sq.mm. wire insulated with green colour PVC. For measurement purpose each meter of submain shall comprise of 2 wires of 10 sq.mm. of 1 mtr. length each and one earthing wire of 2.5 sq.mm of 1 mtr. length along with associated accessories like PVC casing –capping/ PVC conduit etc. The sub-mains shall be run inside the PVC casing capping /PVC conduit of suitable size as per site condition as per standard practice specified above as per the instructions of field Engineer. The item submain shall be measured only for length upto switch board in room . The remaining wiring will be as per specification given for point wiring as stated in specification for point wiring in this technical specification.

### **36.Schedule item no. B-43**

**Supply, erection, testing and commissioning of flexible Copper Cable 3 core 2.5 sqmm**

Supply, erection, testing and commissioning of water proof PVC insulated and sheathed flat flexible 1100 V grade Copper Cable 3 core x 4 sq.mm conforming to IS: 694/1990 for the motor supply connected through a water tight sealing device and suitably clamped at fixed intervals with column pipe assembly.

### **37.Schedule item no. A(I)-30 to A(I)-36, A(I)-40, B-17 to B-23, B-27**

**Supply of 4 core 16 sqmm armoured XLPE Cable.**

**Supply of 4 core 25 sqmm armoured XLPE Cable.**

**Supply of 4 Core 70 Sqmm armoured LT XLPE Cable.**

**Supply of 4 core 300 sqmm armoured LT XLPE cable ISI mark.**

**Supply, laying, running fixing of size 4 core 95 sqmm Aluminium Conductor, XLPE insulated, PVC sheathed, armoured cables as per relevant IS, with cable marker in trench or saddle on the wall/truss or with GI saddles etc.**

**Trenching & refilling of LT/HT/ Various sizes of PVC / XLPE cables- Along the Road (Size - 900mm x 300mm)**

**Digging of cable trench 300/450 mm x 1000 mm in RCC/PCC/hard soil & refilling as per specification and requirement at the site.**

**Transportation, Laying, Installation, terminating, testing and commissioning of LT/HT cable of sizes 10 sqmm to 400 sqmm in existing trench, pipe or on structure.**

**Erection,testing and commissioning of cables other than trench i.e.Wall/Truss including clamp, GI wire and hardware**

**Supply and laying of RCC Hume Pipe of size 6"(150mm) dia 2 mtr. Length.**

### **LT XLPE Copper Cable**

Cable shall be cross linked polyethylene and XLPE insulated PVC outer sheathed cable with copper conductor suitable for rated voltage at 1100 V grade and confirming to IS : 7098 Part -1 1988 with amendment number 1, 2 & 3 Reaffirmed 2005 or latest.

Armouring – Galvanised steel strip armoured

Shape of conductor -stranded

No. of core – 4 core / 2 core (as per schedule item description)

BIS marked,

Material of conductor – Copper EC grade.

Cable to be supplied on wooden drums confirming to IS : 10418/82 with latest amendments.

In addition to marking requirement as per relevant specification, sequential marking for length, size of the cable, type of the cable & drum No., shall be embossed /printed on the cable.

#### **LT XLPE Aluminium Cable –**

Cable shall be cross linked polyethylene (XLPE) insulated PVC outer sheathed cable with alluminium conductor suitable for rated voltage at 1100 V grade and confirming to IS : 7098 Part -1 1988 with amendment number 1, 2 & 3 Reaffirmed 2005 or latest.

Armouring – Galvanised steel strip armoured

Shape of conductor -stranded

No. of core – 4 core / 2 core (as per schedule item description)

BIS marked,

Material of conductor – Aluminium EC grade.

Cable to be supplied on wooden drums confirming to IS : 10418/82 with latest amendments.

In addition to marking requirement as per relevant specification, sequential marking for length, size of the cable, type of the cable & drum No., shall be embossed/printed on of the cable.

### **1. SPECIFICATION OF CABLES**

#### **1.1 L.T CABLE**

Cross linked polyethylene insulated PVC sheathed conductor cable with common covering over cores, provided other by extended inner sheath of thermo plastic vulcanized or invulcanized rubber galvanized single trip armoring suitable for 1100 volts grade conforming to IS 157098 (Pt-I) of 1988 with latest amendments size of cable should be as per requirement shown in plan & scope of work.

#### **1.2 ARMORING**

Armoring of cable should be conform to ISS: 3975/79

#### **1.3 INSULATION**

The insulation of cable should conform to IS 7098 - Pt. -I –1988 table I.

#### **1.4 ALUMINUM CONDUCTOR**

The Aluminum conductor should comply with 8130-1984

#### **1.5 CABLE**

It should be ISI marked and should be of the make specified in attached approved list of Materials

#### **LAYING OF LT / HT CABLE -**

(A)The cable laying shall confirm to IS 1255/1983 or latest. The cable shall be laid by digging a trench in the ground and laying cables on a bedding of minimum 75mm riddled soil or fine sand at the bottom of the trench and covering it with additional riddled soil or sand of minimum 75 mm. The width of the trench should be at-least 300mm(12") and make the surface as original/earlier.

(B)Cable should be covered with best quality of tiles, bricks or slabs continuously on entire length of cable. Layer of bricks/ tiles / slabs shall be ensured to protect the cable from damages. After that it shall be refilled properly upto the ground surface keeping a crown of 150mm (6") above the ground level.(FOR LT CABLE)

(C) The cable shall be covered with RCC Warning Cover of size 450mm X175mmX 37mm (18"X7"X1.5") completely. After that it shall be refilled properly upto the ground surface keeping a crown of 150mm(6") above the ground level.(FOR HT CABLE)

(D) Cable marker should be provided at a spacing of 50 Mtrs. On straight runs one marker at 50 Mtr shall be provided and ends of track or road crossing or as per instructions of railways engineer at every turning of cable. (FOR HT CABLE)

(E) While terminating the cable on the wall, it shall be fixed with the help of “J” hooks and secured properly on walls. Size of hook shall depend on size and weight of the cable.

(F) Where cable has to be taken on pole the suitable size of clamp, nut Bolt shall be used. The cable shall go through GI pipe of suitable size.

(G) The laying of RCC pipe /GI pipe /PVC pipe is also the part of cable laying cost under track /Road/ on pole. However supply of RCC hume pipe /GI pipe/PVC pipe shall be covered separately in schedule or supplied by Rly. at SSE's depot.

(H) Wherever cables are to be taken through pipe on existing steel structures / walls, the pipe shall be supported on steel structures with suitable and proper clamps made from 50 X 6 mm thick GI flat, fixed to the structures with, 16 mm dia GI bolt, nut and plain, spring washer.

(I) **MINIMUM PERMISSIBLE BENDING RADII** –The cable should not be bent to sharp radius. Wherever possible larger radii should be used. Minimum recommended Bending Radii are given as follows-

VOLTAGE RATING	PVC & XLPE CABLE	
	Single core	Multi core
Upto 1.1	15 D	12 D
Above 1.1 to 11	15 D	15 D
Above 11	20 D	15 D

Note D' is outer diameter of cable. Special precaution should be taken so as not to damage the cable. At joints and terminations bending radius for the individual cores should be above 12 times the diameter over the insulation.

(J) **DEPTH :-** The desired minimum depth of laying from ground surface to the top of cables is as follows-

i) Cable up to 11 KV rating =0.9 mtr

ii) 22 KV to 33 KV rating =1.05 mtr

iii) Cables at road crossing =1.00 mtr

iv) Cables at railway level crossing (measured From bottom of sleepers to the top of pipe) =1.00 mtr

Supply and laying of RCC Hume Pipe of size 6"(150mm) dia of 2 mtr. Length for each pipe of standard thickness as per IS 451 Type – NP-2 in provided depth below ground /Road/Track to enclose the cable and necessary back filling.

Note : LT XLPE cable to be terminated by suitable termination kit of reputed make.

### **TESTING OF CABLE-**

i. After laying the XLPE cable and making the cable end termination, it shall be tested by the contractor with high pressure testing equipment as per relevant IS specification in the presence of Railway representative. High pressure testing set shall be arranged by the contractor at site.

ii. Insulation resistance reading of the cable shall be taken before the contractor is allowed to lay the cable or allowed to carry out cable end termination work.

iii. Insulation resistance (IR) values of cable shall be taken in the presence of Railway representative before and after the high pressure testing. Tenderer shall ensure the IR value does not reduce appreciably after carrying out the cable laying, making cable end termination and high pressure testing

iv. The test results jointly be signed by the contractor and SrDEE(G)'s authorized representative.

Laying erection, testing and commissioning of LT 1100V grade PVC armoured aluminium conductor cable of various size as per specification.

Laying/Erection, testing and commissioning of XLPE armored cable with continuous GI Earth wire, Glands/lugs etc. on wall /trusses/pole/pipe etc as per the instruction of field engineer.

### Clearances

The desired minimum clearances are as follows -

Power cable to control cable - 200 mm

Power cable to communication cable - 300 mm

Power cable to gas / water main - 300 mm

Power to power cable - Clearance not necessary: however, larger the clearance, better would be current carrying capacity.

CABLE LAYING (HT & LT) SHOWN		
1	SEPARATE Date of test	
2	Voltage of megger used	
3	Location From & To	
4	Size in sqmm	
5	Total length	
6	Megger value at the time of issue	
7	Megger value during laying & before covering	
8	Signature of contractor	
<b>High voltage testing before commissioning HT/LT cable and overhead lines work</b>		
<b>Cable works</b>		
(1)	i) Wherever high voltage test was conduct	Yes / No
(2)	ii) If conducted, system of supply	
	Test H/V applied (in KV)	
	For Minutes	
	Result of test	Satisfactory / Unsatisfactory
(3)	iii) If not conducted	
	Voltage of megger used	
	Result of megger used	
	Result of megger testing	
	Between R & Y Y & B B & R	
	Between R & N Y & N B & N	
	Between R & E Y & E B & E N & E	
	Signature of contractor's	
(4)	<b>Cable jointing</b>	
	No of joint	
	Location	
	Type of jointing	
	Size of cable I II	
	Clause Nos	
	Voltage of megger used I II	

<b>(5)</b>	<b>i) Insulation resistance before jointing cable</b>	
	Cable I a) Between R & Y Y & B B & R	
	b) -do- R & N Y & N B & N	
	c) -do- R & E Y & E N & E	
	Cable II a) Between R & Y Y & B B & R	
	b) -do- R & N Y & N B & N	
	c) -do- R & E Y & E N & E	
<b>(6)</b>	<b>ii) Insulation resistance of jointed cable</b>	
	Cable a) Between R & Y Y & B B & R	
	b) -do- R & N Y & N B & N	
	c) -do- R & E Y & E N & E	
	Signature of contractor	
<b>(7)</b>	<b><u>IS for Cables</u></b>	
1	IS : 7098 (Part-I)	Cross linked polyethylene insulated PVC sheathed cable for working voltage and including 1100 Volts.
2	IS : 1554 (Part-I)	PVC insulated (heavy duty) electric cables for working voltage upto and including 1100V.
3	IS : 3961 (Part-II)	Recommended current ratings for cables.
4	IS : 3975	Mild steel wires, strips and tapes for armouring of cables
5	IS : 4905	Methods for random sampling
6	IS : 5831	PVC insulation and sheath of electrical cables.
7	IS : 8130	Conductors for insulated electrical cables and flexible cords
8	IS : 10418	Specification for drums for electric cables.
9	IS : 10810	Method of tests for cables.
10	ASTM-D-2843	Standard test method for density of smoke from the burning or decomposition of plastics.
11	ASTM-D-2863	Standard method for measuring the minimum

		oxygen concentration to support E3 candle like construction plastics.
12	IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
13	SS:424-1475	Flammability testing of cables.
<b>(8)</b>	<b>Technical parameters-</b>	
1	Power system details	415 V +/-10%, 3 phase, 4 wire solidly earthed.
2	Frequency	50 Hz.
3	Size of cable, conductor & quantity	As per S.O.Q.
4	Core identification	Colour scheme as per IS 1554 (part I) /88 or latest
5	Conductor	Stranded circular/sector shape core Aluminium/Copper conductor
6	Rated voltage	1100 Volts
7	Insulation	XLPE
8	Maximum conductor temperature at rated current.	90°C
9	Maximum conductor temperature during short circuit under hot condition	250°C
10	Inner sheath	Extruded PVC inner sheath
11	Filler material	If used, shall be compatible with other materials of cable construction
12	Armouring	Single layer galvanized steel round wire/ flat strip armoured.
13	Overall serving (outer sheath)	Anti rodent and anti termite extruded black FRLS grade PVC sheath (Type ST-2)
14	Embossing on the cable	Cable shall be embossed / printed on the outer sheath at every 1 m. length as under :1.1 kV, PVCA/XLPE, conductor material, No. of core and size of cable, sequential marking for the metered length of cable, make and year of manufacturing

### **38.Schedule item no. B-28**

#### **Supply & erection of cast iron cable marker.**

The cost includes supply erection, testing and commissioning of Cable marker shall consist of M. S. angle of size 35x35x6mm welded with 8mm thick rounded shape Cast Iron plate of 120mm dia, with Raised embossed 2 mm Lettering C.R. CABLE 11KV. M.S. angle shall be welded with cast iron plate 8mm thick of 120 mm dia. MS flat shall be welded at bottom. Item shall be hot dip galvanized in an approved manner.

### **39.Schedule item no. A(I)-8**

#### **Supply, erection, testing & commissioning of 2x4 sqmm FR Stranded/solid copper PVC insulated wire laid inside of pole for connecting the luminaries.**

Supply, erection, testing and commissioning of 2 x 4 sq mm 1100V grade PVC FR copper wire. The wiring shall consist of two wires of single core 4 sq.mm. PVC insulated multi-stranded FR copper wire of 1.1 KV grade on rigid PVC casing capping/ PVC conduit.

The wire shall be run inside the PVC casing capping /PVC conduit of suitable size as per site condition as per standard practice specified above as per the instructions of field Engineer. The wire shall be measured only for length upto fitting.

**40.Schedule item no. A(I)-37, B-24**

**Supply & laying of GI pipe Class B, ISI marked under road /Clamping with erecting pole or wall as per technical specification & drawing for passing cable.**

Supply & laying of GI pipe Class B, ISI marked under road /Clamping with erecting pole or wall as per technical specification & drawing for passing cable of dia 50-63mm.

This item shall be in conformity to IS 5613/Pt.I Sec. 1 & 2/1985 (Latest Version). GI pipe shall conform to IS 1239/Pt.I/1990 and fittings shall conform to IS 1239/Pt.II/1992(Latest Version).

**41.Schedule item no. A(I)-38, B-25**

**Supply, installation, testing & commissioning of HDPE Pipe 110 mm Nominal Dia as per IS-4984-1995.**

Supply, installation, testing & commissioning of HDPE Pipe 110 mm nominal dia & laying of HDPE (High Density Poly Ethylene polymers) pipe of Material Grade- PE 63 grade, IS 4984 Resistance to chemicals- Exceptional resistance to all external and internal corrosion. Resistant to electrolytic corrosion.

Indian Standards - IS-4984, IS 14151, IS 14333, IS 14930 (part2), IS 14885, IS 16098 (part2).

**42.Schedule item no. A(I)-39, B-26**

**Supply and laying of RCC half round pipe 150 mm ID & 1 mtr length.**

The contractor shall supply half Round RCC pipe of 150mm inner dia. and 1 Mtr in length as per given description. The internal surface shall have a smooth finish without any bulge or projections to avoid damage to the cable.

Internal dia.	External dia.	Thickness	Approx. Weight	Approx. Steel Weight
150mm	184 mm	25 mm	14.5 kg	240 gm

Laying of Pipe - Half round pipes shall be laid above cables for mechanical protection on laid cables in the existing trench. After doing this the trench can be filled up with soil available thereby.

If any damage done, contractor will make good the same on his own cost. The cost of damage will be decided by Railway.

**Note** - Inspection will be carried out as per inspection clause.

**43.Schedule item no. A(I)-42**

**Supply & Erection of RCC Warning Cover and refilling the cable trench in an approved manner.**

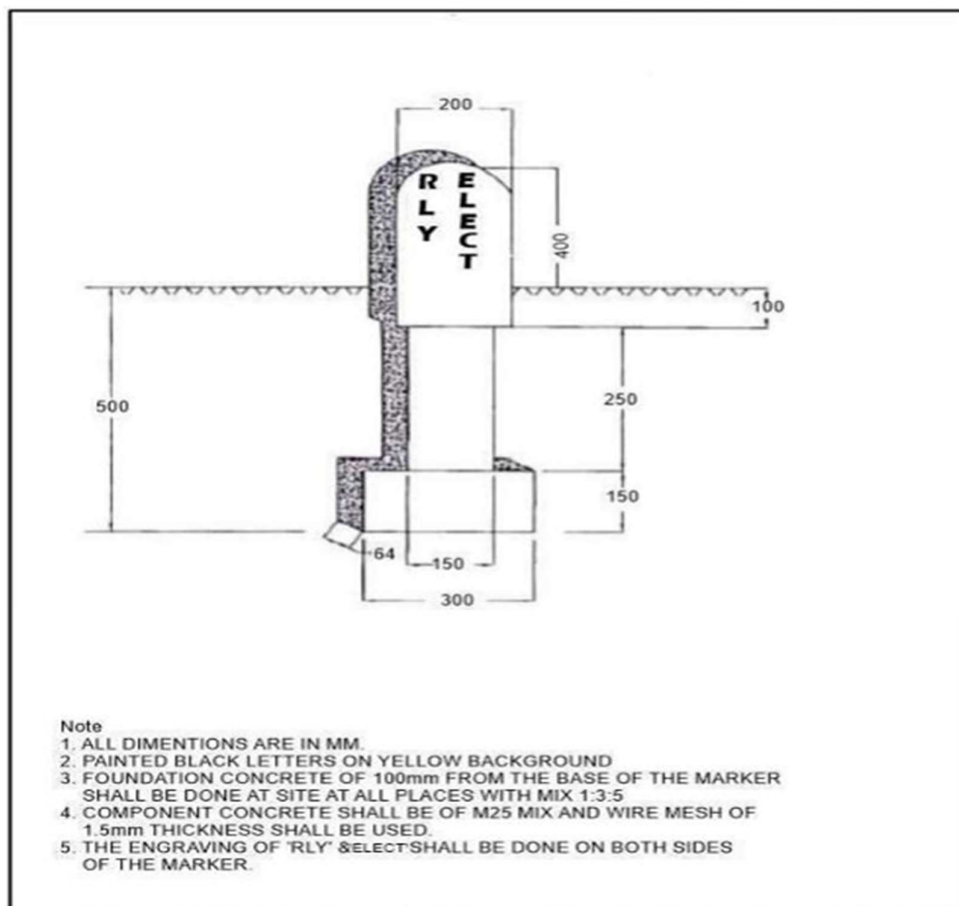
The price shall cover supply, erection testing commissioning of **RCC Warning Cover and refilling the cable trench** of size 450mm X175mmX 37mm (18"X7"X1.5") completely. After that it shall be refilled properly upto the ground surface keeping a crown of 150mm (6") above the ground level.

**44.Schedule item no. A(I)-41**

**Supply, erection of RCC Type Cable route marker with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) of size 60 cm X 60 cm at the bottom and 50 cm X 50 cm at the top with a thickness of 10cm including inscription duly engraved as required.**

The rate includes casting and fixing of cable route marker as per drawing (attached below) at a distance of approx. 50 mtrs or as per site requirement along the trench and at places where the

cable route has taken diversion as per instruction of site Engineer. This includes casting of foundation at site and fixing of the marker in the foundation made earlier at site as per railway directives and specifications. This also includes proper curing of the structure. All materials required for this like cement, sand, 15 mm chips and steel rod of ISI marks should be supplied by the tenderer.



#### **45.Schedule item no. A(I)-43, A(III)-20, B-33**

**Supply, fabrication, fixing and erection of MS work of miscellaneous size and for cable tray etc. including painting complete.**

The price shall cover the cost of Work includes fabricating and erecting MS work, riveted, bolted or welded in built up sections including cutting, grinding and straightening, drilling, riveting, handling, hoisting and fixing in position etc. including applying a priming coat of approved steel primer etc. and duly painted with fine finish with contractors steel and materials. The work shall be done as per the site requirement in an approved manner and as per the instructions of field supervisor.

#### **46.Schedule item no. B-31**

**Supply, fabrication, laying welding and connection of GI Flat of size 25x3 mm from earth pit with GI nut Bolt suitable size.**

The work for Supply, fabrication, laying welding and connection of GI Flat/ strip of size 25x3 mm from earth pit with GI nut Bolt suitable size from main earth pit to main board/metallic body of installation. The work shall be done in an approved manner as per site conditions as per the instructions of field engineer. GI flat shall conform to IS-2062 & its latest amendments for steel & Galvanization as per IS-4759/1996 and its latest amendments.



**47. Schedule item no. A(I)-46, A(II)-11, A(III)-23, B-30**

**Supply, erection, testing & commissioning of maintenance free earth as per RDSO specification no. RDSO/PE/SPEC/ PS/0109-008(REV '0') with improved earthing enhancing compound and exothermic welding as per specifications attached.**

The maintenance free earthing arrangement shall be done in accordance with RDSO specification no. RDSO/ PE/ SPE/ PS/ 0109-2008 (REV'0'). For transformers, substation earthing, LT line equipment (**40 kA**), The IR value shall be less than 1 ohm., in normal soil resistivity upto 50 ohm-mtr, single electrode type earth system.

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus. The work shall be done in an approved manner as per site conditions as per the instructions of field Engineer.

**Concentric pipe earth electrode : (Current capacity 40 kA)****Primary conductor -**

MS pipe with 40 mm diameter, class B, ISI mark as per IS-1239, length 3000 mm.

**Secondary conductor -**

MS pipe with 80 mm diameter, class B, ISI mark as per IS-1239, Length 3000 mm.

**Current carrying capacity :** The design of the electrode should be such as to have current carrying capacity in 40 kA (for 1 second).

S.N.	Current Capacity	Primary Conductor diameter	Electrode dimensions (dia. X length)
1	40 kA	40 mm	80 mm x 3000 mm

**Dimensions and Nominal Mass of Steel Tubes — Medium (as per IS 1239)**

Nominal Bore	Outside Diameter		Thickness	Mass of Tube
(mm)	Maximum (mm)	Minimum (mm)	(mm)	Plain End (kg/m)
40	48.8	47.9	3.2	3.56
80	89.5	88.0	4.0	8.36

**Conductive mixture**

- 1) For hermetically filling inside the cavity i.e. between secondary conductor and primary conductor, crystalline compound is to be injected in the electrode assembly. It is a combination of high conductivity metal alloys, copper and aluminium powder, conductive carbon/cement and bonding material etc. mixed in different portion. The mixture is forced (pressurized) filled inside the earth electrode in the paste form and after solidification of the same, the end caps are welded. The metal alloys shall help in conducting the current and conductive carbon gives anti corrosive property. Bonding material should provide strength to the mixture. Resistivity of the mixture shall be less than 0.2 ohm-meter. Resistivity shall be tested by making a 20 cm cube of the material and checking resistance across the opposite face of the cube.

- 2) Complete electrode shall be molecularly bonded by 99.99% pure, high conductivity copper on outer surface with copper coating thickness 300 micron or more.
- 3) Its surface shall be clean and free from any visible oxide layer or foreign material.
- 4) Copper bus bar of size 250 mm x 50 mm x 6 mm having electrical conductivity of 101% IACS, minimum 99.9% copper content shall preferably be exothermically welded to earth electrode or connected with the help of two number stainless steel nut bolts of appropriate size having 4 holes of 12 mm dia. (2 on each side) for connecting earthing conductor.

**Minimum quantity of earth enhancement material to be supplies :**

For 5'x5'x10' earth pit – min 75 kgs per pit

For 300 mm bore type earth pit – min 50 kgs per pit

The earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with manufacturers name or trade name, quantity, batch no & date of manufacture.

**Warranty : 05 year against earth electrode for copper plating. If found faded or corrosive whole earthing is to be replaced by tenderer.**

**Note :** *Earthing Pit Box should be supplied & erected by contractor. Also necessary cementing work to be done by contractor to make site as original.*

**R.C.C. earth pit box**

R.C.C. earth pit box of size 450 X 450 X 50mm including cover of size 450 X 450 X 4.5mm along with white wash. The work shall be done in an approved manner as per the instructions of field supervisor.

**PVC Large Earth Pit**

PVC Large Earth Pit Cover (10 inches) At Top (Dia) -252 mm At Bottom (Dia) – 334 mm Height – 260 mm (IS-3043).

**Special Features -**

- A durable round valve box ideal for commercial and residential installation.
- Round Valve box extra support for strong load
- Twist lock design cover
- UV Resistant
- Pipe cutouts for quick and easy installation
- Damper proof

➤ **Every individual earth shall be allotted a serial number. Following information shall be suitably written with white or yellow paint.**

- a) Earth No. \_\_\_\_\_
- b) Individual earth resistance \_\_\_\_\_ ohms
- c) Overall earth resistance \_\_\_\_\_ ohms
- d) Date of test \_\_\_\_\_

**Test report of earthing system (To be connected by earth Tester)**

**i) Individual Earth Resistance**

Earth Electrode No 1 \_\_\_\_\_ ohm

Earth Electrode No 2 \_\_\_\_\_ ohms

Earth Electrode No 3 \_\_\_\_\_ ohms

**ii) Overall Earth Resistance:**

a) HT earth electrode \_\_\_\_\_ ohms

b) LT earth electrode \_\_\_\_\_ ohms

c) Neutral earth electrode \_\_\_\_\_ ohms

Note: Before energization of installation earthing system will have to be checked by contractor in presence of Sr. DEE/G/BSL's authorized representative/Site in charge and test report be submitted to Sr. DEE/G/BSL for his approval on above prescribed Performa.

Signature of Tenderer

**48.Schedule Item No. A(II)-9**

**Supply, Erection, Testing & Commissioning of Microprocessor Based Equipment functional item.**

The price shall cover Transportation, Supply and erection of microprocessor based equipment functional item. The proposed functional item to be supplied to the Sr.DEE(G)BSL office after completing the formalities with concerned stores depot of Rly. The details requirement of various type of functional items will be advised to the successful tenderer at the appropriate times as per requirement of department based on the prevailing market rate of various type of functional item keeping the total cost of schedule cost same.

**49.Schedule item no. B-32**

**Supply & erection of FRP junction box of suitable size having terminals and 1x16 A Cut out with Two Nos of entry glands.**

Supply & erection of FRP junction box of suitable size having terminals and 1x16 A Cut out with Two Nos of entry glands.

The junction box should be water tight made of FRP of size 300 x 200 x 125 mm, 2.7 mm thick with electrically insulated body shock proof, connector leads and control equipped with 1 nos.16 amps cutout and rewirable fuse. The box should be of front door opening with rubber gasket to make it water tight. The junction box shall be vermin proof having rubber bushes at cable entry. The junction box shall be mounted on pole/ wall etc at the height of 1.50 mtrs or as per site condition by providing MS clamps of suitable size. Colour of junction box shall be got approved before erection. The junction box shall be erected in an approved manner as per the site condition and instructions of field Engineer.

**50.Schedule item no. A(I)-27**

**Supply, erection, testing & commissioning of self contained drinking water cooler unit energy efficient compressor IS mark suitable for operation on 230 V +10 % 50 cycle single phase Ac supply storage capacity 150 Ltr cooling capacity 150 Ltr/Hr complete in place of old one as per specification.**

The description of Schedule Item is self-explanatory. The Contractor will have to make own arrangement for transportation up to work site. The erection is to be done at nominated place, the work also include electrical connections, painting of CR number with stencil and commissioning of water cooler.

The water cooler shall have following function.

1) Water tank sheet material – Stainless Steel (SS 304)

Water tank sheet thickness – minimum 0.5 mm

2) Drip Tray - Stainless Steel (SS 304)

3) Faucet material – Brass (Cr Plated)

4) Condenser tubing – Grooved copper.

5) Legs – PP (B120mA)

6) Water inlet- hose & overflow pipe shall be provided.

7) Compressor Energy efficient – Hermetically Sealed Type with overload protector, Relay & other accessories make Kirloskar, Denfoss confirming to IS 10617 (Part - I) 1983 with amendments 1 & 2.

8) Refrigerant – R 134a or latest ecofriendly gas.

- 9) Power input – 1550 W
- 10) Final water temperature shall be from 13°C to 18°C  $\pm 2^\circ\text{C}$
- 11) Plastic used in storage tank or any part coming in contact with water shall be of food grade.
- 12) Water cooler storage shall be suitable insulated to keep the water cool for longer period.
- 13) Thermostat – Automatically controls temperature.
- 14) Lock – Locking facility on tank door for safety.
- 15) Anti corrosive – Blue fins on condenser for longer life.
- 16) ISI mark.
- 17) Warranty on machine – 1 yrs.
- 18) Warranty on Compressor – 1 yrs.
- 19) Water tank cover & lid bottom sheet material – Epoxy painted Galvanized Iron Sheet.
- 20) Water tank cover & lid bottom sheet thickness – 2 mm
- 21) Cooler Cabinet – sheet material – Stainless steel – 0.80 mm
- 22) Cooler Cabinet sheet thickness – minimum 0.80 mm

#### **51.Schedule item no. A(I)-28, A(III)-19**

**Supply, erection, testing & commissioning of electric water heater/ geyser Cap- 15 Liters 230 V 50 Hz AC Input-2 KW (Glass Coated Heating Element, inner tank made up of mild steel with blue diamond glass lining tank, Temperature range :- 25-75 Deg Cent., BEE 5 STAR RATING, with wireless remote control.**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of electric water heater/ geyser Cap- 15 Liters 230 V 50 Hz, AC Input-2 KW(Glass Coated Heating Element, inner tank made up of mild steel with blue diamond glass lining tank, Temperature range:- 25-75 Deg Cent., BEE 5 STAR RATING, with wireless remote control.

#### **Features -**

- 1) Anode Rod - The tank has an anode rod with a stainless-steel core that is designed to protect the tank from corrosive elements.
- 2) PUF Insulation - CFC free thicker PUF insulation offers complete protection against radiant heat loss, reduces energy consumption and provides higher energy efficiency
- 3) Whirl flow Technology - It avoids direct contact between cold and hot water flow for a faster heating.
- 4) 0.8 MPa high working pressure - Suitable for high rise buildings. The multi-function valve prevents pressure to increase beyond 8 bar
- 5) Water Resistance and Splash Proof (IPX 4) - Ensure high level of protection for electrical parts from water splashing.
- 6) Adjustable Knob - Adjustable knob for setting the temperature conveniently
- 7) Feroglas Technology
- 8) Incoloy Glass Coated Heating Element
- 9) RCCB for earth leakage protection**
- 10) Shock resistant and rust-proof engineering thermoplastic body
- 11) MULTIPLE SAFETY SYSTEMS Helps in avoiding any operational hazard, ensuring more safety
- 12) HIGH GRADE STAINLESS STEEL TANK Corrosion resistant base material for longer life
- 13) FLAME FAILURE PROTECTION If the flame gets extinguished, the gas flow will be stopped automatically
- 14) AUTO SHUT OFF The Water Heater goes into Standby Mode if the water is not used within 90 minutes. This enhances safety and saves energy

1	Rated Capacity (L)	15 L
2	Wattage	2000 W or as per OEM
3	Star Rating	5 Star
4	Rated Voltage & Frequency	230 V, 1 Phase, 50 Hz AC
9	Inner Tank Warranty	10 Years
10	Body and Electrical Components Warranty	2 Years
11	Heating Element Warranty	6 Years
12	product	4 years
13	Thermostat	Yes
14	Thermal cut off	Yes
15	Net Contents	1 N storage electric water heater, 1 N user manual, 1 N multi-function safety valve, 2 N fasteners 2 N flexi pipes

#### **52.Schedule item no. A(I)-51, B-34**

**Supply, installation, testing & commissioning of 5 Mtr long hot dip galvanised octagonal pole with 130 mm bottom & 70 mm top made up of 3mm thick steel sheet along with base plate of size 200x200x12mm with foundation. (Along with 2 pole RCBO 6A, with 30 mA sensitivity).**

The contractor has to supply and erect Octagonal GI pole 5 mtrs long on cement concrete foundation complete with foundation bolt, inbuilt junction box, etc. Pole shall be got approved from Sr.DEE/G/BSL before supply.

**DESIGN OF POLE:-** The Octagonal Poles shall be designed to withstand the maximum wind speed as per IS 875 as these poles. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole. The pole shall be octagonal cross section and shall be continuously tapered with single longitudinal welding without any circumferential welding. The bottom dia. shall be 130mm (Across Face) and top dia. shall be 70mm (Across Face) made up of 03mm thick plate. The base plate shall be of size not less than 200x200x12mm. The hot dip galvanization shall be not less than 65 micron and shall be uniform and smooth finish. No minus side variation in dimensions is allowed. The octagonal Poles shall have door opening of approximate 400 mm length at the elevation of 600 mm from the Base plate. The door shall be vandal resistance and shall be weather proof to ensure safety of inside connections. The door shall be flush with the exterior surface and shall have suitable locking arrangement. There shall also be suitable arrangement for the purpose of earthing. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section. Bakelite sheet with stud terminal & RCBO shall be provided inside the opening for the purpose of termination of cables /wires. The contractor shall also have to provide suitable bracket on the top of the pole for mounting one/two Nos. Street light fitting. Supply price shall include poles, Suitable bracket, terminal strip & OEM name plate.

**DESIGN OF FOUNDATION :-** The RCC foundation shall be of 500x500 square and 1000 mm long OR 400x400 square and 1300 mm long. The foundation shall be 200mm above the ground level. The foundation shall have 04 Nos. M 16x 600 long “J” type GI bolts along with template and suitable reinforcement. Grade of RCC for foundation shall be M20. The contractor shall arrange cement, sand, concrete & water on their own cost. Connection to the street light fittings shall be given through inside the pole with flexible, 3- core, multistrand copper conductor, PVC insulated & sheathed wire. Erection of pole means RCC foundation, J bolt, wiring, testing & commissioning etc.

**Note:-** The octagonal pole, bracket and foundation bolt shall be supplied by OEM only. The Inspection of poles shall be offered by contractor at the approved make manufacturer's premises at his own cost before supply at site.

**RCBO** - It shall be 2 pole type Earth leakage circuit breaker of rating 6 amps with rated residual operating current of 30 mA. with enclosure. It shall be provided with rotary handle with ON/OFF indication, positive contact indication along with test button for regular inspection. It shall be Conforming to IS 12640-1/2000.

It shall be erected in an approved manner as per site condition & instructions of field supervisor.

**RCBO –**

RCBO shall have conformance to IS 12640-2 / IEC 61009-1.

RCBO shall be of breaking capacity of 10kA.

RCBO shall not be line load biased.

RCBO shall have minimum electric life of 10,000 electric operations.

Single Phase RCBO of 6A-40A to be in 2 Modules size with a breaking capacity of 10kA.

The RCBO shall have separate indications for short circuit fault and earth leakage fault.

The RCBO shall trip on leakage fault of AC waveform consisting of pulsating DC along with transients and harmonics.

The RCBO shall have pollution degree 3.

The RCBO shall have rated impulse withstand of 6 kV.

The RCBO shall have IP20.

The RCBO shall have a test button to check health of RCBO by creating artificial fault.

The RCBO shall be suitable for isolation.

The RCBO shall have bi-connect terminals for both bus bar and cable termination.

The RCBO, up to 63A, shall have cable termination capacity of 35 sq mm for rigid cable & 25 sq mm for flexible.

The RCBO shall have safety shutter to avoid any wrong insertion of cable.

The RCBO shall have operating temperature -5 °C to +60 °C.

The RCBO shall have a provision for padlock to prevent unauthorized access.

The RCBO shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release.

The RCBO shall have DIN clip on both the sides for easy removal of an RCBO from the DIN rail.

### **53.Schedule item no. A(I)-48**

**Supply, erection, testing and commissioning of LT Panel Outdoor type as per IEC 61439 with closing double door powder coated consisting 1x250 A 4 Pole MCCB for I/C and 3x63 A 4 Pole MCCB, 6x32 A 4 Pole RCBO for O/G ELR with CBCT for each MCCB, Power Quality analyzer, 3ph KWH meter, ammeter, voltmeter and other accessories. All MCCB are Microprocessor based (completely wired with suitable communication cable to fetch data from each compartment functional Unit (ACB/MCCB/SFU etc) / Multifunction Meter)**

This specification covers design, manufacture supply, erection, testing and commissioning of cubicle type sheet steel floor mounting, LT panel board for distribution of power.

### **SYSTEM PARTICULARS:-**

<b>RATED VOLTAGE</b>	<b>440 VOLT 3 PHASE 4 WIRE</b>
<b>RATED FREQUENCY</b>	<b>50 HZ.</b>
<b>MAX. AMBIENT TEMPERATURE</b>	<b>55° C</b>
<b>IP rating</b>	<b>Minimum IP 55</b>
<b>Compliance</b>	<b>IEC 61439</b>

## 1. SCOPE

- This Specification covers the design, engineering, manufacture, testing at manufacturer's works before dispatch, packing, forwarding and delivery, supervision of erection, testing at site and commissioning of cubicle type indoor, floor mounted, dust and vermin proof main free standing 415V LT distribution panel / sub distribution panels as per the rating and configuration stated in BOQ complete with all accessories such as protection relays, control wiring, auxiliary contacts, indicating lamps etc.

## 2. STANDARDS

- In general, the equipment shall conform to all relevant IS/IEC standards. In case of any contradiction between the IS/IEC and this specification, the more stringent of the two shall apply.

STANDARD	DESCRIPTION
IEC 61439	Low-voltage switchgear and control gear assemblies
IEC 60228	Conductors of insulated cables
IEC 60255	Measuring relays and protection equipment
IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 60831	Shunt power capacitors of the self-healing type for AC systems having a rated voltage up to and including 1000 V
IEC 60871	Shunt capacitors for AC power systems having a rated voltage above 1000 V
IEC 60898	Electrical accessories – Circuit-breakers for over current protection for household and similar installations
IEC 60947-6-1/EN 60947-6-1	low-voltage and control gear Multiple function equipment. Automatic transfer switching equipment.
IEC 60947-2/EN 60947-2	Specification for low-voltage switchgear and control gear circuit breakers
IEC 60947-1	Specification for low-voltage switchgear and control gear. Contactors and motor- starters. Electromechanical contactors and motor-starters.
IEC 61008	Residual current operated circuit-breakers without integral over current protection for household and similar uses (RCCBs)
IEC 62262	Degrees of protection provided by enclosures for electrical equipment against mechanical impacts(IK code)
IEC 61641	Enclosed low-voltage switchgear and control gear assemblies - Guide for testing under conditions of arcing due to internal fault.
IEC 61869/ BSEN 61869	Instrument transformers
IS 13779	ac Static Watt-hour Meters, Class 1 and 2
IS 13947-5-2	Low-Voltage Switchgear and Control gear, Part 5: Control Circuit Devices and Switching Elements, Section 2: Proximity Switches
IS 13947-5-1	Low-Voltage Switchgear and Control gear, Part 5: Control Circuit Devices and Switching Elements, Section 1: Electromechanical Control Circuit
IS 13947-4-1	Low-Voltage Switchgear and Control gear : Part 4 - Contactors and Motor-Starters

IS 13947-3	Low voltage switchgear and control gear, part 3: switches, disconnectors, switch-disconnectors and fuse combination units
IS 13947-2	Low-Voltage Switchgear and Control gear, Part 2: Circuit Breakers
IS 13947-1	Low-voltage switchgear and control gear, Part 1: General rules
IS 5553	Reactors – Specification

### 3. SWITCHBOARD CONSTRUCTIONAL FEATURES

- The LV switchboards should be certified for compliance with IEC 61439-1 and 2 standards. Their construction, including switchgear, control gear, busbar supports, busbar orientation, and busbar links, shall be identical to the assembly that has compliance tested as per standard.
- The LV switchboards shall be manufactured in accordance with switchgear OEM design guidelines, ensuring full compliance with IEC 61439 standards. The type test certification shall be done by OEM and franchisee shall carry out assembly as per type tested design. To ensure compatibility, both the panel design and the switchgear components (ACB/MCCB/Control gear etc) should be from same OEM. The type designation and certification label on the panel shall prominently feature the OEM's name.
- Manufacturing / Assembly should be done at authorized franchisee works proposed by the switchgear OEM and an authorization certificate must be submitted prior to order finalization.
- The General Arrangement (GA) prepared by the franchisee must be verified by the OEM, who will authenticate it with their signature and stamp with designation and contact number.
- The OEM shall submit type test certificates/reports from an independent test lab (i.e., ASTA, ERDA, or CPRI) for design verification via methods and tests specified in Annexure D of IEC 61439, based on the feeder Incomer's rating, at the time of drawing approval.
- The Switchboards shall be metal clad totally enclosed, floor mounted freestanding, fully compartmentalized bolted type of modular extensible design suitable for indoor mounting.
- All covers and doors provided shall offer adequate safety to operating persons and provide ingress protection as per BOQ.
- Switchboard panels and cubicles shall be fabricated with load bearing members with not less than 2 mm and shall be folded and braced as necessary to provide a rigid support for all components. The doors and covers shall be fabricated from CRCA sheet steel of thickness not less than 1.6 mm.
- The front of the compartment shall feature a concealed hinged door with a key-operated metal camlock, providing secure locking facilities that enhance safety, improve aesthetics, and increase security.
- All doors and covers shall also be fully gasketed with EPDM gaskets to prevent any ingress of dust and vermin.
- Switchboards shall meet the minimum ingress protection (IP) requirements:
  - Indoor applications: IP42
  - Outdoor installations: Min IP55
- There should be generous availability of space for ease of installation and maintenance with adequate safety for working in one vertical section without encountering any live parts.



- **Note – (1) All incoming and outgoing MCCB should be 4 pole microprocessor based with adjustable short circuit, overload, ground fault (LSIG) and earth leakage protection (ELR with CBCT for each MCCB required).**
- **(2) Electrical interlocking between MCCB to be done.**
- **(3) Busbar shall be of copper only.**
- **(4) Busbar size should be same for phase and neutral.**
- **(5) Indicating lamp LED type required for outgoing and incoming supply**

#### 4. SWITCHBOARD COMPARTMENTALIZATION

- For compartmentalized switchboards, separate totally enclosed compartments shall be provided for horizontal bus bars, vertical bus bars, ACBs, MCCBs and cable alleys.
- Hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.
- For all Circuit Breakers separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, bus bars and connections.
- Cable compartments shall be of adequate size for easy termination of all incoming and outgoing cables entering from bottom or top.

#### 5. SWITCHBOARD BUS BARS

- The ratings and configuration of bus bars shall be as per type tested design of OEM.
- The bus bars shall be extensible on either side of the switchboard.
- The bus bars shall be supported on non-breakable, non-hygroscopic SMC insulated supports at regular intervals, to withstand the forces arising from a fault level as stipulated in schedule of quantities. They should have minimum Comparative Tracking Index (CTI) of 600V (as per IS 2824).
- All bus bars shall be color-coded.
- Minimum clearances between phases / live parts shall be 25mm and phases/ live parts/ neutral to ground shall be 19mm except on the equipment terminals.
- **Busbar shall be of copper only.** The current carrying capacity shall be as per IEC 61439.

#### 6. EARTHING

- One earthing terminal shall be provided on each side of switchboard.
- An earth bar size must be at least 1: 6 x 50 sq mm Aluminium (same can be provided with GI or Cu also, if required). Provision for arrangement for 2: 6x50 sq mm shall be possible, if required.
- The earth bar shall be electrically continuous and shall run the full extent of each board.
- Door earthing shall be provided for all doors.

#### 7. INSTRUMENT ACCOMODATION

- Instruments and indicating lamps shall not be mounted on the Air Circuit Breaker Compartment door. A separate and adequate compartment shall be provided, and the instrumentation shall be accessible for testing and maintenance without danger of accidental contact with live parts of the Switchboard.
- For MCCBs, instruments and indicating lamps can be provided on the compartment doors.
- The current transformers for metering and for protection shall be mounted on the solid aluminium bus bars/cables (for wire feeders) with proper supports.

## 8. WIRING

- All wiring for relays and meters shall be with PVC insulated copper conductor wires.
- The wiring shall be coded and labelled with approved ferrules for identification.
- Runs of wires shall be neatly bunched and suitably supported and clamped.
- Means shall be provided for easy identification of wires.
- Identification ferrules shall use at both end of wires.
- All control wires meant for external connections are to be brought out on a terminal board.

## 9. CABLE TERMINATION

- Knockout holes of appropriate size and number shall be provided in the Switchboard in conformity with the location of incoming and outgoing conduits/cables.
- The cable terminations of the Circuit Breakers shall be brought out to terminal cable sockets suitably located.
- The cable terminations for the MCCB's shall be brought out to the rear in the case of rear access switchboards.
- Removable gland plates shall be provided for power and control cables. The gland plates shall be 3 mm thick and for single core cables shall be of non-magnetic material.

## 10. PAINTING AND FINISHING

- Sheet steel used in the fabrication of switchboards shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process after which a coat of primer paint with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 70-micron thickness shall then be provided.

## 11. NAME PLATES AND LABELS

- Suitable engraved black letters on white nameplates and identification labels of metal for all Switchboards and Circuits shall be provided. These shall indicate the feeder number and feeder designation.

## 12. TESTING AND INSPECTION

- The switchgear shall be completely assembled, wired, adjusted and all routine tests as specified by the applicable standard code shall be conducted.
- Visual Inspection and Dimensional Check.
- Verification of Bill of Material.
- Check of conformity with wiring diagrams and plans.
- Functional test for control circuits.
- Tightness of screwed/bolted connections.
- Electrical & mechanical operational checks.

### Note –

- 1) A base channel of 50 mm x 50 mm fabricated out of 3 mm thick hot rolled sheet steel galvanized shall be provided to prevent corrosion of the sheet steel cubicles and facilitate cleaning of floors. All switches shall be operatable from front.
- 2) The LT panel shall be floor mounting type comprising or following items suitably on ½ ft. height foundation or Iron angle frame.

**SWITCH FUSE UNITS :-** Air-Brake, Heavy Duty SFU switch with HRC fuses for incoming and outgoing supply shall be provided Switch fuse unit shall be confirming to IS 13947 pt-3 1993 or latest and HRC fuse confirming to IS 13703 – PT-1&2 -1993 or latest. All SFU should be 4 pole. The panel board shall be provided with following Items:-

**CHANGE OVER SWITCH-** 4 pole, 415 volt onload changeover switch as per IS 13947 (Pt-I&III).

### **MCCB- General Scope**

- The circuit breakers shall comply with the requirement of IEC 60947, IS/IEC 60947-2. MCCBs shall be suitable for operational voltage of 3 phase 415 Volts AC 50/60 HZ supply.
- The circuit breaker shall comply with the isolation function requirement of IEC 60947-2, IS/IEC 60947-2
- MCCBs shall be suitable for 3 Phase 690 Volts AC 50 HZ supply. Rated insulation voltage ( $U_i$ ) 800 V AC and rated Impulse voltage 8 KV.
- They shall be of utilization category A.
- Reference ambient temperature: 40°C.
- MCCB should not have any deration up to 50°C.
- No rating derations in MCCB till 2000-meter altitude.
- The circuit breaker shall provide IP 2X protection for insulation between the front cover and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.
- All products should have BIS certification.
- MCCBs should have  $I_{cs}=I_{cu}$  with Minimum fault level as specified in SOQ.
- MCCBs should Microprocessor based releases with LSIG protection. MCCBs shall be suitable for 3 Phase 415 Volts AC 50/60 Hz supply with rated insulation voltage ( $U_i$ ) of 800VAC and rated Impulse voltage ( $U_{imp}$ ) of 8 kV.
- The MCCB shall have rated ultimate short circuit breaking capacity ( $I_{cu}$ ) equal to rated service short circuit breaking capacity ( $I_{cs}$ ) as per the attached table at 415 volts AC.

	Up to 100A	101- 160A	161-630A
$I_{cu}$ (kA)	25	25	36/50
$I_{cs}$ (kA)	25	25	36/50

- MCCBs shall be designed for both vertical and horizontal mounting, as per recommendation of manufacturer, without any adverse effect on electrical performance.
- True-RMS sensing should be present.
- It shall be possible to supply power either from the upstream or downstream side i.e. there should be no Load-line bias.
- MCCBs shall provide double insulation between the live power parts and the front part of MCCB.
- Manufacturer must furnish Type test certificates of all the models of MCCBs from acceptable, NABL accredited and reputed laboratories to prove the same, if so desired by Engineer.
- The double break mechanism should have Contact Locking Dead-Centre (D/C) mechanism.
- In case of 3 ph, 4 wire system, 4 pole MCCBs to be used.
- All microprocessor based MCCB, the release must have Thermal memory as a standard feature, and there should be provision to defeat Thermal Memory.

### **Construction & Operation**

- MCCB should be supplied along with Extended Rotary handle for interlocking so that it should be possible to ON/OFF MCCB without opening the panel.
- All poles shall operate simultaneously for circuit breaker opening, closing, and tripping.
- MCCBs shall be actuated by a handle that clearly indicated the three positions: ON, OFF and TRIP.
- To ensure suitability for isolation complying with IEC 60947-2.

- The operating mechanism shall be designed such that the handle can only be in OFF and TRIP position if the power contacts are all separated.
  - The MCCB knob should indicate the true position of the contacts.
  - The MCCB should be provided with disconnecting functions with positive isolation features in both OFF and TRIP position.
- MCCBs shall be equipped with a “push to trip” button in front to test operation and opening of the poles.
  - The design & operating principle of MCCB should be of current limiting design with extremely low trip times under short circuit conditions and low thermal stress with compact size and independent manual operation.
  - All MCCBs above 63A shall be provided with Silver Plated Copper Spreader Links for enhancing termination capacity.
  - Operating mechanism of the MCCB shall be quick make, quick break and trip-free type.
  - Protection setting can be adjusted from front.
  - The release should be shrouded from the front to prevent unauthorized access.

#### **Protection Functions for MCCBs**

- Microprocessor-based release the O/L adjustment settings should be from 25% - 100 % and S/C for 1.5 to 12 times.
- Variable earth fault settings should be preferred as per manufacturer's claims.
- Electronic trip units shall comply with the requirements as specified in Appendix-F (EMC/EMI Compatibility) of IEC 60947-2 or EN 60947-2.
- There should be provision of Thermal Memory ON-OFF from the release front fascia itself.
- MCCBs shall be designed to enable safe on-site installation of auxiliaries such as voltage releases (shunt and under voltage releases) and indication switches as follows:
  - They shall be separated from power circuits.
  - All electrical auxiliaries shall be of the snap-in-type.
  - The addition of auxiliaries shall not increase the volume of the circuit breaker.
- The degree of protection of MCCBs should be IP54 (with extended Handle)
- MCCBs should have extended rotary operating handle for easy operation. Door interlock & door defeat feature should be available with extended rotary handles.
- Phase barriers should be an integral part of the MCCBs.
- MCCBs of 63A and above shall be provided with Spreader Links for enhancing termination capacity.
- The MCCB feeder should be equipped with adjustable earth leakage sensing device 0.3A -30A & CBCT and Shunt trip.

**Note – (1) All incoming and outgoing MCCB should be 4 pole microprocessor based with adjustable short circuit, overload, ground fault (LSIG) and earth leakage protection (ELR with CBCT for each MCCB required).**

**(2) Electrical interlocking between MCCB to be done.**

**(3) Busbar shall be of copper only.**

**(4) Busbar size should be same for phase and neutral.**

**(5) Indicating lamp LED type required for outgoing and incoming supply**

**MCB:-** Miniature circuit breaker ‘C’ Class of 10 kA breaking cap. for outgoing supply. MCB as per IEC60947-2.

**Contactor** :- 4 Pole power contactor, AC1 Rating 440 Volt AC 50 Hz. Conform to IS /IEC 60947-4-1

**MCB DB-** MCB Distribution board consisting with various capacity of MCB's as in schedule. MCB shall be 'C' Class, of 10 kA breaking capacity and conforming to IEC60947-2 with latest amendments. MCB shall be with ON/OFF indication, IP 20 degree protection, MCB shall be having bi-connect terminals, load-line reversibility and with energy limitation class –III features.

The MCB Distribution board should conform to IEC61439-3 standard. It shall be provided with cements spill protection and side locking DIN bar interchangeable door.

**ACB-** ACB shall be microprocessor based EDO type having breaking capacity 50 kA with following features.

- 4 pole conforming to IS/IEC- 60947 (Part 1 & 2)
- High short time withstand capacity.  $I_{cu}=I_{cs}=I_{ew}$  for 1 sec total selectivity.
- High mechanical and electrical operating life.
- Advanced micro-processor based protection release with LSING protection & type of fault indication.
- 50% and 200% neutral protection solution
- RoHS compliant.
- Inbuilt Electrical and Mechanical Anti-Pumping prevent multiple breaker closures due to persistent closing command
- CE marking.
- Arc-chute interlocking prevents the closure of breaker if arc-chute is missing or not properly installed.
- Smart-racking shutter interlock ensures breaker is switched off before racking out the breaker.
- Conforms to Glow wire Testing.
- .ACB Release should provide overload / Short Circuit/Instantaneous/Ground fault & Neutral current protection  
IS/IEC 60947-2 & IEC 60947-2.
- Electrical Interlocking between ACB/Switchgears to be done.
- ACB release should give last 10 fault history.

**Bus Coupler** - It shall be similar to incomer switchgears and should be electrically and mechanically interlocked.

**Protection** - over load protection (phase wise) short circuit protection, reverse power over / under voltage & current, under / over frequency, earth fault protection with type of fault indication.

**ELCB/ RCCB-** It shall be 2 pole RCCB 16/25/40/63 A, electromagnetic type with 30 mA sensitivity with earth leakage trip indication complete as per specification with Metal enclosure It shall be Conforming to IS 12640-1/2000. It shall be erected in an approved manner as per site condition and instructions of field supervisor.

**Residual Current Circuit Breakers:** - The RCCB shall have conformance to IS 12640-1 / IEC 61008-1

- The RCCB shall be truly current operated and shall operate on Core Balance Current Transformer (CBCT) mechanism
- The RCCB shall have advanced neutral mechanism
- The RCCB shall have pollution degree 3
- The RCCB shall have minimum electric life of 10,000 electric operations
- The RCCB shall have terminal capacity of 35 sq. mm up to 63A, 50 sq. mm up to 100A
- The RCCB shall have IP20

- The RCCB shall have operating temperature -5 °C to +60 °C.
- The RCCB shall have a test button to check health of RCCB by creating artificial fault
- The RCCB shall have rated impulse withstand up to 6 kV
- The RCCB shall have no line load bias.
- The RCCB shall have bi-connect terminals for both bus bar and cable termination
- The RCCB shall give an indication for leakage fault when tripping
- The RCCB shall have rated conditional short circuit current of 10kA
- The RCCB shall have rated residual making and breaking capacity of 1kA
- The RCCB shall have flag indication for Earth Leakage Faults - The RCCB shall have a provision for padlock to prevent unauthorized access
- The RCCB shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release
- The RCCB shall be suitable for isolation
- The RCCB shall have safety shutter to avoid any wrong insertion of cable
- The RCCB shall have DIN clip on both the sides for easy removal of an RCCB from the DIN rail.

#### **RCBO –**

RCBO shall have conformance to IS 12640-2 / IEC 61009-1.

RCBO shall be of breaking capacity of 10kA.

RCBO shall not be line load biased.

RCBO shall have minimum electric life of 10,000 electric operations.

Single Phase RCBO of 6A-40A to be in 2 Modules size with a breaking capacity of 10kA.

The RCBO shall have separate indications for short circuit fault and earth leakage fault.

The RCBO shall trip on leakage fault of AC waveform consisting of pulsating DC along with transients and harmonics.

The RCBO shall have pollution degree 3.

The RCBO shall have rated impulse withstand of 6 kV.

The RCBO shall have IP20.

The RCBO shall have a test button to check health of RCBO by creating artificial fault.

The RCBO shall be suitable for isolation.

The RCBO shall have bi-connect terminals for both bus bar and cable termination.

The RCBO, up to 63A, shall have cable termination capacity of 35 sq mm for rigid cable & 25 sq mm for flexible.

The RCBO shall have safety shutter to avoid any wrong insertion of cable.

The RCBO shall have operating temperature -5 °C to +60 °C.

The RCBO shall have a provision for padlock to prevent unauthorized access.

The RCBO shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release.

The RCBO shall have DIN clip on both the sides for easy removal of an RCBO from the DIN rail.

**ELECTRONIC KWH METER:-** Electronic KWH meter, 3 phase, 4 wire, CT operated with unbalanced load and reverse protection for AC 415 Volt, 50 Hz supply This shall comply with Is 13779 Pt. I of 1972 and following features –

Instantaneous start, low power consumption, Meter shall record correct energy with same accuracy under reverse current connection. LED indication for current reversal tampering shall be provided. Phase available indication to be provided.

**AMMETER-** Digital type Ammeter 3 1/2 Digit LED display CT operated cap. as per panel requirement with necessary wiring and fixing accessories with selector switch.

**VOLTMETER:** Digital type Voltmeter 3 1/2 Digit LED display 0-750 volts with necessary wiring and fixing accessories with selector switch.

### **Multifunction Meter – Features**

- Accuracy Class 1.0, 0.5
- Input voltage measurement range 50-520 VAC
- Aux supply 80-300 VAC/DC
- CT secondary site selectable 1A / 5A
- Flush mounting 96 x 96 mm
- CT/PT site programmable
- V, A, F, PF, kW, kVA, Old energy, On and Run hours, site selectable kWh/ kVAh
- True PF or Displacement PF site selectable
- 3 line LED display
- With communication port RS485

### **Power Quality Analyzer –**

- Bidirectional MFM with Datalog, LCD Display, RS485, 128 samples/cycle
- Class of accuracy : 0.5s
- Parameters : V, A, F, kW, KVA, kVAh, kVArh, PF(True & Displacement), Run hr, On hr, Interrupts, Phase angle, Total Harmonic Distortion, Neutral current, Max Demand (with RTC) K Factor
- Export / Import
- Events with high-low Time stamp
- Individual Harmonics upto 31<sup>st</sup> order

**INDICATING LAMPS :-** LED type for outgoing and incoming supply separately.

### **GUARANTEE/ WARRANTEE :**

The equipment shall give satisfactory service for 12 month from the date of commissioning or 18 months from the date of supply against all designs, manufacturing, workmanship and material defect. In case of failure of equipment's within 12 months. The contractor shall rectify /replace the defective parts/equipment's free of cost. In case of failure within 3 months from the date of commissioning. The tenderer shall replace the defective equipment's with accessories by new one free of cost. However beyond 3 months the same will be repaired by the contractor as per the existing condition of the defective equipment's.

**WIRING** -The internal control wiring of panel shall be done by FRLS 2.5 sqmm copper wire as per IS 694 as per ratings of connected switchgear in an approved manner. The internal connections shall be easily accessible during inspection and maintenance of the panel board. Sufficient space shall be provided for cable entering hole and cable gland plate at the bottom.

**CABLE ENTRY:** Provision of suitable cable entry through brass glands to connect the equipment to incoming and outgoing cables shall be made. The cable entry to terminal of transformer shall be provided with suitable glands to avoid mechanical damage to the cable insulation. The cable shall be easily accessible.

**Distribution board** -Distribution board shall be made of high quality CRCA steel sheet with surface finish power coated mat finish broken white distribution board double door & neutral link with box type terminal tin plated Electrolyte grade copper bus bar & phase link tin plated brass earthing link and wire set for internal wiring DB shall be with IP 65 protection.

**ERECTION-** The panel board shall be installed on cement concrete foundation and cement mortar ratio of 1:2:4 or fabricated stand of Iron angle frame as per site condition & requirement. Height of

cement concrete foundation / angle frame shall be 1 feet.(1/2 ft below ground level and ½ ft above ground level). Fabricated Iron angle frame shall be of 40mm x 40mm x 4 mm size angle. In Outdoor type panel board top sheet shall be provided such as to protect the panel board from entering the rainy water as per the instructions of field Engineer. Panel board shall be charged with existing power supply arrangement. The work shall be carried out under the supervision of field Engineer.

**Successful tenderer shall submit the General Arrangement Drawing of panel board and get it approved before execution of the work at site.**

**54.Schedule Item No. A(III)-25, B-29**

**Supply, erection, testing and commissioning of LT Panel Outdoor type with closing double door powder coated consisting 1x250 A 4 Pole MCCB for I/C and 3x63 A 4 Pole MCCB, 6x32 A 4 Pole MCB for O/G 3ph KWH meter, ammeter, voltmeter and other accessories. (All MCCB are Microprocessor based)**

**SETC of LT Panel outdoor with closing double door powder coated consisting 800 A x 2 Nos 4P ACB for I/C , 1 x 800 A 4P Bus coupler and 2 x400 A MCCB, 2 x 250 A 4P MCCB, 4 x 125 A MCCB for O/G with 3 Ph KWH meter and other accessories. All MCCB are Microprocessor based (completely wired with suitable communication cable to fetch data from each compartment functional Unit (ACB/MCCB/SFU etc) / Multifunction Meter)**

This specification covers design, manufacture supply, erection, testing and commissioning of cubicle type sheet steel floor mounting, LT panel board for distribution of power.

**SYSTEM PARTICULARS:-**

<b>RATED VOLTAGE</b>	<b>440 VOLT 3 PHASE 4 WIRE</b>
<b>RATED FREQUENCY</b>	<b>50 HZ.</b>
<b>MAX. AMBIENT TEMPERATURE</b>	<b>55° C</b>
<b>IP rating</b>	<b>54 or above</b>

**CONSTRUCTIONAL FEATURES-** The design shall be totally enclosed completely dust tight and vermin proof, neoprene gaskets shall be used between all adjacent units and beneath all covers to render the joints effectively dust proof, Powder coated inside & outside. Sheet steel work shall be of high quality. All openings and out cuts in the doors shall be free from, burrs. Weld runs shall be ground smooth. All sheet surfaces shall be free from dents and hammer marks. A base channel of 50 mm x 50 mm fabricated out of 3 mm thick hot rolled sheet steel galvanized shall be provided to prevent corrosion of the sheet steel cubicles and facilitate cleaning of floors. All switches shall be operatable from front. The compartment of the outgoing switch fuse unit shall be provided with properly interlocking arrangement.

**FABRICATION-**The Control Panel shall be fabricated with CRCA steel sheet 1.6 mm and shall be with front and back opening with locking arrangement. The LT panel shall be floor mounting type comprising or following items suitably on ½ ft. height foundation or Iron angle frame.

**BUSBAR-** Busbar chamber with 4 nos busbars and supported on ceramic / epoxy insulators of 500V cap. as per respective panel. The busbars shall be separated at a distance of 3" minimum and covered with coloured insulated heat shrinkable sleeve /epoxy coating of the red, yellow, blue colour indicating the phases and black for indicating the neutral. Busbar shall be of high conductivity of uniform cross section. Busbar shall be housed in separate bus bar chamber. Capacity of Main/Branch. The connectors between horizontal and vertical bus bar shall be short and neat.



Connections shall be fully enclosed, so as to leave no access to live parts and shall present neat appearance.

**Note** – Busbar shall be of copper only and as per IS 8623-1 (1993). The current carrying capacity shall not be less than **1.25 Amp / 1 sqmm** for copper Busbar and **0.8 Amp / 1 Sqmm** for Aluminium Busbar.

**SWITCH FUSE UNITS :-** Air-Brake, Heavy Duty SFU switch with HRC fuses for incoming and outgoing supply shall be provided Switch fuse unit shall be confirming to IS 13947 pt-3 1993 or latest and HRC fuse confirming to IS 13703 – PT-1&2 -1993 or latest. All SFU should be 4 pole. The panel board shall be provided with following Items:-

**CHANGE OVER SWITCH-** 4 pole, 415 volt onload changeover switch as per IS 13947 (Pt-I&III).

#### **MCCB- General Scope**

- The circuit breakers shall comply with the requirement of IEC 60947, IS/IEC 60947-2. MCCBs shall be suitable for operational voltage of 3 phase 415 Volts AC 50/60 HZ supply.
- The circuit breaker shall comply with the isolation function requirement of IEC 60947-2, IS/IEC 60947-2
- MCCBs shall be suitable for 3 Phase 690 Volts AC 50 HZ supply. Rated insulation voltage ( $U_i$ ) 800 V AC and rated Impulse voltage 8 KV.
- They shall be of utilization category A.
- Reference ambient temperature: 40°C.
- MCCB should not have any deration up to 50°C.
- No rating derations in MCCB till 2000-meter altitude.
- The circuit breaker shall provide IP 2X protection for insulation between the front cover and internal power circuits to avoid any accidental contact with the live main current carrying path with the front cover open.
- All products should have BIS certification.
- MCCBs should have  $I_{cs}=I_{cu}$  with Minimum fault level as specified in SOQ.
- MCCBs should Microprocessor based releases with LSIG protection. MCCBs shall be suitable for 3 Phase 415 Volts AC 50/60 Hz supply with rated insulation voltage ( $U_i$ ) of 800VAC and rated Impulse voltage ( $U_{imp}$ ) of 8 kV.
- The MCCB shall have rated ultimate short circuit breaking capacity ( $I_{cu}$ ) equal to rated service short circuit breaking capacity ( $I_{cs}$ ) as per the attached table at 415 volts AC.

	Up to 100A	101- 160A	161-630A
$I_{cu}$ (kA)	25	25	36/50
$I_{cs}$ (kA)	25	25	36/50

- MCCBs shall be designed for both vertical and horizontal mounting, as per recommendation of manufacturer, without any adverse effect on electrical performance.
- True-RMS sensing should be present.
- It shall be possible to supply power either from the upstream or downstream side i.e. there should be no Load-line bias.
- MCCBs shall provide double insulation between the live power parts and the front part of MCCB.
- Manufacturer must furnish Type test certificates of all the models of MCCBs from acceptable, NABL accredited and reputed laboratories to prove the same, if so desired by Engineer.
- The double break mechanism should have Contact Locking Dead-Centre (D/C) mechanism.

- In case of 3 ph, 4 wire system, 4 pole MCCBs to be used.
- All microprocessor based MCCB, the release must have Thermal memory as a standard feature, and there should be provision to defeat Thermal Memory.

### **Construction & Operation**

- MCCB should be supplied along with Extended Rotary handle for interlocking so that it should be possible to ON/OFF MCCB without opening the panel.
- All poles shall operate simultaneously for circuit breaker opening, closing, and tripping.
- MCCBs shall be actuated by a handle that clearly indicated the three positions: ON, OFF and TRIP.
- To ensure suitability for isolation complying with IEC 60947-2.
  - The operating mechanism shall be designed such that the handle can only be in OFF and TRIP position if the power contacts are all separated.
  - The MCCB knob should indicate the true position of the contacts.
  - The MCCB should be provided with disconnecting functions with positive isolation features in both OFF and TRIP position.
- MCCBs shall be equipped with a “push to trip” button in front to test operation and opening of the poles.
- The design & operating principal of MCCB should be of current limiting design with extremely low trip times under short circuit conditions and low thermal stress with compact size and independent manual operation.
- All MCCBs above 63A shall be provided with Silver Plated Copper Spreader Links for enhancing termination capacity.
- Operating mechanism of the MCCB shall be quick make, quick break and trip-free type.
- Protection setting can be adjusted from front.
- The release should be shrouded from the front to prevent unauthorized access.

### **Protection Functions for MCCBs**

- Microprocessor-based release the O/L adjustment settings should be from 25% - 100 % and S/C for 1.5 to 12 times.
- Variable earth fault settings should be preferred as per manufacturer’s claims.
- Electronic trip units shall comply with the requirements as specified in Appendix-F (EMC/EMI Compatibility) of IEC 60947-2 or EN 60947-2.
- There should be provision of Thermal Memory ON-OFF from the release front fascia itself.
- MCCBs shall be designed to enable safe on-site installation of auxiliaries such as voltage releases (shunt and under voltage releases) and indication switches as follows:
  - They shall be separated from power circuits.
  - All electrical auxiliaries shall be of the snap-in-type.
  - The addition of auxiliaries shall not increase the volume of the circuit breaker.
- The degree of protection of MCCBs should be IP54 (with extended Handle)
- MCCBs should have extended rotary operating handle for easy operation. Door interlock & door defeat feature should be available with extended rotary handles.
- Phase barriers should be an integral part of the MCCBs.
- MCCBs of 63A and above shall be provided with Spreader Links for enhancing termination capacity.
- The MCCB feeder should be equipped with adjustable earth leakage sensing device 0.3A -30A & CBCT and Shunt trip.

- **Note – (1) All incoming and outgoing MCCB should be 4 pole microprocessor based with adjustable short circuit, overload, ground fault (LSIG) and earth leakage protection (ELR with CBCT for each MCCB required).**
- **(2) Electrical interlocking between MCCB to be done.**
- **(3) Busbar shall be of copper only.**
- **(4) Busbar size should be same for phase and neutral.**
- **(5) Indicating lamp LED type required for outgoing and incoming supply**

**MCB:-** Miniature circuit breaker 'C' Class of 10 kA breaking cap. for outgoing supply. MCB as per IS 8828-1976 or latest.

**Contactor :-** 4 Pole power contactor, AC1 Rating 440 Volt AC 50 Hz. Conform to IS / IEC 60947-4-1

**MCB DB-** MCB Distribution board consisting with various capacity of MCB's as in schedule. MCB shall be 'C' Class, of 10 kA breaking capacity and conforming to IS 8828 –78 with latest amendments. MCB shall be with ON/OFF indication, IP 65 degree protection, showing mid trip position in case of overload or short circuit conditions. MCB shall be having bi-connect terminals, load-line reversibility and with energy limitation class –III features.

It shall be provided with cements skill protection and side locking DIN bar interchangeable door.

**Bus Coupler** - It shall be similar to incomer switchgears and should be electrically and mechanically interlocked.

**Protection** - over load protection (phase wise) short circuit protection, reverse power over / under voltage & current, under / over frequency, earth fault protection with type of fault indication.

**ELCB/ RCCB-** It shall be 2 pole RCCB 16/25/40/63 A, electromagnetic type with 30 mA sensitivity with earth leakage trip indication complete as per specification with Metal enclosure. It shall be Conforming to IS 12640-1/2000. It shall be erected in an approved manner as per site condition and instructions of field supervisor.

**Residual Current Circuit Breakers:** - The RCCB shall have conformance to IS 12640-1 / IEC 61008-1

- The RCCB shall be truly current operated and shall operate on Core Balance Current Transformer (CBCT) mechanism
- The RCCB shall have advanced neutral mechanism
- The RCCB shall have pollution degree 3
- The RCCB shall have minimum electric life of 10,000 electric operations
- The RCCB shall have terminal capacity of 35 sq. mm up to 63A, 50 sq. mm up to 100A
- The RCCB shall have IP20
- The RCCB shall have operating temperature -5 °C to +60 °C.
- The RCCB shall have a test button to check health of RCCB by creating artificial fault
- The RCCB shall have rated impulse withstand up to 6 kV
- The RCCB shall have no line load bias.
- The RCCB shall have bi-connect terminals for both bus bar and cable termination
- The RCCB shall give an indication for leakage fault when tripping
- The RCCB shall have rated conditional short circuit current of 10kA
- The RCCB shall have rated residual making and breaking capacity of 1kA
- The RCCB shall have flag indication for Earth Leakage Faults - The RCCB shall have a provision for padlock to prevent unauthorized access
- The RCCB shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release
- The RCCB shall be suitable for isolation

- The RCCB shall have safety shutter to avoid any wrong insertion of cable
- The RCCB shall have DIN clip on both the sides for easy removal of an RCCB from the DIN rail.

#### **RCBO –**

RCBO shall have conformance to IS 12640-2 / IEC 61009-1.

RCBO shall be of breaking capacity of 10kA.

RCBO shall not be line load biased.

RCBO shall have minimum electric life of 10,000 electric operations.

Single Phase RCBO of 6A-40A to be in 2 Modules size with a breaking capacity of 10kA.

The RCBO shall have separate indications for short circuit fault and earth leakage fault.

The RCBO shall trip on leakage fault of AC waveform consisting of pulsating DC along with transients and harmonics.

The RCBO shall have pollution degree 3.

The RCBO shall have rated impulse withstand of 6 kV.

The RCBO shall have IP20.

The RCBO shall have a test button to check health of RCBO by creating artificial fault.

The RCBO shall be suitable for isolation.

The RCBO shall have bi-connect terminals for both bus bar and cable termination.

The RCBO, up to 63A, shall have cable termination capacity of 35 sq mm for rigid cable & 25 sq mm for flexible.

The RCBO shall have safety shutter to avoid any wrong insertion of cable.

The RCBO shall have operating temperature -5 °C to +60 °C.

The RCBO shall have a provision for padlock to prevent unauthorized access.

The RCBO shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release.

The RCBO shall have DIN clip on both the sides for easy removal of an RCBO from the DIN rail.

**ELECTRONIC KWH METER:-** Electronic KWH meter, 3 phase, 4 wire, CT operated with unbalanced load and reverse protection for AC 415 Volt, 50 Hz supply This shall comply with Is 13779 Pt. I of 1972 and following features –

Instantaneous start, low power consumption, Meter shall record correct energy with same accuracy under reverse current connection. LED indication for current reversal tampering shall be provided. Phase available indication to be provided.

**AMMETER-** Digital type Ammeter 3 1/2 Digit LED display CT operated cap. as per panel requirement with necessary wiring and fixing accessories with selector switch.

**VOLTMETER:** Digital type Voltmeter 3 1/2 Digit LED display 0-750 volts with necessary wiring and fixing accessories with selector switch.

**INDICATING LAMPS :-** LED type for outgoing and incoming supply separately.

**WIRING** -The internal control wiring of panel shall be done by FRLS 2.5 sqmm copper wire as per IS 694 as per ratings of connected switchgear in an approved manner. The internal connections shall be easily accessible during inspection and maintenance of the panel board. Sufficient space shall be provided for cable entering hole and cable gland plate at the bottom.

**CABLE ENTRY:** Provision of suitable cable entry through brass glands to connect the equipment to incoming and outgoing cables shall be made. The cable entry to terminal of transformer shall be provided with suitable glands to avoid mechanical damage to the cable insulation. The cable shall be easily accessible.

**Distribution board** -Distribution board shall be made of high quality CRCA steel sheet with surface finish power coated mat finish broken white distribution board double door & neutral link with box type terminal tin plated Electrolyte grade copper bus bar & phase link tin plated brass earthing link and wire set for internal wiring DB shall be with IP 65 protection.

**1)SCOPE:**

The specification covers design, manufacture, testing and commissioning of fabricated lighting / power distribution boards. (Readymade DB to be supplied & installed as per the preferred makes of material & Schedule of Quantity.)

**2)STANDARDS:**

The design, manufacture and testing of lighting/power distribution board shall comply with the latest issue of following standards :

IS – 61439	:	Low-voltage switchgear and control gear assemblies - part 3 distribution boards intended to be operated by ordinary persons ( dbo )
IS - 60529	:	Degree of protection provided by enclosure for low voltage switchgear.
IS 60947	:	LV switchgear
IS 12640	:	Residual current operated circuit- breakers without integral overcurrent protection (RCCB) / with integral overcurrent protection (RCBO) for household and similar uses
IS 14614	:	Residual current-operated protective devices RCDs for household and similar use electromagnetic compatibility
IS 60898	:	Electrical accessories-circuit-breakers for overcurrent protection(MCB) for household and similar installations

**ERECTION-** The panel board shall be installed on cement concrete foundation and cement mortar ratio of 1:2:4 or fabricated stand of Iron angle frame as per site condition & requirement. Height of cement concrete foundation / angle frame shall be 1 feet.(1/2 ft below ground level and ½ ft above ground level). Fabricated Iron angle frame shall be of 40mm x 40mm x 4 mm size angle. In Outdoor type panel board top sheet shall be provided such as to protect the panel board from entering the rainy water as per the instructions of field Engineer. Panel board shall be charged with existing power supply arrangement. The work shall be carried out under the supervision of field Engineer.

**Successful tenderer shall submit the General Arrangement Drawing of panel board and get it approved by Sr. DEE(G)BSL before execution of the work at site.**

**55.Schedule item no. A(II)-19**

**Supply of battery operated Saw cutting having Weight less than 5 Kg Complete.**

The cost includes the supply of battery operated Saw cutting having Weight less than 5 Kg Complete.

**Product Features**

- Outer Rotor BL Brushless motor direct-drive system delivers 0-20 m/s (0-1,200 m/min) (0-3,940 FPM) chain speed for fast cutting, equivalent to 30 mL class engine chain saw
- Kickback brake and Variable speed trigger switch provide high operability equivalent to engine chain saw
- Main power switch with auto power-off function for battery saving and avoiding unintentional start up
- Constant speed control maintains constant speed under heavy load

- Powered by two 18V LXT Li-Ion batteries
- Two 18V LXT Li-Ion batteries deliver power and performance without leaving the 18V LXT platform
- Low vibration level at only 5.3 m/s; for operator comfort
- Low noise level at only 87.7 dB(A) and zero emissions for operator comfort
- Tool-less chain adjustment for convenient operation and maintenance
- Kickback brake & electric brake for maximum productivity and maximum operator safety
- 35 cm guide bar for increased capacity
- Cordless for reduced maintenance; no need to change engine oil or spark plug, clean air filter or drain fuel for storage
- Lightweight for reduced operator fatigue
- Features Extreme Protection Technology (XPT) which is engineered to provide increased dust and water resistance in harsh job site conditions
- Soft grip handle for non-skid operation
- Instant start-up: simply load two 18V LXT batteries and the saw is ready to use
- Adjustable automatic chain lubrication with large oil reservoir
- Large oil filling port with view window allows operator to easily add and check bar oil level
- LED battery indicators show charge level for each 18V LXT battery. Battery protection circuit protects against overloading, over-discharging and over-heating. Lock-off lever prevents accidental startup. Metal spike bumper firmly grips workpiece to provide more control, making cutting easier

#### **Technical Details**

Guide Bar Length : 350 mm (14)

Chain Pitch : 3/8

Chain Gauge : 1.1 / 1.3 mm (0.043 / 0.050)

Chain Speed : 0 – 20 m/s (0 – 1,200 m/min) (0 – 3,940 FPM)

Chain Oil Tank Volume : 200 mL

Sound Pressure Level: 87.7 dB(A)

Sound Power Level: 100.4 dB(A)

Noise K Factor: 2 dB(A)

Vibration Level: Cutting Wood: 5.3 m/s.

Vibration K Factor: Cutting Wood: 1.5 m/s<sup>2</sup>;

Dimensions (L x W x H) : 762x215x235 mm (30x8-1/2x9-1/4)

Net weight: 4.6 – 5.5 kg (10.2 – 12.1 lbs.)

#### **56.Schedule item no. A(II)-20**

#### **Supply of Heavy duty Hammer Drill Machine of approved make.**

The price shall cover the cost of supply of multipurpose Portable corded Power Hammer Drill Machine of confirming to relevant IS/IEC with standard accessories, equivalent to model no. Hilti TE 6-22 + TE-CX 12/22 or similar model.

Type of Product	Cordless Rotary Hammer Kit
Impact Energy	2.6 J
Weight	2.84 Kg
Item Code	TE 6-22 + TE-CX 12/22
Rpm	Hammer Drilling: 1050 RPM
Functionality	Active Torque Control (ATC), Active Vibration Reduction (AVR), Chiselling, Chipping, Depth Gauge, Removable Chuck, Reverse Mode, Torque Clutch, <b>Dust removal system available</b> -TE DRS-4/6, TE DRS-C, TE DRS-D

Package Contains	1x Cordless Rotary Hammer TE 6-22 05, 1x Hilti Grease 50ml, 1x Tool Case TE 6-22 assy, 1x Hammer Drill Bit TE-CX(5) 12/22, 1x Hanger Clip D12, 1x Tool Tether 25lb (11.4 Kg), suitable battery and charger.
Series	TE 6-22
Range	Optimum Hammer Drilling: 6 - 18 mm
Hammer drilling diameter range	4 - 28 mm
A-Weighted Emission Sound Power Level	102 dB (A)
Triaxial Vibration Value	10.7 m/s <sup>2</sup> [For Hammer Drilling into Concrete (ah,HD)], 5.5 m/s <sup>2</sup> (For Chiselling in Concrete)

The drill machine should be with three year warranty. The contractor shall submit warranty certificates from the OEM.

**57.Schedule item no. A(II)-14**

**Supply of Aluminium self supporting ladders, height 10 Foot**

Specification: Bottom Width 28, Reach Height, feet 14, Ladder Closed Height 10, Ladder Open Height 10, Material Aluminium, Type- Self Supporting Strength- Very Strong Step, Details Number of Steps- 1-20, Step Type- Flat, Capacity Minimum Load Capacity, Kg 200 Generic Fitted Bottom Rubber, Side Lock, Side Plug Locking System

**58.Schedule item no. A(II)-21**

**Supply of Hydraulic crimping tools capacity 10 mm<sup>2</sup> to 185 mm<sup>2</sup> dies: R-1 to R13.**

This price includes Handle Material- Plastic, Grip Type- Ergonomic, 5 Stroke Crimping. 360° Rotating head for any angle crimping. Hexagon Die Size: 10, 16, 25, 35, 50, 70, 95, 120, 150, 185mm<sup>2</sup> Compact , light weight design Built in safety valve for high pressure, C Type open head & Manual retraction knob.

**59.Schedule item no. A(II)-22**

**Portable hand held electric air blower (Detail specification attached.) DEWALT Fibre Body Handheld Electric Blower, Warranty 12 months**

Product Specification for Fibre Body Handheld Electric Blower, Warranty 12 months Specification- Generic Material Type- Fibre Body, Technical Parameters: Phase- Single Phase, Frequency - 50 Hz Load Speed- RPM 16000, Air Volume- 3.8 m<sup>3</sup>/min, Voltage- 230, Full Load Current- 1.8 A, Power Consumption- 800 Watt, Cord Specifications Cord Material- PVC Cord Length 3 Mtr.

**60.Schedule item no. A(II)-24**

**Long Range 1KM Torch Light Beam Battery Included 1500 Lumens. Make:- Nei, Ascebtch, kinnav or similar as per annexure-I (make list attached)**

1	Type of lamp	LED
2	Dia of search light (mm)	126 to 150 or as per design
3	Wattage of lamp (Watt)	55
4	Color temperature (Degree K)	5500 to 6500 deg. K
5	Lumens	1500 Lm
6	Beam angle selection	wide
7	Beam Range	Upto 1000 mtr

8	Range of Narrow beam angle (Degree) and Range of wide beam angle (Degree)	Up to 4 deg.
9	Type of front glass	Toughened, scratch resistant
10	One hand operated switch	Yes
11	Built-in battery charger	Yes
12	Type of battery	Lithium ion
13	Battery voltage	3.7 V
14	Battery capacity	5000 mAh
15	Provision of Lanyard/ strap	Yes
16	Type of housing material	ALUMINIUM
17	Operation modes	1. HIGH 2. LOW 3. FLASH
18	Accessories such as battery charger with cable for External type Charging cable for inbuilt type	Yes
19	Protection against reverse polarity	Yes
20	Protection from battery over discharge	Yes
21	Protection from battery over-charge	Yes
22	Short circuit protection	Yes
23	Operating Temperature range (Degree C)	-10 deg C to +50 deg c
24	IP designation for Ingress protection	IP 65

#### **61.Schedule item no. A(II)-15**

##### **Supply of Digital Megger 2500V.**

Supply of approved make Digital (Megger) type 2500 V, 2000 M-ohms with standard accessories and carrying case. Necessary test certificates should be supplied along with the meter.

##### **Safety**

**General** - IEC 61010-1, Pollution Degree 2, IEC 61557-1

**Measurement** - IEC 61010-2-030: CAT IV 600 V, IEC 61010-2-034: 2500 V dc

**Insulation resistance measurement** - IEC 61557-1, IEC 61557-2

**Ingress Protection (IP) Rating** - IEC 60529 IP40

**High Accuracy.**

#### **62.Schedule item no. A(II)-16**

##### **Supply of Digital Clamp on Earth Tester.**

Supply of approved make Digital Clamp on earth tester, range 0-0.01 Ohms/1000 Ohms, complete with all accessories such as pair of leads, carrying case, battery & instruction Manual etc. Make as per list attached in Annexure-I. Necessary test certificates should be supplied along with the meter.

Clamp on Earth / Ground resistance tester (Digital Earth Tester) equipped with Long Jaw suitable for grounding, earthing strip of 65 mm x 32 mm having non contact ground Resustable Tester, Data hold, Noise signal, Ground resistance measurement 0.01 M Ohm to 1000 Ohm suitable for grounding with the flat strip, Jaw size 65 mm. Leakage ground 0.5mA-30A. Auto ranging continuity loop test, Auto power OFF, Jaw 65x32 mm approximate, Battery . Display 4 digit 9999 Count LCD with Test Certificate. Safety as per CE Marking, ROHS and complies to Complies to: IEC61010-1 and IEC61010-2-032.



**Features**

- 1 Non Contact Ground Resistance Measurement
- 1 No Auxillary Electrodes Needed
- 1 Data Storing Memory
- 1 Data Hold, Noise Signal
- 1 Ground Resistance Measurement 0.01V ~1000V
- 1 Suitable for Earthing Strip upto 65mm
- 1 Suitable for Round Conductor upto 25mm F
- 1 Leakage Current (0.5mA~30.00A)
- 1 Auto Ranging
- 1 Continuity Loop Test
- 1 Auto Power Off

**Protection grade :** double insulation

- **External Magnetic Field :** < 40A / m
- **External Electric Field :** < 1V/m

**SAFETY :**

**EMC Directive 2004/108/EC for CE marking**

**Emission :** EN 61326-1:2006 Class B; EN 55011:2009/A1:2010 Group 1 Class B

**Immunity :** EN 61326-1:2006; EN61000-4-2:2009; EN 61000-4-3:2006/A2:2010

**ACCESSORIES :**

Standard Testing Coil (5.1W),  
Strong Carrying Case,  
Batteries & User Manual.

**ELECTRICAL SPECIFICATIONS :**

Accuracy :  $\pm\%$  reading  $\pm$  digits

Environment to guarantee accuracy :  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ , less than 75% RH

**63.Schedule Item No. A(II)-17**

**Supply of Digital Clamp on Meter (Tong Tester).**

**SPECIAL FEATURES :-**

- DC 1000A / AC 800A Clamp-on + Full Multimeter ranges
- Versatile & Handy
- Fully Auto-ranging on all functions
- Backlighted Display (Model 2754A-T)
- 30ms Max HOLD to capture in-rush currents
- Data Hold, Max Hold & Relative Zero Mode
- Fast Audible continuity Test & Diode test
- Auto Power off

**General Specifications :-**

- Sensing : Average sensing (Model 2754A)  
AC TRMS Voltage & Current functions (Model 2754A-T)
- Jaws Opening size : 50mm Max.
- Display :  $3\frac{3}{4}$  digits 4000 counts
- Update Rate : 3 per second nominal
- Polarity : Automatic

- Operating Temperature : 0°C ~ 40°C
- Relative Humidity : Maximum 80%R.H. for Temperature upto 31°C decreasing linearly to 50% R.H. at 40°C
- Altitude : Operating below 2000m
- Storage Temperature : -20°C ~ 60°C, <80% R.H. (with battery removed)
- Temperature Coefficient : Nominal 0.15 x (specified accuracy) / °C @ (0°C ~ 18°C or 28°C ~ 40°C),
- or otherwise Specified
- Power Supply : Standard 1.5V AAA Battery x 2
- Power Consumption : typical 11mA for DCA / ACA & 2.9mA for other Functions
- Low Battery : Below approx. 2.5V
- APO timing : Idle for 30 minutes
- APO Consumption : typical 10mA (Model 2754A); typical 190mA (Model 2754A-T)
- Dimension : 227(L) x 78(W) x 40(H)mm
- Weight : approx 290 gms.

#### **SAFETY :**

Safety : Meets IEC61010-2-032(2002), EN61010-2-032 (2002), UL61010B-2-032(2003)

Measurement Category : CAT III 600V AC & DC

E.M.C. : Meets EN61326(1997, 1998/A1), EN61000-4-2 (1995), & EN61000-4-3 (1996)

In an RF Field of 3V/m :

Capacitance function is not specified

Other function ranges : Total accuracy = Specified accuracy + 45 digits

Performance above 3V/m is not specified

Overload Protection :

Clamp-on jaws : DC 1000A or AC 800A rms continuous

+ & COM terminals : 600VDC/VAC rms

Pollution Degree : 2

Transient Protection : 6.5kV (1.2/50ms surge)

Battery cover with Probe holders

Rugged Fire retarded casing.

LVD EN61010-2-032 CAT III 600V

#### **ACCESSORIES :**

Test lead pair, Batteries installed, User's manual & Carrying case

#### **64.Schedule item no. A(II)-18**

**Digital Earth tester with in built rechargeable battery, 3.5 digit LCD display, testing range 0.01 ohm to 2000 ohm & all accessories as four spikes, suitable length cable (10M,20M,30M,40M) on winder.**

The price shall covers supply and testing for digital Earth tester with in built rechargeable battery , 3.5 digit LCD display, testing range 0.01 ohm to 2000 ohm & all accessories as four spikes, suitable length cable (10M,20M,30M,40M) on winder.

**65.Schedule item no. A(II)-23****Supply of Hand held LED search light (Dragon torch)**

The cost includes supply, erection testing and commissioning of hand held LED search light (Dragon Torch). Detailed specification is as follows –

Type of lamp LED, Battery capacity (AH)  $\geq$  5000 mAh, 1500 lumens, Dia of search light (mm) 101 to 125, Wattage of lamp (Watt) 55, Color temperature (Degree K) 5500 to 6500 deg. K, Beam angle selection Narrow, Range of Narrow beam angle (Degree) and Range of wide beam angle (Degree) up to 4 deg, Type of front glass Toughened, scratch resistant, One hand operated switch Yes, Built-in battery charger Yes, Type of battery Lithium ion Battery Voltage (Volts) 3.6 to 4.2, Provision of Lanyard/ strap Yes, Rugged, impact and water resistant material of housing, Type of housing material ALUMINIUM, Accessories such as Battery charger with cable for External type Charging cable for inbuilt type Yes Gross weight of Hand Held Search with battery (grams) 1.8 kg (max.) with Li-ion battery. PROTECTION- Protection against reverse polarity Yes, Protection from battery over-discharge Yes, Protection from battery over-charge Yes, Short circuit protection Yes, IP designation for Ingress protection IP 65.

**66.Schedule item no. A(II)-12****Table for operator exactly similar to Godrej Model Enterprise**

The price shall cover cost of supply, loading, transportation and unloading to site of Table for operator exactly similar to Godrej Model at site in an approved manner.

5 Ft Engineered Wood Computer Desk with 3 Drawers & Storage Cabinet, Study & Workstation

Shape	Rectangular
Desk design	Computer Desk, Writing Desk
Product Dimensions	76.2D x 152.4W x 76.2H Centimeters
Colour	Black
Style	Classic
Base Material	Wood
Top Material Type	Wood
Finish Type	Laminated
Special Feature	Collapsible, DIY, Handle-less, Top is 18 mm thick with reinforced 34mm thick border for sturdiness

- Spacious 5 Ft Study & Office Table :- Large 5' x 2.5' tabletop fits laptop, monitor, books, files and accessories—ideal for work-from-home, study rooms, and professional office setups.
- Strong & Durable Engineered Wood Build :- Made with high-quality engineered wood that offers strength, long life and a premium finish—perfect for daily heavy office or study use.
- Organized Storage: 3 Drawers + 1 Chamber :- Comes with three smooth drawers and one closed chamber for storing documents, office items, chargers, books, and essentials neatly.
- Perfect for Home Office / Study Setup :- Designed for professionals, students, creators, and anyone needing a stable workstation for multitasking, reading, writing, or computer work.
- Modern Look & Modular Design :- Minimal, modern design suits any home or office interior. Comes with 1-Year Warranty for worry-free use and assured performance.
- BIFMA, ISO 9001:2015, ISO 14001:2015, OHSAS 18001:2017 certified and MSME & NSIC registered.

**67.Schedule item no. A(II)-13****Chair for operator exactly similar to Godrej Model BRAVO**

GODREJ INTERIO Vurv Chair Mesh Back Ergonomic Work from Home/Revolving Study Chair, 1 Year Warranty, Height Adjustable | Heavy Duty Polypropylene Base | DIY Installation (Blue, Set of 5)

- Wide Backrest: Flexible mesh backrest ensures back support in every posture.
- Wide Armrest: Offers ample support to elbow and forearms while working on laptop. Attached to the backrest, it offers stability and durability.
- Adjustable Lumbar Support: Supports lower back in preferred sitting postures.
- Ergonomic Seat Cushion: Provides sufficient space behind the knees (popliteal region), allowing you to lean back in comfort.
- Center Tilt Mechanism: The chair comes with Center tilt mechanism with upright position locking. Offers maximum comfort and safety for the user.
- 100% VOC free powder coating
- Designed for long life and easy part replacement.

Colour	Blue
Brand	GODREJ INTERIO or Godrej Bravo or similar
Size	Mid Back
Style	Mid Back - Blue
Cushion	Thick cushion seat and back
Mechanism	Centre tilt synchronous mechanism with tilt tension adjustment
Armrest	Polypropylene abuse resistive armrest
Length	76.30 CM (minimum)
Depth	76.30 CM (minimum)
Height	97-109 CM (minimum)
Seat Height	42.50-54.50 CM

**68.Schedule item no. A(II)-25****Supply of Steel Almirah, Size - 6 ft x 3 ft**

Tender price shall provide Godrej or as per make list attached in Annexure-I.

- Door Type –Hinged
- Primary material subtype- CRCA steel
- Warranty – 1 year
- Reinforced top
- Adjustable Shelving-The adjustable shelf allow you to use the interior space as per your choice offering customization and convenience.
- Secure Lock- The storage unit is equipped with a 3-point locking system to ensure the utmost safety.
- Efficient Hinge Operation- The precisely engineered hinges allow for smooth opening and closing of the doors.
- Recessed Handle/Lock Provision- Providing both locking and handling functionality, the lock serves as a reliable grip for accessing the door. The advanced ultra EXS lock featuring a unique dimple key.
- Sturdy Construction- The steel build combined with an aesthetic look ensures durability, functionality and design.
- Coating – Anti corrosive oven baked powder coating.

**69.Schedule item no. A(I)-54**

**Supply, erection, testing & commissioning of 20 Mtrs. GI Stadium Mast as per Dimension: Top Dia.-150 mm, Bottom Dia. - 480 mm, Section- 2 (Section Length - 10300 mm.) Thick- T1- 4 /T2- 5 mm.Base Plate - 670 X 32 mm.PCD: 590; stadium Mast suitable to with stand wind speed 50 m/s with 11 nos LED FLOOD LIGHT Mounted in Asymetrical arrangement, With Foundation Bolts : M30 X 850 X 12Sets., 32 Amp Feeder Pillar, Platform and Ring for housing LED Luminaires, Counterweightarrangement with fixing studs, Motorized accessories with winch,trailing cable,wire rope, SD LED AOL.**

The Work includes Supply, erection, testing and commissioning of 20 mtr. stadium mast lighting structure in 2 sections and hot dip galvanized including head frame, steel wire rope 6 mm dia.(7/19 construction), trailing cables, galvanized lantern carriage suitable for 11 nos. luminaries 350 Watt LED.& compact cast aluminium HID lamp control gear boxes, lighting finial, Double drum winch, Power tool, Aviation light with 2x10 W LED lamp, control panel housing contactors, single dial timer, MCBs for auto switching ON & OFF on preset time through timer and dusk to dawn controller to switch ON/OFF lights as per sunset / sunrise through photo sensing relay. Work includes casting of suitable foundation with M-20 concrete considering the safe soil bearing at site. All material & accessories shall be from OEM only.

**DETAIL SPECIFICATION FOR 20 MTR. STADIUM MAST LIGHTING.****1.01 APPLICABLE STANDARDS**

The following shall be the Reference Standards for the stadium Mast.

Sr.No.	<u>Code No.</u>	<u>Title</u>
1	I.S.875(Part III) 1987	Code and practice for design loads for structures
2	BS EN 10025:2004 /DIN 17100 grade S355 J0	Grades of M.S. Plates
3	BS.5135/AWS	Welding
4	BS ISO 1461	Galvanizing
5	TR.No.7 2000 of ILE,UK	Specification for Mast and foundation
6	IS 2062	Mild Steel
7	IS 3459 / 2266	Stainless steel Wire rope
8	IS 9968 Part – 1	Trailing Cable
9	IS 325	Motor

**1.02 STADIUM MAST**

**1.02.1 Structure :-** The stadium mast shall be of continuously tapered cross section, at least 18 sided, presenting a good and pleasing appearance and shall be based on proven in Tension design conforming to the standards referred to above, to give an assured performance, and reliable service.The structure shall be suitable for wind loading as per IS 875 part 3 1987.The mast dimension shall be as per enclosed datasheet.

**1.02.2 Construction:-** The mast shall be fabricated from special steel plates, conforming to BS-EN 10-025 or equivalent, cut and folded to form a polygonal section as stated at 1.02.1 above and shall be telescopically jointed and welded. The welding shall be in accordance with BS.5135/AWS. The procedural weld geometry and the workmanship shall be exhaustively tested on the completed welds. Mast shall be delivered to site in sections.

Each section shall be fabricated out of individual plates duly folded and welded. There shall be only one longitudinal seam weld per section. Sections fabricated out of multiple plates or with more than one weld shall not be accepted. There shall not be any other internal or external welds in the mast sections.

At site the section shall be joined together by slip-stressed – fit method. No site welding or bolted joint shall be done on the mast. The minimum overlap distance shall be 1.5 times the diameter at penetration. The dimensions of the mast shall be based on proper design. Manufacturer of the mast must have conducted wind Tunnel test on their mast sample. Parameters considered for design shall be taken from the wind Tunnel Test.

The mast shall be provided with fully penetrated flange, which shall be free from any lamination or incursion. The welded connection of the base flange shall be fully developed to the strength of the entire section. The base flange shall be provided with supplementary gussets between the bolt- hole to ensure elimination of helical stress concentration. For the environmental protection of the mast, the entire fabricated mast shall be hot dip galvanized, internally and externally having a uniform thickness of 70 micron for the bottom and top sections. The mast sections shall be galvanized by single dipping method for better adhesion and life. Sections galvanized by double /multiple dipping methods shall not be accepted.

- 1.02.3 **Door Opening :-** An adequate door opening shall be provided at the base of the mast and the opening shall be such that it permits clear access to equipment like winches, cables, plug and socket, etc. and also facilitate easy removal of the winch. The door opening shall be complete with a close fitting, vandal resistant, weatherproof door, provided with a heavy duty double internal lock with special paddle key.

The door opening shall be carefully designed and reinforced with welded steel section, so that the mast section at the base shall be unaffected and undue buckling of the cut portion is prevented. Size of door opening shall not be more than 1200 x 300 mm to avoid bucking of the mast section under heavy wind conditions.

- 1.02.4 **Dynamic Loading for the Mast :** The mast structure shall be suitable to sustain an assumed maximum reaction arising from a wind speed as per IS 875 (3 Second gust) and shall be measured at a height of 10 mtrs. above ground level. The design life of the mast shall be minimum of 25 years.

### 1.03 **Lantern Carriage:**

- 1.03.1 **Fabrication:-** A fabricated lantern carriage shall be provided for fixing and holding the flood light fittings and control gear boxes. The lantern carriage shall be of special design and shall be of steel tube construction, the tubes acting as conduits for wires, with holes fully protected by grommets. The lantern carriage shall be so designed and fabricated to hold the required number of flood light fittings and the control gear boxes and also have a perfect self -balance.

The lantern carriage shall be fabricated in two halves and joined by bolted flanges with stainless steel bolts and nylock type stainless steel nuts to enable easy installation or removal from the erected mast. The inner lining of the carriage shall be provided with protective PVC arrangement, so that no damage is caused to the surface of the mast during the raising and lowering operation of the carriage. The entire lantern carriage shall be hot dip galvanized after fabrication.

1. 03.2 **Junction Box :-** Weather proof junction box, made of cast Aluminum shall be provided on the carriage Assembly as required, from which the inter –connections to the designed number of the flood light luminaries and associated control gears fixed on the carriage, shall be made.

1.04 **Raising and Lowering Mechanism:-** For the installation and maintenance of the luminaries and lamps, it will be necessary to lower and raise the lantern carriage assembly. To enable this a suitable Winch Arrangement shall be provided, with the winch fixed at the base of the mast and the specially designed head frame assembly at the top.

1.04.1 **Winch:-** The winch shall be of completely self sustaining type, without the need for brake shoe, springs or clutches. Each driving spindle of the winch shall be positively locked when not in use, by gravity activated PAWLS. Individual drum also should be operated for fine adjustment of lantern carriage. The capacity, Operating speed, safe working load, recommended lubrication and serial number of the winch shall be clearly marked on each winch.

The gear ratio of the winch shall be 53:1. However, the minimum working load shall be not less than as specified in datasheets. The winch shall self-lubricating type by means of an oil bath and shall be readily available grades of reputed producers.

The winch drums shall be grooved to ensure perfect seat for stable and tidy rope lay, with no chances of rope slippage. The rope termination in the winch shall be such that distortion or twisting is eliminated and at least 5 to 6 turns of rope remains on the drum when the lantern carriage is fully lowered and rested on the rest pad. It should be possible to operate the winch manually by a suitable handle and /or by an integral power tool. Operation of the winch manual handle will be independent of the power tool. Winches with manual operation through the power tool shaft shall not be accepted. It shall be possible to remove the double drums after dismantling, through the door opening provided at base of the mast. Also, a winch gear box for simultaneous and reversible operation of the double drum winch shall be provided as part of the contract.

The winch shall be type tested in presence of reputed institution and the test certificates shall be furnished before supply of materials. A test certificate shall be furnished by the contractor from original equipment manufacturer, for each winch in support of maximum load operated by the winch.

1.04.2 **Head frame :-** The head frame which is to be designed as a capping unit of the mast, shall be welded steel construction, galvanized both internally and externally after assembly. The top pulley shall be of appropriate diameter, large enough to accommodate the stainless steel wire ropes and the multi-core electric cable. The pulley block shall be made of non-corrodible material, and shall be of die cast aluminum alloy (LM-6 ). Pulley made of synthetic materials such as plastic or PVC are not acceptable. Self-lubricating bearing and stainless steel shaft shall be provided to facilitate smooth and maintenance free operation for a long period. The pulley assembly shall be fully protected by a canopy galvanized internally and externally.

Close fitting guides and sleeves shall be provided to ensure that the ropes and cables do not dislodge from their respective positions in the grooves. The head frame shall be provided with guides and stops with PVC buffer for docking the lantern carriage.

**Stainless Steel :-** The suspension system shall essentially be without any intermediate and shall consist of only non-corrodible stainless steel of **AISI 316 or better grade.**

The stainless steel wire ropes shall be of 7/19 construction, the central core being of the same material. The overall diameter of the rope shall not be less than 6 mm. The breaking load of each rope shall not be less than 2350 Kg. giving a factor of safety of over 5 for the system at full load as per the TR-7 referred to in the beginning of this specification. The end construction of ropes the drum shall be fitted with talurit.

The thimbles shall be secured on ropes by compression splices. Two continuous lengths of stainless steel wire ropes shall be used in the system and no intermediate joints are acceptable in view of the required safety. No intermediate joints/ terminations, either bolted or else, shall be provided on the wire ropes between winch and lantern carriage.

1.05 **Electrical system, cable and cable connections:-**

A suitable terminal box shall be provided as part of the contract at the base compartment of the stadium mast for terminating the incoming cable. The electrical connections from the bottom to the top shall be made by special trailing cable. The cable shall be EPR insulated and PCP sheathed to get flexibility and endurance. Size of the cable shall be minimum 5 core 2.5 sqmm copper.

The cable shall be of reputed make. At the top there shall be weather proof junction box to terminate the trailing cable. Connections from the top junction box to terminate to the individual luminaries shall be made by using 3 core 1.5 sqmm flexible PVC cables of reputed make. The system shall have in-built facilities for testing luminaries while in lowered position.

Also, suitable provision shall be made at the base compartment of the mast to facilitate the operation of internally mounted, electrically operated power tool for raising and lowering of the lantern carriage assembly. The trailing cables of the lantern carriage assembly. The trailing cables of the lantern carriage rings shall be terminated by means of specially designed, metal clad, multipin plug and socket provided in the base compartment to enable easy disconnection when required. Automatic lighting ON-OFF based on dawn to dusk operation through suitable photo sensing relays and automatic switching ON/OFF at preset time through timer relay.

- 1.06 Power Tool for the Winch:-** A suitable, high-powered, electrically driven internally mounted power tool with manual over ride shall be supplied for the raising and the lowering of the lantern carriage for maintenance purposes. The speed the power tool shall be to suit the system. The power tool shall be single speed, provided with a motor of the required rating. The power tool shall be supplied complete with a suitable control switch so that the operation of the Mast can be done at a safe distance. The capacity and speed of the electric motor used in the power tool shall be suitable for the lifting of the design load installed on the lantern carriage.

The power tool mounting shall be so designed that it will be not only self-supporting but also aligns the power tool perfectly with respect to the winch spindle during the operation. Also, a handle for the manual operation of the winches in case of problems with the electrically operated tool, shall be provided and shall incorporate a torque limiting device.

There shall be a separate torque-limiting device to protect the wire ropes from over stretching. It shall be mechanical with suitable load adjusting device. The torque limiter shall trip the load when it exceeds the adjusted limits. There shall be suitable provision for warning the operator once the Load is tripped off. The torque limiter is a requirement as per the relevant standards in view of the overall safety of the system. Each Mast shall have its own power tool motor.

- 1.07 Lightning Finial :-** One number heavy duty hot dip galvanized lightning finial shall be provided for each mast. The lightning finial shall be minimum 1.2 meter in length and shall be provided at the center of the head frame. It shall be bolted solidly to the head frame to get a direct conducting path to the earth through the mast. The lightning finial shall not be provided on the lantern carriage under any circumstances in view of safety of the system.

- 1.08 Aviation Obstruction Lights :-** Suitable Aviation Obstruction 02 Nos Lights of reliable design and reputed manufacturer shall be provided on top of each Mast.

- 1.09 Earthing Terminals :-** Suitable earth terminal using 12 mm diameter stainless steel bolts shall be provided at a convenient location on the base of the Mast, for lightning and electrical earthing of the Mast.

- 1.10 Feeder Pillar :-** Each Mast shall be provided with a Feeder pillar fabricated out of 14 SWG CRCA sheet and finished with two coats of red oxide primer and grey enamel paint of shade 631 of IS -5. The feeder pillar shall comprise of incoming 32 TPN switch, HRC fuses, double dial plus photo sensor timer, suitable size of contactors for lighting and power tool, 2 nos. outgoing, reversing switch for motor. Feeder pillar shall be mounted on suitable foundation near to the Mast.



**1.11 Incoming Power Cable :-** 4 x 2.5 sqmm. Copper conductor armoured cable for motor supply shall be provided from feeder pillar to the base compartment of the stadium Mast. Cable shall be taken to the base compartment of the stadium Mast through the provision made in the foundation. Power cable of suitable size up to the feeder pillar, from supply point, shall be provided by the contractor. All the work for the power supply to the stadium mast shall be carried out by the contractor. Supply point to stadium mast will be made available suitably by laying of cable as separate schedule item and as per site requirement.

**1.12 Luminaires :-** The price shall cover cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of 350W, IP66, LED flood light fitting made of Matt black polyester powder coated pressure die cast aluminium housing. Matt black polyester powder coated pressure die cast aluminium frame with heat resistant toughened clear glass fixed with SS screw. LEDs are provided with secondary lens optics to get optimum optical performance. The driver used is specially designed to have built in surge voltage, open/short circuit protections. External surge protection provided for additional safety 4kV inbuilt & 10kV external. Luminaire is provided with a MS mounting bracket fixed on pressure die cast aluminum housing for aiming adjustment complete with all other accessories and fixing arrangements i.e. GI pipe, GI bracket / clamp, stainless steel nut bolts etc. as per site requirements. The cost shall also cover supply & laying of 3Cx2.5 sq.mm Cu cable for the individual wiring of the luminaire. The fittings shall be similar to model no. BJFL 350 W of M/s Bajaj make or similar model as per list of acceptable make enclosed. The technical parameter will generally be conforming to specification enclosed. Lumens-120Lumens/W, CRI >80, PF- >0.9. The flood light fitting should be got approved by Sr. DEE(G)BSL before supply.

### **1.13 FOUNDATION FOR STADIUM MAST**

Foundation for the stadium mast should be in accordance with the standard design of stadium mast manufacturer. Detailed foundation design should be submitted to the Rly. before commencement of work.

### **1.14 TECHNICAL DATA SHEET FOR 20 MTRS. STADIUM MAST AND COMPONENTS**

#### **1. STADIUM MAST STRUCTURE**

a	Height of Mast	20 Mtrs.
b	Material Construction	BS-EN 10 025, S 355
c	Thickness ( in mm )	Top 4 (minimum) Bottom 5 (minimum)
d	Cross section of Mast in Polygon (Number of sides)	18 sides( Minimum )
e	Length of individual sections	10300 MM Each.
f	Base and top diameter	Top diameter 150 mm (minimum) Bottom diameter 480 mm (minimum)
g	Type of joints	Stress fit side joints.
h	Length of overlap	0.60 mt.(Approx)
i	Metal protection treatment for Mast section	Hot dip Galvanized through Single dip process.
j	Thickness of galvanization	70 microns (average) Top to bottom (minimum)
k	Size of Opening and door at base	1200 x 300mm
l	Type of locking arrangement and door panel	Double internal

m	Details of Slack board inside the base compartment	PVC Board 200 mmx 610 mmx 10 mm
n	Size material and thickness of cable terminal box	MCB Isolator
o	Thickness of base plate	32 mm
p	Size of anchor plate and thickness	Uniform PCD of 590 mm
q	Details of template	Uniform PCD of 590 mm
r	Weight in Kgs. of 20 mtrs. Mast (without accessories)	650 Kg.(minimum)
s	Lighting protection final	G.I. single spike of length 1200 mm

## 2. DYNAMIC LOADING AS PREVALING AT SITE

a	Max. wind speed	As per IS 875 par 3
b	Factor of safety for other load	1: 15 (1.0 as per TR No-7)

## 3. FOUNDATION DETAILS

A	Type of foundation	Open raft shallow footing
B	Size of foundation	As per design
C	Designed load bearing capacity	10 T per Sq. M at 2 M depth
D	Design safety factor	As per IS 456
E	Considered wind pressure (Kg/Mt <sup>2</sup> )	As per IS 875 – 1987
F	Considered wind speed (Km /hr)	As per IS 875- 1987, 50 m/sec
G	Depth of foundation	Minimum 2200 mm above PCC upto GL & 300 mm above GL
H	Average soil bearing capacity	As confirmed
I	Number of foundation bolts	Minimum 12 Nos
J	PCD of foundation bolts	590 mm
k	Type of foundation bolts	EN- 8 grade with hot dipped galvanized as per BS 970 standards & should be supplied along with stadium mast from OEM only.
l	Bolt diameter	30 mm / 850 mm long (minimum)
m	Concrete grade	M-25
n	Checknut	Minimum 05 Nos for each bolts
o	Washer / spring washer	Minimum 02 Nos

## 4. LANTERN CARRIAGE

a	Material of construction	50 NB ERW Class B- M.
b	Diameter of carriage ring (mm)	710 mm( I.D.) or as per design
c	Construction	To suit Lighting Design
d	Number of joints	2 Nos.
e	Buffer arrangement between carriage and Mast	PVC sleeve on carriage
f	Load carrying capacity	750 Kg.
g	Total weight of assembly with fittings	As per No. of Luminaires
h	Number of fittings /fixture	11 nos. (As per lighting design)

		<b>Counterweight arrangement with fixing studs</b>
i	Type of fittings / fixtures	<b>Counterweight arrangement with fixing studs.</b>
j	RCBO	4 Pole 16 A
h	Aviation Light	02 Nos (As per make list attached in Annexure-I)

## 5. WINCH

a	Number of drums /Winch	Double drum type
b	Gear ratio	53:1
c	Capacity	750 Kg.
d	Method of operation	Manual / Electricals
E	Lubrication arrangement	Permanent oil bath.
f	Type of Lubricant	SAE 107/SAE 90
g	Tested load per drum	750 kgs. per drum, 1500 kgs for winch

## 6. STAINLESS STEEL WIRE ROPES

a	Grade	AISI 316
b	No. of Ropes	2 continuous ropes
c	Construction	7/19
d	Center core materials	Stainless steel core
e	Diameter	6 mm (minimum)
f	Thimble & Talurit	SS Thimble
g	Braking load capacity	Minimum 2400kgs X2
h	Safety factor	> 5 for system at full load

## 7. CABLE

a	Type	Trailing cable
b	Material	Copper Conductor, EPR insulated PCP Sheathed
c	Current carrying capacity	24 amps
d	Conductor size	2.5 sq.mm
e	No. of cores	5 Nos (minimum)
f	No.of Circuit	One/two
g	RCBO	4 Pole 16 A
h	Coupler	Required

## 8. POWER TOOLS

a	Model	Internal
b	Input supply	1 Phase, 415 volts
c	Wattage/ H.P.	1100 watts/ 1.5 HP
d	Number of speed	Single speed
e	Operating speed	2 M / minute

## 9. TORQUE LIMITER

a	Lifting capacity	Up to 750 Kgs,
b	Adjustable /Non-adjustable	Adjustable
c	Tripping device	Mechanical

**RCBO –**

RCBO shall have conformance to IS 12640-2 / IEC 61009-1.

RCBO shall be of breaking capacity of 10kA.

RCBO shall not be line load biased.

RCBO shall have minimum electric life of 10,000 electric operations.

Three Phase RCBO of 16A-25A with a breaking capacity of 10kA.

The RCBO shall have separate indications for short circuit fault and earth leakage fault.

The RCBO shall trip on leakage fault of AC waveform consisting of pulsating DC along with transients and harmonics.

The RCBO shall have pollution degree 3.

The RCBO shall have rated impulse withstand of 6 kV.

The RCBO shall have IP20.

The RCBO shall have a test button to check health of RCBO by creating artificial fault.

The RCBO shall be suitable for isolation.

The RCBO shall have bi-connect terminals for both bus bar and cable termination.

The RCBO, up to 63A, shall have cable termination capacity of 35 sq mm for rigid cable & 25 sq mm for flexible.

The RCBO shall have safety shutter to avoid any wrong insertion of cable.

The RCBO shall have operating temperature -5 °C to +60 °C.

The RCBO shall have a provision for padlock to prevent unauthorized access.

The RCBO shall have provision for mounting of accessories – Auxiliary Contact, Trip Alarm Contact, UV, OV, Shunt Release.

The RCBO shall have DIN clip on both the sides for easy removal of an RCBO from the DIN rail.

**NOTES-**

1. Detail technical specification of stadium Mast lighting shall be submitted.
2. Typical illumination design of stadium mast shall be submitted.
3. The detail maintenance manual of stadium mast shall be submitted.
4. The contractor shall arrange the training for the Railway representative regarding operational mechanism of stadium mast.
5. The contractor shall arrange the required inspection facilities at manufacturer premises and inform the Rly. representative for the inspection. Inspection shall be carried out in accordance with the relevant specification and the test data and relevant specification shall be handed over to Rly. representative for record.
6. The contractor has to supply individual power tool for stadium Mast to make it self-sufficient for operation.
7. “Wind Tunnel Test” of stadium Mast shaft must be carried out successfully by the manufacturer. Wind Tunnel Test report shall be submitted.
8. Contractor shall submit detail foundation design for stadium Masts. They must also submit detail structural design of the stadium Mast, parameters considered for design shall be taken from the wind Tunnel Test.
9. Contractor shall specify the makes for the gadgets provided by him.
10. The erection cost of stadium mast also covers cost of foundation.
11. The luminaries and lamps provided should be guaranteed for one year.
12. Stadium mast lighting structure shall be supplied duly inspected at manufacturer’s premises by RITES or representative nominated by Sr.DEE(G)BSL
13. **The contractor should check Soil Bearing capacity and accordingly submit drawing for Stadium Mast foundation duly signed by M.E.(Structures)/Civil Engineer.**

**70.Schedule item no. A(I)-53, A(III)-28****Dismantling of existing infrastructure like cable, wire, fittings and other accessories.**

The work involves the dismantling the materials, electric pole /pipe with cables/wires/ Overhead lines, fittings with brackets, clamps, insulators, stay from the cement concrete foundation and making the site clear by refilling the pits with excavated materials and bringing it to the ground level. The dismantled Pole/Material shall be deposited in concern SSE(EM) Depot with necessary transportation for shifting of material.

**71.Schedule item no. A(I)-47****Supply, erection, testing & commissioning of Online UPS with isolation transformer suitable for single phase AC input & single phase AC output, floor mounted type rating of UPS 5 KVA indicative back-up time 120 minutes complete with Battery and stand.**

The price shall cover Supply, erection, testing & commissioning of Online UPS with isolation transformer suitable for single phase AC input & single phase AC output, floor mounted type rating of UPS 5 – 5.5 KVA indicative back-up time 120 minutes complete with Battery and stand.

**FEATURES:**

- Inbuilt over voltage cut off device with surge protection
- Smart display for real time information
- Constant voltage constant frequency operation without battery
- Conformal coated PCV assemblies to withstand harsh environment
- External charger capacity expansion to 4 amps (Optional)
- EMI/RFI Noise Filter
- Waveform (Battery Mode): Pure Sine wave

1	Capacity	5- 5.5 KVA
2	DC VOLTAGE	DEFAULT:192VDC ADJUSTABLE: 216 VDC
3	PHASE	Single Phase with Ground
INPUT		
1	NOMINAL VOLTAGE	208 / 220 / 230 VAC
2	Acceptable Voltage Range	165 ~ 285 VAC
3	FREQUENCY RANGE	40~55 Hz @ 50 Hz system
OUTPUT		
1	Nominal voltage	208 / 220 / 230 VAC
2	AC VOLTAGE REGULATION	±1% (Battery Mode)
3	FREQUENCY RANGE	Mains Mode (synchronized range) : 45 Hz ~ 55 Hz / Battery Mode : 50 Hz 0.1 Hz
TRANSFER TIME		
1	AC to DC	Zero
2	Inverter to Bypass mode	Zero
3	Bypass to Inverter Mode	<5 ms
WAVEFORM		
1	WAVEFORM (BATTERY MODE)	Pure Sine Wave
EFFICIENCY		
1	AC Mode / Battery Mode	87% / 91%

<u>External Battery</u>		
1	BATTERY TYPE	Default : VRLA / SMF battery
2		Tubular Battery : ok (with charger cut -off voltage adjustable from LCD display)
3	Battery charging Amp.	2/4/8 Amp (default 8 Amp)
4	NUMBER of batteries	16/18 batteries
<u>INDICATORS</u>		
1	Status on LCD	Load level, Battery level, AC mode, battery mode, Bypass mode and fault indicators
<u>Alarm</u>		
1	Battery Mode	Sounding every 4 seconds
2	Low battery	Sounding every second
3	Overload	Sounding twice every seconds
4	Fault	Continuously Sounding
<u>MANAGEMENT</u>		
1	RS-232 / USB & OPTIONAL SNMP	Supports Windows® 2000/2003/XP/Vista/2008/7/8, Linux and MAC

## **72.Schedule item no. A(III)-24**

**Supply,Installation,Testing & Commissioning of 20 KVA ONLINE UPS, AC 3 Phase 300V-450V sinewave 50 Hz input voltage & AC 3 Phase 400V +/- 1% with alternative user settable setting of 380V +/- 1% 50 Hz output voltage, with SMF-VRLA type battery having 120 minute battery backup with two years warranty complete and as per IS, IE rules and site requirement.**

Principle of 3-level IGBT technology which maximizes the efficiency and the 3-stage extendable charging design to optimizes the battery performance. This series is generator compatible and parallel operation up to 3 units is possible. The communication over SNMP, USM and RS-232 available

- Unity Output Power Factor
- DSP Technology with IGBT based PFC & Inverter section
- 3-Level IGBT Inverter design Maximizes Efficiency
- Active Power Factor Correction in all 3-Phases
- 50Hz/60Hz Frequency Converter mode
- ECO mode operation for Energy Saving (ECO)
- Backfeed Energy Absorption Box (OPTIONAL), if Need to Operate Motor type Loads on UPS
- Generator Compatible
- USB+RS-232 Multiple Communications available, SNMP (Optional)
- 3-Stage extendable Charging Design for Optimized Battery Performance
- Adjustable Battery Numbers 2 Hrs Backup (from 32 to 40-Batteries in pairs of 2)
- Built-In Maintenance Bypass & Static Bypass Switches
- Parallel Operation upto 3 Units. (with Common Battery Bank)
- Isolation Transformer
- Smart 4.3" Touch Panel LCD Display for Real-time information for measurement & adjustment of maximum parameters
- EMI Protection (C3-Level) available at Input & Output
- Surge Protection available at Input across R/S/T - N & R/S/T/N - G

1	Capacity	20KVA/20KW
2	DC VOLTAGE	DEFAULT: $\pm 192\text{VDC}$ (32-Battery), ADJUSTABLE: $\pm 240\text{VDC}$ (40-Battery)
3	PHASE	3 PHASE IN ~ 3 PHASE OUT
INPUT		
1	NOMINAL VOLTAGE	3 x 400 VAC (3Ph+N)
2	ACCEPTABLE VOLTAGE RANGE	190-520 VAC (3-Phase) @ 50% Load / 305-478 VAC (3-Phase) @ 100% Load
3	FREQUENCY RANGE	46~54 Hz or 56~64Hz
4	POWER FACTOR	$\geq 0.99$ @ 100% load
5	INPUT CURRENT HARMONIC DISTORTION THD(i)	<6% @ 50% R-load, < 12% @ 50% RCD Load at 230VAC
OUTPUT		
1	NOMINAL VOLTAGE	3 x 360*/380/400/415 VAC (3Ph+N)
2	AC VOLTAGE REGULATION	$\pm 1\%$ (Battery Mode)
3	FREQUENCY RANGE	50 Hz $\pm 0.1$ Hz or 60 Hz $\pm 0.1$ Hz (Battery Mode)
4	CURRENT CREST RATIO	3:1 (Max)
5	HARMONIC DISTORTION	$\leq 2\%$ THD (LinearLoad) ; $\leq 5\%$ THD (Non-Linear Load)
6	OVERLOAD CAPABILITY	AC Mode: 100-110% for 60 min, 110-125% for 10 min, 125%~150% 1min, >150% immediately Battery Mode: 100-110% for 60 min, 110-125% for 10 min, 125%~150% 1min, >150% immediately
TRANSFER TIME		
1	AC MODE TO BATTERY MODE	Zero
2	INVERTER TO BYPASS	Zero
3	WAVEFORM(BATTERY MODE)	Pure Sine Wave
4	EFFICIENCY	AC Mode: 95.5% / ECO Mode: 98.5% BATTERY Mode: 94.5%
Battery		
1	BATTERY TYPE	VRLA / LEAD-ACID Type
2	NUMBER of batteries	Default:32 Nos. Adjustable: 40 Nos. 100AH/12V Batteries for your 2 Hrs. battery backup (NOTE: Double Bank in Series of (16~20) + (16~20) Battery with Centre-Tapped Configuration)
3	CHARGING CURRENT (MAX.)	12A Maximum, Adjustable = 1A/2A/3A/4A/5A/6A/7A/8A/9A/10A/11A/12A, Factory Setting = 4A
4	CHARGING VOLTAGE	$\pm 13.65\text{V} \times \text{N}$ (N = 16~20)
INDICATORS		
1	LCD PANEL	UPS status, Load percentages & amperes on each phase at output, Output VA & Wattage in each phase, Battery level (Charging ampere & discharging ampere), Input/Output voltage (Phase to Neutral & phase to phase information), Input / output Frequency, Input

		Line Current per phase, Input VA/ Wattage/ PF per phase, Temperature information, Data Log Events (max 500-events) and Fault conditions
ENVIRONMENT		
1	OPERATING HUMIDITY / TEMP.	<95% and non-condensing / 0-40°C
2	NOISE LEVEL	Less than 65dB @ 1 Meter
3	INGRESS PROTECTION (IP Rating)	IP-20
MANAGEMENT		
1	SMART RS-232 OR USB	Supports Windows® 2000/2003/XP/ Vista/2008/7/8, Linux and MAC
2	OPTIONAL SNMP	Power Management from SNMP Manager and Web Browser

### **73.Schedule item no. A(III)-30**

**Design, supply,installation,testing and commissioning of ON GRID solar photovoltaic power plants with required mono crystalline solar PV modules, MS Hot dipped Galvanized structure for mounting of panles , suitable power conditioning units able to adjust volatge and frequency level to suit the grid voltage frequency, Array and main junction boxes with IP65 protection, required AC & DC distribution boards with switchgear , armoured power and control cables ,remote data monitoring system , EB approved Bidirectional energy metering system , Earthing arrangements , suitable lightning and surge protection etc., as per detailed specifications including all necessary works,accessories as per site conditions. Tentative list of locations and capacity of solar plants are attached . Liasoning , registration and inspection charges of EB to be born by contractor. Sites to be surveyed and GADs to be submitted for approval before starting of work.**

### **TECHNICAL SPECIFICATIONS, EXPLANATORY NOTES & DRAWINGS**

#### **Specifications:**

#### **GENERAL REQUIREMENTS:**

- i. The work to be governed by this contract shall cover designing, manufacturing, transporting till site, safe custody at site, insurance, erection, and commissioning of equipments as detailed in SOQ technical specifications/ explanatory notes and in the scope of Work of tender documents. All the materials and workmanship shall strictly conform to the provision of this specification primarily and to the related Indian Standard Specification and code of practice mentioned in the specifications.
- ii. All the materials brought to site for use on this work shall be new of the best quality of approved makes/manufacture as per list of approved makes of equipments/materials enclosed and conforming to the relevant BIS specifications.
- iii. All the cable routes, locations of relevant items of work shall be first shown in drawing and marked at site and approval of the Engineer-in-charge obtained for the same before starting the work. Such drawings shall be based on the drawings issued and further based on the changes made at site by the Engineer-in-charge through instructions to the site representative of the contractor.
- iv. The rates quoted for the relevant items of work shall include the cost of materials and equipments, their accessories, fixing labour, together with the cost of providing the necessary tools and tackles etc., so as to ensure that the work carried out forms a complete installation to the satisfaction of the Engineer-in-charge.



v. Any deviation from the specifications shall be clearly brought out in the offer along with the reasons for such deviations. If, no such deviations are brought out in the offer, it will be deemed that the tenderer has fully understood the requirements of the tender and no extra cost will be paid under any circumstances for carrying out the works under this tender in accordance with the interpretations of the Engineer-in-charge.

vi. The rates quoted shall also include the cost of any civil works connected with the relevant items of works.

vii. The rates quoted shall also provide for handing over the necessary completion drawings together with the test results of commissioning tests carried out by the contractor, in accordance with BIS before the installation & handed over to the Railways.

viii. The contractor is bound by the opinion of the Engineer-in-charge in accepting whether the work is carried out in accordance with the provisions of these specifications or not and shall take steps to rectify or replace such parts of the materials and installations as in the opinion of the Engineer-in-charge which are unsatisfactory in relation to this specifications.

ix. The contractor shall ensure proper liaison with SEB, LOCAL BODIES and any other authorities for obtaining all statutory approvals and to co-ordinate with SEB/ LOCAL BODIES /any other authorities for timely inspections, quality control inspections. Payments for all inspection charges shall be borne by the contractor. Applications in this regard shall be prepared by the contractor and signature of Railway authorities shall be obtained. Responsibility of resolving of Right of Way (ROW) issues during execution of the work lies with the contractor.

a) Railway shall be responsible for payment of

I. Availing of new supply connection charges/deposit

II. Testing/ Supervision charges based on s estimate of SEB.

Only after receiving the written advice from supply authority to obtain the sanction for commencing the work / electrical installations.

b) All the other incidental charges payable to SEB/Local authorities/ Electrical Inspectorate charges (State Govt.), charges for stamp duties/ agreements, inspection charges, statutory amount to remit for approval from local bodies etc. in connection with the work shall be paid by the contractor as part of the tender work. Claim for such payment shall not be entertained by Railways.

x. All Drawings, tests and measurements, readings and documentation required for EIG approval shall be arranged and prepared by the contractor without any extra cost.

xi. Substation shall be completed in full compliance with CPWD specification Part IV for substations and in full compliance with SEB standard practice.

xii. All works pertaining to SEB shall be completed as per the standard practice of SEB and to the satisfaction engineers in-charge of SEB and Railways as well.

xiii. STANDARDS FOR EQUIPMENTS AND WORKMANSHIP:

a) The materials and equipments to be supplied and installed under this contract shall conform to the requirements of these specifications.

b) In further support of what is contained in this specifications, the materials and equipments as well as workmanship shall satisfy the requirements.

c) All the materials and equipments shall conform to the Standards not less than those stipulated under the current Indian Standard Specifications.

xiv. For such of the materials and methods of construction for which BIS have not been published, British Standards shall be followed subject to the approval of the Engineer-in-charge.

xv. In addition to the above, the equipment and workmanship shall satisfy the requirements of the following:-

- a) Method of construction approved by the Electrical Inspectorate.
- b) Indian Electricity Acts and Rules.
- c) Fire Insurance Regulations.
- d) I.E.E. wiring regulations.
- e) Instructions of the Engineer-in-charge based on the site conditions and revised requirements, if any.

xvi. Electrical Safety: -

- a) The work is to be done in compliance with the National Electrical Code-2011 or the latest issued by BIS.
- b) The work done to comply with the provision of CEA (Measures relating to safety and electric supply) regulation, 2010.
- c) Only items confirming relevant BIS to be used if issued by BIS in compliance of CEA (Measures relating to safety and electric supply) regulation, 2010. In case no specification is mentioned then the contractor is restricted to use the material in conformity with BIS in vogue. In such case contractor is to obtain approval of Sr.DEE(G) in advance.
- d) Contractor is advised to train/counsel or use only trained workers having the competency to work in the LV system and aware of electrical safety.

#### **NOTES -**

All safety precautions are to be ensured by the contractor while execution of work and no work has to be carried out without permission of Engineer in charge. Also, the execution of work should not infringe the train moving dimension as per permanent way manual nor affect the train traffic in any way.

The following Statutory Clearances to be obtained by the contractor wherever applicable:

- a. Electrical System approval (Electrical Inspector) if required.
- b. Fire System approval (CFO) if required.
- c. All equipment, accessories, materials, civil construction & erection works should comply with statutory requirements and IS standards.
- d. All statutory requirements for working at the Project Site like Labour Registration, Workman Compensation Policy, ESIC etc. to be complied with by the Vendor before deployment of resources at the Project Site.

#### **Obligations of the contractor:**

(a) The contractor will Design, Engineer, Procure, Undertake Civil and Electrical works including Erection, Testing & Commissioning of the solar PV project.

(b) bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the CONTRACTOR under this document.

(c) The contractor shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act 2003, CEA guidelines etc.

(d) The contractor will install the Main Metering System at the Delivery Point for the measurement of electrical energy produced by the System.

- (e) Ensure net metering with the concerned Distribution Company on the behalf of Railways. Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility.
- (f) To apply for and obtain net metering on behalf of the Railways for the Project and bear all the costs for the same on behalf of Railways;
- (g) Procure all the Approvals specified in this document and also from other agencies unconditionally or if subject to conditions, then all such conditions required to be fulfilled by the date specified therein shall have been satisfied in full and such Approvals are in full force and effect;
- (h) Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility.
- (i) To apply for net metering related work on the behalf of Railway with the concerned DISCOM within 15 days of LOA & before execution of work.
- (j) To identify & finalise all required steps as per the concerned DISCOM within 45 days of LOA
- (k) Acquire and maintain in effect all approvals and clearances in order to enable it to perform its obligations under this document.
- a) Governmental Approvals: While providing the Installation Work, the Solar Power and System Operations, the contractor will obtain and maintain and secure all Governmental Approvals required to be obtained and maintained and secured by the contractor and to enable the contractor to perform such obligations.
- b) Interconnection Requirements: The interconnection of the rooftop solar system with the network of the Railways will be made as per the technical standards for connectivity of distributed generated resources regulations as may be notified by the competent authority.
- l) Subject to and on the terms and conditions of this document, the contractor shall, at its own cost and expense, procure finance for and undertake the design, engineering, procurement, construction and commissioning of the rooftop solar project and observe, fulfill, comply with and perform all its obligations set out in this document.
- m) The contractor shall comply with all Applicable Laws and obtain Approvals (including renewals as required) in the performance of its obligations under this document.
- (n) Procure, as required, the appropriate proprietary rights, licenses, agreements and permissions for materials, methods, processes and systems used or incorporated into the rooftop solar project;
- (o) Procure that all facilities and amenities within the solar rooftop power system are operated and maintained in accordance with Good Industry Practice
- (p) Undertake Interconnection Facilities as per the specifications and requirements laid down by the Central Electricity Authority and respective State ERCs.
- (q) Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility

(r) The contractor shall ensure efficient operation of the Project and the associated facilities to achieve the maximum power generation from the Project. For this purpose, the contractor shall engage the services of adequate number of Engineers and Technicians. Daily Management Information System (MIS) reports with generation and down time analysis data shall be made available to Railways office by E-mail.

(s) All minor items viz. hardware items, foundation bolts, termination lugs for electrical connections etc. as required and necessary for proper working of the equipment shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.

(t) To comply with the latest guidelines of MNRE and DISCOM in regard to Solar energy and solar plants.

#### **Obligations during Construction and Commissioning:**

The contractor will be responsible for the design, implementation and commissioning of the project. The contractor will Design, Engineer, Procure, Undertake Civil and Electrical work including Erection, Testing & Commissioning of the solar PV project.

- a. The contractor shall procure the solar plant in line with the MNRE requirements on domestic content.
- b. The contractor will bear all costs pertaining to the installation and Commissioning of the systems and these costs will not be recoverable in any form from Railways.
- c. Testing Procedures: The contractor and Railways or its representative(s) shall implement the testing procedures as attached.
- d. The contractor will provide and lay down the dedicated electrical cables for transmission of Solar Power from the Project up to the metering point of Railways.

#### **Obligations relating to aesthetic quality of the rooftop solar project:**

The contractor shall maintain a high standard in the appearance and aesthetic quality of the rooftop solar project and achieve integration of the Solar Rooftop Power System with the character of the surrounding landscape through both appropriate design and sensitive management of all visible elements. The contractor shall engage professional architects and town planners of repute for ensuring that the design of the rooftop solar project meets the aforesaid aesthetic standards.

**The Panels Contains ultra-high-efficiency N-Type TOPCon bifacial dual-glass solar module designed for next-generation performance, durability, and long-term power reliability. Built using advanced G12 cells and dual-glass architecture, this module ensures maximum energy yield and superior field performance under all weather conditions.**

**Engineered to deliver exceptional performance even in low-light environments, the 685 W bifacial module generates power from both the front and rear surfaces, increasing overall energy generation by up to 30%. The N-Type TOPCon cell technology minimizes degradation (LID & PID-free) and ensures better thermal stability, making it ideal for high-temperature zones in India.**

#### **Key Features**

- High Power Output (685 W) – Delivers maximum performance with N-Type TOPCon cells for higher conversion efficiency (up to 22.05%).
- Bifacial Dual-Glass Technology – Generates energy from both sides for up to 30% additional power gain depending on site reflectivity.
- N-Type TOP Con Cells – Ensures higher reliability, minimal light-induced degradation, and superior performance in all climates.

- Enhanced Durability – Dual 2 mm semi-tempered glass on both sides with anodized aluminum frame for long-term outdoor protection.
- PID-Free & UV Resistant Encapsulation – Maintains module integrity and performance stability over decades.
- Excellent Low-Light Performance – Optimized for morning, evening, and cloudy conditions.

1	Solar Cells per Module (Units)/Arrangements	Minimum 132 cells
2	Solar Cell Type & Size	TOPCon N-type Mono Bifacial
4	Front / Back Glass (Material / Thickness)	2 mm Low Iron HTAR semi-tempered Glass
5	Encapsulate	PID Free & UV Resistant
6	Junction Box (Protection degree/Material)	IP68 / Weatherproof PPO
7	Cable & Connector (Protection degree/Type)	IP68 rated / MC4 compatible
9	Frame	Anodized Aluminium Alloy
10	Application class	Class A (Safety Class II)
11	Substrate	Transparent / patterned Back sheet
12	Design mechanical load	3600 Pa-downward ; 1600 Pa-Upward
13	Safety factor for mechanical load	1.5
14	Maximum series fuse rating	30 A
15	Bifaciality Factor	80 ± 5 %
16	Better Temperature Coefficient	Higher power generation under higher ambient temperature conditions
17	Better Output In Low Irradiance	Higher power output even under low-light environments like on cloudy or foggy days

#### DEFINITION:

A Grid Tied Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter, and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid tied SPV system is without battery and should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. Solar PV system shall consist of following equipments/components.

- Solar PV modules consisting of required number of **Mono Crystalline N-Type TOPCon bifacial** PV modules.
- Grid interactive Power Conditioning Unit with Remote Monitoring System
- Mounting structures
- Junction Boxes
- Earthing and lightning protections.
- IR/UV protected PVC Cables, pipes and accessories

#### 1. SOLAR PHOTOVOLTAIC MODULES:

I. The PV modules used should be made in India.

II. The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286 or latest. In addition, the modules must conform to IEC 61730 Part-2-or latest - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS. certificates\*: IEC 61215, IEC 61730, UL 61730, BIS, IEC 61853-1, IEC 62782, IEC 61853-2, IEC 61701, IEC 60068-2-68, IEC 62716

a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701/IS 61701 or latest.

b) The total solar PV array capacity should not be less than allocated capacity (kWp) and should comprise of solar mono crystalline modules of minimum **685** Wp and above wattage. Module capacity less than minimum **685** watts should not be accepted .

c) Protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.

d) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.

e) The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid. Railway shall allow only minor changes at the time of execution.

f) Other general requirement for the PV modules and subsystems shall be the following:

i. The rated output power of any supplied module shall have tolerance of +/- 3%.

ii. The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 (two) percent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.

iii. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of bypass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP-65 rated.

iv. I-V curves at STC should be provided by bidder.

#### **Solar PV modules:**

III. Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each module. This should be inside laminate only.

a) Name of the manufacturer of the PV module

b) Name of the manufacturer of Solar Cells.

c) Month & year of the manufacture (separate for solar cells and modules)

d) Country of origin (separately for solar cells and module)

e) I-V curve for the module Wattage,  $I_m$ ,  $V_m$  and FF for the module

f) Unique Serial No and Model No of the module

g) Date and year of obtaining IEC PV module qualification certificate.

h) Name of the test lab issuing IEC certificate.

i) Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001

#### IV. Warranties:

**a) Material Warranty:** The minimum CUF of solar power plant shall not be less than 16% of installed capacity.

The PV Modules shall be warranted for minimum of **12 Years Product Warranty** against all material/manufacturing defects and workmanship & **30 Years Power Output Warranty**.. The inverter shall be warranted for minimum of 10 years against all material/manufacturing defects and workmanship.

#### V. ARRAY STRUCTURE

a) Hot dip galvanized MS mounting structures may be used for mounting the modules/ panels/arrays. Each structure should have angle of inclination as per the site conditions to take maximum insolation. However to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.

b) The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed. It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to Railway. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed.

c) The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.

d) Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Aluminium structures also can be used which can withstand the wind speed of respective wind zone. Necessary protection towards rusting need to be provided either by coating or anodization.

e) Aluminium frames should be avoided for installations in coastal areas.

f) The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.

g) Regarding civil structures the bidder need to take care of the load bearing capacity of the roof and need arrange suitable structures based on the quality of roof.

h) The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m<sup>2</sup>.

i) The contractor may suitable decide upon the clearance keeping in view the need of heat dissipation etc.

#### VI. JUNCTION BOXES (JBs)

- a) The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP/FRP/Powder Coated Aluminum /cast aluminum alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.
- b) Copper bus bars/terminal blocks housed in the junction box with suitable termination threads conforming to IP65 standard and IEC 62208 or latest with Hinged door with EPDM rubber gasket to prevent water entry. Single / double compression cable glands and provision of earthings. It should be placed at 5 feet height or above for ease of accessibility.
- c) Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs) / SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- d) Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- e) All fuses shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

#### **VII. DC DISTRIBUTION BOARD:**

- a) DC Distribution panel to receive the DC output from the array field.
- b) DC DPBs shall have sheet from enclosure of dust & vermin proof conform to IP 65 protection. The bus bars are made of copper of desired size. Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

#### **VIII. AC DISTRIBUTION PANEL BOARD:**

- a) AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- b) All switches and the circuit breakers, connectors should conform to IEC 60947 or latest, part I, II and III/ IS60947 part I, II and III.
- c) The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d) All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air -insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz.
- e) The panels shall be designed for minimum expected ambient temperature of 45° Celsius, 80% humidity and dusty weather.
- f) All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- g) Should conform to Indian Electricity Act and rules (till last amendment).
- h) All the 415 AC or 230 volts devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.



Variation in supply voltage	$\pm 10 \%$
Variation in supply frequency	$\pm 3 \text{ Hz}$

#### IX. PCU/ARRAY SIZE RATIO:

- a) The combined wattage of all inverters should not be less than rated capacity of power plant under STC.
- b) Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

#### X. PCU/ Inverter:

As SPV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the “Power Conditioning Unit (PCU)”. In addition, the PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit/inverter should also be DG set interactive, if necessary. Inverter output should be compatible with the grid frequency. The capacity of inverter is to be designed in such a way that the capacity will suit the capacity of the solar plant executed as warranted at site. Typical technical features of the inverter shall be as follows:

1	Switching devices	IGBT/MOSFET
2	Control	Microprocessor /DSP
3	Nominal AC output voltage and frequency	415V, 3 Phase, 50 Hz
4	Output frequency	50 Hz
5	Grid Frequency Synchronization range	+ 3 Hz or more
6	Ambient temperature considered	-20°C to 50°C
7	Humidity	95 % Non-condensing
8	Protection of Enclosure	IP-20(Minimum) for indoor. IP-65(Minimum) for outdoor.
9	Grid Frequency Tolerance range	+ 3 or more
10	Grid Voltage tolerance	- 20% & + 15 %
11	No-load losses	Less than 1% of rated power
12	Inverter efficiency(minimum)	>93% ( In case of 10kW or above )
13	Inverter efficiency (minimum )	> 90% (In case of less than 10 kW)
14	THD	< 3%
15	PF	> 0.9

**a) Three phase PCU/ inverter shall be used with each power plant system (10kW and/or above) but In case of less than 10kW single / three phase inverter can be used.**

b) PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.

c) The output of power factor of PCU inverter is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.

- d) Built-in meter and data logger to monitor plant performance through external computer shall be provided.
- e) **Anti-islanding** (Protection against Islanding of grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.
- f) Successful Bidder shall be responsible for galvanic isolation of solar roof top power plant (>100kW) with electrical grid or LT panel.
- g) In PCU/Inverter, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer. If Isolation Transformer is not incorporated with PCU/Inverter, there shall be a separate Isolation Transformer of suitable rating provided at the output side of PCU/PCU units for capacity more than 100 kW.
- h) The PCU/ inverter generated harmonics, flicker, DC injection limits, Voltage Range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow the latest CEA (Technical Standards for Connectivity Distribution Generation Resources) Guidelines.
- i) The power conditioning units / inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683 and IEC 60068- 2(1,2,14,30) or latest /Equivalent BIS Std.
- j) The charge controller (if any) / The MPPT units environmental testing should qualify IEC 60068-2(1, 2, 14, 30) or latest/Equivalent BIS std. The junction boxes/ enclosures should be IP 65(for outdoor)/ IP 54 (indoor) and as per IEC 529 or latest specifications.
- k) The PCU/ inverters should be tested from the MNRE approved test centres/ NABL/ BIS/ IEC accredited testing- calibration laboratories/ or NISE or UL India Pvt Ltd, or TUV Rheinland. In case of imported power conditioning units, these should be approved by international test houses.

## **XI. INTEGRATION OF PV POWER WITH GRID:**

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. Once the DG set comes into service PV system shall again be synchronized with DG supply and load requirement would be met to the extent of availability of power. 4 pole isolation of inverter output with respect to the grid/ DG power connection need to be provided.

## **XII. DATA ACQUISITION SYSTEM / PLANT MONITORING**

- i. Data Acquisition System shall be provided for each of the solar PV plant above 10 kWp capacity.
- ii. Data Logging Provision for plant control and monitoring, time and date stamped system data logs for analysis with the high quality, suitable PC. Metering and Instrumentation for display of systems parameters and status indication to be provided.

iii. Solar Irradiance: An integrating Pyranometer / Solar cell based irradiation sensor (along with calibration certificate) provided, with the sensor mounted in the plane of the array. Readout integrated with data logging system.

iv. Temperature: Temperature probes for recording the Solar panel temperature and/or ambient temperature to be provided complete with readouts integrated with the data logging system.

v. The following parameters are accessible via the operating interface display in real time separately for solar power plant:

- a. AC Voltage.
- b. AC Output current.
- c. Output Power
- d. Power factor.
- e. DC Input Voltage.
- f. DC Input Current.
- g. Time Active.
- h. Time disabled.
- i. Time Idle.
- j. Power produced
- k. Protective function limits (Viz-AC Over voltage, AC Under voltage, Over frequency, Under frequency ground fault, PV starting voltage, PV stopping voltage).

vi) All major parameters available on the digital bus and logging facility for energy auditing through the internal microprocessor and read on the digital front panel at any time) and logging facility (the current values, previous values for up to a month and the average values) should be made available for energy auditing through the internal microprocessor and should be read on the digital front panel.

vii) PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.5 accuracy class.

viii) Computerized DC String/Array monitoring and AC output monitoring shall be provided as part of the inverter and/or string/array combiner box or separately.

ix) String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.

x) Computerized AC energy monitoring shall be in addition to the digital AC energy meter.

xi) The data shall be recorded in a common work sheet chronologically date wise. The data file shall be MS Excel compatible. The data shall be represented in both tabular and graphical form.

xii) All instantaneous data shall be shown on the computer screen.

xiii) Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.

xiv) Provision for instantaneous Internet monitoring and download of data shall be also incorporated.

xv) Remote Server and Software for centralized Internet monitoring system shall be also provided for download and analysis of cumulative data of all the plants and the data of the solar radiation and temperature monitoring system.

xvi) Ambient / Solar PV module back surface temperature shall be also monitored on continuous basis.

xvii) Simultaneous monitoring of DC and AC electrical voltage, current, power, energy and other data of the plant for correlation with solar and environment data shall be provided.

xviii) Remote Monitoring and data acquisition through Remote Monitoring System software at the railways location with latest software/hardware configuration and service connectivity for online / real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the supplier. Provision for interfacing these data on Railway server and portal in future shall be kept.

Provision of SIM card for internet connectivity and it's recharge will be the responsibility of agency for the 5 years. Data charges in this regard shall be borne by the contractor.

xix) The bidders shall be obligated to push real-time plant monitoring data on a specified intervals (say 15 minute) through open protocol at receiver location (cloud server) in XML/JSON format, preferably. Suitable provision in this regard will be intimated to the bidders.

### **XIII. METERING (Mandatory)**

a) The bidirectional electronic energy meter (0.5 S class or as per the latest mandates by DISCOM) /SEB shall be installed for the measurement of import/Export of energy.

b) The bidder must take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to Railway before commissioning of SPV plant.

c) Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM /SEB requirement.

d) Metering cubicle as per DISCOMs / SEB approved make and drawings shall be provided.

### **XIV. PROTECTIONS**

The system should be provided with all necessary protections like earthing, Lightning, and grid islanding as follows:

#### **➤ LIGHTNING PROTECTION**

The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IEC 62305 or latest standard. The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

#### □ **SURGE PROTECTION**

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement).

#### □ **EARTHING PROTECTION**

a) Each array structure of the PV yard should be grounded/ earthed properly as per relevant IS (maintenance free earthing). In addition, the lightning arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of Railways as and when required after earthing by calibrated earth tester. PCU, AC DB and DC DB should also be earthed properly.

b) Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

#### □ **GRID ISLANDING:**

a) In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as “islands.” Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

b) A manual disconnect 4 pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel.

**XV. CABLES :** Cables of appropriate size to be used in the system shall have the following characteristics:

- Shall meet IEC 60227/IS 694, IEC 60502/IS1554 or latest standards
- Temp. Range: –10oC to +80oC.
- Voltage rating 660/1000V
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- Flexible
- Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- For the DC cabling, XLPE or, XLPO insulated and sheathed, UV-stabilized single core multi-stranded flexible copper cables shall be used; Multi-core cables shall not be used.
- For the AC cabling, PVC insulated and PVC sheathed single or, multi-core multi-stranded flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.
- The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use. Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour.
- The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.
- Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers
- All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm2

copper; the minimum AC cable size shall be 4.0 mm<sup>2</sup> copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.

□ Cable Routing/ Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified. In addition, cable drum no. / Batch no. to be embossed/ printed at every one meter.

□ Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.

□ All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV as per relevant standards only.

□ The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant provided by the bidder. Any change in cabling sizes if desired by the bidder/approved after citing appropriate reasons. All cable schedules/layout drawings approved prior to installation.

□ Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation. Overall PVC insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All cables conform to latest edition of IEC/ equivalent BIS Standards as specified below: BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC insulated cables for working Voltage up to and including 1100 V ,UV resistant for outdoor installation IS /IEC 69947.

□ The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.

□ The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

## **XVI. CONNECTIVITY**

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply Code of the State and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

<b>Plant Capacity</b>	<b>Connecting voltage</b>
Up to 10 kW	240V-single phase or 415V-three phase at the option of the consumer
Above 10kW	415V – three phase

a) The maximum permissible capacity for rooftop shall be 1 MW for a single net metering point.

b) Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and specification be made accordingly.

## **XVII. TOOLS & TACKLES AND SPARES:**

a) The downtime of the solar PV system installed at each location shall not be more than 72 hours. If the defects in the solar PV system are not rectified within a period of 72 hours, warranty period of 36 months will be extended accordingly and SD will be released after completion of the extended warranty period.

b) After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder for maintenance purpose.

c) list of requisite spares in case of PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc, Junction Boxes, Fuses, MOVs / arrestors, DC/AC MCB/ MCCB's etc along with spare set of PV modules be made available for maintenance. Required set of spares shall be maintained in the plant itself for the entire period of maintenance and Operation & Maintenance which upon its use shall be replenished.

#### **XVIII. DANGER BOARDS AND SIGNAGES:**

Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage shall be provided one each at battery –cum- control room, solar array area and main entry from administrative block. Text of the signage may be finalized in consultation with railways.

#### **XIX. FIRE EXTINGUISHERS:**

The fire fighting system for the proposed power plant for fire protection shall be consisting of:

- a) Portable fire extinguishers in the control room for fire caused by electrical short circuits
- b) Sand buckets in the control room
- c) The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have been installed.

#### **XX. DRAWINGS & MANUALS:**

a) Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.

b) Approved ISI and reputed makes for equipment be used.

c) For complete electro-mechanical works, bidders shall supply complete design, details and drawings for approval to Railways before progressing with the installation work

d) Single Line Diagrams with operation instructions indicating the interconnection of equipment shall be displayed in each location

#### **XXI. PLANNING AND DESIGNING:**

**a) The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The bidder should submit the array layout drawings along with Shadow Analysis Report to Railways for approval.**

b) Railways reserve the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions/requirements.

c) The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder shall submit three sets and soft copy of final drawing for formal approval to proceed with construction work.

#### **XXII. DRAWINGS TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT**

a) The Contractor shall furnish the following drawings Award/Intent and obtain approval

- b) General arrangement and dimensioned layout
- c) Schematic drawing showing the requirement of SPV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
- d) Structural drawing along with foundation details for the structure.
- e) Itemized bill of material for complete SPV plant covering all the components and associated accessories.
- f) Layout of solar Power Array
- g) Shadow analysis of the roof

### **XXIII. SAFETY MEASURES:**

The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines etc.

### **XXIV. DISPLAY BOARD**

The bidder has to display a board at the project site mentioning the following:

- a. Plant Name, Capacity, Location, Type of Renewable Energy plant (Like solar wind etc.), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
- b. Financial Assistance details from SECI/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful bidder
- c. The size and type of board and display shall be approved by Engineer-in-charge before site inspection.

The IEC standards to be mandatorily adhered are as given below:

### **Quality Certification, Standards and Testing for Grid-connected Rooftop Solar PV Systems/Power Plants**

Quality certification and standards for grid-connected rooftop solar PV systems are essential for the successful mass-scale implementation of this technology. It is also imperative to put in place an efficient and rigorous monitoring mechanism, adherence to these standards. Hence, all components of grid-connected rooftop solar PV system/ plant must conform to the latest and updated version of relevant standards and certifications given below with latest amendments, additions and corrections:

#### **Solar PV Modules/Panels**

<b>Solar PV Modules/Panels</b>		
1	IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
2	IEC 61701	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules
3	IEC 61853- Part 1/ IS	Photovoltaic (PV) module performance testing and energy rating –:



	16170: Part 1	Irradiance and temperature performance measurements, and power rating
4	IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH <sub>3</sub> ) Corrosion Testing (As per the site condition like dairies, toilets)
5	IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
6	IEC 62804	Photovoltaic (PV) modules - Test methods for the detection of potential induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon (mandatory for applications where the system voltage is > 600 VDC and advisory for installations where the system voltage is < 600 VDC)
7	IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units
<b>Solar PV Inverters</b>		
1	IEC 62109-1, IEC 62109-2	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems. Part 2: Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting)
2	IEC/IS 61683 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
	IEC/IS 61683 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
	BS EN 50530 (as applicable)	Overall efficiency of grid-connected photovoltaic inverters: This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.
3	IEC 62116/ UL 1741/ IEEE 1547 (as applicable)	Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures
4	IEC 60255-27	Measuring relays and protection equipment – Part 27: Product safety requirements
	IEC 60068-2 (1, 2, 14, 27, 30 & 64)	Environmental Testing of PV System – Power Conditioners and Inverters a) IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold b) IEC 60068-2-2: Environmental testing - Part 2-2: Tests - Test B: Dry heat c) IEC 60068-2-14: Environmental testing - Part 2-14: Tests – Test N: Change of temperature d) IEC 60068-2-27: Environmental testing -Part 2-27: Tests - Test Ea and guidance: Shock e) IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) f) IEC 60068-2-64: Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance

5	IEC 61000 – 2,3,5 (as applicable)	Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) testing of PV Inverters
<b>Fuses</b>		
1	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Lowvoltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers c) Lowvoltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Low voltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers c) Low voltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests
2	IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
<b>Surge Arrestors</b>		
1	BFC 17-102:2011	Lightening Protection Standard
2	IEC 60364-5-53/ IS 15086-5 (SPD)	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control
3	IEC 61643-11:2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
<b>Cables</b>		
1	IEC 60227/IS 694, IEC 60502/ IS 1554 (Part 1 & 2)/ IEC69947 (as applicable)	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation)
2	BS EN 50618	Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DC Cables
<b>Junction Boxes</b>		
1	IEC 60529	Junction boxes and solar panel terminal boxes shall be of the thermo-plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use

<b>Energy Meter</b>		
1	IS 16444 or as specified by the SEB/DISCOMs	A.C. Static direct connected watt-hour Smart Meter Class 1 and 2 — Specification (with Import & Export/Net energy measurements)
<b>Solar PV Roof Mounting Structure</b>		
1	IS 2062/IS 4759	Material for the structure mounting

Note- Equivalent standards may be used for different system components of the plants. In case of clarification following person/agencies may be contacted.

- Ministry of New and Renewable Energy (Govt. of India)
- National Institute of Solar Energy
- The Energy & Resources Institute
- TUV Rheinland
- UL

**In addition to the above specifications following is also required:**

#### **Remote Display**

Contractor will arrange to install LED based display screens along with relevant hardware at each stations and will develop relevant software programs which will display real time generation on a minute, hourly, daily, monthly and annual basis. The cost of development of these systems will have to be borne by the contractor. In addition, the system have to send SMS regarding Solar generation at each location to the selected officials of Railways on Daily basis.

The contractor shall provide and maintain perimeter fencing or other suitable protection around the rooftop solar project and shall be responsible for the security arrangements, which also includes providing & maintaining necessary equipment at the entry, exit and within the rooftop solar project in order to maintain orderly conduct of its business and the security thereof.

#### **Interconnection Scheme**

##### **Interconnection Requirements: Scope of Work for the contractor**

##### **A. All work must be carried out as per the following:**

- Indian Electricity Act and rules therein
- Indian Electricity Grid Code
- Regulations of Chief Electrical Inspector

Besides the above measures, certain precautions prescribed by the CEA shall also be incorporated into the solar PV system design:

☐ PV systems shall be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) side for overload and short circuit protection as well as disconnecting switches to isolate the DC and AC system for maintenances.

☐ Fuses of adequate rating shall also be provided in each solar array module to protect them against short circuit.

##### **B. Phase Imbalance:**

☐ Phase imbalance can occur due to varied power injected into different phases of the grid. Whenever solar power plants (SPPs) of lower capacities with single phase inverters are used to feed power into the grid using a single phase injection point, they tend to induce imbalance. This

imbalance can be resolved simply by connecting / injecting power to different phases in the same grid.

☐ The developer shall have to follow the phase imbalance limits imposed by the Off Taker and shall also have to follow the guidelines before connecting such limits to the grid.

☐ The injection phase for each system to be injected into a single phase shall be approved by the Off Taker.

**a) Statutory clearances to be arranged by the contractor.**

- a) Building and Architectural Drawings approval
- b) Factory Inspector approval on drawings, wherever necessary
- c) Electrical System approval (Electrical Inspector)
- d) Fire System approval (CFO)
- e) All statutory requirements for working at the Project Site like Labour Registration, Workman Compensation Policy, ESIC etc.

**All the documents necessary for obtaining statutory clearances/ permissions/authorisations by various government organisations/ other agencies shall be collected and prepared by the successful tenderer, without any extra cost and got signed from the competent authority of Railways.**

**TESTING PROCEDURE**

The contractor shall adhere to the Testing Procedures given in this document.

**Mandatory check before and after connecting the SPV system with DISCOM Network and steps for maintenance of network shall be ensured. The following shall be provided by the contractor and ensured.**

**1. Mandatory safety precautions / features:**

The following are mandatory safety precautions which will be taken care before and after commissioning of grid connected Solar PV system.

(a) An inbuilt Inverter relay which trips on DISCOM / Railway supply failure and thus prevents any solar power injection to the DISCOM / Railway Network when there is no power from DISCOM / Railways. The anti-islanding protection shall be tested by respective Railway Engineer and the contractor during the release of connection.

**(b) The Solar PV system should be separately grounded / earthed. A minimum of two Separate dedicated and interconnected earth electrodes must be used for the Earthing of the PV system support structure, with a total earth resistance not exceeding 5 ohms. There must be at least three different earth pits, with minimum distance of 3 meters between any two, for each PV system; one for DC side (panels and structure), second for AC side (also called as neutral earthing) and lightning arrestor earthing. Additionally, inverter body must be earthed as per instructions from inverter manufacturer.**

(c) A properly designed Lightning Protection System (including arrestors as necessary) also must be provided for SPV.

(d) Manual isolator switch, at an easily accessible location with locking facility, shall be provided between inverter AC output and grid interconnection.

(e) Caution Stickers shall be used with the green background and the text “Solar PV Systems” written in white letters. The size of these stickers shall be 10 CM (width) x 7 CM (height) with the text clearly printed in the center of the sticker.

(f) All SPV systems should have a mandatory sign board fitted near the existing meter reading terminal stating that ‘This service is fitted with a LT grid connected SPV plant’. The Solar PV system Caution Stickers shall be fixed under the supervision of Railway Engineer and the contractor in the following locations.

- i. On or near to meter of service with grid connected solar PV system;
- ii. On The Consumer main switch, of a service connected with a grid connected Solar PV System;
- iii. On LT poles with grid connected Solar PV Systems at height of about 1.50 meter from the ground;
- iv. On LT feeder pillars with grid connected Solar PV System on the street-facing door of the feeder pillar.
- v. On each of the LT take off poles of a Distribution Transformer to which Solar PV Systems are connected.
- vi. On substation end of HT feeder having Solar PV System.
- vii. A List of service connected with grid connected Solar PV Systems shall be available at the Railway office.

(g) During planned / forced maintenance work on DISCOM network, before taking up the work in hand, besides ensuring all other provisions such as line earthing, de-energizing the line section where the work is to be carried out as per prevailing norms, it should also be ensured that supply from such small solar roof-top PV power plants are not back feeding and supply should also be disconnected by manual isolating switch with locking facility installed in the premises of such consumers and ensuring proper earthing.

### **Automatic cleaning system**

The contractor to provide necessary arrangement by laying pipe lines and all necessary accessories from nearest water connection point made available.

### **Products Features**

- Automatically clean the solar panels according to the time set by user
- Water-sprinkler based programmable cleaning systems
- Automatic as well as manual mode for solar panels cleaning
- Latest MCU based technology
- Advance Motor Dry Run Protection sensor
- Pump Dry run protection sensors available which protect your pump running in dry run (no water) conditions
- Set system Cleaning time 1 & 2 minutes
- set system Cleaning mode Daily & Alternate day
- Compact design and Powerful operation
- More Reliable, Powerful & smooth Device
- Low power consumption
- Water empty indication by Buzzer tones
- Shock free connection
- 0.5Hp to 10Hp open well Submersible Motor pump Handling capacity
- Capable for all types of submersible pump control
- Power cut does not effect on system operation
- Easily reprogrammed

- Simple and time saving installation, no special tools required

### **Product specification**

- I/P Voltage: 230vac
- Capacity: 0.5Hp to 10Hp
- Openwell Submersible pump
- Time setting: User friendly time setting
- Sensor: Pump Dry run protection sensors available
- Technology: Latest MCU based technology
- RTC: Available
- Cleaning mode: Daily & Alternate day
- Cleaning time: Set 1 & 2 minute
- Cleaning operation: Automatic & Manual
- Water indication: Water empty indication by Buzzer tones
- Wire connection: Shock free connection
- Battery: Lithium Battery
- Power: very low Consumption
- Design: Compact design and Powerful operation
- Power effect: Power cut does not effect on system operation

### **E-welt Solar Sprinkler**

- E-welt novel design solar panel cleaning sprinkler
- Unique Spray Nozzle
- 180degree projection area
- Wide spread water
- single sprinkler cleans whole panel
- Zero Shadow effect
- Zero maintenance
- Perfect water flow controller
- Utilize less water
- Cleaning with High presser
- Compact design and Powerful cleaning
- Remove Dust & Bird drops
- Long life span
- Suitable with all types of panel
- Perfect fitting with UPVC & Lateral martial

### **Sprinkler Bracket**

- Universal Clip Design -Clamps to any Solar Panel
- Sprinkler Bracket hold the sprinkler & pipe with solar panel
- Suitable with all types of solar panel
- Galvanize material
- Corrosion free
- High strength
- Long life span
- More reliable
- Easy to use
- **Warranty – minimum 05 years**

## **TECHNICAL SPECIFICATIONS FOR OTHER ITEMS**

### **SPECIFICATION FOR MULTI CORE PVC INSULATED FLEXIBLE COPPER CONDUCTOR CABLES FOR VOLTAGE GRADE 650/ 1100 VOLTS**

Multi Core PVC insulated multi stranded flexible copper cable conforming to IS: 694-2010 or its latest editions with bright annealed based copper conductor as per IS: 8130 of 2013 or its latest editions, with ISI marked.

### **SPECIFICATION FOR SINGLE CORE PVC INSULATED FLEXIBLE COPPER CONDUCTOR CABLES FOR VOLTAGE GRADE 650/ 1100 VOLTS**

Multi Core PVC insulated multi stranded flexible copper cable conforming to IS: 694-2010 or its latest editions with bright annealed based copper conductor as per IS: 8130 of 2013 or its latest editions, with ISI marked.

### **GENERAL GUIDELINES FOR PVC CONDUIT WIRING**

- a) This includes supply of materials and wiring as required.
- b) Drilling holes in the walls should be done very carefully without causing damage to supporting wall and structure of building. Minor damages caused if any to the plastering on the wall should be repaired by the contractor.
- c) Wall crossings should be through PVC pipe of 25/20 mm dia (2 mm wall thickness).
- d) Looping of neutral is not permitted; a separate neutral wire is to be drawn from the neutral strip connector in Sub circuit board to each point.
- e) The wiring shall conform to latest IS specification (IS-732) and NEC Code for internal wiring in buildings. No joint is permitted in wiring.
- f) The pipes should be fixed on to the walls in exactly horizontal or vertical fashion as required as per site condition and there should not be gap left between the consecutive lengths. The pipes should be fairly tight to facilitate easy removal and replacement of the same for maintenance wherever required.
- g) The Junction Boxes, straight through joints, bends etc should be provided where ever necessary.
- h) The wires taken inside the pipe shall not be cramped and wires should be easy to pull out at the time of maintenance/checking.
- i) Number of wires that can be drawn through a PVC conduit/ casing and capping shall be as per CPWD specifications Part I Internal 2013 or latest
- j) Wall shall be neatly plastered to bring it to the original finish after Groove cutting.

### **SPECIFICATION FOR CABLE TRENCH FOR LTUG CABLES**

#### **a) EXCAVATION OF CABLE TRENCH**

Excavation of cable trench 450 mm wide and 1000 mm deep in all kinds of soil and refilling the cable trench with excavated soil free from unwanted materials, ramming, consolidating and bringing the surface to its original finish.

- b) Cable route indicators have to be provided along the route of LTUG cable in ground at both the ends of the length and at all deviation points. Cable route indicators have to be provided along the route of LTUG cable in ground at both the ends of the length and at all deviation points. Cable route

indicators shall be with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size ) of size 60 cm X 60 cm at the bottom and 50 cm X 50 cm at the top with a thickness of 10cm including inscription duly engraved as required)

c) Trench for cable underneath the track/road:-

Cables shall be drawn through HDPE pipes. Trench to accommodate pipe shall be of suitable width and excavated at 1.0 m below the formation level. Once the pipes are laid in the trench, it should be made to its original formation level by filling it up with excavated earth by watering and ramming process and resetting the ballast of track to its original level. Similarly wherever road has been dug for laying the cable the same should be filled, rammed and asphalted and brought to original condition.

The cable rising above ground shall be taken through GI pipe neatly clamped and open end of GI pipe has to be sealed with bitumen compound. The cable has to be laid along the route as per instruction of Engineer-in-charge.

#### **SPECIFICATION FOR LAYING OF LTUG CABLES.**

The laying of LTUG Cable includes un-coiling of cable from cable drum, Laying the cable in the trench free from twists, bends, Peeling of Insulation, Dressing at Terminal Ends, Provision of Cable glands, Crimping with suitable shoe, Connection at both ends & Earthing of Armour at both ends.

#### **SPECIFICATION FOR HDPE PIPE**

The HDPE pipe material should be confirming to standard IS 4984-1995 or latest and should be of PE-80 material designation which has MRS(Minimum Required Strength) of 8.0MPa and maximum allowable hydrostatic design stress of 6.3 MPa (@20 °C) with pressure rating of PN-6(6kg/cm<sup>2</sup>), heavy gauge has to be provided.

The cable has to be laid through HDPE pipe with all necessary accessories for jointing, clamping, bends etc. as per site condition has to be provided.

#### **SPECIFICATION FOR LTUG CABLES**

PVC insulated armoured with heat resistant insulation, PVC outer sheathed multi core LTUG cable with standard aluminium conductor, with IS 1554 Part I/1988 with latest amendment suitable for working voltage up to and including 1100volts.

#### **Moulded Case Circuit Breakers (MCCB)**

MCCBs shall conform to IEC 60947-2:2016+AMD1:2019 or latest (Ics = 100% Icu) and shall have ON, OFF & TRIP indications with breaking capacity as specified in the relevant Schedule item. MCCBs shall be suitable for three phase, 415 Volt, AC supply.

#### **SPECIFICATION FOR MAINTENANCE FREE EARTHING**

The maintenance free earthing arrangement shall be done in accordance with RDSO specification no. RDSO/ PE/ SPEC/ PS/ 0109-2008 (REV'0'). For transformers, substation earthing, LT line equipment (**40 kA**), The IR value shall be less than 1 ohm., in normal soil resistivity upto 50 ohm-mtr, single electrode type earth system.

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus. The work shall be done in an approved manner as per site conditions as per the instructions of field Engineer.

#### **Concentric pipe earth electrode : (Current capacity 40 kA)**

##### **Primary conductor -**

MS pipe with 40 mm diameter, class B, ISI mark as per IS-1239, length 3000 mm.



**Secondary conductor -**

MS pipe with 80 mm diameter, class B, ISI mark as per IS-1239, Length 3000 mm.

**Current carrying capacity :** The design of the electrode should be such as to have current carrying capacity in 40 kA (for 1 second).

S.N.	Current Capacity	Primary Conductor diameter	Electrode dimensions (dia. X length)
1	40 kA	40 mm	80 mm x 3000 mm

**Dimensions and Nominal Mass of Steel Tubes — Medium (as per IS 1239)**

Nominal Bore	Outside Diameter		Thickness	Mass of Tube
(mm)	Maximum (mm)	Minimum (mm)	(mm)	Plain End (kg/m)
40	48.8	47.9	3.2	3.56
80	89.5	88.0	4.0	8.36

**Conductive mixture**

- 5) For hermetically filling inside the cavity i.e. between secondary conductor and primary conductor, crystalline compound is to be injected in the electrode assembly. It is a combination of high conductivity metal alloys, copper and aluminium powder, conductive carbon/cement and bonding material etc. mixed in different portion. The mixture is forced (pressurized) filled inside the earth electrode in the paste form and after solidification of the same, the end caps are welded. The metal alloys shall help in conducting the current and conductive carbon gives anti corrosive property. Bonding material should provide strength to the mixture. Resistivity of the mixture shall be less than 0.2 ohm-meter. Resistivity shall be tested by making a 20 cm cube of the material and checking resistance across the opposite face of the cube.
- 6) Complete electrode shall be molecularly bonded by 99.99% pure, high conductivity copper on outer surface with copper coating thickness 300 micron or more.
- 7) Its surface shall be clean and free from any visible oxide layer or foreign material.
- 8) Copper bus bar of size 250 mm x 50 mm x 6 mm having electrical conductivity of 101% IACS, minimum 99.9% copper content shall preferably be exothermically welded to earth electrode or connected with the help of two number stainless steel nut bolts of appropriate size having 4 holes of 12 mm dia. (2 on each side) for connecting earthing conductor.

**Minimum quantity of earth enhancement material to be supplies :**

For 5'x5'x10' earth pit – min 75 kgs per pit

For 300 mm bore type earth pit – min 50 kgs per pit

The earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with manufacturers name or trade name, quantity, batch no & date of manufacture.

**Warranty : 05 year against earth electrode of copper plating. If found faded or corrosive whole earthing is to be replaced by tenderer.**

**Note :** Earthing Pit Box should be supplied & erected by contractor. Also necessary cementing work to be done by contractor to make site as original.

**R.C.C. earth pit box**

R.C.C. earth pit box of size 450 X 450 X 50mm including cover of size 450 X 450 X 4.5mm along with white wash. The work shall be done in an approved manner as per the instructions of field supervisor.

**PVC Large Earth Pit**

PVC Large Earth Pit Cover (10 inches) At Top (Dia) -252 mm At Bottom (Dia) – 334 mm Height – 260 mm (IS-3043).

**Special Features -**

- A durable round valve box ideal for commercial and residential installation.
- Round Valve box extra support for strong load
- Twist lock design cover
- UV Resistant
- Pipe cutouts for quick and easy installation
- Damper proof

➤ **Every individual earth shall be allotted a serial number. Following information shall be suitably written with white or yellow paint.**

- a) Earth No. \_\_\_\_\_
- b) Individual earth resistance \_\_\_\_\_ ohms
- c) Overall earth resistance \_\_\_\_\_ ohms
- d) Date of test \_\_\_\_\_

**Test report of earthing system (To be connected by earth Tester)****i) Individual Earth Resistance**

Earth Electrode No 1 \_\_\_\_\_ ohm  
 Earth Electrode No 2 \_\_\_\_\_ ohms  
 Earth Electrode No 3 \_\_\_\_\_ ohms

**ii) Overall Earth Resistance:**

- a) HT earth electrode \_\_\_\_\_ ohms
- b) LT earth electrode \_\_\_\_\_ ohms
- c) Neutral earth electrode \_\_\_\_\_ ohms

**Note:** Before energization of installation earthing system will have to be checked by contractor in presence of Sr. DEE/G/BSL's authorized representative/Site in charge and test report be submitted to Sr. DEE/G/BSL for his approval on above prescribed Performa.

Signature of Tenderer

**Note – Capacity for Rooftop Solar Plants may be vary as per feasibility of site at various locations over Bhusaval Division.**

Making arrangements for water in the plant area for module cleaning for maintaining minimum CUF as given in warranty clause. **The contractor shall make arrangement for fortnightly cleaning of the solar PV modules during the maintenance period. Logbook for the same shall be jointly signed by contractors representative and SSE incharge.**

**74.Schedule item no. B-35**

**Supply, Erection, testing, and commissioning of 1MVA, 11KV/433V, 3 Phase, 50Hz, Oil Immersed, ONAN, Outdoor Type, Vector group Dyn11, Copper Wound Distribution Transformer losses as per IS : 1180 EEL-2 with OCTC**

- **Distribution transformers are covered under the mandatory standards and labelings (S&L) program of BEE under section 14 (a) of energy conservation act, 2021, since 2009. Therefore, BEE star labelling is compulsory.**
- **Firm (Manufacturer) should hold a valid BIS licence as per IS 1180 : 2021 and BEE star labeling is also required.**
- **Applicable standards vide as per letters below :**
  - 1) Gazette of India Letter No.5018 dtd. 11/12/2023**
  - 2) Gazette of India Letter No.4939 dtd. 10/12/2024**
  - 3) Gazette of India Letter No.5769 dtd. 23/12/2025**
- **Transformer shall be copper wound.**
- **Transformer shall comply IS 1180 latest.**

This includes supply, erection, testing & commissioning of 3 phase 50 Hz, AC, 1000-KVA (1MVA), 11KV/0.433KV, Step Down, distribution transformer, double wound with copper conductor, Outdoor type, oil immersed, naturally cooled, delta/ Star connected, vector Dyn-11, noise free, core type with “A” Class insulation level 75 kVP minimum.

The equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation, in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which, in his judgment is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble-free operation. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification.

The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. The design shall incorporate every precaution and provision for the safety of equipment.

**STANDARDS :-**

The major materials used in the transformer shall conform in all respects to the relevant/specified Indian Standards with latest amendments thereof as on bid opening date, unless otherwise specified herein. Some of the applicable Indian Standards are listed as hereunder:

<b>Indian Standards</b>	<b>Title</b>
<b>IS 1180 (Part-I): 2014</b>	Outdoor type oil immersed distribution transformers up to and including 2500kVA, 11 kV- specification
<b>IS 12444</b>	Specification for copper wire rod
<b>IS-335</b>	Specification of transformer / Mineral Oil
<b>IS-5</b>	Specification of colors for ready missed paints
<b>IS-104</b>	Ready mixed paint, brushing zinc chromate, priming
<b>IS-2099</b>	Specification for high voltage porcelain bushing
<b>IS-649</b>	Testing for steel sheets and strips and magnetic circuits

IS-3024	Cold rolled grain oriented electrical sheets and strips
IS-4257	Dimensions for clamping arrangement for bushings
IS-7421	Specification for low voltage bushings
IS-3347	Specification for outdoor bushings
IS-5484	Specification for Al wire rods
IS-9335	Specification for insulating kraft paper
IS-1576	Specification for insulating press board
IS- 6600	Guide for loading of Oil immersed transformers
IS- 2362	Determination of water content in oil for porcelain bushing of transformer
IS-6162	Paper covered aluminum conductor
IS-6160	Rectangular electrical conductor for electrical machines
IS-5561	Electrical Power connector
IS-6103	Testing of specific resistance of electrical insulating liquids
IS-6262	Method of test for power factor and dielectric constant of electrical insulating liquids
IS-6792	Determination of electrical strength of insulating oil
IS-10028	Installation and maintenance of transformers
IS:3024	Core Material
IS:11149/4253	Gaskets wherever used

#### PRINCIPAL PARAMETERS:

The transformers shall be suitable for outdoor installation with three phase, 50 Hz, 33 kV system in which the neutral is effectively earthed and they should be suitable for service with fluctuations in supply voltage as per Indian Electricity Rules.

The transformers shall conform to the following specific parameters:

Sr No	Item	11 Kv Distribution Transformer
1	Rated capacity	1000 KVA (1MVA)
2	Rated Voltage (HV)	11 kV
3	Rated Voltage (LV)	433 V
4	Frequency	50 HZ (+/- 3%)
5	No. of Phases	Three
6	Connection – primary/secondary	Delta/star
7	Winding	Double wound copper
8	Insulation	Class” A” mineral oil
9	Cooling	ONAN
10	Vector group	Dyn-11
11	Off load Tap changing	HT
12	Transformer type	Outdoor
13	Percentage impedance	As recommended by relevant and other governing codes
14	H.V terminals	Cable box suitable to accept 3cx300 sq.mm HT cable or as per requirement
15	L.V terminals	Cable box suitable to accept 3 run 4c x 4 00 sq.mm LT cable or as per requirement and with disconnecting chambers
16	Tap settings	Tapping shall be provided, on the higher voltage winding for variation of HV voltage within range of (+) 5.0 % to (-) 10% in steps of 2.5%.
17	Winding material	Copper Conductor

18	Insulating paper	Kraft paper (as per relevant IS)
19	Noise level at rated voltage and frequency, maximum (in dB)	45-55
20	Buchholz relay	Shall be provided (as per relevant IS)
21	Standard fittings and accessories	<ul style="list-style-type: none"> <li>• Name rating and connection diagram plate</li> <li>• Explosion vent</li> <li>• Earthing terminal</li> <li>• Lifting legs/ hooks</li> <li>• Plain window type level gauge with level markings</li> <li>• Drain cum bottom filter valve with plug with oil sampling valve</li> <li>• Thermometer pocket with dial type thermometer for oil</li> <li>• Oil level indicator</li> <li>• Air release plug</li> <li>• Conservator with oil filling hole and cap/shut off valve</li> <li>• Silica gel dehydrating breather- transparent type</li> <li>• Filter valve</li> <li>• Detachable Rollers</li> <li>• Non return valve</li> <li>• Radiators</li> <li>• For connection at HV and LV terminals, any material required i.e. copper busbar/terminal connector etc. shall be arranged by contractor.</li> </ul> <p>All standard accessories as per relevant Indian standards</p>

#### **TECHNICAL REQUIREMENTS:**

##### **CORE MATERIAL:**

The core shall be stack / wound type of high-grade Cold Rolled Grain Oriented or Amorphous Core annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the frames firmly to prevent vibration or noise. The core shall be stress relieved by annealing under inert atmosphere if required. The complete design of core must ensure permanency of the core loss with continuous working of the transformers. The value of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated in the offer.

The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall furnish necessary design data in support of this situation.

##### **WINDINGS:**

- HV and LV windings shall be wound from Super Enamel covered /Double Paper covered Aluminum/ Electrolytic Copper conductor.
- LV winding shall be such that neutral formation will be at top.
- The winding construction of single HV coil wound over LV coil is preferable.
- The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- Joints in the winding shall be avoided.

**TAPPING RANGES AND METHODS:**

- Tapping shall be provided, on the higher voltage winding for variation of HV voltage within range of (+) 5.0 % to (-) 10% in steps of 2.5%.
- Tap changing shall be carried out by means of an externally operated self position switch with mechanical locking device and a position indicator and when the transformer is in de-energized condition. Switch position No.1 shall correspond to the maximum plus tapping. Each tap change shall result in variation of 2.5% in voltage. Arrangement for pad locking shall be provided. Suitable aluminum anodized plate shall be fixed for tap changing switch to know the position number of tap.

**OIL:**

- The insulating oil shall comply with the requirements of IS 335. Use of recycled oil is not acceptable. The specific resistance of the oil shall be tested as per IS 6103 or relevant latest.
- Oil shall be filtered and tested for break down voltage (BDV- minimum 55KV) and moisture content before filling.
- The oil shall be filled under vacuum.
- The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

**TANK:**

- Transformer tank construction shall conform in all respect to IS 1180(Part-1):2014 or relevant latest.
- The internal clearance of tank shall be such, that it shall facilitate easy lifting of core with coils from the tank without dismantling LV bushings.
- All joints of tank and fittings shall be oil tight and no bulging should occur during service.
- Inside of tank shall be painted with varnish/hot oil-resistant paint.
- The top cover of the tank shall be slightly sloping to drain rain water.
- The tank plate and the lifting lugs shall be of such strength that the complete transformer filled with oil may be lifted by means of lifting shackle.
- Manufacturer should carry out all welding operations as per the relevant ASME standards.

1	Transformer tank cover construction	Non sealed, Bolted
2	Tank configuration with	Radiator fins
3	Type of cooling	ONAN
4	Material of transformer tank	Mild/stainless steel
5	Minimum thickness of top and bottom material of transformer tank (mm)	6 mm
6	Minimum thickness of side material of transformer tank (mm)	4 mm
7	Material of bolts/ Nuts/Washers exposed to atmosphere	Stainless steel/ Brass/ Electro Galvanized / Hot dip galvanized
8	Provision of conservator	Yes, for non-sealed type with plain tank construction
9	Insulating Oil	Mineral Oil (IS 335 latest)
10	Transformer supplied with Transformer Oil	Yes
11	Pressure and vacuum requirements	As per IS 1180 or latest

**Other General conditions:**

- The Phase & Neutral connection on primary and secondary side shall be brought out through porcelain bushing confirming to IS – 2099 /1973 or relevant latest and accessories as below.
- The value of the parameters of the transformer shall not exceed the limits specified by the relevant IS code. (Subject to tolerance limits specified thereon)
- Type of painting inside tank or external surface of tank shall be confirming to IS 1180 (Pt.1) 2014 or relevant latest.
- The percentage impedance of transformers at 75 degree C shall be as per IS 1180(Part-1):2014 or relevant latest.
- The item includes all type loading, loading and transportation as per site requirement.
- Type test reports of NABL accredited lab to prove the conformity of the specification shall be submitted.

**EFFICIENCY:** - Efficiency should not be less than 98% at 0.8 PF.

**Transformer should conforming to latest energy efficiency norms stipulated by BEE (Level II or above) as per IS 1180 with latest revisions.**

**FOUNDATION:** Suitable size foundation as per recommendation of OEM shall be constructed by contractor.

**NOTE:** Before charging the transformer, all tests recommended by OEM shall be done by contractor at site.

**16. TESTS**

**General-** All routine, type and special tests shall be performed as per relevant parts of IS 2026. Pressure and oil leakage test shall be conducted.

**17. Routine Tests** (to be conducted on all units)

The following shall constitute the routine tests:

- a) Measurement of winding resistance (IS 2026 Part 1)
- b) Measurement of voltage ratio and check of phase displacement (IS 2026 Part 1)
- c) Measurement of short-circuit impedance (principal tapping, when applicable) and load loss at 50% and 100% load (IS 2026 Part 1)
- d) Measurement of no-load loss and current (IS 2026 Part 1)
- e) Measurement of insulation resistance (IS 2026 Part 1)
- f) Induced over-voltage withstand test (IS 2026 Part 3)
- g) Separate-source voltage withstand test (IS 2026 Part 3)
- h) Pressure test.
- i) Oil leakage test.

**1. Type Tests**

**(Type Test Certificate must be submitted by Contractor)**

**19. Pressure and Oil leakage Test For Transformers 1 MVA.****19.1 Pressure test (routine test)****a) Plain tanks**

The transformer tank with welded / bolted cover shall be tested at a pressure of 35 kPa above atmosphere pressure maintained inside the tank for 10 minutes. There should be no leakage at any point.

### b)Corrugated tanks

The corrugated transformer tank shall be tested for air pressure of 15 kPa above atmosphere pressure maintained inside the tank for 10 minutes. There should be no leakage at any point.

#### 19.2 Oil leakage test (routine test).

The assembled transformer for non-sealed and sealed type with all fittings including bushing in position shall be tested at a pressure equivalent to twice the normal head measured at the base of the tank for 8 Hrs. There should be no leakage at any point. Tank with corrugations shall be tested for oil leakage test a pressure of 15 kPa measured at the top of the tank for 6 Hrs. There should be no leakage at any point.

**Note :- HT Terminal with right angle bushing OR HT termination should be done through touch proof termination kit.**

#### **75.Schedule item no. B-40**

##### **Excavation and casting of cement concrete foundation including plinth in all type of soil.**

Supply of all the required material for concreting, excavation of pit of required size in all type soils. Casting of cement concrete foundation in ratio 1:3:6 in accordance with the standard. The excess soil / material excavated shall be removed to safe place as per the directives of Railway representative. Work includes grouting of pole, casting of muffing to poles transformer plinth and foundation of various panel shall be done in 1:3:6 ratio. The cost of work also include, painting of muffing and plinth with cement paint of black color. The work shall be done under joint supervision of Railways representative.

#### **76.Schedule item no. B-41**

##### **Supply, installation and commissioning of 1.5 Ton Split Air conditioner of Green AC -With 5 BEE Star Rating inverter, copper coil, ISEER : 5.8 or above with connected accessories etc.**

The cost includes supply erection, testing and commissioning of Split Air Conditioner 1.5 Ton capacity inverter type with Remote & AC bracket.

<b>CAPACITY / GENERIC</b>	
Type of Air conditioner	High wall Split AC
Technology of AC	Inverter (Variable Speed)
Nominal cooling capacity in Ton	1.5 Ton
cooling capacity in Watts	5275 Watts
Coil Material	Copper
Eco-friendly refrigerant	R-32
Minimum length of copper pipe and suitable connecting electrical cable for installation and commissioning	3 metre
Swing	4 way
<b>CONFORMITY / CERTIFICATION</b>	
BEE Star Rating	As per BEE 5 star rating and details should be available at BEE website.
ISEER	5.8 or above
Conformity to Indian Standard	IS 1391 or latest (ISI marked)
Stabiliser free operation – voltage range	160V-280V
<b>WARRANTY</b>	
Warranty on Machine	1 year
Warranty on Compressor	10 years
Warranty on PCB	5 years



➤ **AC Pipe to be covered by UPVC ducts, details as below :**

1. Anti-Rat bite
2. UV Protection
3. Professional look
4. All Weather Proof
5. Maintains Heat Insulation
6. Easy To Install/Remove
7. Long Lasting
8. Ducts are made up of high Quality Fresh UPVC, Fresh UPVC is the original molecule granules (Unplasticized).
9. Smart guard cover to maintain heat insulation which ensures overall efficiency of the AC
10. Should Fit larger AC pipes, covering up to 4.5 inches in width especially for heavy ton ACs
11. Ultra-Durable, Lightweight, Easy to Install, Paintable, Anti-Heat/UV & Weatherproof, made up of High-quality UPVC materials, especially for AC
12. Made up of High Quality Original & Fresh PVC granules, ensuring exceptional weather resistance (Rain & Anti-UV).
13. Smart Guard cover as AC pipeline hider which leads to beautification of your interior/exterior walls
14. Duct wall hole cover, Diversion elbow & 360° Flexible pipe are key when overcoming installation obstacles

**Included Parts –**

**T-Joint** - It facilitates the horizontal passing of pipelines installed between T-joint connections. (for VRV/VRF)

**Wall Cap** - It provides a secure, polished finish for pipelines passing through wall cap Installations.

**Bridge Joint** - It enables the seamless transition of Pipelines across bridge joint connections.

Stand	Wall Mount for 1.5 ton AC
Model Number	100% High quality Metal Wall Mounted Heavy Duty Air Conditioner Outdoor Unit Mounting Brackets Ac outdoor stand 500mm x 160mm Shelf Bracket
Type	Wall Mount
Shape	L Shape
Material	Iron
Finish	Chrome Finish
Length of Arms	0.8 Ton to 2.0 Ton
Compatible With	Free Fitting Material Inside
Adjustable	Yes
Color	White
Maximum Supported Weight	35 Kg
Weight	2000 g

**77.Schedule item no. B-44**

**SETC of metallic mount suitable for outdoor unit (1.5 ton/ 2 ton), wall mounted.**

Stand	Wall Mount for <b>1.5/2 ton</b> AC
Model Number	100% High quality Metal Wall Mounted Heavy Duty Air Conditioner Outdoor Unit Mounting Brackets Ac outdoor stand 500mm x 160mm Shelf Bracket

Type	Wall Mount
Shape	L Shape
Material	Iron
Finish	Chrome Finish
Length of Arms	0.8 Ton to 2.0 Ton
Compatible With	Free Fitting Material Inside
Adjustable	Yes
Color	White
Maximum Supported Weight	35 Kg
Weight	2000 g

#### **78.Schedule item no. B-45, B-46**

**Supply, erection, testing & commissioning of Nitrile rubber/ Thermal insulation for refrigerant pipe of class 'O' size 9 mm**

**Supply, erection, testing & commissioning of Nitrile rubber/ Thermal insulation for refrigerant pipe of class 'O' size 13 mm**

The price shall cover cost of Nitrile rubber/ Thermal insulation for refrigerant pipe of class 'O' size 9 mm & 13 mm.

Closed cell, flexible & has a built-in vapor barrier.

1. High Strength
2. Environmental friendly
3. Heat Resistance

Insulation must have a thermal conductivity of  $\leq 0.034$  W/(m.K) at 0°C and  $\leq 0.036$  W/(m.K) at 24°C when measured according to ASTM C 177, ASTM C 518 or EN ISO 8497. Insulation must have water vapour permeability of 0.13  $\mu\text{gm}/(\text{N.h})$  when measured to BS4370-2:1993.

Insulation must have an operational temperature range of -50°C to +105°C (tubes) and -50°C to +85°C (flat sheets).

Preferably the material shall incorporate Microban® anti-microbial protection to actively inhibit the growth of mould.

Insulation must achieve the following fire performance:

- (i)BS 476-6:1989 – low contribution to fire growth with Fire Propagation Index of performance (I) no exceeding 12 and sub index (i1) not exceeding 6; and
- (ii)BS 476-7:1997 - of very low Surface Spread of Flame (class 1)

#### **79.Schedule item no. B-47, B-48**

**Supply, erection, testing & commissioning of 25 mm Hard PVC Drain Piping with 9 MM insulation.**

**Supply, erection, testing & commissioning of 16 mm Hard PVC Drain Piping with 9 MM insulation.**

The price shall cover the cost of supply, loading, transportation and unloading to site, erection, testing and commissioning of material, fixing of Hard PVC Drain piping with 9 MM pipe lagging foam insulation of size 25 MM and 16 MM. The pipe shall Excellent quality, Sturdy, dimensionally accurate, Leak proof, Low maintenance.

#### **80.Schedule item no. B-49**

**Supply and fixing of Refrigerant Piping with Hard Drawn Copper pipe/ Tube of various sizes with accessories to connect condenser unit and cooling coil including suction and discharge line.**

This item comprises of suction and discharge copper pipe of  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{5}{8}$ ,  $\frac{3}{8}$  inch dia. respectively. One meter of schedule item will comprise one mtr. of suction pipe plus one meter of

discharge pipe running in respective circuit of specified diameter along with all necessary pipe fitting, joints etc.

All the refrigerant piping should be done according to standard of air conditioning practice with 16 SWG thick hard drawn copper pipes with necessary fittings. Refrigerant pipe shall be clamped properly whenever necessary. Entire piping work shall be executed by the contractor. The piping shall be leak proof.

Oil trapping loops to be provided wherever required to ensure proper oil return to the compressors.

The refrigerant and drain pipe should be insulated with suitable nitrile rubber pipe sections/ tape.

Each refrigerant circuit should be suitable for operation on R-407 and should include the hand shut off valves, Suction and discharge valves for isolation of each Compressor.

The serviceable / removable components should have union connections for easy removal /assembly.

**Necessary clamping and fixing of refrigerant piping should be made with required suitable MS angles etc.**

#### **81.Schedule item no. A(I)-25**

**Supply, erection, testing and commissioning of air curtain size 6' (Six feet) operated with single phase 230 V /50 Hz, 500 Watts, along with starter and shall be as railway requirement.**

The price shall cover cost of supply, erection, testing and commissioning of air curtain size 6' (Six feet) operated with single phase 230 V /50 Hz, 500 Watts, along with starter and shall be as railway requirement.

#### **SALIENT CONSTRUCTIONAL FEATURES OF "AIRCURTAIN"**

- The casing (shell) of Air curtain is of Robust construction.
- The impeller is of Aluminium construction with forward curve blades to minimise the air cutting Noise. The impellers can be made out of SS & with special coating on specific request.
- Easy mounting arrangement with a flat frame which can be fixed on the wall by suitable coach screws.
- Adjustable louvers to streamline the air delivery.
- Air curtains are coupled with sturdy motors for the continuous duty application.
- "VIBRATION FREE" Operation.
- Pre-lubricated both side sealed double ball bearing / Bush bearings to take any load and also for smooth running of Air curtain.
- Elegant look and with superior quality powder coated finish.

#### **Technical Specification**

- Velocity – 15/16 M/Sec.
- Effective Air Throw in Mtrs. – 2.5
- Watt – 250X2= 500 watt
- RPM – 1400
- Current Input in Amps. – 3.4x2
- Noise Level Decibels –  $\leq 78$  dB

#### **82.Schedule item no. A(I)-29**

**Supply, erection, Testing and Commissioning of Refrigerator (Double Door), Capacity- 300 to 320 ltrs, 5 Star Rating or highest star rating available in market, 230 V AC, 50 Hz.**

The cost includes supply erection, testing and commissioning of double-door domestic Refrigerator capacity 300 to 320 Ltrs as per IS 15750 (2006) complete with all accessories.

- **Reciprocatory Compressor**
- Energy savings
- Defrosting type- Direct Cool which used for Economical, consumes less electricity, requires manual defrosting.
- **Frost Free** : Auto fridge defrost to stop ice-build up

Linear Cooling Technology, Inverter Linear Compressor, Door Cooling+, LD Dual Fridge and Auto Smart Connect Technology. It is also equipped with the quick Chill Technology and the Easy Defrosting Mechanism, IS 15750 (2006)

Capacity	•	300 to 320 Ltrs.
Number of Doors	•	Double door with Top Mount
Star Rating	•	5 Star Rating or highest star rating available in market
Coolpad	•	Yes
Toughened Glass	•	Yes
Built-in Stabilizer	•	Yes
Shelf Material	•	Toughened Glass
Stabilizer Required	•	No
Other Features	•	Freezer Location: Top Mount
Warranty Service Type	•	Technician Visit
Warranty Summary	•	2 Year on Product and 10 Years on Compressor from company

**Chiller** - The special compartment that keeps juice cans and milk packets chilled.

**Stabilizer-free Operation-** The refrigerator to function steadily and reliably even during voltage fluctuations, without installing a separate stabilizer. It can function optimally within a fluctuation range of 130 - 300 V.

**Inverter Linear Compressor-**It temperature range of  $\pm 0.5^{\circ}\text{C}$  and reduces noise by up to 25%, ensuring durability and energy saving of up to 51%.

**Dual Convertible Freezer** - Converting the freezer into a fridge, to provide additional storage during any occasion.

**Auto Smart Connect Technology-** The refrigerator connects its own way to your home inverter whenever the power goes off, consuming minimum electricity.

### **Intelli Sensor Technology**

It ensures optimum cooling and long-lasting freshness by sensing the load, weather conditions, and usage patterns with the help of the three Intelli Sensors and an advanced Adaptive Intelligence (AI) Microprocessor.

### **Micro Block Technology**

Your food will not be contaminated easily as the material of the vegetable crisper, fruit crisper, ice twister, and collector are coated with a special anti-microbial additive that kills up to 99.9% of microbes.

### **Fresh flow Air Tower with Flexi Vents**

It has a scientifically designed air tower and a set of vents that are placed at strategic locations to let out cool air into the refrigerator's various sections, thereby ensuring uniform cooling for long-lasting freshness.

### Deep Freeze Technology

The Deep Freeze Technology ensures a full circular air flow to keep frozen food, crystal-free.

### 83.Schedule item no. A(I)-21

**Supply, erection, testing & commissioning of Solar Street light of 15 W white LED luminaire with inbuilt 12 V 12 Ah L lithium - ion battery for 12 hrs back up 40 Wp PV module solar plate motion sensor along with 6 mtr long octagonal GI pole having mounting arrangement for PV panel fixing and single arm for erection of LED outdoor luminaire complete with other accessories**

### All in one Solar Street Light Technical Specification

<b>Technical Specifications: All in One Solar Street Lights</b>	
<b>Model</b>	<b>15W LED</b>
<b>Physical Parameters</b>	
Power of PV Module	40Wp
Lithium Battery capacity( 1 day -1.5 Days)	Li-ion 12 V/12AH Li-FePO4 12.8V/13.5AH
Lithium Battery capacity( 2 Days)	Li-ion 12 V/12AH Li-fePO4 12.8V/21AH
PIR Sensor	Provided
<b>Driver Parameters</b>	
Charge controller Type	PWM
LED Driver Efficiency	>90%
<b>Light Parameters</b>	
Colour Temperature	5500K-6500K
Typical Luminous Flux(Lm)	1500
Light backup Time(1 Day -1.5 Days)	14Hr-15Hr
Light backup Time( 2 Days)	23Hr-24Hr
<b>Mounting recommendations</b>	
Top of Pole OD(mm)	70mm-76mm
Recommended Installation Height(Mtr.)	5Mtr.
<b>Protection Provided</b>	
All in one protections	Battery deep discharge protection, over charge protection, Load open Protection, Charging and battery indication, Reverse current flow protection, Temperature compensation, short circuit protection.
All in one Operations	Light will glow in full bright mode for first 4 Hrs., After 4 Hrs. Light will dim to 33% power and motion sensor will activate for detection of motion. If any motion is detected in 12M area around the light then it will glow in full mode for 2 min, After that it will again come to 33%

	Power.
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#### **Octagonal Pole -**

The Octagonal GI pole with arm bracket, foundation bolts. Height shall be 6 mtr long having mounting arrangement for PV panel fixing and single arm for erection.

1. The Octagonal Poles shall be Hot Deeped Galvanized in single dip to 65 micron DFT.
2. The Octagonal Poles are designed for maximum wind speed of 169 Km/Hr.
3. Octagonal Poles are manufactured in single section.  
pole with arm bracket, foundation bolts.

#### **84.Schedule item no. A(III)-29**

**Supplying, installing, testing and commissioning of 5 kWp OFF-GRID solar power pack with interconnecting wires / cables up to 24V pure sine wave solar power inverter (THD<3%), SPV Modules- Ultra-high-efficiency N-Type TOPCon bifacial dual-glass solar module, C-10 rated lead acid battery bank 24V, 300Ah x 4 nos. (12V, 300 Ah x 8 nos) suitable for 4 Hours backup with suitable MS powder coated stand to hold battery bank and keeping sufficient space for filling distilled water, canopy box to house inverter and other electronics, wiring up to solar inverter in casing and capping, display board, sign board, two distinct earthing, spike type lightning arrester, necessary accessories complete with 5 years ON SITE warranty and fully comprehensive maintenance contract as per specification.**

#### **TECHNICAL SPECIFICATIONS, EXPLANATORY NOTES & DRAWINGS**

##### **Specifications:**

##### **GENERAL REQUIREMENTS:**

- i. The work to be governed by this contract shall cover designing, manufacturing, transporting till site, safe custody at site, insurance, erection, and commissioning of equipments as detailed in SOQ technical specifications/ explanatory notes and in the scope of Work of tender documents. All the materials and workmanship shall strictly conform to the provision of this specification primarily and to the related Indian Standard Specification and code of practice mentioned in the specifications.
- ii. All the materials brought to site for use on this work shall be new of the best quality of approved makes/manufacture as per list of approved makes of equipments/materials enclosed and conforming to the relevant BIS specifications.
- iii. All the cable routes, locations of relevant items of work shall be first shown in drawing and marked at site and approval of the Engineer-in-charge obtained for the same before starting the work. Such drawings shall be based on the drawings issued and further based on the changes made at site by the Engineer-in-charge through instructions to the site representative of the contractor.
- iv. The rates quoted for the relevant items of work shall include the cost of materials and equipments, their accessories, fixing labour, together with the cost of providing the necessary tools and tackles etc., so as to ensure that the work carried out forms a complete installation to the satisfaction of the Engineer-in-charge.
- v. Any deviation from the specifications shall be clearly brought out in the offer along with the reasons for such deviations. If, no such deviations are brought out in the offer, it will be deemed that the tenderer has fully understood the requirements of the tender and no extra cost will be paid under any circumstances for carrying out the works under this tender in accordance with the interpretations of the Engineer-in-charge.

vi. The rates quoted shall also include the cost of any civil works connected with the relevant items of works.

vii. The rates quoted shall also provide for handing over the necessary completion drawings together with the test results of commissioning tests carried out by the contractor, in accordance with BIS before the installation & handed over to the Railways.

viii. The contractor is bound by the opinion of the Engineer-in-charge in accepting whether the work is carried out in accordance with the provisions of these specifications or not and shall take steps to rectify or replace such parts of the materials and installations as in the opinion of the Engineer-in-charge which are unsatisfactory in relation to this specifications.

ix. The contractor shall ensure proper liaison with SEB, LOCAL BODIES and any other authorities for obtaining all statutory approvals and to co-ordinate with SEB/ LOCAL BODIES /any other authorities for timely inspections, quality control inspections. Payments for all inspection charges shall be borne by the contractor. Applications in this regard shall be prepared by the contractor and signature of Railway authorities shall be obtained. Responsibility of resolving of Right of Way (ROW) issues during execution of the work lies with the contractor.

a) Railway shall be responsible for payment of

I. Availing of new supply connection charges/deposit

II. Testing/ Supervision charges based on s estimate of SEB.

Only after receiving the written advice from supply authority to obtain the sanction for commencing the work / electrical installations.

b) All the other incidental charges payable to SEB/Local authorities/ Electrical Inspectorate charges (State Govt.), charges for stamp duties/ agreements, inspection charges, statutory amount to remit for approval from local bodies etc. in connection with the work shall be paid by the contractor as part of the tender work. Claim for such payment shall not be entertained by Railways.

x. All Drawings, tests and measurements, readings and documentation required for EIG approval shall be arranged and prepared by the contractor without any extra cost.

xi. Substation shall be completed in full compliance with CPWD specification Part IV for substations and in full compliance with SEB standard practice.

xii. All works pertaining to SEB shall be completed as per the standard practice of SEB and to the satisfaction engineers in-charge of SEB and Railways as well.

xiii. STANDARDS FOR EQUIPMENTS AND WORKMANSHIP:

a) The materials and equipments to be supplied and installed under this contract shall conform to the requirements of these specifications.

b) In further support of what is contained in this specifications, the materials and equipments as well as workmanship shall satisfy the requirements.

c) All the materials and equipments shall conform to the Standards not less than those stipulated under the current Indian Standard Specifications.

xiv. For such of the materials and methods of construction for which BIS have not been published, British Standards shall be followed subject to the approval of the Engineer-in-charge.

xv. In addition to the above, the equipment and workmanship shall satisfy the requirements of the following:-

a) Method of construction approved by the Electrical Inspectorate.

- b) Indian Electricity Acts and Rules.
- c) Fire Insurance Regulations.
- d) I.E.E. wiring regulations.
- e) Instructions of the Engineer-in-charge based on the site conditions and revised requirements, if any.

xvi. Electrical Safety: -

- a) The work is to be done in compliance with the National Electrical Code-2011 or the latest issued by BIS.
- b) The work done to comply with the provision of CEA (Measures relating to safety and electric supply) regulation, 2010.
- c) Only items confirming relevant BIS to be used if issued by BIS in compliance of CEA (Measures relating to safety and electric supply) regulation, 2010. In case no specification is mentioned then the contractor is restricted to use the material in conformity with BIS in vogue. In such case contractor is to obtain approval of Sr.DEE(G) in advance.
- d) Contractor is advised to train/counsel or use only trained workers having the competency to work in the LV system and aware of electrical safety.

**NOTES -**

All safety precautions are to be ensured by the contractor while execution of work and no work has to be carried out without permission of Engineer in charge. Also, the execution of work should not infringe the train moving dimension as per permanent way manual nor affect the train traffic in any way.

The following Statutory Clearances to be obtained by the contractor wherever applicable:

- a. Electrical System approval (Electrical Inspector) if required.
- b. Fire System approval (CFO) if required.
- c. All equipment, accessories, materials, civil construction & erection works should comply with statutory requirements and IS standards.
- d. All statutory requirements for working at the Project Site like Labour Registration, Workman Compensation Policy, ESIC etc. to be complied with by the Vendor before deployment of resources at the Project Site.

**Obligations of the contractor:**

- (a) The contractor will Design, Engineer, Procure, Undertake Civil and Electrical works including Erection, Testing & Commissioning of the solar PV project.
- (b) bear and pay all costs, expenses and charges in connection with or incidental to the performance of the obligations of the CONTRACTOR under this document.
- (c) The contractor shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act 2003, CEA guidelines etc.
- (d) The contractor will install the Main Metering System at the Delivery Point for the measurement of electrical energy produced by the System.
- (e) Ensure net metering with the concerned Distribution Company on the behalf of Railways. Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility.



- (f) To apply for and obtain net metering on behalf of the Railways for the Project and bear all the costs for the same on behalf of Railways;
- (g) Procure all the Approvals specified in this document and also from other agencies unconditionally or if subject to conditions, then all such conditions required to be fulfilled by the date specified therein shall have been satisfied in full and such Approvals are in full force and effect;
- (h) Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility.
- (i) To apply for net metering related work on the behalf of Railway with the concerned DISCOM within 15 days of LOA & before execution of work.
- (j) To identify & finalise all required steps as per the concerned DISCOM within 45 days of LOA
- (k) Acquire and maintain in effect all approvals and clearances in order to enable it to perform its obligations under this document.
- a) Governmental Approvals: While providing the Installation Work, the Solar Power and System Operations, the contractor will obtain and maintain and secure all Governmental Approvals required to be obtained and maintained and secured by the contractor and to enable the contractor to perform such obligations.
- b) Interconnection Requirements: The interconnection of the rooftop solar system with the network of the Railways will be made as per the technical standards for connectivity of distributed generated resources regulations as may be notified by the competent authority.
- l) Subject to and on the terms and conditions of this document, the contractor shall, at its own cost and expense, procure finance for and undertake the design, engineering, procurement, construction and commissioning of the rooftop solar project and observe, fulfill, comply with and perform all its obligations set out in this document.
- m) The contractor shall comply with all Applicable Laws and obtain Approvals (including renewals as required) in the performance of its obligations under this document.
- (n) Procure, as required, the appropriate proprietary rights, licenses, agreements and permissions for materials, methods, processes and systems used or incorporated into the rooftop solar project;
- (o) Procure that all facilities and amenities within the solar rooftop power system are operated and maintained in accordance with Good Industry Practice
- (p) Undertake Interconnection Facilities as per the specifications and requirements laid down by the Central Electricity Authority and respective State ERCs.
- (q) Facilitate the execution of the Net Metering agreement (including procurement & all cost related to Net Metering connection thereof) of Railways with the utility
- (r) The contractor shall ensure efficient operation of the Project and the associated facilities to achieve the maximum power generation from the Project. For this purpose, the contractor shall engage the services of adequate number of Engineers and Technicians. Daily Management Information System (MIS) reports with generation and down time analysis data shall be made available to Railways office by E-mail.

(s) All minor items viz. hardware items, foundation bolts, termination lugs for electrical connections etc. as required and necessary for proper working of the equipment shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.

(t) To comply with the latest guidelines of MNRE and DISCOM in regard to Solar energy and solar plants.

**Obligations during Construction and Commissioning:**

The contractor will be responsible for the design, implementation and commissioning of the project. The contractor will Design, Engineer, Procure, Undertake Civil and Electrical work including Erection, Testing & Commissioning of the solar PV project.

- a. The contractor shall procure the solar plant in line with the MNRE requirements on domestic content.
- b. The contractor will bear all costs pertaining to the installation and Commissioning of the systems and these costs will not be recoverable in any form from Railways.
- c. Testing Procedures: The contractor and Railways or its representative(s) shall implement the testing procedures as attached.
- d. The contractor will provide and lay down the dedicated electrical cables for transmission of Solar Power from the Project up to the metering point of Railways.

**Obligations relating to aesthetic quality of the rooftop solar project:**

The contractor shall maintain a high standard in the appearance and aesthetic quality of the rooftop solar project and achieve integration of the Solar Rooftop Power System with the character of the surrounding landscape through both appropriate design and sensitive management of all visible elements. The contractor shall engage professional architects and town planners of repute for ensuring that the design of the rooftop solar project meets the aforesaid aesthetic standards.

**The Panels Contains ultra-high-efficiency N-Type TOPCon bifacial dual-glass solar module designed for next-generation performance, durability, and long-term power reliability. Built using advanced G12 cells and dual-glass architecture, this module ensures maximum energy yield and superior field performance under all weather conditions.**

**Engineered to deliver exceptional performance even in low-light environments, the 685 W bifacial module generates power from both the front and rear surfaces, increasing overall energy generation by up to 30%. The N-Type TOPCon cell technology minimizes degradation (LID & PID-free) and ensures better thermal stability, making it ideal for high-temperature zones in India.**

**Key Features**

- High Power Output (685 W) – Delivers maximum performance with N-Type TOPCon cells for higher conversion efficiency (up to 22.05%).
- Bifacial Dual-Glass Technology – Generates energy from both sides for up to 30% additional power gain depending on site reflectivity.
- N-Type TOP Con Cells – Ensures higher reliability, minimal light-induced degradation, and superior performance in all climates.

- Enhanced Durability – Dual 2 mm semi-tempered glass on both sides with anodized aluminum frame for long-term outdoor protection.
- PID-Free & UV Resistant Encapsulation – Maintains module integrity and performance stability over decades.
- Excellent Low-Light Performance – Optimized for morning, evening, and cloudy conditions.

1	Solar Cells per Module (Units)/Arrangements	Minimum 132 cells
2	Solar Cell Type & Size	TOPCon N-type Mono Bifacial
4	Front / Back Glass (Material / Thickness)	2 mm Low Iron HTAR semi-tempered Glass
5	Encapsulate	PID Free & UV Resistant
6	Junction Box (Protection degree/Material)	IP68 / Weatherproof PPO
7	Cable & Connector (Protection degree/Type)	IP68 rated / MC4 compatible
9	Frame	Anodized Aluminium Alloy
10	Application class	Class A (Safety Class II)
11	Substrate	Transparent / patterned Back sheet
12	Design mechanical load	3600 Pa-downward ; 1600 Pa-Upward
13	Safety factor for mechanical load	1.5
14	Maximum series fuse rating	30 A
15	Bifaciality Factor	80 ± 5 %
16	Better Temperature Coefficient	Higher power generation under higher ambient temperature conditions
17	Better Output In Low Irradiance	Higher power output even under low-light environments like on cloudy or foggy days

#### DEFINITION:

A Grid Tied Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter, and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid tied SPV system is without battery and should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. Solar PV system shall consist of following equipments/components.

- Solar PV modules consisting of required number of **Mono Crystalline N-Type TOPCon bifacial** PV modules.
- Grid interactive Power Conditioning Unit with Remote Monitoring System
- Mounting structures
- Junction Boxes
- Earthing and lightning protections.
- IR/UV protected PVC Cables, pipes and accessories

## 1. SOLAR PHOTOVOLTAIC MODULES:

I. The PV modules used should be made in India.

II. The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286 or latest. In addition, the modules must conform to IEC 61730 Part-2-or latest - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS. . certificates\*: IEC 61215, IEC 61730, UL 61730, BIS, IEC 61853-1,IEC 62782, IEC 61853-2, IEC 61701, IEC 60068-2-68, IEC 62716

a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701/IS 61701 or latest.

b) The total solar PV array capacity should not be less than allocated capacity (kWp) and should comprise of solar mono crystalline modules of minimum **685 Wp** and above wattage. Module capacity less than minimum **685 watts** should not be accepted .

c) Protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.

d) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminium.

e) The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid. Railway shall allow only minor changes at the time of execution.

f) Other general requirement for the PV modules and subsystems shall be the following:

i. The rated output power of any supplied module shall have tolerance of +/- 3%.

ii. The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 (two) percent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.

iii. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of bypass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP-65 rated.

iv. I-V curves at STC should be provided by bidder.

### Solar PV modules:

III. Modules deployed must use a RF identification tag. The following information must be mentioned in the RFID used on each module. This should be inside laminate only.

- a) Name of the manufacturer of the PV module
- b) Name of the manufacturer of Solar Cells.
- c) Month & year of the manufacture (separate for solar cells and modules)
- d) Country of origin (separately for solar cells and module)
- e) I-V curve for the module Wattage, Im, Vm and FF for the module
- f) Unique Serial No and Model No of the module
- g) Date and year of obtaining IEC PV module qualification certificate.

- h) Name of the test lab issuing IEC certificate.
- i) Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001

#### **IV. Warranties:**

**a) Material Warranty:** The minimum CUF of solar power plant shall not be less than 16% of installed capacity.

The PV Modules shall be warranted for minimum of **12 Years Product Warranty** against all material/manufacturing defects and workmanship & **30 Years Power Output Warranty**.. The inverter shall be warranted for minimum of 10 years against all material/manufacturing defects and workmanship.

#### **V. ARRAY STRUCTURE**

a) Hot dip galvanized MS mounting structures may be used for mounting the modules/ panels/arrays. Each structure should have angle of inclination as per the site conditions to take maximum insolation. However to accommodate more capacity the angle inclination may be reduced until the plant meets the specified performance ratio requirements.

b) The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed. It may be ensured that the design has been certified by a recognized Lab/ Institution in this regard and submit wind loading calculation sheet to Railway. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed.

c) The mounting structure steel shall be as per latest IS 2062: 1992 and galvanization of the mounting structure shall be in compliance of latest IS 4759.

d) Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, its fasteners, nuts and bolts. Aluminium structures also can be used which can withstand the wind speed of respective wind zone. Necessary protection towards rusting need to be provided either by coating or anodization.

e) Aluminium frames should be avoided for installations in coastal areas.

f) The fasteners used should be made up of stainless steel. The structures shall be designed to allow easy replacement of any module. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from the SPV panels.

g) Regarding civil structures the bidder need to take care of the load bearing capacity of the roof and need arrange suitable structures based on the quality of roof.

h) The total load of the structure (when installed with PV modules) on the terrace should be less than 60 kg/m<sup>2</sup>.

i) The contractor may suitable decide upon the clearance keeping in view the need of heat dissipation etc.

## **VI. JUNCTION BOXES (JBs)**

- a) The junction boxes are to be provided in the PV array for termination of connecting cables. The J. Boxes (JBs) shall be made of GRP/FRP/Powder Coated Aluminum /cast aluminum alloy with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The JB's shall be such that input & output termination can be made through suitable cable glands.
- b) Copper bus bars/terminal blocks housed in the junction box with suitable termination threads conforming to IP65 standard and IEC 62208 or latest with Hinged door with EPDM rubber gasket to prevent water entry. Single / double compression cable glands and provision of earthings. It should be placed at 5 feet height or above for ease of accessibility.
- c) Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors (MOVs) / SPDs, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- d) Suitable markings shall be provided on the bus bar for easy identification and the cable ferrules must be fitted at the cable termination points for identification.
- e) All fuses shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

## **VII. DC DISTRIBUTION BOARD:**

- a) DC Distribution panel to receive the DC output from the array field.
- b) DC DPBs shall have sheet from enclosure of dust & vermin proof conform to IP 65 protection. The bus bars are made of copper of desired size. Suitable capacity MCBs/MCCB shall be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

## **VIII. AC DISTRIBUTION PANEL BOARD:**

- a) AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- b) All switches and the circuit breakers, connectors should conform to IEC 60947 or latest, part I, II and III/ IS60947 part I, II and III.
- c) The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d) All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air -insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz.
- e) The panels shall be designed for minimum expected ambient temperature of 45° Celsius, 80% humidity and dusty weather.
- f) All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- g) Should conform to Indian Electricity Act and rules (till last amendment).
- h) All the 415 AC or 230 volts devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions.

Variation in supply voltage	$\pm 10\%$
Variation in supply frequency	$\pm 3\text{ Hz}$

#### IX. PCU/ARRAY SIZE RATIO:

- The combined wattage of all inverters should not be less than rated capacity of power plant under STC.
- Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

#### X. PCU/ Inverter:

<b>A</b>	<b>SOLAR CHARGE CONTROLLER (SCC)</b>	
1	Charge Controller Type	MPPT
2	PV Nominal Capacity (Total) (kWp)	PV Nominal Capacity (Total) (kWp)
3	No of MPPT Channels	Minimum one
4	Battery Type Supported	Lithium-ion battery
5	Min. Battery AH Required (AH)	<b><math>\geq 18\text{ KW Lithium battery}</math> <b>OR</b> <b>24V, 300Ah x 4 nos. (12V, 300 Ah x 8 nos) suitable for 4 Hours backup with minimum 5 years warranty as per list of make attached in Annexure-I.</b></b>
6	Min Charging Efficiency (%)	94%
<b>B</b>	<b>SOLAR INVERTER</b>	
1	Battery back up Capacity	Equivalent to more than 1 hour of inverter rating
2	Nominal Battery Voltage (VDC)	As per Inverter Manufacturer
3	Nominal Capacity (KW)	Inverter Rated capacity shall be at 0.8 PF
4 (a)	Operation AC voltage	415 Volt 03 phase four wire or as per availability of the main grid supply
4 (b)	Voltage Regulation (in Standalone Mode) (%)	$\pm 2$
5	Frequency Regulation (in Standalone Mode) (Hz)	$\pm 5$
6	THD (%)	< than 5
7	Power Factor	> 0.90
8	Over Loads: 60 secs/50 secs/5 secs (%)	110 %/ 125 %/ 150%
9	Minimum Phase imbalance capability (%)	30%
10	Auto Bypass Feature	To Be provided
11	Parallel Operation with Grid/ DG	To Be provided
12	Power Export to Grid Facility	To Be provided
13	Anti-Islanding from Grid	To Be provided
14	Switching device	MOSFET/ IGBT
15	Control Device	Microprocessor /DSP
16	No loaded losses	Less than 01% of rated power
<b>C</b>	<b>GRID CHARGER</b>	
1	Grid Voltage Sync Range (%)	+10% to - 20%
2	Grid Frequency Sync Range	+5% to - 5%
3	Max Grid Import Power (kW)	Same as inverter Rating

<b>D</b>	<b>INDICATION &amp; PROTECTION</b>	
1	Type of User Interface with Key PAD	LCD based UI interface with Alphanumeric indications
2	Display Parameters	Battery voltage/current
		Solar Panel voltage/current/ Power
		Grid voltage/Current/frequency/power/ power factor
		Emergency Load voltage /current /power
		System fault including temperature and active faults
		Solar power generated in day/ till the time
3	Communication with other system	Wi-Fi or GSM in built in the inverter
4	ON line monitoring	on-line monitoring on cloud platform shall be provided
5	ON Line monitoring software	Shall be already in operation
<b>E</b>	<b>Isolating Switches</b>	
1	Grid side disconnection	To be provided
2	Load side disconnection	To be provided
3	Battery side disconnection	To be provided
4	PV side disconnection	To be provided
<b>F</b>	<b>Operational Requirements</b>	
1	Charging the battery from Solar and Grid (Solar priority)	
2	Cater to Priority load and other load through solar energy first and balance energy from Grid as per the load and battery charging state.	
3	Synchronize and share the energy with grid power supply whenever grid is available.	
4	In absence of Grid power supply non availability; the grid connection shall be isolated from the grid and battery shall supply the energy to Priority load.	
5	If grid and solar power is available and battery is fully charged, then the self consumption load shall be fully catered by the solar and balance power to be taken from grid if required.	

**a) Three phase PCU/ inverter shall be used with each power plant system (10kW and/or above) but In case of less than 10kW single / three phase inverter can be used.**

b) PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.

c) The output of power factor of PCU inverter is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.

d) Built-in meter and data logger to monitor plant performance through external computer shall be provided.

e) **Anti-islanding** (Protection against Islanding of grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.

f) Successful Bidder shall be responsible for galvanic isolation of solar roof top power plant (>100kW) with electrical grid or LT panel.

g) In PCU/Inverter, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer. If Isolation Transformer is not incorporated with PCU/Inverter, there shall be a separate Isolation Transformer of suitable rating provided at the output side of PCU/PCU units for capacity more than 100 kW.

h) The PCU/ inverter generated harmonics, flicker, DC injection limits, Voltage Range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow



the latest CEA (Technical Standards for Connectivity Distribution Generation Resources) Guidelines.

i) The power conditioning units / inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683 and IEC 60068- 2(1,2,14,30) or latest /Equivalent BIS Std.

j) The charge controller (if any) / The MPPT units environmental testing should qualify IEC 60068- 2(1, 2, 14, 30) or latest/Equivalent BIS std. The junction boxes/ enclosures should be IP 65(for outdoor)/ IP 54 (indoor) and as per IEC 529 or latest specifications.

k) The PCU/ inverters should be tested from the MNRE approved test centres/ NABL/ BIS/ IEC accredited testing- calibration laboratories/ or NISE or UL India Pvt Ltd, or TUV Rheinland. In case of imported power conditioning units, these should be approved by international test houses.

**L) Battery Pack:  $\geq 18$  KW Lithium battery Warranty - minimum 5years.**

**OR**

**24V, 300Ah x 4 nos. (12V, 300 Ah x 8 nos) suitable for 4 Hours backup with minimum 5 years warranty as per list of make attached in Annexure-I.**

The system is to be installed with lithium-ion battery pack  $\geq 18$  KW Lithium battery Warranty - minimum 5years. The capacity of battery bank should be designed for minimum 10 KWH (Units). Warranty of battery shall be minimum of 5 years. The voltage of battery may be selected according to the PCU design. A copy of the relevant test certificate for the battery should be furnished. Battery pack should be in an enclosure. Single enclosed container for battery pack. Proper cooling is required. Battery should withstand all type of weather Condition minimum IP55.

#### **Batteries :-**

- 1) Cylindrical and prismatic LifePo4 cells
- 2) Fast charging
- 3) 3000 Life cycles
- 4) High quality cells
- 5) High efficiency
- 6) Fire safe
- 7) Optimal thermal performance with charging 0.5C or less
- 8) Thermal seal to improve overall thermal performance of packs
- 9) Long battery life of 7-10 years
- 10) Maintenance free
- 11) MCB at back for extra protection
- 12) Battery indication at front panel

Sr No	Standard	Description	Certification Requirements
1	IEC 62281 / UN 38.3	Safety of primary and secondary lithium cells and batteries during transport: Applicable for storage systems using Lithium Ion chemistries	Required for both Battery and Cell.

**OR**

- **24V, 300Ah x 4 nos. (12V, 300 Ah x 8 nos) suitable for 4 Hours backup with minimum 5 years warranty as per list of make attached in Annexure-I.**

#### **XI. INTEGRATION OF PV POWER WITH GRID:**

The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. Once the DG set comes into service PV system shall again be

synchronized with DG supply and load requirement would be met to the extent of availability of power. 4 pole isolation of inverter output with respect to the grid/ DG power connection need to be provided.

## **XII. DATA ACQUISITION SYSTEM / PLANT MONITORING**

- i. Data Acquisition System shall be provided for each of the solar PV plant above 10 kWp capacity.
- ii. Data Logging Provision for plant control and monitoring, time and date stamped system data logs for analysis with the high quality, suitable PC. Metering and Instrumentation for display of systems parameters and status indication to be provided.
- iii. Solar Irradiance: An integrating Pyranometer / Solar cell based irradiation sensor (along with calibration certificate) provided, with the sensor mounted in the plane of the array. Readout integrated with data logging system.
- iv. Temperature: Temperature probes for recording the Solar panel temperature and/or ambient temperature to be provided complete with readouts integrated with the data logging system.
- v. The following parameters are accessible via the operating interface display in real time separately for solar power plant:
  - a. AC Voltage.
  - b. AC Output current.
  - c. Output Power
  - d. Power factor.
  - e. DC Input Voltage.
  - f. DC Input Current.
  - g. Time Active.
  - h. Time disabled.
  - i. Time Idle.
  - j. Power produced
  - k. Protective function limits (Viz-AC Over voltage, AC Under voltage, Over frequency, Under frequency ground fault, PV starting voltage, PV stopping voltage.
- vi) All major parameters available on the digital bus and logging facility for energy auditing through the internal microprocessor and read on the digital front panel at any time) and logging facility (the current values, previous values for up to a month and the average values) should be made available for energy auditing through the internal microprocessor and should be read on the digital front panel.
- vii) PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.5 accuracy class.
- viii) Computerized DC String/Array monitoring and AC output monitoring shall be provided as part of the inverter and/or string/array combiner box or separately.
- ix) String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
- x) Computerized AC energy monitoring shall be in addition to the digital AC energy meter.
- xi) The data shall be recorded in a common work sheet chronologically date wise. The data file shall be MS Excel compatible. The data shall be represented in both tabular and graphical form.
- xii) All instantaneous data shall be shown on the computer screen.

xiii) Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.

xiv) Provision for instantaneous Internet monitoring and download of data shall be also incorporated.

xv) Remote Server and Software for centralized Internet monitoring system shall be also provided for download and analysis of cumulative data of all the plants and the data of the solar radiation and temperature monitoring system.

xvi) Ambient / Solar PV module back surface temperature shall be also monitored on continuous basis.

xvii) Simultaneous monitoring of DC and AC electrical voltage, current, power, energy and other data of the plant for correlation with solar and environment data shall be provided.

xviii) Remote Monitoring and data acquisition through Remote Monitoring System software at the railways location with latest software/hardware configuration and service connectivity for online / real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the supplier. Provision for interfacing these data on Railway server and portal in future shall be kept.

Provision of SIM card for internet connectivity and it's recharge will be the responsibility of agency for the 5 years. Data charges in this regard shall be borne by the contractor.

xix) The bidders shall be obligated to push real-time plant monitoring data on a specified intervals (say 15 minute) through open protocol at receiver location (cloud server) in XML/JSON format, preferably. Suitable provision in this regard will be intimated to the bidders.

### **XIII. METERING (Mandatory)**

a) The bidirectional electronic energy meter (0.5 S class or as per the latest mandates by DISCOM) /SEB shall be installed for the measurement of import/Export of energy.

b) The bidder must take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to Railway before commissioning of SPV plant.

c) Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM /SEB requirement.

d) Metering cubicle as per DISCOMs / SEB approved make and drawings shall be provided.

### **XIV. PROTECTIONS**

The system should be provided with all necessary protections like earthing, Lightning, and grid islanding as follows:

#### **➤ LIGHTNING PROTECTION**

The SPV power plants shall be provided with lightning & overvoltage protection. The main aim in this protection shall be to reduce the over voltage to a tolerable value before it reaches the PV or other sub system components. The source of over voltage can be lightning, atmosphere disturbances etc. The entire space occupying the SPV array shall be suitably protected against Lightning by deploying required number of Lightning Arrestors. Lightning protection should be provided as per IEC 62305 or latest standard. The protection against induced high-voltages shall be

provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to earth.

#### ☐ **SURGE PROTECTION**

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and –ve terminals to earth (via Y arrangement).

#### ☐ **EARTHING PROTECTION**

a) Each array structure of the PV yard should be grounded/ earthed properly as per relevant IS (maintenance free earthing). In addition, the lighting arrester/masts should also be earthed inside the array field. Earth Resistance shall be tested in presence of the representative of Railways as and when required after earthing by calibrated earth tester. PCU, AC DB and DC DB should also be earthed properly.

b) Earth resistance shall not be more than 5 ohms. It shall be ensured that all the earthing points are bonded together to make them at the same potential.

#### ☐ **GRID ISLANDING:**

a) In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as “islands.” Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

b) A manual disconnect 4 pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel.

**XV. CABLES :** Cables of appropriate size to be used in the system shall have the following characteristics:

- ☐ Shall meet IEC 60227/IS 694, IEC 60502/IS1554 or latest standards
- ☐ Temp. Range: –10oC to +80oC.
- ☐ Voltage rating 660/1000V
- ☐ Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- ☐ Flexible
- ☐ Sizes of cables between array interconnections, array to junction boxes, junction boxes to Inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).
- ☐ For the DC cabling, XLPE or, XLPO insulated and sheathed, UV-stabilized single core multi-stranded flexible copper cables shall be used; Multi-core cables shall not be used.
- ☐ For the AC cabling, PVC insulated and PVC sheathed single or, multi-core multi-stranded flexible copper cables shall be used; Outdoor AC cables shall have a UV-stabilized outer sheath.
- ☐ The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use. Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour.
- ☐ The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm.

- Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers
- All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm; the minimum DC cable size shall be 4.0 mm<sup>2</sup> copper; the minimum AC cable size shall be 4.0 mm<sup>2</sup> copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.
- Cable Routing/ Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified. In addition, cable drum no. / Batch no. to be embossed/ printed at every one meter.
- Cable Jacket should also be electron beam cross-linked XLPO, flame retardant, UV resistant and black in colour.
- All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV as per relevant standards only.
- The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant provided by the bidder. Any change in cabling sizes if desired by the bidder/approved after citing appropriate reasons. All cable schedules/layout drawings approved prior to installation.
- Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation. Overall PVC insulation for UV protection Armoured cable for underground laying. All cable trays including covers to be provided. All cables conform to latest edition of IEC/ equivalent BIS Standards as specified below: BoS item / component Standard Description Standard Number Cables General Test and Measuring Methods, PVC insulated cables for working Voltage up to and including 1100 V ,UV resistant for outdoor installation IS /IEC 69947.
- The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.

## XVI. CONNECTIVITY

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply Code of the State and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

Plant Capacity	Connecting voltage
Up to 10 kW	240V-single phase or 415V-three phase at the option of the consumer
Above 10kW	415V – three phase

- a) The maximum permissible capacity for rooftop shall be 1 MW for a single net metering point.
- b) Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and specification be made accordingly.

## XVII. TOOLS & TACKLES AND SPARES:

- a) The downtime of the solar PV system installed at each location shall not be more than 72 hours. If the defects in the solar PV system are not rectified within a period of 72 hours, warranty period of 36 months will be extended accordingly and SD will be released after completion of the extended warranty period.

b) After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder for maintenance purpose.

c) list of requisite spares in case of PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc, Junction Boxes, Fuses, MOVs / arrestors, DC/AC MCB/ MCCB's etc along with spare set of PV modules be made available for maintenance. Required set of spares shall be maintained in the plant itself for the entire period of maintenance and Operation & Maintenance which upon its use shall be replenished.

#### **XVIII. DANGER BOARDS AND SIGNAGES:**

Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Three signage shall be provided one each at battery –cum- control room, solar array area and main entry from administrative block. Text of the signage may be finalized in consultation with railways.

#### **XIX. FIRE EXTINGUISHERS:**

The fire fighting system for the proposed power plant for fire protection shall be consisting of:

- a) Portable fire extinguishers in the control room for fire caused by electrical short circuits
- b) Sand buckets in the control room
- c) The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the Roof or site where the PV arrays have been installed.

#### **XX. DRAWINGS & MANUALS:**

a) Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.

b) Approved ISI and reputed makes for equipment be used.

c) For complete electro-mechanical works, bidders shall supply complete design, details and drawings for approval to Railways before progressing with the installation work

d) Single Line Diagrams with operation instructions indicating the interconnection of equipment shall be displayed in each location

#### **XXI. PLANNING AND DESIGNING:**

**a) The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The bidder should submit the array layout drawings along with Shadow Analysis Report to Railways for approval.**

b) Railways reserve the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions/requirements.

c) The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder shall submit three sets and soft copy of final drawing for formal approval to proceed with construction work.

#### **XXII. DRAWINGS TO BE FURNISHED BY BIDDER AFTER AWARD OF CONTRACT**

a) The Contractor shall furnish the following drawings Award/Intent and obtain approval

- b) General arrangement and dimensioned layout
- c) Schematic drawing showing the requirement of SPV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
- d) Structural drawing along with foundation details for the structure.
- e) Itemized bill of material for complete SPV plant covering all the components and associated accessories.
- f) Layout of solar Power Array
- g) Shadow analysis of the roof

### **XXIII. SAFETY MEASURES:**

The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines etc.

### **XXIV. DISPLAY BOARD**

The bidder has to display a board at the project site mentioning the following:

- a. Plant Name, Capacity, Location, Type of Renewable Energy plant (Like solar wind etc.), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
- b. Financial Assistance details from SECI/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful bidder
- c. The size and type of board and display shall be approved by Engineer-in-charge before site inspection.

The IEC standards to be mandatorily adhered are as given below:

### **Quality Certification, Standards and Testing for Grid-connected Rooftop Solar PV Systems/Power Plants**

Quality certification and standards for grid-connected rooftop solar PV systems are essential for the successful mass-scale implementation of this technology. It is also imperative to put in place an efficient and rigorous monitoring mechanism, adherence to these standards. Hence, all components of grid-connected rooftop solar PV system/ plant must conform to the latest and updated version of relevant standards and certifications given below with latest amendments, additions and corrections:

#### **Solar PV Modules/Panels**

<b>Solar PV Modules/Panels</b>		
1	IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
2	IEC 61701	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules

3	IEC 61853- Part 1/ IS 16170: Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements, and power rating
4	IEC 62716	Photovoltaic (PV) Modules – Ammonia (NH <sub>3</sub> ) Corrosion Testing (As per the site condition like dairies, toilets)
5	IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
6	IEC 62804	Photovoltaic (PV) modules - Test methods for the detection of potential induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon (mandatory for applications where the system voltage is > 600 VDC and advisory for installations where the system voltage is < 600 VDC)
7	IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units
<b>Solar PV Inverters</b>		
1	IEC 62109-1, IEC 62109-2	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems. Part 2: Particular requirements for inverters. Safety compliance (Protection degree IP 65 for outdoor mounting, IP 54 for indoor mounting)
2	IEC/IS 61683 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
	IEC/IS 61683 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
	BS EN 50530 (as applicable)	Overall efficiency of grid-connected photovoltaic inverters: This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.
3	IEC 62116/ UL 1741/ IEEE 1547 (as applicable)	Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures
4	IEC 60255-27	Measuring relays and protection equipment – Part 27: Product safety requirements
	IEC 60068-2 (1, 2, 14, 27, 30 & 64)	Environmental Testing of PV System – Power Conditioners and Inverters a) IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold b) IEC 60068-2-2: Environmental testing - Part 2-2: Tests - Test B: Dry heat c) IEC 60068-2-14: Environmental testing - Part 2-14: Tests – Test N: Change of temperature d) IEC 60068-2-27: Environmental testing -Part 2-27: Tests - Test Ea and guidance: Shock e) IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) f) IEC 60068-2-64: Environmental testing - Part 2-64:



		Tests - Test Fh: Vibration, broadband random and guidance
5	IEC 61000 – 2,3,5 (as applicable)	Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) testing of PV Inverters
<b>Fuses</b>		
1	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Lowvoltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers c) Lowvoltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Low voltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers c) Low voltage switchgear and Control-gear, Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests
2	IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
<b>Surge Arrestors</b>		
1	BFC 17-102:2011	Lightening Protection Standard
2	IEC 60364-5-53/ IS 15086-5 (SPD)	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control
3	IEC 61643-11:2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
<b>Cables</b>		
1	IEC 60227/IS 694, IEC 60502/ IS 1554 (Part 1 & 2)/ IEC69947 (as applicable)	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation)
2	BS EN 50618	Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DC Cables
<b>Junction Boxes</b>		
1	IEC 60529	Junction boxes and solar panel terminal boxes shall be of the thermo-plastic type with IP 65 protection for outdoor use, and IP 54 protection

		for indoor use
<b>Energy Meter</b>		
1	IS 16444 or as specified by the SEB/DISCOMs	A.C. Static direct connected watt-hour Smart Meter Class 1 and 2 — Specification (with Import & Export/Net energy measurements)
<b>Solar PV Roof Mounting Structure</b>		
1	IS 2062/IS 4759	Material for the structure mounting

Note- Equivalent standards may be used for different system components of the plants. In case of clarification following person/agencies may be contacted.

- Ministry of New and Renewable Energy (Govt. of India)
- National Institute of Solar Energy
- The Energy & Resources Institute
- TUV Rheinland
- UL

**In addition to the above specifications following is also required:**

**Remote Display**

Contractor will arrange to install LED based display screens along with relevant hardware at each stations and will develop relevant software programs which will display real time generation on a minute, hourly, daily, monthly and annual basis. The cost of development of these systems will have to be borne by the contractor. In addition, the system have to send SMS regarding Solar generation at each location to the selected officials of Railways on Daily basis.

The contractor shall provide and maintain perimeter fencing or other suitable protection around the rooftop solar project and shall be responsible for the security arrangements, which also includes providing & maintaining necessary equipment at the entry, exit and within the rooftop solar project in order to maintain orderly conduct of its business and the security thereof.

**Interconnection Scheme**

**Interconnection Requirements: Scope of Work for the contractor**

**A. All work must be carried out as per the following:**

- Indian Electricity Act and rules therein
- Indian Electricity Grid Code
- Regulations of Chief Electrical Inspector

Besides the above measures, certain precautions prescribed by the CEA shall also be incorporated into the solar PV system design:

☐ PV systems shall be provided with adequate rating fuses, fuses on inverter input side (DC) as well as output side (AC) side for overload and short circuit protection as well as disconnecting switches to isolate the DC and AC system for maintenances.

☐ Fuses of adequate rating shall also be provided in each solar array module to protect them against short circuit.

**B. Phase Imbalance:**

☐ Phase imbalance can occur due to varied power injected into different phases of the grid. Whenever solar power plants (SPPs) of lower capacities with single phase inverters are used to feed power into the grid using a single phase injection point, they tend to induce imbalance. This imbalance can be resolved simply by connecting / injecting power to

different phases in the same grid.

- ☐ The developer shall have to follow the phase imbalance limits imposed by the Off Taker and shall also have to follow the guidelines before connecting such limits to the grid.
- ☐ The injection phase for each system to be injected into a single phase shall be approved by the Off Taker.

**a) Statutory clearances to be arranged by the contractor.**

- a) Building and Architectural Drawings approval
- b) Factory Inspector approval on drawings, wherever necessary
- c) Electrical System approval (Electrical Inspector)
- d) Fire System approval (CFO)
- e) All statutory requirements for working at the Project Site like Labour Registration, Workman Compensation Policy, ESIC etc.

**All the documents necessary for obtaining statutory clearances/ permissions/authorisations by various government organisations/ other agencies shall be collected and prepared by the successful tenderer, without any extra cost and got signed from the competent authority of Railways.**

**TESTING PROCEDURE**

The contractor shall adhere to the Testing Procedures given in this document.

**Mandatory check before and after connecting the SPV system with DISCOM Network and steps for maintenance of network shall be ensured. The following shall be provided by the contractor and ensured.**

**1. Mandatory safety precautions / features:**

The following are mandatory safety precautions which will be taken care before and after commissioning of grid connected Solar PV system.

(a) An inbuilt Inverter relay which trips on DISCOM / Railway supply failure and thus prevents any solar power injection to the DISCOM / Railway Network when there is no power from DISCOM / Railways. The anti-islanding protection shall be tested by respective Railway Engineer and the contractor during the release of connection.

**(b) The Solar PV system should be separately grounded / earthed. A minimum of two Separate dedicated and interconnected earth electrodes must be used for the Earthing of the PV system support structure, with a total earth resistance not exceeding 5 ohms. There must be at least three different earth pits, with minimum distance of 3 meters between any two, for each PV system; one for DC side (panels and structure), second for AC side (also called as neutral earthing) and lightning arrestor earthing. Additionally, inverter body must be earthed as per instructions from inverter manufacturer.**

(c) A properly designed Lightning Protection System (including arrestors as necessary) also must be provided for SPV.

(d) Manual isolator switch, at an easily accessible location with locking facility, shall be provided between inverter AC output and grid interconnection.

(e) Caution Stickers shall be used with the green background and the text “Solar PV Systems” written in white letters. The size of these stickers shall be 10 CM (width) x 7 CM (height) with the text clearly printed in the center of the sticker.

(f) All SPV systems should have a mandatory sign board fitted near the existing meter reading terminal stating that ‘This service is fitted with a LT grid connected SPV plant’. The Solar PV system Caution Stickers shall be fixed under the supervision of Railway Engineer and the contractor in the following locations.

- i. On or near to meter of service with grid connected solar PV system;
- ii. On The Consumer main switch, of a service connected with a grid connected Solar PV System;
- iii. On LT poles with grid connected Solar PV Systems at height of about 1.50 meter from the ground;
- iv. On LT feeder pillars with grid connected Solar PV System on the street-facing door of the feeder pillar.
- v. On each of the LT take off poles of a Distribution Transformer to which Solar PV Systems are connected.
- vi. On substation end of HT feeder having Solar PV System.
- vii. A List of service connected with grid connected Solar PV Systems shall be available at the Railway office.

(g) During planned / forced maintenance work on DISCOM network, before taking up the work in hand, besides ensuring all other provisions such as line earthing, de-energizing the line section where the work is to be carried out as per prevailing norms, it should also be ensured that supply from such small solar roof-top PV power plants are not back feeding and supply should also be disconnected by manual isolating switch with locking facility installed in the premises of such consumers and ensuring proper earthing.

### **Automatic cleaning system**

The contractor to provide necessary arrangement by laying pipe lines and all necessary accessories from nearest water connection point made available.

### **Products Features**

- Automatically clean the solar panels according to the time set by user
- Water-sprinkler based programmable cleaning systems
- Automatic as well as manual mode for solar panels cleaning
- Latest MCU based technology
- Advance Motor Dry Run Protection sensor
- Pump Dry run protection sensors available which protect your pump running in dry run (no water) conditions
- Set system Cleaning time 1 & 2 minutes
- set system Cleaning mode Daily & Alternate day
- Compact design and Powerful operation
- More Reliable, Powerful & smooth Device
- Low power consumption
- Water empty indication by Buzzer tones
- Shock free connection
- 0.5Hp to 10Hp open well Submersible Motor pump Handling capacity
- Capable for all types of submersible pump control
- Power cut does not effect on system operation
- Easily reprogrammed

- Simple and time saving installation, no special tools required

### **Product specification**

- I/P Voltage: 230vac
- Capacity: 0.5Hp to 10Hp
- Openwell Submersible pump
- Time setting: User friendly time setting
- Sensor: Pump Dry run protection sensors available
- Technology: Latest MCU based technology
- RTC: Available
- Cleaning mode: Daily & Alternate day
- Cleaning time: Set 1 & 2 minute
- Cleaning operation: Automatic & Manual
- Water indication: Water empty indication by Buzzer tones
- Wire connection: Shock free connection
- Battery: Lithium Battery
- Power: very low Consumption
- Design: Compact design and Powerful operation
- Power effect: Power cut does not effect on system operation

### **E-welt Solar Sprinkler**

- E-welt novel design solar panel cleaning sprinkler
- Unique Spray Nozzle
- 180degree projection area
- Wide spread water
- single sprinkler cleans whole panel
- Zero Shadow effect
- Zero maintenance
- Perfect water flow controller
- Utilize less water
- Cleaning with High presser
- Compact design and Powerful cleaning
- Remove Dust & Bird drops
- Long life span
- Suitable with all types of panel
- Perfect fitting with UPVC & Lateral martial

### **Sprinkler Bracket**

- Universal Clip Design -Clamps to any Solar Panel
- Sprinkler Bracket hold the sprinkler & pipe with solar panel
- Suitable with all types of solar panel
- Galvanize material
- Corrosion free
- High strength
- Long life span
- More reliable
- Easy to use
- **Warranty – minimum 05 years**

## **TECHNICAL SPECIFICATIONS FOR OTHER ITEMS**

### **SPECIFICATION FOR MULTI CORE PVC INSULATED FLEXIBLE COPPER CONDUCTOR CABLES FOR VOLTAGE GRADE 650/ 1100 VOLTS**

Multi Core PVC insulated multi stranded flexible copper cable conforming to IS: 694-2010 or its latest editions with bright annealed based copper conductor as per IS: 8130 of 2013 or its latest editions, with ISI marked.

### **SPECIFICATION FOR SINGLE CORE PVC INSULATED FLEXIBLE COPPER CONDUCTOR CABLES FOR VOLTAGE GRADE 650/ 1100 VOLTS**

Multi Core PVC insulated multi stranded flexible copper cable conforming to IS: 694-2010 or its latest editions with bright annealed based copper conductor as per IS: 8130 of 2013 or its latest editions, with ISI marked.

### **GENERAL GUIDELINES FOR PVC CONDUIT WIRING**

- a) This includes supply of materials and wiring as required.
- b) Drilling holes in the walls should be done very carefully without causing damage to supporting wall and structure of building. Minor damages caused if any to the plastering on the wall should be repaired by the contractor.
- c) Wall crossings should be through PVC pipe of 25/20 mm dia (2 mm wall thickness).
- d) Looping of neutral is not permitted; a separate neutral wire is to be drawn from the neutral strip connector in Sub circuit board to each point.
- e) The wiring shall conform to latest IS specification (IS-732) and NEC Code for internal wiring in buildings. No joint is permitted in wiring.
- f) The pipes should be fixed on to the walls in exactly horizontal or vertical fashion as required as per site condition and there should not be gap left between the consecutive lengths. The pipes should be fairly tight to facilitate easy removal and replacement of the same for maintenance wherever required.
- g) The Junction Boxes, straight through joints, bends etc should be provided where ever necessary.
- h) The wires taken inside the pipe shall not be cramped and wires should be easy to pull out at the time of maintenance/checking.
- i) Number of wires that can be drawn through a PVC conduit/ casing and capping shall be as per CPWD specifications Part I Internal 2013 or latest
- j) Wall shall be neatly plastered to bring it to the original finish after Groove cutting.

### **SPECIFICATION FOR CABLE TRENCH FOR LTUG CABLES**

#### **a) EXCAVATION OF CABLE TRENCH**

Excavation of cable trench 450 mm wide and 1000 mm deep in all kinds of soil and refilling the cable trench with excavated soil free from unwanted materials, ramming, consolidating and bringing the surface to its original finish.

- b) Cable route indicators have to be provided along the route of LTUG cable in ground at both the ends of the length and at all deviation points. Cable route indicators have to be provided along the

route of LTUG cable in ground at both the ends of the length and at all deviation points. Cable route indicators shall be with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size ) of size 60 cm X 60 cm at the bottom and 50 cm X 50 cm at the top with a thickness of 10cm including inscription duly engraved as required)

c) Trench for cable underneath the track/road:-

Cables shall be drawn through HDPE pipes. Trench to accommodate pipe shall be of suitable width and excavated at 1.0 m below the formation level. Once the pipes are laid in the trench, it should be made to its original formation level by filling it up with excavated earth by watering and ramming process and resetting the ballast of track to its original level. Similarly wherever road has been dug for laying the cable the same should be filled, rammed and asphalted and brought to original condition.

The cable rising above ground shall be taken through GI pipe neatly clamped and open end of GI pipe has to be sealed with bitumen compound. The cable has to be laid along the route as per instruction of Engineer-in-charge.

### **SPECIFICATION FOR LAYING OF LTUG CABLES.**

The laying of LTUG Cable includes un-coiling of cable from cable drum, Laying the cable in the trench free from twists, bends, Peeling of Insulation, Dressing at Terminal Ends, Provision of Cable glands, Crimping with suitable shoe, Connection at both ends & Earthing of Armour at both ends.

### **SPECIFICATION FOR HDPE PIPE**

The HDPE pipe material should be confirming to standard IS 4984-1995 or latest and should be of PE-80 material designation which has MRS(Minimum Required Strength) of 8.0MPa and maximum allowable hydrostatic design stress of 6.3 MPa (@20 °C) with pressure rating of PN-6(6kg/cm<sup>2</sup>), heavy gauge has to be provided.

The cable has to be laid through HDPE pipe with all necessary accessories for jointing, clamping, bends etc. as per site condition has to be provided.

### **SPECIFICATION FOR LTUG CABLES**

PVC insulated armoured with heat resistant insulation, PVC outer sheathed multi core LTUG cable with standard aluminium conductor, with IS 1554 Part I/1988 with latest amendment suitable for working voltage up to and including 1100volts.

### **Moulded Case Circuit Breakers (MCCB)**

MCCBs shall conform to IEC 60947-2:2016+AMD1:2019 or latest ( $I_{cs} = 100\% I_{cu}$ ) and shall have ON, OFF & TRIP indications with breaking capacity as specified in the relevant Schedule item. MCCBs shall be suitable for three phase, 415 Volt, AC supply.

### **SPECIFICATION FOR MAINTENANCE FREE EARTHING**

The maintenance free earthing arrangement shall be done in accordance with RDSO specification no. RDSO/ PE/ SPEC/ PS/ 0109-2008 (REV'0'). For transformers, substation earthing, LT line equipment (**40 kA**), The IR value shall be less than 1 ohm., in normal soil resistivity upto 50 ohm-mtr, single electrode type earth system.

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus. The work shall be done in an approved manner as per site conditions as per the instructions of field Engineer.

### Concentric pipe earth electrode : (Current capacity 40 kA)

#### Primary conductor -

MS pipe with 40 mm diameter, class B, ISI mark as per IS-1239, length 3000 mm.

#### Secondary conductor -

MS pipe with 80 mm diameter, class B, ISI mark as per IS-1239, Length 3000 mm.

**Current carrying capacity :** The design of the electrode should be such as to have current carrying capacity in 40 kA (for 1 second).

S.N.	Current Capacity	Primary Conductor diameter	Electrode dimensions (dia. X length)
1	40 kA	40 mm	80 mm x 3000 mm

### Dimensions and Nominal Mass of Steel Tubes — Medium (as per IS 1239)

Nominal Bore	Outside Diameter		Thickness	Mass of Tube
(mm)	Maximum (mm)	Minimum (mm)	(mm)	Plain End (kg/m)
40	48.8	47.9	3.2	3.56
80	89.5	88.0	4.0	8.36

#### Conductive mixture

- 1) For hermetically filling inside the cavity i.e. between secondary conductor and primary conductor, crystalline compound is to be injected in the electrode assembly. It is a combination of high conductivity metal alloys, copper and aluminium powder, conductive carbon/cement and bonding material etc. mixed in different portion. The mixture is forced (pressurized) filled inside the earth electrode in the paste form and after solidification of the same, the end caps are welded. The metal alloys shall help in conducting the current and conductive carbon gives anti corrosive property. Bonding material should provide strength to the mixture. Resistivity of the mixture shall be less than 0.2 ohm-meter. Resistivity shall be tested by making a 20 cm cube of the material and checking resistance across the opposite face of the cube.
- 2) Complete electrode shall be molecularly bonded by 99.99% pure, high conductivity copper on outer surface with copper coating thickness 300 micron or more.
- 3) Its surface shall be clean and free from any visible oxide layer or foreign material.
- 4) Copper bus bar of size 250 mm x 50 mm x 6 mm having electrical conductivity of 101% IACS, minimum 99.9% copper content shall preferably be exothermically welded to earth electrode or connected with the help of two number stainless steel nut bolts of appropriate size having 4 holes of 12 mm dia. (2 on each side) for connecting earthing conductor.

#### Minimum quantity of earth enhancement material to be supplies :

For 5'x5'x10' earth pit – min 75 kgs per pit

For 300 mm bore type earth pit – min 50 kgs per pit

The earth enhancement material shall be supplied in sealed, moisture proof bags. These bags shall be marked with manufacturers name or trade name, quantity, batch no & date of manufacture.

**Warranty : 05 year against earth electrode for copper plating. If found faded or corrosive whole earthing is to be replaced by tenderer.**



**Note :** *Earthing Pit Box should be supplied & erected by contractor. Also necessary cementing work to be done by contractor to make site as original.*

#### **R.C.C. earth pit box**

R.C.C. earth pit box of size 450 X 450 X 50mm including cover of size 450 X 450 X 4.5mm along with white wash. The work shall be done in an approved manner as per the instructions of field supervisor.

#### **PVC Large Earth Pit**

PVC Large Earth Pit Cover (10 inches) At Top (Dia) -252 mm At Bottom (Dia) – 334 mm Height – 260 mm (IS-3043).

#### **Special Features -**

- A durable round valve box ideal for commercial and residential installation.
- Round Valve box extra support for strong load
- Twist lock design cover
- UV Resistant
- Pipe cutouts for quick and easy installation
- Damper proof

➤ **Every individual earth shall be allotted a serial number. Following information shall be suitably written with white or yellow paint.**

- a) Earth No. \_\_\_\_\_
- b) Individual earth resistance \_\_\_\_\_ ohms
- c) Overall earth resistance \_\_\_\_\_ ohms
- d) Date of test \_\_\_\_\_

#### **Test report of earthing system (To be connected by earth Tester)**

- i) Individual Earth Resistance
  - Earth Electrode No 1 \_\_\_\_\_ ohm
  - Earth Electrode No 2 \_\_\_\_\_ ohms
  - Earth Electrode No 3 \_\_\_\_\_ ohms
- ii) Overall Earth Resistance:
  - a) HT earth electrode \_\_\_\_\_ ohms
  - b) LT earth electrode \_\_\_\_\_ ohms
  - c) Neutral earth electrode \_\_\_\_\_ ohms

Note: Before energization of installation earthing system will have to be checked by contractor in presence of Sr. DEE/G/BSL's authorized representative/Site in charge and test report be submitted to Sr. DEE/G/BSL for his approval on above prescribed Performa.

Signature of Tenderer

**Note – Capacity for Rooftop Solar Plants may be vary as per feasibility of site at various locations over Bhusaval Division.**

Making arrangements for water in the plant area for module cleaning for maintaining minimum CUF as given in warranty clause. **The contractor shall make arrangement for fortnightly cleaning of the solar PV modules during the maintenance period. Logbook for the same shall be jointly signed by contractors representative and SSE incharge.**

### **GENERAL CONDITIONS FOR SUPPLY AND ERECTION**

1. The work is to be done as per tender technical specification. In case of any doubt etc. the details as given in tender technical specifications will prevail.
2. All the supply and erection work shall be done in accordance with relevant IS.
3. Contractor shall supply the material duly inspected by Railway representative or agency as per inspection clause mentioned below.
4. Any kind of testing required to confirm suitability of material either at manufacturers premises or at Rly. Stores before material is accepted by consignee shall be the responsibility of contractor. All testing charges shall be borne by the contractor.
5. Due care has been taken while framing technical specification, however if any deviation from prevailing standard norms is noticed at the time of execution the same shall be rectified and made good by the contractor. Contractor shall also bring such things if ever noticed by them to the knowledge of this office and to field Engineer.
6. Site survey shall be carried out by the contractor and Rly. Representative on award of LOA and before starting the work. Targeted Action Plan with material delivery schedule based on above survey shall be prepared by the contractor. One copy of the same shall be submitted to Engineer for monitoring the progress.
7. All material to be used for work shall be duly supported with test/inspection reports shall be deposited with SSE in charge of execution for ensuing quality before fitment. Only after clearance and satisfaction of quality the material shall be taken to site for erection and commissioning. Contractor shall therefore supply material in bulk lots to avoid repetitions of inspections/ testing.
8. **INSPECTION and TESTING:-**
  - (i) The stores material shall be inspected by Railway Representative nominated by Sr.DEE (G) BSL. All the inspection and testing charges shall be borne by the contractor. The contractor shall submit details of the material being offered before inspection schedule date at manufactures premises/ consignee premises. Where RITES or any third party is nominated as inspection agency, the inspection fee charged to the agency shall be borne by Contractor.
  - (ii) Material having value above Rs.5 lakhs shall be inspected by RITES. Inspection of other materials shall be done by Railway's representative.
9. **Successful bidder/tenderer shall survey the site and submit action plan within 15 days immediately after issuing of LOA to this office.**
10. All released material to be deposited to concern field In-charge office/depot.
11. There may be minor variation in rating / other parameters from make to make. The variation in positive side and beneficial to Railway is acceptable. However, prior approval of Sr.DEE(G)BSL shall be required before delivery of material to Railways.
12. In case, any contradiction in schedule of rate and specification; final decision of Railway authority will be final as per railway requirement.
13. LED fittings shall be guaranteed for 5 years

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## **CHAPTER –IV**

### **SCHEDULE OF QUANTITIES**

**AND**

**RATES**

## CENTRAL RAILWAY

## ELECT (G) BRANCH

## BHUSAWAL DIVISION

## TENDER No. BSL-L-W-T-51-2026

Schedule of work, rates and quantities for the work of Electrification work in connection with following, Sch. A :- Development of Infrastructure and other needs of Railway School at Bhusawal. ; Sch. B :- Construction of Integrated Crew Lobby with provision of basic amenities at Bhusawal.

	S N	Description	QTY.	Unit	Sup. Rate	Erec. Rate	Total cost of sup.	Total cost of erec.	Grand Total
<b>Sch. A :- Electrification work in connection with development of Infrastructure and other needs of Railway School at Bhusawal.</b>									
<b>Part I - Development of academic block for primary section.</b>									
A(I)	1	Wiring of the <b>conceaLED Light / fan Point</b> with all accessories and running earthing copper conductor as per standard practise. The switches shall be of modular type. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.)</i>	1000	Nos	529	144	529000	144000	673000
A(I)	2	Supply of material and fixing and concealed wiring for <b>(3 Plug &amp; 3 switch on separate board) 6 A 3 pin</b> universal socket outlet complete with 6 Sqmm PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25mm / 32mm dia PVC conduit pipe flush type 5A socket outlet and 5A piano type switch in GI box with PVC topsheet 5mm thick.. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</i>	100	Nos	590	136	59000	13600	72600
A(I)	3	Supply, erection, testing & commissioning of <b>6A &amp; 3 Pin Universal Modular</b>	100	Nos	499	136	49900	13600	63500

		<b>Type</b> Plug Socket with switch & concealed type point wiring with 2x2.5 sq mm FRLS Multistranded PVC Copper wire with all accessories and running earth <b>on seprate board..(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</b>							
<b>A(I)</b>	4	SETC of Wiring of the concealed <b>6 A / 3 Pin</b> Universal plug point as per latest IS on switch board with all accessories and running earthing copper conductor as per standard practise. The Switches shall be of ModularType.	200	Nos	517	27	103400	5400	108800
<b>A(I)</b>	5	Wiring of Concealed <b>15 A 6 Pin Wall Socket Point</b> complete with 4 Sqmm Wiring all accessories and running earthing copper conductor as per standard practice. The switches shall be of modular type for Gyser, Kettle & Fridge. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</i>	100	Nos	1001	130	100100	13000	113100
<b>A(I)</b>	6	Supply, erection, testing & commissioning of <b>Concealed wiring for call bell</b> with copper PVC insulated FRLS 1.1 KV point wiring of 2 x1.5 sq.mm. wire on PVC conduit of suitable size with all accessories and running earthing.The plug point to be provided on separate switch board and switch with supply and fixing of bell and switchHThe switch should be bell push	5	Nos	365	23	1825	115	1940

		type 5 A capacity. <i>.(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</i>							
<b>A(I)</b>	7	Supply of material and fixing and <b>concealed power point wiring 20A DP MCB</b> complete with 4 Sqmm PVC insulated copper conductor wires along with 14SWG tinned copper earth wire in 25/32mm dia PVC conduit pipe flush type 5/15A socket outlet and 15A piano type switch in GI box with PVC topsheet 5 mm thick for AC.. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</i>	50	Nos	737	147	36850	7350	44200
<b>A(I)</b>	8	Supply, erection, testing & commissioning of 2x4 sqmm FR Stranded/solid copper PVC insulated wire laid inside of pole for connecting the luminaries.	700	Nos	62	10	43400	7000	50400
<b>A(I)</b>	9	Supply, erection, testing & commissioning of <b>Submain</b> from switch board to single phase DP switch / DP one circuit meter comprising of <b>2x4 sq.mm.</b> PVC insulated FRLS 1.1KV multistranded wire & one running earth of 2.5 sq.mm. copper conducting PVC insulation green colour of 1.1 KV grade on rigid PVC casing capping with all accessories.	1300	Ckt Mtr	156	24	202800	31200	234000
<b>A(I)</b>	10	Supply, erection, testing & commissioning of <b>Submain</b> with <b>2x6 sqmm</b> FRLS copper wire inside PVC Casing capping with running earth etc complete. (1 m length of submain consists one cktmtr including all	1100	Ckt Mtrs	200	26	220000	28600	248600

		accessories & 2 wire of 6 sqmm with one wire of 2.5 sqmm for earth conn).							
<b>A(I)</b>	11	Provision for supply & laying of 10 Sq. mm copper unarmoured, multistrand, PVC insulated PVC sheathed wire, alongwith earth wire of 1.5 Sq. mm. copper PVC insulated/heathed wire in separate PVC casing-capping with all accessories. (Sub Main - 32 Amp MCCB to DB).	250	Nos	321	26	80250	6500	86750
<b>A(I)</b>	12	Supply, erection, testing & commissioning of LED Reading Lamp of 01-02 W Along with all accessories with 1.5 Sq mm 2 Core Copper Wire for connections.	50	Nos	393	7	19650	350	20000
<b>A(I)</b>	13	Supply, erection, testing & commissioning of LED concealed type foot/step light suitable upto 2W LED including driver having fibre reinforced plastic hosing as per specification.	50	Nos	1341	75	67050	3750	70800
<b>A(I)</b>	14	Supply, erection, testing & commissioning of Indoor type Energy Efficient.The fitting shall be complete with 2x18 W LED luminaire with ballast (driver)etc. and connection to over head mains/junction box.	400	Nos	1753	72	701200	28800	730000
<b>A(I)</b>	15	Supply, erection, testing & commissioning of 15/18 Watt Warm White SLD Square / Round LED downlight fitting of size 6"x6" complete with all accessories.	50	Nos	1425	130	71250	6500	77750
<b>A(I)</b>	16	Supply, erection, testing & commissioning of 2Ft 10 watt LED tube 4000 k all in one fixtures for Dressing, mirror and kitchen.	40	Nos	585	159	23400	6360	29760
<b>A(I)</b>	17	Supply, erection, testing & commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts.	100	Nos	851	130	85100	13000	98100
<b>A(I)</b>	18	Supply, erection, testing & commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts.	100	Nos	2718	118	271800	11800	283600

A(I)	19	Supply, erection, testing & commissioning of LED Bollard 8W	20	Nos	10840	1084	216800	21680	238480
A(I)	20	Supply, erection, testing & commissioning of LED Post top 65 Watt with spun aluminium housing for lamp and reflector assembly with clear polycarbonate cover and IP 65 protection.	2	Nos	17147	131	34294	262	34556
A(I)	21	Supply, erection, testing & commissioning of Solar Street light of 15 W white LED luminaire with inbuilt 12 V 12 Ah L lithium - ion battery for 12 hrs back up 40 Wp PV module solar plate motion sensor along with 6 mtr long octagonal GI pole having mounting arrangement for PV panel fixing and single arm for erection of LED outdoor luminaire complete with other accessories	2	Nos	24193	2419	48386	4838	53224
A(I)	22	Supply, erection, testing and commissioning of <b>BLDC</b> Super efficient electrical <b>Ceiling Fan 1400 mm</b> sweep (56') 260-280 RPM, Services value 7.7 input voltage 140-285 V. Power consumption 26 W to 30 W. Air delivery 270 CMM or more, 3 blades with double ball bearing with regulator of electronic step type and down rod 300-600 mm as per requirement, canopies, shackle.	180	Nos	3103	149	558540	26820	585360
A(I)	23	Supply, erection, testing & commissioning of single phase Domestic Exhaust Fan of 250 mm size sweep,1200 RPM with self closing Louvers, full plastic body, colour white complete.	20	Nos	1060	108	21200	2160	23360
A(I)	24	Supply, erection, testing & commissioning of Heavy Duty single phase <b>Exhaust Fan of 380 mm</b> size sweep,1440 RPM duly wired with 3 core flexible copper wire and fixing arrangement, hardware etc. complete.	30	Nos	3807	192	114210	5760	119970
A(I)	25	Supply, erection, testing and	1	Nos	48967	637	48967	637	49604



		commissioning of air curtain size 6' (Six feet) operated with single phase 230 V /50 Hz, 500 Watts, along with starter and shall be as railway requirement.							
A(I)	26	Supply, erection, testing & commissioning of <b>Astronomical Timer</b> 3Ph with multitiming setting including suitable contactor of 100 Amp.	5	Nos	15453	1074	77265	5370	82635
A(I)	27	Supply, erection, testing & commissioning of self contained drinking <b>water cooler</b> unit energy efficient compressor IS mark suitable for operation on 230 V +10 % 50 cycle single phase Ac supply storage capacity <b>150 Ltr</b> cooling capacity 150 Ltr/Hr complete in place of old one as per specification.	2	Nos	66251	1324	132502	2648	135150
A(I)	28	Supply, erection, testing & commissioning of electric water heater/ geyser Cap- 15 Liters 230 V 50 Hz AC Input-2 KW(Glass Coated Heating Element, inner tank made up of mild steel with blue diamond glass lining tank, Temprature range:- 25-75 Deg Cent., BEE 5 STAR RATING, with wireless remote control.	1	Nos	8591	334	8591	334	8925
A(I)	29	Supply Erection, Testing and Commissioning of Refrigerator (Double Door), Capacity- 300 to 320 ltrs, 3-5 Star Rating, 230 V AC, 50 Hz.	1	Nos	35983	0	35983	0	35983
A(I)	30	Supply of <b>4 core 16 sqmm</b> armoured XLPE Cable.	1300	Mtrs.	187	0	243100	0	243100
A(I)	31	Supply of <b>4 core 25 sqmm</b> armoured XLPE Cable.	1500	Mtrs.	232	0	348000	0	348000
A(I)	32	Supply of <b>4 Core 70 Sqmm</b> armoured LT XLPE Cable.	1500	Mtrs.	519	0	778500	0	778500
A(I)	33	Trenching & refilling of LT/HT/ Various sizes of PVC / XLPE cables- <b>Along the Road</b> (Size - 900mm x 300mm)	3200	Mtr.	0	211	0	675200	675200
A(I)	34	Digging of cable trench 300/450 mm x 1000 mm in <b>RCC/PCC/hard soil &amp; refilling</b> as per specification	600	Mtr.	0	368	0	220800	220800

		and requirement at the site.							
<b>A(I)</b>	35	Transportation, Laying, Installation, terminating, testing and commissioning of LT/HT cable of sizes 10 sqmm to 400 sqmm in existing trench, pipe or on structure.	3800	Mtr.	0	30	0	114000	114000
<b>A(I)</b>	36	Erection, testing and commissioning of cables other than trench i.e. Wall/Truss including clamp, GI wire and hardware	500	Mtr.	0	72	0	36000	36000
<b>A(I)</b>	37	Supply & laying of GI pipe Class B, ISI marked under road /Clamping with erecting pole or wall as per technical specification & drawing for passing cable.	50	Mtr.	202	0	10100	0	10100
<b>A(I)</b>	38	Supply, installation, testing & commissioning of <b>HDPE Pipe</b> 110 mm Nominal Dia as per IS-4984-1995.	90	Mtr.	500	0	45000	0	45000
<b>A(I)</b>	39	Supply and laying of <b>RCC half round pipe</b> 150 mm ID & 1 mtr length.	3672	Nos.	84	13	308448	47736	356184
<b>A(I)</b>	40	Supply and laying of <b>RCC Hume Pipe</b> of size 6"(150mm) dia 2 mtr. Length.	19	Nos.	656	99	12464	1881	14345
<b>A(I)</b>	41	Supply, erection of RCC Type cable route marker with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) of size 60 cm X 60 cm at the bottom and 50 cm X 50 cm at the top with a thickness of 10cm including inscription duly engraved as required.	76	Nos	499	0	37924	0	37924
<b>A(I)</b>	42	Supply & Erection of <b>RCC Warning Cover</b> and refilling the cable trench in an approved manner.	76	Nos	327	146	24852	11096	35948
<b>A(I)</b>	43	Supply, fabrication, fixing and erection of MS Work of miscellaneous size and for cable tray etc. including painting complete.	500	Kg	91	16	45500	8000	53500
<b>A(I)</b>	44	Supply, erection, testing and commissioning of PVC flexible pipe 16 mm	300	Mtr	27	0	8100	0	8100
<b>A(I)</b>	45	Supply, erection, testing and commissioning of PVC flexible pipe 25 mm	300	Mtr	42	0	12600	0	12600

A(I)	46	Supply, erection, testing & commissioning of maintenance free earth as per RDSO specification no. RDSO/PE/SPEC/ PS/0109-008(REV '0') with improved earthing enhancing compound and exothermic welding	15	No	12965	2048	194475	30720	225195
A(I)	47	Supply, erection, testing & commissioning of Online UPS with isolation transformer suitable for singlephase AC input & single phase AC output,floor mounted type rating of UPS <b>5.0 KVA</b> indicative back-up time <b>120 minutes</b> complete with Battery and stand.	2	Nos	191042	9553	382084	19106	401190
A(I)	48	Supply, erection, testing and commissioning of LT Panel Outdoor type <i>as per IEC 61439</i> with closing double door powder coated consisting 1x250 A 4 Pole MCCB for I/C and 3x63 A 4 Pole MCCB, 6x32 A 4 Pole RCBO for O/G ELR with CBCT for each MCCB, Power Quality analyzer, 3ph KWH meter, ammeter, voltmeter and other accessories. <i>All MCCB are Microprocessor based (completely wired with suitable communication cable to fetch data from each compartment functional Unit (ACB/MCCB/SFU etc) / Multifunction Meter)</i>	4	Nos	398349	14978	1593396	59912	1653308
A(I)	49	Supply, erection, testing & commissioning of Three phase Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 63 A 4P MCB as I/C and 6 Nosx10 A SPN MCB and 4 Nosx 20A SPN MCB for O/G.	10	Nos	8525	1164	85250	11640	96890
A(I)	50	Supply, erection, testing & commissioning of Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 32 A	40	Nos	6087	690	243480	27600	271080



<b>Part II - Development of academic block for primary section - DUTY Room.</b>									
<b>A(II)</b>	1	Wiring of the <b>concealed Light / fan Point</b> with all accessories and running earthing copper conductor as per standard practise. The switches shall be of modular type. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site.)</i>	25	Nos	499	136	12475	3400	15875
<b>A(II)</b>	2	Supply of material and fixing and concealed wiring for <b>(3 Plug &amp; 3 switch on separate board) 6 A 3 pin</b> universal socket outlet complete with 6 Sqmm PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25mm / 32mm dia PVC conduit pipe flush type 5A socket outlet and 5A piano type switch in GI box with PVC topsheet 5mm thick.. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)</i>	5	Nos	590	136	2950	680	3630
<b>A(II)</b>	3	Supply, erection, testing & commissioning of <b>6A &amp; 3 Pin Universal Modular Type</b> Plug Socket with switch & concealed type point wiring with 2x2.5 sq mm FRLS Multistranded PVC Copper wire with all accessories and running earth <b>on seprate board</b> .. <i>(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed</i>	5	Nos	499	136	2495	680	3175

		<i>by Engineer in charge at site)</i>							
<b>A(II)</b>	4	SETC of Wiring of the concealed <b>6 A / 3 Pin</b> Universal plug point as per latest IS on switch board with all accessories and running earthing copper conductor as per standard practise. The Switches shall be of Modular Type.	10	Nos	517	27	5170	270	5440
<b>A(II)</b>	5	Wiring of Concealed <b>15 A 6 Pin Wall Socket Point</b> complete with 4 Sqmm Wiring all accessories and running earthing copper conductor as per standard practice. The switches shall be of modular type for Gysar, Kettle & Fridge.(along with the all accessories and including cutting the wall / ceiling / chipping and re plastering, distempered / painted as the case may be, the same as good condition as directed by Engineer in charge at site)	5	Nos	1001	130	5005	650	5655
<b>A(II)</b>	6	Supply, erection, testing & commissioning of <b>Submain</b> from switch board to single phase DP switch / DP one circuit meter comprising of <b>2x4 sq.mm.</b> PVC insulated FRLS 1.1KV multistranded wire & one running earth of 2.5 sq.mm. copper conducting PVC insulation green colour of 1.1 KV grade on rigid PVC casing capping with all accessories.	40	Ckt Mtr	156	24	6240	960	7200
<b>A(II)</b>	7	Supply, erection, testing & commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts.	4	Nos	851	130	3404	520	3924
<b>A(II)</b>	8	Supply, erection, testing & commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts.	4	Nos	2718	118	10872	472	11344
<b>A(II)</b>	9	Suplpy, Erection, Testing & Commissioning of Microprocessor Based Equipment functional item	1	Nos	108016	0	108016	0	108016
<b>A(II)</b>	10	Supply, erection, testing and commissioning of <b>BLDC</b>	5	Nos	3103	149	15515	745	16260

		Super efficient electrical <b>Ceiling Fan 1400 mm</b> sweep (56') 260-280 RPM, Services value 7.7 input voltage 140-285 V. Power consumption 26 W to 30 W. Air delivery 270 CMM or more, 3 blades with double ball bearing with regulator of electronic step type and down rod 300-600 mm as per requirement, canopies, shackle.							
<b>A(II)</b>	11	Supply, erection, testing & commissioning of maintenance free earth as per RDSO specification no. RDSO/PE/SPEC/ PS/0109-008(REV '0') with improved earthing enhancing compound and exothermic welding	3	No	12965	2048	38895	6144	45039
<b>A(II)</b>	12	Table for operator similar to Godrej Model	3	Nos	10895	0	32685	0	32685
<b>A(II)</b>	13	Chair for operator similar to Godrej Model	3	Nos	6537	0	19611	0	19611
<b>A(II)</b>	14	Supply of Aluminium self supporting ladders, height 10 Foot	2	Nos	10822	0	21644	0	21644
<b>A(II)</b>	15	Supply of Digital Megger 2500 V.	1	Nos	14419	0	14419	0	14419
<b>A(II)</b>	16	Supply of Digital Clamp on Earth Tester.	1	Nos	57952	0	57952	0	57952
<b>A(II)</b>	17	Supply of Digital Clamp on Meter (Tong Tester).	1	Nos	5991	0	5991	0	5991
<b>A(II)</b>	18	Digital Earth tester with in built rechargeable battery, 3.5 digit LCD display, testing range 0.01 ohm to 2000 ohm & all accessories as four spikes, suitable length cable (10M,20M,30M,40M) on winder	1	Nos	8478	0	8478	0	8478
<b>A(II)</b>	19	Supply of battery operated Saw cutting having Weight less than 5 Kg Complete.	1	Nos	26569	0	26569	0	26569
<b>A(II)</b>	20	Supply of Heavy duty Hammer Drill Machine of approved make.	1	Nos	7238	0	7238	0	7238
<b>A(II)</b>	21	Supply of Hydraulic crimping tools capacity 10 mm2 to 185 mm2 dies: R-1 to R13.	1	Nos	16346	163	16346	163	16509
<b>A(II)</b>	22	Portable hand held electric air blower (Detail	1	Nos	4506	0	4506	0	4506

		specification attached.) DEWALT Fibre Body Handheld Electric Blower, Warranty 12 months							
A(II)	23	Supply of Hand held LED search light (Dragon Torch)	1	Nos	4911	0	4911	0	4911
A(II)	24	Long Range 1KM Torch Light Beam Battery Included 1500 Lumens.Make:- Nei, Ascebtch, kinnav orsimilar.	1	Nos	6357	0	6357	0	6357
A(II)	25	Supply of Steel Almirah, Size - 6 ft x 3 ft	1	Nos	9291	0	9291	0	9291
A(II)		<b>Total Part II of Sch. A</b>							<b>461719</b>

**Part III - Development of laboratories for secondary section.**

A(III)	S N	Description	QTY.	Unit	Sup. Rate	Erec. Rate	Total cost of sup.	Total cost of erec.	Grand Total
A(III)	1	Wiring of the concealed Light / fan Point with all accessories and running earthing copper conductor as per standard practise. The switches shall be of modular type.	100	Nos	474	129	47400	12900	60300
A(III)	2	Supply of material and fixing and concealed wiring for (3 Plug & 3 switch on separate board) 5 A 5 pin universal socket outlet complete with 6 Sqmm PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25mm/ 32mm dia PVC conduit pipe flush type 5A socket outlet and 5A piano type switch in GI box with PVC topsheet 5mm thick.	50	Nos	561	129	28050	6450	34500
A(III)	3	Supply, erection, testing & commissioning of 5A & Pin Universal Modular Type Plug Socket with switch & concealed type point wiring with 2x2.5 sq mm FRLS Multistranded PVC Copper wire with all accessories and running earth on seprate board.	50	Nos	474	129	23700	6450	30150
A(III)	4	Supply of material and fixing and concealed power point wiring 20A DP MCB complete with 4 Sqmm PVC insulated copper conductor wires along with 14SWG tinned copper earth wire in	10	Nos	701	140	7010	1400	8410



		25/32mm dia PVC conduit pipe flush type 5/15A socket outlet and 15A piano type switch in GI box with PVC topsheet 5mm thick for AC.							
A(III)	5	Wiring of Concealed 15 A 6 Pin Wall Socket Point complete with 4 Sqmm Wiring all accessories and running earthing copper conductor as per standard practice. The switches shall be of modular type for Gyser, Kettle & Fridge.	20	Nos	992	129	19840	2580	22420
A(III)	6	Wiring of the concealed 6A /3 Pin Universal Plug Point on switch board with all accessories and running Earthing copper conductor as per standard practice. The switches shall be of Modular Type.	50	Nos	67	67	3350	3350	6700
A(III)	7	S.E T.C. of <b>Submain with 2x6 sqmm</b> FRLS copper wire inside PVC Casing capping with running earth etc complete. (1 m length of submain consists one cktmtr including all accessories & 2 wire of 6 sqmm with one wire of 2.5 sqmm for earth conn).	250	Ckt Mtr	168	23	42000	5750	47750
A(III)	8	Supply, erection, testing & commissioning of submain from switch board to single phase DP switch / DP one circuit meter comprising of 2x4 sq.mm. PVC insulated FRLS 1.1KV multistranded wire & one running earth of 2.5 sq.mm. copper conducting PVC insulation green colour of 1.1 KV grade on rigid PVC casing capping with all accessories.	400	Ckt Mtrs	128	20	51200	8000	59200
A(III)	9	Provision for supply & laying of 10 Sq. mm copper unarmoured, multistrand, PVC insulated PVC sheathed wire, alongwith earth wire of 1.5 Sq. mm. copper PVC insulated/heathed wire in separate PVC casing-capping with all accessories. (Sub Main - 32 Amp MCCB to DB).	100	Mtr.	321	26	32100	2600	34700

<b>A(III)</b>	10	Supply, erection, testing & commissioning of LED concealed type foot/step light suitable upto 2W LED including driver having fibre reinforced plastic housing as per specification.	30	Nos	1571	88	47130	2640	49770
<b>A(III)</b>	11	Supply, erection, testing & commissioning of Indoor type Energy Efficient. The fitting shall be complete with 2x18 W LED luminaire with ballast (driver)etc. and connection to over head mains/junction box.	60	Nos	1667	68	100020	4080	104100
<b>A(III)</b>	12	Supply, erection, testing & commissioning of 15/18 Watt Warm White SLD Square / Round LED downlight fitting of size 6"x6" complete with all accessories.	20	Nos	1425	130	28500	2600	31100
<b>A(III)</b>	13	Supply, erection, testing & commissioning of 2Ft 10 watt LED tube 4000 k all in one fixtures for Dressing, mirror and kitchen.	10	Nos	556	151	5560	1510	7070
<b>A(III)</b>	14	Supply, erection, testing & commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts.	20	Nos	809	124	16180	2480	18660
<b>A(III)</b>	15	Supply, erection, testing & commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts.	30	Nos	2584	112	77520	3360	80880
<b>A(III)</b>	16	Supply, erection, testing & commissioning of BLDC Super Efficient Electrical Ceiling Fan 1400 MM sweep (56')260-280 RPM, Services value 7.7 Input voltage 140-285 V. Power Consumption 26 W to 30 W. Air delivery 270 CMM or more, 3 Blades with double ball bearing regulator of electronic step type and down rod 300-600 MM as per requirement canopies shackle.	40	Nos	3290	148	131600	5920	137520
<b>A(III)</b>	17	Supply, erection, testing & commissioning of single phase Domestic Exhaust Fan of 250 mm size sweep,1200 RPM with self closing Louvers, full plastic body, colour white complete.	10	Nos	1060	108	10600	1080	11680

A(III)	18	Supply, erection, testing & commissioning of Heavy Duty single phase Exhaust Fan of 380 mm size sweep, 1440 RPM duly wired with 3 core flexible copper wire and fixing arrangement, hardware etc. complete.	15	Nos	3242	162	48630	2430	51060
A(III)	19	Supply, erection, testing & commissioning of electric water heater/ geyser Cap- 15 Liters 230 V 50 Hz AC Input-2 KW(Glass Coated Heating Element, inner tank made up of mild steel with blue diamond glass lining tank, Temperature range:- 25-75 Deg Cent., BEE 5 STAR RATING, with wireless remote control.	2	Nos	8591	334	17182	668	17850
A(III)	20	Supply, fabrication, fixing and erection of MS Work of miscellaneous size and for cable tray etc. including painting complete.	200	Kg	85	15	17000	3000	20000
A(III)	21	Supply, erection, testing and commissioning of PVC flexible pipe 16 mm	400	Mtr	30	0	12000	0	12000
A(III)	22	Supply, erection, testing and commissioning of PVC flexible pipe 25 mm	356	Mtr	42	0	14952	0	14952
A(III)	23	Supply, erection, testing & commissioning of maintenance free earth as per RDSO specification no. RDSO/PE/SPEC/ PS/0109-008(REV '0') with improved earthing enhancing compound and exothermic welding	7	Nos	11520	1819	80640	12733	93373
A(III)	24	Supply, Installation, Testing & Commissioning of 20 KVA ONLINE UPS, AC 3 Phase 300V-450V sinewave 50 Hz input voltage & AC 3 Phase 400V +/- 1% with alternative user settable setting of 380V +/- 1% 50 Hz output voltage, with SMF-VRLA type battery having 120 minute battery backup with two years warranty complete and as per IS, IE rules and site requirement.	2	Nos	531562	0	1063124	0	1063124
A(III)	25	Supply, erection, testing and	1	Nos	92570	11438	92570	11438	104008

		commissioning of LT Panel Outdoor type with closing double door powder coated consisting 1x250 A 4 Pole MCCB for I/C and 3x63 A 4 Pole MCCB, 6x32 A 4 Pole MCB for O/G 3ph KWH meter, ammeter, voltmeter and other accessories.(All MCCB are Microprocessor based)							
A(III)	26	Supply, erection, testing & commissioning of Three phase Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 63 A 4P MCB as I/C and 6 Nosx10 A SPN MCB and 4 Nosx 20A SPN MCB for O/G.	7	Nos	10571	0	73997	0	73997
A(III)	27	Supply, erection, testing & commissioning of Lighting Circuit Board, Double Door Powder coated with locking arrangement consisting 32 A DP RCBO as I/C and 6 Nos x 6 A SPMCB and 2 Nos x 20A O/G SPMCB Complete.	12	Nos	4603	522	55236	6264	61500
A(III)	28	Dismantling of existing infrastructure like cable, wire, fittings and other accessories.	5	Job	0	12312	0	61560	61560
A(III)	29	Supplying, installing, testing and commissioning of 5 kWp OFF-GRID solar power pack with interconnecting wires / cables up to 24V pure sine wave solar power inverter (THD<3%), SPV Modules- Ultra-high-efficiency N-Type TOPCon bifacial dual-glass solar module, C-10 rated lead acid battery bank 24V, 300Ah x 4 nos. (12V, 300 Ah x 8 nos) suitable for 4 Hours backup with suitable MS powder coated stand to hold battery bank and keeping sufficient space for filling distilled water, canopy box to house inverter and other electronics, wiring up to solar inverter in casing and capping, display board, sign board, two distinct earthing,	1	Nos	440538	0	440538	0	440538

		spike type lightning arrester, necessary accessories complete with 5 years ON SITE warranty and fully comprehensive maintenance contract as per specification.							
<b>A(III)</b>	30	Design, supply, installation, testing and commissioning of ON GRID solar photovoltaic power plants with required mono crystalline solar PV modules, MS Hot dipped Galvanized structure for mounting of panles , suitable power conditioning units able to adjust volatge and frequency level to suit the grid voltage frequency, Array and main junction boxes with IP65 protection, required AC & DC distribution boards with switchgear , armoured power and control cables ,remote data monitoring system , EB approved Bidirectional energy metering system , Earthing arrangements , suitable lightning and surge protection etc., as per detailed specifications including all necessary works, accessories as per site conditions. Tentative list of locations and capacity of solar plants are attached . Liasoning , registration and inspection charges of EB to be born by contractor. Sites to be surveyed and GADs to be submitted for approval before starting of work.	5	KWP	74258	0	371290	0	371290
<b>A(III)</b>		<b>Total Part I of Sch. A</b>							<b>3130162</b>
<b>A</b>		<b>Total (Part I+II+III) of Sch. A</b>							<b>16687056</b>
<b>Sch. B :- Construction Integrated Crew Lobby with provision of basic amenities at Bhusawal.</b>									
<b>B</b>	<b>S N</b>	<b>Description</b>	<b>QTY.</b>	<b>Unit</b>	<b>Sup. Rate</b>	<b>Erec. Rate</b>	<b>Total cost of sup.</b>	<b>Total cost of erec.</b>	<b>Grand Total</b>
<b>B</b>	1	Wiring of the concealed Light / fan Point with all accessories and running earthing copper conductor as per standard practise. The switches shall be of modular type.	200	Nos	474	129	94800	25800	120600
<b>B</b>	2	Supplying and fixing following modular switch	30	Nos	121	0	3630	0	3630

		/socket on the existing modular plate & switch box including connections but excluding modular plate etc. as required. 3 pin 5/6 A socket outlet							
<b>B</b>	3	Supply of material and fixing and concealed wiring for (3 Plug & 3 switch on separate board) 5 A 5 pin universal socket outlet complete with 6 Sqmm PVC insulated copper conductor wires along with 14 SWG tinned copper earth wire in 25mm/ 32mm dia PVC conduit pipe flush type 5A socket outlet and 5A piano type switch in GI box with PVC topsheet 5mm thick.	30	Nos	561	129	16830	3870	20700
<b>B</b>	4	Supply, erection, testing & commissioning of Recessed Mount 2'x2' LED Light Panel light Fitting 29 Watts.	30	Nos	2584	112	77520	3360	80880
<b>B</b>	5	Supply, erection, testing & commissioning of energy efficient 1x18 W indoor fitting LED batten with extruded aluminium housing with integrated LED Driver/Tube complete and associated accessories complete.	40	Nos	449	113	17960	4520	22480
<b>B</b>	6	Supply, erection, testing & commissioning of Recessed Mount 1'x1' LED Light Panel light Fitting 15 Watts.	15	Nos	809	124	12135	1860	13995
<b>B</b>	7	Supply, erection, testing & commissioning of BLDC Super Efficient Electrical Ceiling Fan 1400 MM sweep (56')260-280 RPM, Services value 7.7 Input voltage 140-285 V. Power Consumption 26 W to 30 W. Air delivery 270 CMM or more, 3 Blades with double ball bearing regulator of electronic step type and down rod 300-600 MM as per requirement canopies shackle.	30	Nos	3290	148	98700	4440	103140
<b>B</b>	8	Supply, erection, testing & commissioning of 45W Multi LED Fittings for Outdoor Purpose.	4	Nos	8445	141	33780	564	34344
<b>B</b>	9	Supply, erection, testing &	5	Nos	3242	162	16210	810	17020

		commissioning of Heavy Duty single phase Exhaust Fan of 380 mm size sweep,1440 RPM duly wired with 3 core flexible copper wire and fixing arrangement, hardware etc. complete.							
<b>B</b>	10	Supply, erection, testing & commissioning of Concealed wiring for call bell with copper PVC insulated FRLS 1.1 KV point wiring of 2 x1.5 sq.mm. wire on PVC conduit of suitable size with all accessories and running earthing.The plug point to be provided on separate switch board and switch with supply and fixing of bell and switchHThe switch should be bell push type 5 A capacity.	5	Nos	347	22	1735	110	1845
<b>B</b>	11	Supply, erection, testing & commissioning of Wiring of 15 A power point on separate switch board with wiring 2x4 sqmm FRLS copper wire for earthing with all accessories running earth and finishing of the surface after rewiring etc.	15	Nos	353	57	5295	855	6150
<b>B</b>	12	Supply, erection, testing & commissioning of Industrial type metallic plug sockets 30A with MCB DP 30 A with 2x4 sqmm PVC insulated and sheathed copper conductor complete etc.	15	Nos	701	112	10515	1680	12195
<b>B</b>	13	SETC of Lighting Circuit board, double door powder coated with locking arrangement consisting 40 A 2P RCBO for I/C 6 Nos x 32 A SPMCB and 2 nos x 16 A SPMCB O/G complete.	1	Nos	9876	1333	9876	1333	11209
<b>B</b>	14	SETC of Lighting Circuit board, double door powder coated with locking arrangement consisting 63 A 4P RCBO for I/C 18 Nos x 32 A SPMCB and 4 nos x 16 A SPMCB O/G complete.	2	Nos	16137	1333	32274	2666	34940
<b>B</b>	15	Supply, erection, testing & commissioning of submain from switch board to single	500	Ckt Mtrs	128	20	64000	10000	74000

		phase DP switch / DP one circuit meter comprising of 2x4 sq.mm. PVC insulated FRLS 1.1KV multistranded wire & one running earth of 2.5 sq.mm. copper conducting PVC insulation green colour of 1.1 KV grade on rigid PVC casing capping with all accessories.							
<b>B</b>	16	S.E T.C. of Submain with 2x6 sqmm FRLS copper wire inside PVC Casing capping with running earth etc complete. (1 m length of submain consists one cktmtr including all accessories & 2 wire of 6 sqmm with one wire of 2.5 sqmm for earth conn).	300	Ckt Mtrs	138	18	41400	5400	46800
<b>B</b>	17	Supply of 4 core 300 sqmm armoured LT XLPE cable ISI mark.	100	Mtr.	1406	0	140600	0	140600
<b>B</b>	18	Supply, laying, running fixing of size 4 core 95 sqmm Aluminium Conductor, XLPE insulated, PVC sheathed, armoured cables as per relevant IS, with cable marker in trench or saddle on the wall/truss or with GI saddles etc.	200	Mtr.	450	0	90000	0	90000
<b>B</b>	19	Supply, erection, testing & commissioning of 4 core 25 sqmm armoured XLPE Cable.	200	Mtr.	156	0	31200	0	31200
<b>B</b>	20	Trenching & refilling of LT/HT/ Various sizes of PVC / XLPE cables- <b>Along the Road</b> (Size - 900mm x 300mm)	200	Mtr.	0	177	0	35400	35400
<b>B</b>	21	Digging of cable trench 300/450 mm x 1000 mm in <b>RCC/PCC/hard soil &amp; refilling</b> as per specification and requirement at the site.	100	Mtr.	0	315	0	31500	31500
<b>B</b>	22	<b>Transportation, Laying, Installation, terminating, testing and commissioning</b> of LT/HT cable of sizes 10 sqmm to 300 sqmm in existing trench, pipe or on structure.	300	Mtr.	0	26	0	7800	7800
<b>B</b>	23	Erection,testing and commissioning of cables other than trench	200	Mtr.	0	58	0	11600	11600



		i.e.Wall/Truss including clamp, GI wire and hardware							
<b>B</b>	24	Supply & laying of <b>GI pipe Class B</b> , ISI marked under road /Clamping with erecting pole or wall as per technical specification & drawing for passing cable.	20	Mtr.	173	0	3460	0	3460
<b>B</b>	25	Supply,installation, testing & commissioning of <b>HDPE Pipe</b> 110 mm Nominal Dia as per IS-4984-1995.	23	Mtr.	428	0	9844	0	9844
<b>B</b>	26	Supply and laying of <b>RCC half round pipe</b> 150 mm ID & 1 mtr length.	262	nos.	72	11	18864	2882	21746
<b>B</b>	27	Supply and laying of <b>RCC Hume Pipe</b> of size 6"(150mm) dia 2 mtr. Length.	2	Nos.	526	79	1052	158	1210
<b>B</b>	28	Supply & Erection of <b>cast iron cable</b> marker.	6	Nos	209	94	1254	564	1818
<b>B</b>	29	SETC of LT Panel outdoor with closing double door powder coated consisting 800 A x 2 Nos 4P ACB for I/C , 1 x 800 A 4P Bus coupler and 2 x400 A MCCB, 2 x 250 A 4P MCCB, 4 x 125 A MCCB for O/G with 3 Ph KWH meter and other accessories. <i>All MCCB are Microprocessor based (completely wired with suitable communication cable to fetch data from each compartment functional Unit (ACB/MCCB/SFU etc) / Multifunction Meter)</i>	1	Nos	1371618	10142	1371618	10142	1381760
<b>B</b>	30	Supply, erection, testing & commissioning of maintenance free earth as per RDSO specification no. RDSO/PE/SPEC/ PS/0109-008(REV '0') with improved earthing enhancing compound and exothermic welding	9	Nos	11520	1819	103680	16371	120051
<b>B</b>	31	Supply, fabrication, laying welding and connection of GI Flat of size 25x3 mm from earth pit with GI nut Bolt suitable size.	30	Kg	83	26	2490	780	3270
<b>B</b>	32	Supply & erection of FRP junction box of suitable size	1	Nos	681	113	681	113	794

		having terminals and 1x16 A Cut out with Two Nos of entry glands.							
<b>B</b>	33	Supply, fabrication, fixing and erection of MS Work of miscellaneous size and for cable tray etc. including painting complete.	50	Kg	85	15	4250	750	5000
<b>B</b>	34	Supply, installation, testing & commissioning of <b>5 Mtr</b> long hot dip galvanised octagonal pole with 130 mm bottom & 70 mm top made up of 3mm thick steel sheet along with base plate of size 200x200x12mm with foundation..(Along with <b>2 pole RCBO 6A, with 30 mA sensitivity</b> ).	1	Nos	12541	781	12541	781	13322
<b>B</b>	35	Supply, Erection, testing, and commissioning of <b>1MVA, 11KV/433V, 3 Phase, 50Hz, Oil Immersed, ONAN, Outdoor Type, Vector group Dyn11, Copper Wound</b> Distribution Transformer losses as per IS : 1180 EEL-2 with OCTC	2	Nos	2259700	0	4519400	0	4519400
<b>B</b>	36	Supply, erection, testing & commissioning of LED Reading Lamp of 01-02 W Along with all accessories with 1.5 Sq mm 2 Core Copper Wire for connections.	10	Nos	322	6	3220	60	3280
<b>B</b>	37	Supplying LED concealed type foot / step light with aluminium body for indoor application suitable for upto 5 W LED including driver and erecting by making necessary arrangement/ recess in wall to make it flush with surface.	5	Nos	435	154	2175	770	2945
<b>B</b>	38	Supply of 0.5 W LED Bulb Night lamp complete with associated accessories etc.	5	Nos	45	0	225	0	225
<b>B</b>	39	Supply, erection, testing & commissioning of Bulkhead fitting with 10 W LED light with heat resistant glass cover and MS galvanised wire guard complete in toilet/bath.	5	Nos	825	82	4125	410	4535
<b>B</b>	40	Excavation and casting of cement concrete foundation	1	cum	4872	0	4872	0	4872

		including plinth in all type of soil.							
<b>B</b>	41	Supply, installation and commissioning of 1.5 Ton Split Air conditioner of Green AC -With 5 BEE Star Rating inverter,copper coil, ISEER : 5.8 or above with connected accessories etc.	15	Nos	66014	0	990210	0	990210
<b>B</b>	43	Supply, erection, testing and commissioning of flexible Copper Cable 3 core 2.5 sqmm	100	Mtr	156	14	15600	1400	17000
<b>B</b>	44	Supply, erection, testing and commissioning of <b>Metallic mount</b> suitable for outdoor unit (1.5 ton/2ton), wall mounted.	15	Nos	719	0	10785	0	10785
<b>B</b>	45	Supply, erection, testing & commissioning of Nitrile rubber/ Thermal insulation for refrigerant pipe of class 'O' size 9 mm	30	Mtrs.	33	4	990	120	1110
<b>B</b>	46	Supply, erection, testing & commissioning of Nitrile rubber/ Thermal insulation for refrigerant pipe of class 'O' size 13 mm	30	Mtrs.	41	4	1230	120	1350
<b>B</b>	47	Supply, erection, testing & commissioning of 25 mm Hard PVC Drain Piping with 9 MM insulation.	25	Mtrs.	196	20	4900	500	5400
<b>B</b>	48	Supply, erection, testing & commissioning of 16 mm Hard PVC Drain Piping with 9 MM insulation.	25	Mtrs.	260	175	6500	4375	10875
<b>B</b>	49	Supply and fixing of <b>Refrigerant Piping with Hard Drawn Copper pipe/ Tube of various sizes</b> with accessories to connect condenser unit and cooling coil including suction and discharge line.	40	Mtr	1318	131	52720	5240	57960
<b>B</b>		<b>Total Sch. B</b>							<b>8144250</b>
		<b>Grand Total Sch. (A+B)</b>							<b>24831306</b>

S= Supply, E= Erection/laying, T= Testing, & C= Commissioning, Nos.= numbers, D-Dismantling.

1) The tender schedule shall be read in conjunction with scope of work and technical specification of the work for various items included therein

2) Tenderer / should Quote his / their own single & common percentage rates in offer sheet i.e. above /At Par / below the estimated rates of Railways schedule.

3) I/We agreed to execute the above work at -----% (In figure) -----  
(in words) above /At Par / below of the Railways schedule of rates.

**NOTE:-**

- (i) The above rates are inclusive all taxes and duties including GST.
- (ii) The tenderer shall quote the all-inclusive rates i.e. Labour, Material, tools / repair maintenance including **GST and income tax** etc. No additional payment shall be paid by railway other than accepted offer.

**Signature**

**Address and seal of Contractor**

**Sr DEE(G)Bhusawal**

## The List of Makes to be used in works.

## Annexure-I

SN	Item description	Accepted Makes
1	Switch, Socket, industrial socket, Batton/Angle holder Ceiling rose, SDB	Lauritz Knudsen (L&T), Havells, Legrand, Cona, Crabtree, C&S, Press Fit, Anchor, Benlo
2	Time Switches / Astronomical timer	Lauritz Knudsen (L&T), Siemens, Legrand, Havells, GE
3	DP Switch	Lauritz Knudsen (L&T), Havells, Legrand Siemens, GE, ABB, Cona, Crabtree, HPL
4	MCB /RCCB/RCBO/PRCD	Havells, Lauritz Knudsen (L&T), Legrand, Siemens, ABB, Schneider, Benlo, HPL
5	SFU /ACB / VCB / MCCB / ATS	Lauritz Knudsen (L&T), Siemens, Legrand, ABB, Schneider, Hager, Havells, Benlo, HPL
6	FRMUE/ EFS/ RMU/ Indoor compact switchgear / VCB Panel	ABB, L&T, Schneider, GE, Siemens
7	Switchgear for AMF/APFC panel	Lauritz Knudsen (L&T), Legrand, GE, Siemens, ABB, Hager, Schneider, Havells.
8	Thyrister, Contactors, Reactors	Lauritz Knudsen (L&T), Legrand, GE, Siemens, ABB, Hager, Schneider, Havells.
9	LT Panels (IEC 61439)	Siemens, ABB, Schneider, Lauritz Knudsen (L&T), Havells, Legrand
10	Ray roll plug socket	Legrand, Anchor, GE, Havells and Standard
11	Luminaries fittings/ Facade lighting	Philips, Havells, Jaquar, Wipro, Bajaj, Panasonic, Surya, Orient, Crompton
12	Sensor based Luminaries fittings	Philips, GE, Havells, Wipro, Bajaj, Tata Power.
13	PIR sensors	L&T, Philips, Legrand, Crompton, Havells, Jaquar, Wipro, Bajaj, Orient, Atomberg
14	LED	NICHIA / CREE / OSRAM / SEOUL / PHILIPS /LUMILEDS / Samsung
15	LED Pit Light	Philips, GE, Havells, Syska, Jaquar, Wipro, LED 4 India, Shakti.
16	LED indicators for panel.	Lauritz Knudsen (L&T), Siemens, ABB, Schneider.
17	Solar Standalone street light	Philips, Havells, Exide, Surya, Bajaj, Wipro, Jain Irrigation
18	Torch Light (1.5 -3 Kms range)	Nei, Ascentech, kinnav, Havells, Eveready, GE, Jaquar, Wipro, Yashika
19	High Masts, Flag mast, Poles	Bajaj, Utkarsh, Valmont, Havells, Wipro
20	FRP cable looping boxes	Sintex, Ercon, Bravo, National
21	Junction Boxes	Hensel, Cape Electric, National, Sintex.
22	Cable- HT, UG/Aerial Bunched Cable	Havells, Polycab, RR Kabel, KEI, Finolex
23	Cable/wire- LT, PVC/XLPE, UG/ Aerial Bunched Cable/ flexible, armoured/ unarmoured, domestic cables/wires.	Havells, Polycab, RR Kabel, KEI, Finolex, Vishal
24	Cable/Bus Duct, Bus trunking	Schneider Electric India Ltd. Legrand, Lauritz Knudsen (L&T), ABB, EAE
25	Cable joint and termination kit	M-seal, Dowells, Kaycee, Jainson, Cabseal, 3M, Mahindra & Mahindra.
26	BLDC Ceiling Fan / Pedestal fan / Exhaust Fan, Electronic Fan Regulator	Havells, Orient, Usha, Atomberg, Crompton, Bajaj
27	Wall Bracket fan/Air Circulator	Bajaj, Havells, Usha, Crompton, Orient, Almonard.
28	Casing Capping / PVC conduit	Prestoplast, Precision, Modi, Press Fit
29	Multi-Function meter & Electrical measuring instruments	Lauritz Knudsen (L&T), Siemens, Secure, ABB, Schneider, Set & De, trinity, MECO
30	Megger, Anemometer, Digital Multifunction (Loop Impedance Meter) Tester	Megger, Fluke, Stanlay
31	Earth tester	Meco, Nippen, Stanlay
32	Digital Clamp on Meter (Tong Tester).	Meco, Stanlay, Fluke
33	BDV Testing Kit	Stanley, Motwane
34	Digital lux meter	Fluke / Stanley / meco /Rishabh
35	Digital clamp on earth tester	Motwane, kusum-meco, Megger, Fluke, Stanlay
36	Digital Vernier caliper, Digital screw gauge	Baker, Freemans, Insize, MITUTOYO, TESA
37	Cable Fault Locator	Megger, Stanlay, Kusum-meco, Radiodetection, Fluke
38	Surge Suppressor	Legrand, Rider, Costain, Havells, Schneider, ABB, GE
39	Pumps (Make of Motor for Pump shall be acceptable as per OEM of the Pump)	Kirloskar, Crompton, KSB Pumps, Deccan, Jyoti, Wilo, Flowmore, Goodwin. Mather Platt, CRI, Worthington.
40	Pump Guard	Minilec, Lauritz Knudsen (L&T), Crompton, Siemens, C&S
41	Motor Starter	Lauritz Knudsen (L&T), Kirloskar, Schneider, GE, Siemens, CG, BCH, C&S
42	VFD Drive / Soft Starter	ABB, Siemens, Lauritz Knudsen (L&T), Schneider.
43	Valves all types & Butterfly	C&R / Audco / Castel / Leader / Honeywell / Kirloskar
44	GI Pipes	Tata, Zenith, Jindal, Bansal, Surya Prakash, Swastik, Apollo
45	PVC Pipe/ Column Pipe	Finolex, Supreme, Astral, Ashirvad, Prince, Apollo
46	HDPE Pipe	Supreme, Utkarsh, Jain Pipes, CRI Pipes
47	Polyolefin Cable channel	Finolex, Supreme, Astral, Ashirvad, Prince, Apollo
48	M.S. Pipes	Jindal / Tata / Zenith / GST / Malhotra
49	TMC Pipe	IT Combo, Palak, Sagar, Mahavir
50	UPS Battery	AMARARAJA, EXIDE, CBS, PANASONIC, HITACHI, HBL, OKAYA
51	UPS/ Inverter	Numeric Power Systems Ltd, APC, Schneider, Legrand, Emerson (Siemens), Luminous Power Technologies Pvt. Ltd. Luminous, Su-Kam, Microtek, Uniline
52	Standard Lead Acid Battery	Amararaja, Exide, Okaya, HBL

53	Geysers, Water Heater	Bajaj, Havells, Crompton Greaves, Jaquar, Racold, Morphy Richards
54	Flex for Glow Sign Board	LG 3m penaflex
55	Vinyl for Glow Sign Board	LG 3m penaflex
56	Cement	Ultratech, ACC, Ambuja, JK, Birla
57	Paints	Asian, Nerolac, Dulux, Shalimar, Berger
58	Sleeve Insulation	The Supreme Industries Ltd. / K Flex / Armaflex / A Flex
59	GI sheet	Jindal / Sail / Essar / Tata / Zenith
60	Fly Catcher Fitting	Fly, Kill lite, PCI, Avro, Orchids
61	Window AC / Split AC / AC Plant/ Cassette AC	Blue Star, Voltas, LG, Fedders Lloyd, Hitachi, Samsung, Daikin, O' General, Mitsubishi, Panasonic, Carrier, Godrej, IFB
62	VRF/VRV Units & Ductable split unit inverter type	Blue star / Samsung / Hitachi / Mistubishi / Daikin / O General/ Voltas, Panasonic/ LG
63	Duct Insulation	The Supreme Industries Ltd. / K Flex / Armaflex / A Flex
64	Air diffuser / Grill	Cosmos / Dynacraft / Carrier
65	Volume Control Damper	Cosmos / Dynacraft / Carrier
66	Ventilation Fans	Carrier / Systemair / Kruger / Nicotra/ Almonard
67	AC Compressor	Emersion Copeland/ Kirloskar/ Bluestar/ Carrier/ Daikin/ Tecumseh
68	AC Condenser	Blue Star / Carrier / Hitachi / Daikin
69	Motors	CG, Bharat Bijlee, ABB, Siemens, Kirloskar
70	AHU / IDU	Neutech / Blue Star / Ethos / Voltas / Systemair / Flaktwood / VTS / Trane / York / Blue star / Samsung / Hitachi / Mistubishi / Daikin / O General/ Voltas, Panasonic/ LG
71	Cooling Tower	Paharpur / National / Perfect / Omkar / Choksi Group
72	Chiller line Insulating	Thermoshell / Beardsell Ltd./ Armaflax / Superlone / Century / ECOFLACK
73	Package unit	Blue Star / Hitachi / Daikin / Carrier / Voltas
74	Water Cooler	USHA, Blue Star, Voltas, Sidwal
75	Refrigerator	LG, Voltas, Whirlpool, Haier, Godrej, Samsung, Panasonic
76	Diesel Generating Set	Kirloskar Oil Engines Limited, Mahindra, Cummins, GCL, Ashok Leyland.
77	APFC RELAY / Power capacitor	EPCOS, SELEC, L&T, Schneider, Havells, C&S
78	Transformers	ABB, Siemens, BHEL, GEC, Bharat Bijlee, Crompton, Schneider/ Areva, transdelta, Highvolt, Fairdeal, Tesla, Kirloskar, Power star, Transformer & Rectifier.
78	Oil filtration plant	Spera, CEE DEE, CBS, Minimac, Kristorr
79	Voltage stabilizer	Melcon, servokon, V-guard, Microtek, Jindal, Servomax, Power control systems, GE, Apex
80	IFD	ABB, Motorola, Siemens, JAISuS, Honeywell, L&T
81	ULT	Endress & Hauser, Siemens, Honeywell, Pepperl & Fuchs, Nivelco, Rosemount
82	AB switch	Kiran/ Pactil / ABB
83	Hammer Drill machine	Bosch, Stanley, Dewalt, Hilti
84	Hydraulic crimping tools	Bosch, Stanley, Dowel
85	Thermal image camera	Bosch, TIPL, Fluke, Meco
86	Electric air blower	Bosch, Dewalt
87	Tools & Plant, Chain Pipe Wrenches	Taparia, Tata, Freemans, Fluke, Bosch, Stanley
88	Furniture's, Almirah, BOOK SHELF	Godrej or equivalent.
89	Binoculars	Nikon, ZEISS, Canon, Celestron
90	Day light pipe	Skyshade/ E- VIEW Global/ SKY PIPE/ EGO LIGHT/ EKOOL PLUS
91	Earthing pit Box cover	Sintex, True power, National
92	Ball Bearing	SKF / NBC / FAG
93	Capacitors for fan	Tibcon / Epcos / Syscap / Jimcap / Keltron / Havells
94	Solar Panel	Tata, Waaree, Havells, ABB, Adani, Vikram
95	Solar inverter	Tata, Waaree, Havells, ABB, Adani, Sungrow, Solis, Microtek
96	Solar water heater	V-Guard, Jain Irrigation, Sudarshan, Havells, Racold, Green sense
97	Computer	HP, Dell
98	Printer	HP, Brother
99	Air Cooler /Industrial Cooler	Symphony, Breezeair, Greencon, Arctic
100	Storage Tank	Sintex, Plasto
101	Telescopic Ladder	Corvids, Gorilla
102	Voltage stabilizer for AC	V-guard, IFB, Microtek.
103	BESS	Su-vastika, Lotus, Waaree, Tata, Exide, Amararaja, Panasonic, Schneider, Cummins
104	Portable Generator(Petrol/Kerosene)	Honda, Birla
105	Maintenance free earthing	Cube earthing

**Note** – i) Only ISI / BIS marked items shall be accepted. If ISI / BIS marked materials are not available in market then prior approval shall be taken from Sr. DEE(G)BSL before supply.

ii) The above makes are acceptable subject to fulfillment of technical specification requirement.

## Indian Standard codes/IEC List

## Annexure-II

<i>S.No</i>	<i>Standard</i>	<i>Title</i>	<i>Reaffirm Date</i>	<i>Amdt.</i>
(1)	IEC 61439	The standards for low voltage switchgear and control gear assemblies		
(2)	IS 732:1989	Code of practice for electrical wiring installations (third revision)	March 2010	
(3)	IS 4648:1968	Guide for electrical layout in residential buildings	August 2012	
(4)	IS 8061:1976	Code of practice for design, installation and maintenance of service lines upto and including 650 V	March 2011	
(5)	IS 8884:1978	Code of practice for the installation of electric bells and call systems	August 2012	
(6)	IS 5578:1984/ IEC 60391 (1972)	Guide for marking of insulated conductors (first revision)	March 2011	
(7)	IS 1353:1985/ IEC 60445 (1973)	Guide for uniform system of marking and identification of conductors and apparatus terminals	July 2012	
(8)	IS 3234:1991/ IEC 60909: 1988	Guide for short circuit current calculations in three-phase ac systems (superseding IS 5728)	August 2012	
(9)	IS 7752 (Part 1):1975	Guide for improvement of power factor in consumer installation: Part 1 Low and medium supply voltages	March 2011	
(10)	IS 3646 (Part 1):1992	Code of practice for interior illumination: Part 1 General requirements and recommendations for working interiors (first revision)	March 2008	
(11)	IS 3646 (Part 2):1966	Code of practice for interior illumination: Part 2 Schedule of illumination and glare index	March 2008	
(12)	IS 3646 (Part 3):1968	Code of practice for interior illumination: Part 3 Calculation of coefficients of utilization by the BZ method	March 2008	
(13)	IS 4347:1967	Code of practice for hospital lighting	May 2010	
(14)	IS 6665:1972	Code of practice for industrial lighting	May 2010	
(15)	IS 2672:1966	Code of practice for library lighting	May 2010	
(16)	IS 10118 (Part 1):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear : Part 1 General	March 2011	
(17)	IS 10118 (Part 2):1982	Code of practice for selection, installation and maintenance of Switchgear and controlgear : Part 2 Selection	March 2011	
(18)	IS 10118 (Part 3):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear : Part 3 Installation	March 2011	
(19)	IS 10118 (Part 4):1982	Code of practice for selection, installation and maintenance of switchgear and controlgear : Part 4 Maintenance	March 2011	
(20)	IS 4146:1983	Application guide for voltage transformers (first revision)	September 2011	
(21)	IS 4201:1983	Application guide for current transformers (first revision)	September 2011	
(22)	IS 5547:1983	Application guide for capacitor voltage transformers (first revision)	September 2011	
(23)	IS 2309:1989	Code of practice for protection of buildings and allied structures against lightning (second revision)	March 2010	1

(24)	IS 3043:1987	Code of practice for earthing	March 2011	2
(25)	IS 5216 (Part 1):1982	Recommendations on safety procedures and practices in electrical work: Part 1 General (first revision)	March 2010	
(26)	IS 5216 (Part 2):1982	Recommendations on safety procedures and practices in electrical work: Part 2 Life saving techniques (first revision)	March 2010	
<b>ELECTRIC FANS</b>				
(1)	IS 555:1979	Electric table type fans and regulators (third revision)	July 2010	2
(2)	IS 1169:1967	Electric pedestal type fans and regulators (first revision)	Mar 2009	6
(3)	IS 374:1979	Electric ceiling type fans and regulators (third revision)	September 2010	6
(4)	IS 2997:1964	Air circulator type electric fans and regulators	July 2010	8
(5)	IEC: 60665 (1981) IS 2312:1967	Propeller type ac ventilating fans (first revision) Draft Standard issued in wide circulation	July 2010	8
(6)	IS 3588:1987	Electric axial flow fans (first revision)	August 2009	1
(7)	IS 3963:1987	Roof extractor units (first revision)	August 2009	3
(8)	IS 4283:1981	Hot air fans (first revision)	August 2009	3
(9)	IS 6272:1987	Industrial cooling fans (man coolers) (first revision)	August 2009	2
(10)	IS 4894:1987	Centrifugal fans (first revision)	August 2009	3
(11)	IS 11037:1984	Electronic type fan regulators	August 2010	3
(12)	IS 12155:1987	General and safety requirements for fans and regulators for household and similar purposes		
<b>LOW VOLTAGE SWITCH GEAR AND CONTROL GEAR</b>				
(1)	IS 4237:1982	General requirements for switchgear and controlgear for voltages not exceeding 1000 volts ac or 1200 volts dc (first revision) [superseded by IS 13947 (Part 1):1993]		
(2)	IS 6875 (Part 1):1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac & 1200 V dc: Part 1 General requirements [superseded by IS 13947 (Part 5/Section 1)]		
(3)	IS 6875 (Part 2):1973	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac and 1200 V dc: Part 2 Push- buttons and related control switches [Superseded by IS 13947 (Part 5/Section1)]		
(4)	IS 6875 (Part 3):1980	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto and including 1000 V ac and 1200 V dc : Part 3 Rotary control switches [superseded by IS 13947 (Part 5/ Section 1)]		
(5)	IS 10027:2000	Composite units of air-break switches and rewirable type fuses for voltages not exceeding 650 volt ac - Specification (first revision)	March 2010	
(6)	IS 4064 (Part 1):1978	Air-break switches, air break disconnectors, air-break switch disconnectors and fuse-combination units for voltages not exceeding 1000 V ac or 1200 V dc: Part 1 General requirements (revised) [superseded by IS 13947 (Part 3): 1993]		
(7)	IS 2675:1983	Enclosed Distribution Fuse Boards and Cut Outs for voltages not exceeding 1000 V A.C. or 1200 V D.C.	March 2011	
(8)	IS 8828:1996	Circuit-breakers for over current protection for		



		household and similar installations (second revision)		
(9)	IS 13032:1991	Miniature circuit breaker boards for voltage upto and including 1 000 Volt ac	March 2011	1
(10)	IS 12640 (Part 1):2008	Residual current operated circuit-breakers for household and similar uses : Part 1 circuit-breakers without integral over current protection (RCCBs) (First Revision)		
(11)	IS 12640 (Part 2):2008	Residual current operated circuit-breakers for household and similar uses: Part 2 circuit breakers with integral over current protection (RCBOs) (First Revision)		
(12)	IS 2959:1985	Contactors for voltages not exceeding 1000 V ac or 1200 V dc (first revision) [superseded by IS 13947 (Part 4/ Section 1)]		
(13)	IS 12021:1987	Specification for control transformers for switchgear and controlgear for voltages not exceeding 1000 Volt AC	March 2010	2
(14)	IS 5039:1983	Distribution pillars for voltages not exceeding 1000 volts (first revision)	March 2011	2
(15)	IS 8623 (Part 1): 1993/ IEC 60439-1 (1985)	Specification for low voltage switchgear and controlgear assemblies: Part 1 Requirements for type-tested and partially type tested assemblies (first revision).	March 2008	2
(16)	IS 8623 (Part 2):1993/ IEC 60439-2 (1987)	Specification for low voltage switchgear and controlgear assemblies: Part 2 Particular requirements for busbar trunking systems (busways)-(first revision)	March 2008	2
(17)	IS 8544 (Part 1):1977	Motor starters for voltages not exceeding 1000 V: Part Direction line ac starters [superseded by IS 13947 (Part 4/Section 1): 1993]		2
(18)	IS 8544 (Part 2):1977	Motor starters for voltages not exceeding 1000 V : Part 2 Star-delta starters [superseded by IS 13947 (Part 4/ Section 1): 1993]		
(19)	IS 8544 (Part 3/ Sec 1): 1979	Motor starters for voltages not exceeding 1000 V : Part 3 Rheostatic motor starters, Section 1 General requirements [superseded by IS 13947 (Part 4/Section 1): 1993]		
(20)	IS 8544 (Part 4):1979	Motor starters for voltages not exceeding 1000 V: Part 4 Reduced voltage ac starters: two step auto-transformer starters [superseded by IS 13947 (Part 4/Section 1): 1993]		
<b>POWER CABLE</b>				
(1)	IS 94:1990/ IEC 60227-1 to 5 (1979)	PVC Insulated cables for working voltages upto and including 1100 V	February 2010	5
(2)	IS 694: 2010	Polyvinyl chloride insulated sheathed and unsheathed cables with rigid and flexible conductor for rated voltages upto and including 450/750 V : Part 1 General requirements (fourth revision)		1
(3)	IS 1554 (Part 1): 1988/ IEC 60502 (1983)	PVC insulated (heavy duty) electric cables: Part 2 For working voltages upto and including 1100 V (Third revision)		
(4)	IS 3961 (Part 1):	Recommended current ratings for cables: Part 1 Paper insulated lead sheathed cables	November 2011	

	1967			
(5)	IS 4288:1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages upto and including 1100 V (second revision) (withdrawn)		
(6)	IS 4289 (Part 1): 1984/ IEC 60245-5	Flexible cables for lifts and other flexible connections: Part 1 Elastomer insulated cables (first revision)		
<b>ELECTRIC WIRING ACCESSORIES</b>				
(1)	IS 9537 (Part 1): 1980/ IEC 60614-1 (1978)	Conduits for electrical installations: Part 1 General Requirements	November 2010	(1)
(2)	IS 9537 (Part 2): 1981	Conduits for electrical installations: Part 2 Rigid steel conduits (superseding IS:1653)	May 2012	(2)
(3)	IS 3480:1966	Flexible steel conduits for electrical wiring	May 2012	(1)
(4)	IS 2667:1988	Fittings for rigid steel conduits for electrical wiring (first revision) [Superseded by IS 14768 (Part 2): 2003]	February 2008	
(5)	IS 3837:1976	Accessories for rigid steel conduits for electrical wiring (first revision)	May 2012	(1)
(6)	IS 9537 (Part 4):1983	Conduits for electrical installations: Part 4 Pliable self-recovering conduits of insulating materials	May 2012	
(7)	IS 9537 (Part 5): 2000/ IEC 60614-2-3 (1990)	Conduits for a electrical installations: Part 5 Pliable conduits of insulating material [Superseding IS 6946]	June 2010	
(8)	IS 3419:1989	Fittings for rigid non-metallic conduits (second revision)	May 2012	
(9)	IS 14772:2000/ IEC 60670-1 (1989)	Enclosures for accessories for household and similar fixed electrical installations [Superseding IS 5133 (Part 1 and 2)]	May 2010	
(10)	IS 2412:1975	Link clips for electrical wiring (first revision)	May 2012	(2)
(11)	IS 371:1999	Ceiling roses (third revision)	March 2010	(4)
(12)	IS 3854:1997/ IEC 60669-1 (1998)	Switches for domestic and similar purposes (second revision)	July 2012	(6)
(13)	IS 4615:1968	Switch-socket outlets (non-interlocking type) (Withdrawn)		
(14)	IS 4160:2005/ IEC 60884-2-6 (1997)	Interlocking switch socket outlets - Specification (first revision)	June 2010	
(15)	IS 1293:2005/ IEC 60884-1 (2002)	Plugs and socket outlets of rated voltage upto and including 250 volts and rated current upto and including 16 amperes - Specification (third revision)	June 2010	(5)
<b>ELECTRICAL LAMPS AND THEIR AUXILIARIES</b>				
(1)	IS 418:2004/ IEC 60064 (1993)	Tungsten filament lamps for domestic and similar general lighting purposes (fourth revision)	March 2009	(4)
(2)	IS 2418 (Part 1): 1977/ IEC 81 (1974)	Tubular fluorescent lamps for general lighting service: Part 1 Requirements and tests (first revision)	December 2010	(8)
(3)	IS 9900 (Part 1):1981 / IEC 188 (1974)	High pressure mercury vapour lamps: Part 1 Requirements and test [Superseding IS 2183 and IS 7023]	October 2012	(4)

(4)	IS 9974 (Part 1): 1981/ IEC 662 (1980)	High pressure sodium vapour lamps : Part 1 General requirements and tests	October 2012	(4)
(5)	IS 1258:2005/ IEC 61184 (1997)	Bayonet lamp holders (fourth revision)	June 2010	(3)
(6)	IS 3323:1980/ IEC 60400 (1972)	Bi-pin lamp holders for tubular fluorescent lamps (first revision)	October 2012	(1)
(7)	IS 3324:1982/ IEC 400 (1972)	Holders for starters for tubular fluorescent lamps (first revision)	June 2008	
(8)	IS 2215:2006/ IEC 60155 (1993)	Starters for fluorescent lamps (third revision)	Jun 2010	
(9)	IS 1534 (Part 1):1977 / IEC 82 (1973)	Ballasts for fluorescent lamps: Part 1 For switch start circuits (second revision)	July 2011	(5)
(10)	IS 1569:1976/ IEC 566	Capacitors for use in tubular fluorescent	July 2011	(1)
(11)	IS 6616:1982/ IEC 262 (1969)	Ballasts for high pressure mercury vapour Lamps (first revision)	July 2011	(1)
<b>LIGHT FITTINGS AND LUMINAIRES</b>				
(1)	IS 1913 (Part 1):1978	General and safety requirements for luminaires: Part 1 Tubular fluorescent lamps (second revision)		
(2)	*IS 10322 (Part1) :1982 / IEC 598 - 1(1979)	Luminaires: Part 1 General requirements	May 2010	
(3)	IS 10322 (Part 2):1982 / IEC 598 - 1(1979)	Luminaires: Part 2 Constructional Requirements	May 2010	
(4)	IS 10322 (Part 5/ Sec. 2):2012	Luminaires: Part 5 Particular requirements, Sec 2 Recessed luminaires (First Revision)	March 2012	
(5)	IS 10322 (Part 5/ Sec. 3):2012/ IEC 60598-2-3 (1979)	Luminaires: Part 5 Particular requirements, Sec 3 Luminaires for road and street lighting (First revision)	March 2012	
(6)	IS 10322 (Part 5/ Sec 4):1987/ IEC 60598-2-4 (1979)	Luminaires: Part 5 Particular requirements, Section 4 Portable general purpose	May 2010	1
(7)	IS 10322 (Part 5/ Sec 5):1987/ IEC 60598-2-5	Luminaires: Part 5 Particular requirements, Section 5 Flood lights [superseding IS 1947]	May 2010	(1)
(8)	IS 3287:1965	Industrial lighting fittings with plastic reflectors		
(9)	IS 1777:1978	Industrial luminaires with metal reflectors (first revision)		
(10)	IS 2206 (Part 1):1984	Flameproof electric lighting fittings: Part 1 Well-glass and bulkhead types (first revision)		
(11)	IS 3528:1966	Waterproof electric lighting fittings	May 2010	

(12)	IS 3553:1966	Watertight electric lighting fittings	May 2010	
(13)	IS 8030:1976/ IEC 162 (1972)	Luminaires for hospitals	March 2008	
(14)	IS 7537:1974	Road traffic signals	March 2008	
(15)	IS 9583:1981/ IEC 598-2-22 (1980)	Emergency lighting units	March 2008	
<b>ELECTRICAL APPLIANCES</b>				
(1)	IS 302 (Part 1): 2008/ IEC 60335-1 (2006)	Safety of household and similar electrical appliances: Part 1 General requirements (sixth revision)		(1)
(2)	IS 2268:1994	Electric call bells and buzzers for indoor use (second revision)	March 2009	
(3)	IS 3412:1994	Electric water boilers (second revision)	March 2009	
<b>ELECTRICAL INSTRUMENTS</b>				
(1)	IS 6236:1971/ IEC 60258 (1968)	Direct recording electrical measuring Instruments	January 2010	
(2)	IS 1248 (Part 1): 2003/ IEC 600 51-1 (1997)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 1 General requirements (fourth revision)	Sep 2008	
(3)	IS 1248 (Part 2): 2003/ IEC 600 51-2 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 2 Ammeters and voltmeters (third revision)	Aug 2008	
(4)	IS 1248 (Part 3): 2003/ IEC 600 51-3 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 3 Wattmeters and varmeters (third revision)	Aug 2012	
(5)	IS 1248 (Part 4): 2003/ IEC 600 51-4 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 4 Frequency meters (third revision)	Aug 2008	
(6)	IS 1248 (Part 5): 2003/ IEC 600 51-5 (1984)	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 5 Phase meters, power factor meters and synchroscope (third revision)	Aug 2008	
(7)	IS 722 (Part 1):1998	AC electricity meters : General requirement and tests		
(8)	IS 722 (Part 2):1977	AC electricity meters: Part 2 Single-phase whole-current watt-hour meters, Class 2 (first revision)		
(9)	IS 722 (Part 3):1988	AC electricity meters: Part 3 Three-phase whole current and transformer operated and single-phase transformer operated watt-hour meters, class 2 (second revision)		
(10)	IS 722 (Part 5):1980	AC electricity meters: Part 5 Volt-ampere hour meters for restricted power factor range, class 3.5 (first revision)		
(11)	IS 722 (Part 7/Sec 1): 1987	AC electricity meters: Part 7 Volt-ampere hour meters for full power factor range, Section 1 General requirements (first revision)		
(12)	IS 722 (Part 8):1972	AC electricity meters: Part 8 Single-phase 2-wire whole current watt-hour meter (class 1.0)		

(13)	IS 722 (Part 9):1972	AC electricity meters: Part 9 Three-phase whole current and transformer operated watt-hour meters and single- phase two-wire transformer operated watt-hour meters (class 1.0)		
(14)	IS 8530: 1977 IEC 60211:1966	Maximum demand indicators (class 1)		
(15)	*IS 2992:1987	Insulation resistance testers, hand operated (magneto generator type) (second revision)	Jan 2010	
<b>INSTRUMENT TRANSFORMERS</b>				
(1)	IS 2705 (Part 1): 1992/ IEC 60185 (1966)	Current transformers: Part 1 General requirements (second revision)	Aug 2012	(1)
(2)	IS 2705 (Part 2): 1992/ IEC 60185 (1966)	Current transformers: Part 2 Measuring current transformers (second revision)	Aug 2012	
(3)	IS 2705 (Part 3): 1992/ IEC 60185 (1966)	Current transformers: Part 3 Protective current transformers (second revision)	Aug 2012	
(4)	IS 2705 (Part 4): 1992/ IEC 60185 (1966)	Current transformers: Part 4 Protective current transformers for special purpose applications (second revision)	Aug 2012	
(5)	IS 6949:1973	Summation current transformers	Sep 2011	
<b>FUSES</b>				
(1)	IS 9224 (Part 1):1979	Low voltage fuses: Part 1 General requirements [superseded by IS 13703 (Part 1):1993]		
(2)	IS 9224 (Part 2):1979	Low voltage fuses: Part 2 Supplementary requirements for fuses for industrial applications (superseding IS 2208) [superseded by IS 13703 (part 2/Section 1):1993]		
(3)	IS 2086:1993	Carriers and bases used in rewirable type electric fuses for voltages upto 650 V (third revision) [Superseding IS 8724]	Mar 2009	(1)
(4)	IS 9926:1981	Fuse wires used in rewirable type electric fuses upto 650 volts	Mar 2011	
(5)	IS 8187:1976/ IEC 269-3 (1973)	D-type fuses		
<b>MISCELLANEOUS</b>				
(1)	IS 2551:1982	Danger notice plates (first revision)	Mar 2010	
(2)	IS 2448 (Part 1):1963	Adhesive insulating tapes for electrical purposes: Part 1 Tapes with cotton textile substrates	Oct 2010	(5)
<b>ELECTROTECHNICAL VOCABULARY</b>				
(1)	IS 1885 (Part 1):1961	Electrotechnical vocabulary: Part 1 Fundamental Definitions	Jul 2012	(2)
(2)	IS 1885 (Part 9):1992/ IEC 60050 (446):1983	Electrotechnical Vocabulary: Part 9 Electrical relays (second revision)	Jul 2012	
(3)	IS 1885 (Part 11):1966	Electrotechnical vocabulary: Part 11 Electrical Measurements	Jul 2012	
(4)	IS 1885	Electrotechnical vocabulary: Part 16 Lighting, Section	Jul 2012	

	(Part 16/ Sec 1):1968	1 General aspects		
(5)	IS 1885 (Part 16/ Sec. 2):1968	Electrotechnical vocabulary: Part 16 Lighting, Section 2 General illumination, lighting fittings and lighting for traffic and signaling	Jul 2012	
(6)	IS 1885 (Part 16/ Sec. 3):1967	Electrotechnical vocabulary: Part 16 Lighting, Section 3 Lamps and auxiliary apparatus	Jul 2012	
(7)	IS 1885 (Part 17):1979	Electrotechnical vocabulary: Part 17 Switchgear and control gear (first revision)	Jul 2012	
(8)	IS 1885 (Part 32):1993/ IEC 60050 (461):1984	Electrotechnical Vocabulary: Part 32 Electric cables (first revision)	Mar 2009	
<b>SAFETY</b>				
(1)	IS 4770:1991	Rubber Gloves for electrical purposes		
(2)	IS 5424:1969	Rubber mats for electrical purpose (Superseded by IS 15652:2006)	April 2011	(2)

## **CHAPTER- V**

### **FORMS FOR TENDER ETC.**

**Proforma A**

**LIST OF WORKS COMPLETED IN LAST THREE FINANCIAL YEARS**

SN	Description of work	Organization for whom executed	Approximate value of contract at the time of award.	Date of award	Date of scheduled completion of work	Actual completion	Final value of contract

Signature of the Contractor.



**Proforma B****LIST OF WORKS ON HAND**

SN	Description of work	Contract value	Approximate value of balanced work yet to be done	Date of award

Signature of the Contractor

**FORM 14****उपबंद**

सविंदा करार सं.....तारीख.....यह करार आनुचछेद एक पक्षकार के रूप में.....रेल प्रशासन के माध्यम से कार्यरत भारत के राष्ट्रपति, जिनहे ईस्मे आगे "रेल" कहा गया है, तथा दूसरे पक्षकार के रूप में मेसर्स..... जिनहे इसमें आगे ठेकेदार कहा गया है, के बीच आज तारीख.....को किया गया ।।

ठेकेदारों को इसमें उपापबद्ध अनुसूची में उपवर्णित.....कार्य के निष्पादन के लिए ता.....की मुद्रित/अग्रिम संशोधन पर्ची सं.....संशोधित कार्य पुस्तिका भाग III में और ता.....की मुद्रित/अग्रिम संशोधन पर्ची सं.....तक संशोधित सवाछता संबंधी कार्य पुस्तिका में अंतर्विष्ट मध्य रेल के विनिर्देशों तथा तारीख.....की मुद्रित/अग्रिम संशोधन पर्ची सं ..... तक संशोधित मध्य रेल की दर अनुसूची, भाग I तथा विशेष विनिर्देशों, यदि कोई हो, पर और इससे उपापबद्ध रेखाचित्र के अनुरोध कार्य करो का करार किया है और उक्त का निष्पादन ऐसा कार्य है, जिससे जाता हितबद्ध है।

अब यह विलेख इस बात का साक्षी है की, रेलों द्वारा किए जो वाले संदायों के प्रतिफलस्वरूप, ठेकेदार उक्त अनुसूची में उपवर्णित उक्ता कार्य का सम्यक रूप से निष्पादन करेंगे और उक्ता कार्य मध्य रेल के समाधानप्रद रूप में बहुत तत्परता, सावधानी और सही ढंग से कुशलता से करेंगे तथा तारीख.....को या इससे पहले उक्ता विनिर्देशों और उक्ता रेखाचित्रों तथा सविन्दा की उक्ता शर्तों के अनुसार पूरा करेंगे और उक्ता कार्यों के पूरा होने की प्रामाणिक तारीख से.....कलेंडर मास अवधि के लिए उनका अनुरक्षण करेंगे तथा उसमें उल्लेखित सभी शर्त (जिनहे इस सविन्दा का भाग समझा और मान जाएंगा मानें वे इसमें पूर्णता उपवर्णित की गई है) को मानेंगे, पूरा करेंगे उनका निर्वाह करेंगे और रेल इसके दुवारा करार करती है की, यदि ठेकेदार उक्ता कार्य का पूर्वोक्त रीति से सम्यक रूप से निष्पादन करेगा उक्ता निर्बंधनों और शर्तों का पाला और विवाह करेगा तो रेल उक्ता कार्यों के अंतिम रूप से पूरा हो जाने पर ठेकेदार को उक्ता कार्यों के संबंध में इससे उपबद्ध अनुसूची में विनिर्दिष्ट दरो पर देय रक्कम का संदाय करेंगी या कराएंगी ।

ठेकेदार.....	पदनाम.....
पता.....	भारत के राष्ट्रपति के लिए
तारीख.....	तारीख.....
ठेकेदार के हस्ताक्षर, साक्षियों के हस्ताक्षर तथा पते	साक्षी
1.....	1.....
2.....	2.....

### **MANDATE FORM FOR EFT/NEFT**

**1. Particulars of the Party.**

- i) Name:- \_\_\_\_\_
- ii) Address:- \_\_\_\_\_
- iii) Phone No.:- \_\_\_\_\_ Mobile No. \_\_\_\_\_  
Fax No:- \_\_\_\_\_
- iv) Income Tax PAN No. \_\_\_\_\_
- v) E Mail ID \_\_\_\_\_

**2. Particulars of Bank Account**

- i) City :- \_\_\_\_\_
- ii) Bank Name: \_\_\_\_\_
- iii) Branch: \_\_\_\_\_
- iv) Bank Address:- \_\_\_\_\_
- v) Bank Tel. No. \_\_\_\_\_ FAX no. \_\_\_\_\_
- vi) Bank MICR Code(9 Digit) \_\_\_\_\_
- vii) Bank IFS Code: \_\_\_\_\_
- viii) Bank Account No. \_\_\_\_\_  
(Please enclose a canceled blank cheque)
- ix) Account type :- (Saving/Current/Cash Credit) \_\_\_\_\_

**3. Certified that the particulars furnished with reference to Bank Account are correct and the bank guarantees to honor all EFT/NEFT advices/reports as per RBI Regulations.**

\_\_\_\_\_  
Bank Seal Signature of the authorized official of the bank

**4. DECLARATION BY THE PARTY**

- i. I hereby declare that the particulars given in this mandate form are correct and complete. If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, the User institution i.e. FA & CAO/Central Railway Mumbai will not be held responsible.

Date \_\_\_\_\_  
Signature of the party with stamp

**FORM-15**  
**(On Stamp Paper of Requisite Value)**  
**GUARANTEE BOND FOR SECURITY DEPOSIT**

**(TO BE USED BY APPROVED SCHEDULE BANKS/NATIONALISED BANKS)**

1. In consideration of the President of India " hereinafter called "the Government" having agreed to exempt.....(hereinafter called "the said Contractor (s)" from the demand, under the terms and conditions of an Agreement dated.....made between.... and..... for (hereinafter called "the said Agreement") of security deposit for the due fulfillment by the said Contractor (s) of the terms and conditions contented in the said Agreement, on production of a Bank guarantee for Rs.....(Rupees.....only). We,..... (indicate the name of Bank) hereinafter referred to as "the Bank" at the request of..... (Contractor(s) do hereby undertake to pay to the Government an amount not exceeding Rs..... against any loss or damage caused to or suffered or would be caused to or suffered by the Government by reason of any breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement.
2. We..... (indicate the name of Bank) do hereby undertake to Pay the amount due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Government by reason of breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement or by reason of the Contractor (s) failure to perform the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding.....
3. We undertake to pay to the Government any money so demanded notwithstanding any dispute or disputes raised by the Contractor (s)/ supplier (s) in any suit for proceeding pending before any court or Tribunal relating thereto our liability under this present contract being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor (s)/supplier (s) shall have no claim against us for making such payment.

4. We..... (indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till..... office / Department Ministry of.....certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges this guarantee. Unless a Demand or claim under this guarantee is made on us in writing on or before the..... (b) we shall be discharged from all liability under this guarantee thereafter.
5. We..... (indicate the name of Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor (s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said Contractor (s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor (s) or for any forbearance, act or omission on the part of the Government or any indulgence by the

Government to the said Contractor (s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

- 6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor (s)/ Supplier (s).
- 7. We..... (indicate the name of Bank) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Government in writing.  
Dated : the..... day of.....20  
for.....  
(indicate the name of Bank)

- .....
- (a) The guarantee shall be valid for a period of two months after the expiry of the guarantee period of the equipment.



**FORM-16****STANDING INDEMNITY BOND FOR 'ON ACCOUNT' PAYMENTS****(On paper of requisite stamp value)**

We, M/s..... hereby undertake that we hold at our stores Depot/s at..... for and on behalf of the President of India acting in the premises through the General Manager or his successor of Central Railway (hereinafter referred to as "The Purchaser") all materials for which 'On Account' payments have been made to us against the Contract for supply and erection of (Name of work) \*.on the section/s of Central Railway also referred to as Group/s..... vide letter of Acceptance of Tender No..... dated..... and materials handed over to us by the purchaser for the purpose of execution of the said Contract, until such time the materials are duly erected or otherwise handed over to him.

We shall be entirely responsible for the safe custody and protection of the said materials against all risk till they are duly delivered as erected equipment to the purchaser or as he may direct otherwise and shall indemnify the purchaser against any loss damage or deterioration whatsoever in respect of the said materials while in our possession and against disposal of surplus materials. The said materials shall at all times be open to inspection by any officer authorized by the General Manager incharge of Railway Electrification (whose address will be intimated in due course).

Should any loss, damage or deterioration of materials occur or surplus materials disposed off and refund becomes due, the Purchaser shall be entitled to recover from us the full cost as per prices included in Schedule 3 to the Contract (as applicable) and in respect of other materials as indicated in part I, Chapter- IV, section 1 and also compensation for such loss or damage if any long with the amount to be refunded without prejudice to any other remedies available to him by deduction from any sum due or any sum which at any time hereafter becomes due to us under the said or any other Contract.

Dated this day..... day of..... 20

for and on behalf of

M/s.....(Contractor)

Signature of witness

Name of witness in Block Letters

Address.

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\* Strike out whichever is not applicable

**FORM-19**  
**(On Stamp Paper of Requisite Value)**  
**GUARANTEE BOND AGAINST "ON ACCOUNT" PAYMENTS**

**(TO BE USED BY APPROVED SCHEDULE BANKS/NATIONALISED BANKS)**

1. In consideration of the President of India " hereinafter called "the Government") having agreed to exempt.....(hereinafter called "the said Contractor (s)") from the demand, under the terms and conditions of an Agreement dated.....made between.... and..... for (hereinafter called "the said Agreement") of "On- Account" Payments for the due fulfillment by the said Contractor (s) of the terms and conditions contented in the said Agreement, on production of a Bank guarantee for Rs.....(Rupees.....only).

We,..... (indicate the name of Bank) hereinafter referred to as "the Bank" at the request of..... (Contractor(s) do hereby undertake to pay to the Government an amount not exceeding Rs..... against any loss or damage caused to or suffered or would be caused to or suffered by the Government by reason of any breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement.

2. We..... do hereby undertake to Pay (indicate the name of the Bank) the amount due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Government by reason of breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement or by reason of the Contractor (s) failure to perform the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding.....
3. We undertake to pay to the Government any money so demanded notwithstanding any dispute or disputes raised by the Contractor (s)/ supplier (s) in any suit for proceeding pending before any court or Tribunal relating thereto our liability under this present contract being absolute and unequivocal.

The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor (s)/supplier(s) shall have no claim against us for making such payment.

4. We..... (indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till..... office/ Department Ministry of.....certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges this guarantee. Unless a Demand or claim under this guarantee is made on us in writing on or before the..... (b) we shall be discharged from all liability under this guarantee thereafter.
5. We..... (indicate the name of Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor (s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said Contractor (s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such

variation, or extension being granted to the said Contractor (s) or for any forbearance, act or omission on the part of the Government or any indulgence by the Government to the said Contractor (s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

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

Dated : the..... day of..... 20

for.....

(indicate the name of Bank)

1. The guarantee shall be valid for a period of two months after the completion of installation and testing to the satisfaction of Engineer-in-Charge.





**FORM-21****(On Stamp Paper of Requisite Value)****GUARANTEE BOND AGAINST PROVISIONAL ACCEPTANCE PAYMENTS****(TO BE USED BY APPROVED SCHEDULE BANKS/NATIONALISED BANKS)**

1. In consideration of the President of India " hereinafter called "the Government" having agreed to exempt.....(hereinafter called "the said Contractor (s)" from the demand, under the terms and conditions of an Agreement dated.....made between.... and..... for (hereinafter called "the said Agreement") of Provisional Acceptance Payments for the due fulfillment by the said Contractor (s) of the terms and conditions contented in the said Agreement, on production of a Bank guarantee for Rs.....(Rupees.....only). We,..... hereinafter referred to as "the Bank" (indicate the name of Bank) at the request of..... (Contractor(s) do hereby undertake to pay to the Government an amount not exceeding Rs..... against any loss or damage caused to or suffered or would be caused to or suffered by the Government by reason of any breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement.
2. We..... (indicate the name of the Bank) do hereby undertake to Pay the amount due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the Government by reason of breach by the said Contractor (s) of any of the terms or conditions contained in the said Agreement or by reason of the Contractor (s) failure to perform the said Agreement. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding.....
3. We undertake to pay to the Government any money so demanded notwithstanding any dispute or disputes raised by the Contractor (s), supplier (s) in any suit for proceeding pending before any court or Tribunal relating thereto our liability under this present contract being absolute and unequivocal.  
The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor (s)/supplier (s) shall have no claim against us for making such payment.
4. We..... (indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till..... office/Department Ministry of.....certifies that the terms and conditions of the said Agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges this guarantee. Unless a Demand or claim under this guarantee is made on us in writing on or before the..... (b) we shall be discharged from all liability under this guarantee thereafter.
5. We..... (indicate the name of the Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said Contractor (s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor (s) or for any forbearance, act or omission on the part of the Government or any indulgence by the Government to the said Contractor (s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor (s)/ Supplier (s).

7. We..... (indicate the name of the Bank) lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Government in writing.

Dated: the..... day of..... 20

for.....

(indicate the name of Bank)

---

(a) The guarantee shall be valid for a period of two months after the completion of work.

## ANNEXURE 'A'

## DECLARATION FORMAT

As per GCC April 2022, Clause No.16 Employment / Partnership etc. of Retired Railway Employees.

Clause	CONDITIONS	WRITE YES/NO WHICH IS APPLICABLE
16 (a)	(i) Should a tenderer be a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement, whether in the executive or administrative capacity or whether holding a pensionable post or not, in the Engineering or any other department of any of the railways owned and administered by the President of India for the time being,	YES/NO In case where such Engineer or officer had not retired from government service at least 1 year prior to the date of submission of the Tender.
	OR (ii) Should a tenderer being partnership firm / joint venture (JV) / registered society / registered trust etc. have as one of its partners a retired Engineer of the gazetted rank or any other gazetted officer working before his retirement,	THEN The tenderer will give full information as to the date of retirement of such Engineer or gazetted officer from the said service and as to whether permission for taking such contract, or if the Contractor be a partnership firm or an incorporated company, to become a partner or director as the case may be, has been obtained by the tenderer or the Engineer or officer, as the case may be from the President of India or any officer, duly authorized by him in this behalf, shall be clearly stated in writing at the time of submitting the tender.
	OR (iii) Should a tenderer being an incorporated company have any such retired Engineer of the gazetted rank or any other gazetted officer working before his retirement as one of its directors	
16 (b)	In case, upon successful award of contract, should a tenderer depute for execution of the works under or to deal matters related with this contract, any retired Engineer of gazette rank or retired gazetted officer working before his retirement in the Engineering or any other department of any of the railways owned and administered by the President of India for the time being, and now in his employment.	YES/NO If yes then the tenderer will ensure that retired Engineer or retired gazetted officer had retired from government service at least 1 year prior to the date of his employment with tenderer and in case he had retired from service within a year then he possesses the requisite permission from the President of India or any officer, duly authorized by him in this behalf, to get associated with the tenderer.
16 (c)	Should a tenderer or Contractor being an individual, have member(s) of his family or in the case of partnership firm/ company / joint venture (JV) / registered society / registered trust etc. one or more of his partner(s) / shareholder(s) or member(s) of the family of partner(s)/shareholder(s)having share of more than 1% in the tendering entity employed in gazetted capacity in the Engineering or any other department of the railway	YES/NO If yes then the tenderer at the time of submission of tender, will inform the Authority inviting tenders the details of such persons.
Note: - If information as required as per 16. a), b), c) above has not been furnished; contract is liable to be dealt in accordance with provision of clause 62 of Standard General Condition of contract.		

Date:  
Place:Signature  
(Name of contractor/firm)

**Annexure-B****SAMPLE FORMAT OF COMPLETION CERTIFICATE**

<b>SN</b>	<b>Name of Item</b>	<b>Description</b>
1	LOA No. and date	
2	Name of the work	
3	Contract Agreement No. and date	
4	Name of the contractor	
5	Original Agreement Value	
6	Revised Agreement Value, if any	
7	Date of commencement of work	
8	Date of completion of work as per original / revised agreement	
9	Date of actual completion	
10	Cumulative payment made to the contractor up to the Last paid bill	
11	Total Penalty Imposed (If No penalty, please specified as NIL)	
12	Performance of the contractor	

This certificate submitted by the tenderer should be signed by competent authority of the concerned department.

**Annexure –VIA**

Para 5 of the Instructions to Tenderers

**(Bid Security)**

**Bank Guarantee Bond from any scheduled commercial bank of India**  
*(On non-judicial stamp paper, which should be in the name of the Executing Bank).*

**Name of the Bank: -----**

President of India,

Acting through .....,

..... Railway,

Beneficiary: ..... Railway

Date:.....

**Bank Guarantee Bond No.:****Date:-----**

In consideration of the President of India acting through----- *(Designation & address of Contract Signing Authority)*, ..... Railway, ....., .... (hereinafter called "The Railway") having invited the bid for \_\_\_\_\_ through Notice inviting tender (NIT) No. \_\_\_\_\_, We have been informed that *[Insert name of the Bidder]*..... (hereinafter called "the Bidder") intends to submit its bid (hereinafter called "the Bid")

WHEREAS, the Bidder is required to furnish Bid Security for the sum of *[Insert required Value of Bid Security]*, in the form of Bank Guarantee, according to conditions of Bid.

**AND**

WHEREAS,.....*[Insert Name of the Bank]*, with its Branch.....*[Insert Address]* having its Headquarters office at..... *[Insert Address]*, hereinafter called the **Bank**, acting through.....*[Insert Name and Designation of the authorised persons of the Bank]*, have, at the request of the Bidder, agreed to give guarantee for Bid Security as hereinafter contained, in favour of the Railway:

1. KNOW ALL MEN that by these present that I/We the undersigned *[Insert name(s) of authorized representatives of the Bank]*, being fully authorized to sign and incur obligations for and on behalf of the Bank, confirm that the Bank, hereby, unconditionally and irrevocably guarantee to pay to the Railway full amount in the sum of *[Insert required Value of Bid Security]* as above stated.
2. The Bank undertakes to immediately pay on presentation of demand by the Railway any amount up to and including aforementioned full amount without any demur, reservation or recourse. Any such demand made by the Railway on the Bank shall be final, conclusive and binding, absolute and unequivocal on the Bank notwithstanding any disputes raised/ pending before any Court, Tribunal, Arbitration or any Authority or any threatened litigation by the Bidder or Bank.
3. The Bank shall pay the amount as demanded immediately on presentation of the demand by Railway without any reference to the Bidder and without the Railway being required to show grounds or give reasons for its demand of the amount so demanded.
4. The guarantee hereinbefore shall not be affected by any change in the constitution of the Bank or in the constitution of the Bidder.
5. The Bank agrees that no change, addition, modifications to the terms of the Bid document or to any documents, which have been or may be made between the Railway and the Bidder, will in any way absolve the Bank from the liability under this guarantee; and the Bank, hereby, waives any requirement for notice of any such change, addition or modification made by Railway at any time.
6. This guarantee will remain valid and effective from.....*[insert date of issue]*till .....*[insert date, which should be minimum 90 days beyond the expiry of validity of Bid]*. Any demand in respect of this Guarantee should reach the Bank within the validity period of Bid Security.

7. The Bank Guarantee is unconditional and irrevocable.
8. The expressions Bank and Railway herein before used shall include their respective successors and assigns.
9. The Bank hereby undertakes not to revoke the guarantee during its currency, except with the previous consent in writing of the Railway. This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No.758.
10. The Bank hereby confirms that it is on the SFMS (Structured Financial Messaging System) and shall invariably send the advice of this Bank Guarantee to the following bank details –

IFSC CODE	SBIN00RAIL
IFSC TYPE	BRANCH
BANK NAME	STATE BANK OF INDIA
BRANCH NAME	RAIL
CITY NAME	NAVI MUMBAI
ADDRESS	SECTOR-11, CBD BELAPUR, NAVI MUMBAI
DISTRICT	NAVI MUMBAI
STATE	MAHARASHTRA
BG ENABLED	YES

11. The Guarantee shall be valid in addition to and without prejudice to any other security Guarantee(s) of Bidder in favour of the Railway. The Bank, under this Guarantee, shall be deemed as Principal Debtor of the Railway.

Date .....

Place.....

.....

Bank's Seal and authorized signature(s)

*[Name in Block letters]* .....

*[Designation with Code No.]*.....

*[P/Attorney]* No.

Witness:

1 Signature, Name & Address & Seal

2 Signature, Name& address & Seal

Bank's Seal

*[P/Attorney]*No.

**Note: All italicized text is for guidance on how to prepare this bank guarantee and shall be deleted from the final document.**

**Annexure –VIB**

Reference -Para 10.2 & 17.15.2 of Tender Form (Second Sheet) of Annexure I of ITT

**Each Bidder or each member of a JV must fill in this form separately:**

**NAME OF BIDDER/JV PARTNER:**

<b>Annual Contractual Turnover Data for the Previous 3/4 Years (Contractual Payment only)</b>			
<b>Year</b>	<b>Amount Currency</b>	<b>Exchange Rate</b>	<b>Indian National Rupees Equivalent</b>
<b>Average Annual Contractual Turnover for last 3 years</b>			

1. The average annual contractual turnover shall be calculated as an average of “total contractual payments” in the previous three financial years. However, in case balance sheet of the previous year is yet to be prepared/ audited, the audited balance sheet of the fourth previous year shall be considered for calculating average annual contractual turnover.
2. The information supplied shall be substantiated by data in the audited balance sheets and profit and loss accounts for the relevant years in respect of the bidder or all members constituting the bidder.
3. Contents of this form should be certified by a Chartered Accountant duly supported by Audited Balance Sheet duly certified by the Chartered Accountant.

***SEAL AND SIGNATURE OF THE BIDDER***

Certified that all figures and facts submitted in this form have been furnished after full consideration of all observations/notes in Auditor’s reports. \_\_\_\_\_

***(Signature of Chartered Accountant)***

**Name of CA:** \_\_\_\_\_

**Registration No:** \_\_\_\_\_

***(Seal)***

**ANNEXURE-V(A)**

Reference -Para 6.1 of ITT

(This certificate is to be given by attorney/authorized signatory/each member of Partnership firm/Joint Venture (JV)/ Hindu Undivided Family (HUF)/ Limited Liability Partnership (LLP) etc.)

I/We.....(Name), attorney/authorized signatory of the .....(constituent firm / constituent partner) and member/partner of the .....(tendering firm) hereby solemnly affirm and state as under:

1. I/we certify that.....(Constituent firm/constituent partner) is/are not blacklisted or debarred by Railways or any other Ministry/ Department of Govt. of India from participation in tender on the date of submission of bids, either in individual capacity or as a HUF/ member of the partnership firm LLP/JV/Society/Trust.
2. I/We have read the clause regarding restriction on procurement from a bidder of a country which shares a land border with India and certify that I am/We are not from such a country or, if from such a country, have been registered with the competent Authority. I/We hereby certify that I/we fulfil all the requirements in this regard and am/are eligible to be considered (evidence of valid registration by the competent authority is enclosed),

SEAL AND SIGNATURE  
OF THE CONSTITUENT FIRM/CONSTITUENT PARTNER

Place :

Dated :

-----End of the document---